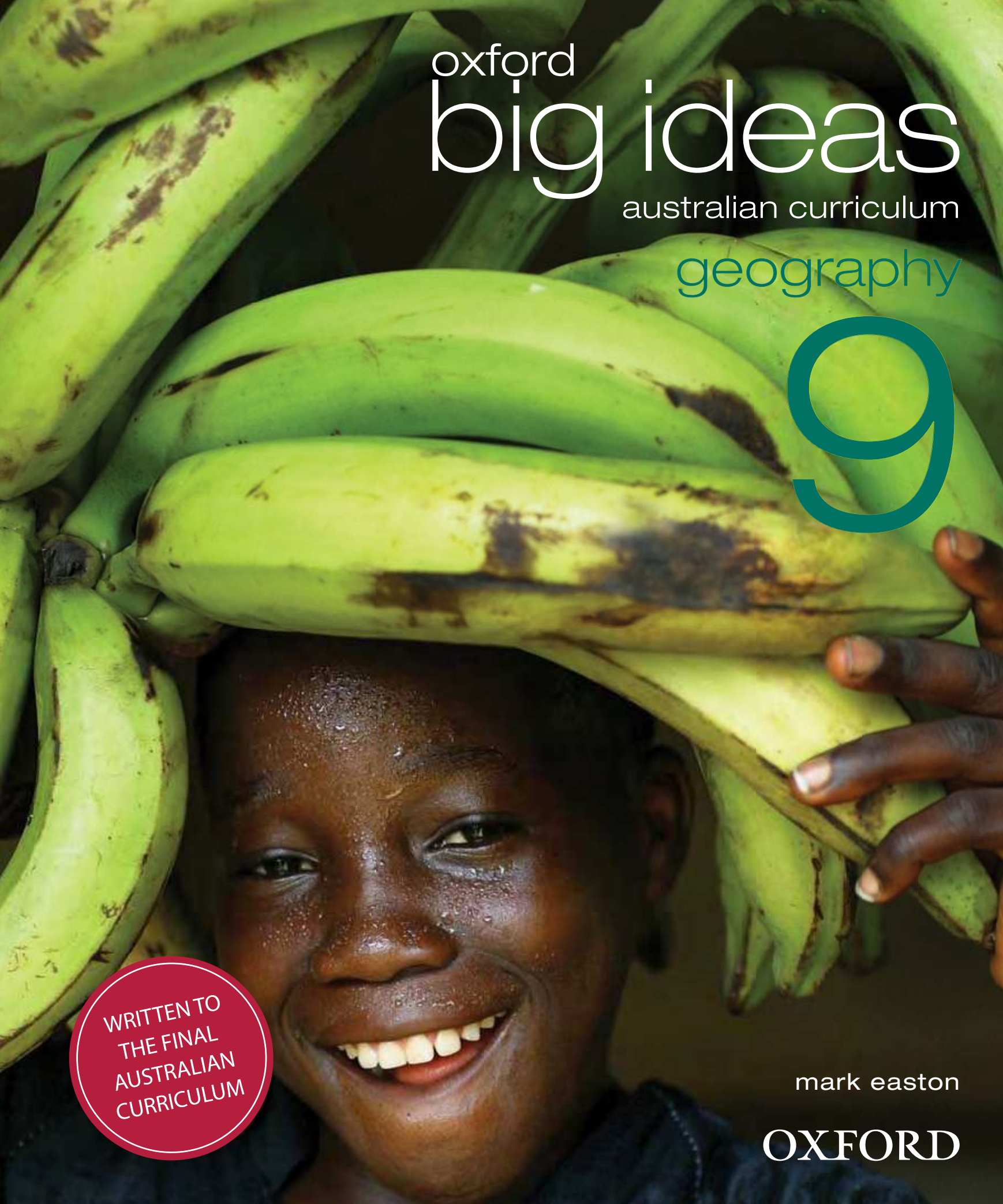

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WRITTEN TO THE FINAL AUSTRALIAN CURRICULUM

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contents

Using Oxford Big Ideas Geography

Oxford Big Ideas Geography is a brand-new series developed and written to meet the requirements of both the *Australian Curriculum: Geography* across Years 7–10. Based on the big ideas framework, it follows an inquiry-based approach that encourages students to develop deep, transferable skills and understanding in Geography.

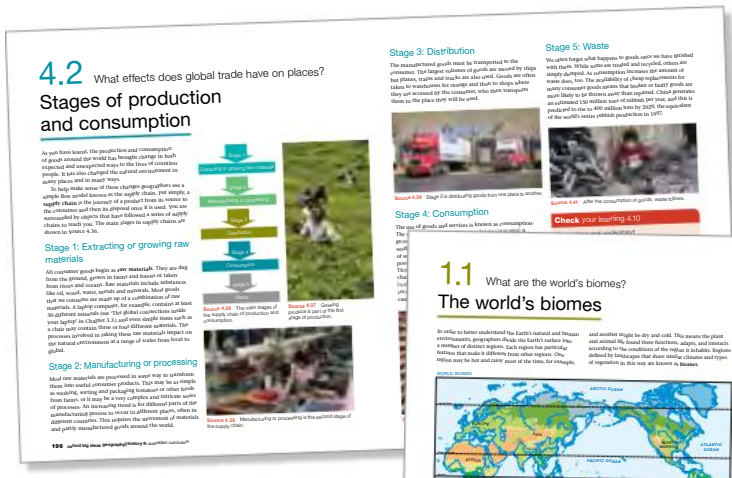
Big questions

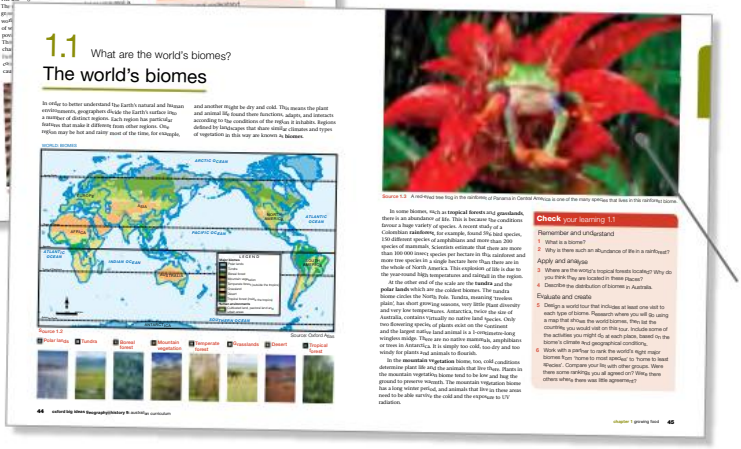
Each chapter of *Oxford Big Ideas Geography* is structured around key inquiry questions from the *Australian Curriculum: Geography* – supporting teachers and students as they implement an inquiry-based approach to Geography.

Stunning full-colour photography generates discussion and interest

Engaging learning

Each chapter of the Student Book combines a range of engaging source materials – maps, photographs, field sketches, data tables, satellite imagery, graphs and illustrations – all with supporting questions and activities.





The learning sequence in each chapter is clearly set out under key inquiry questions. Students are encouraged to use their prior knowledge and make predictions at the start of each new topic.

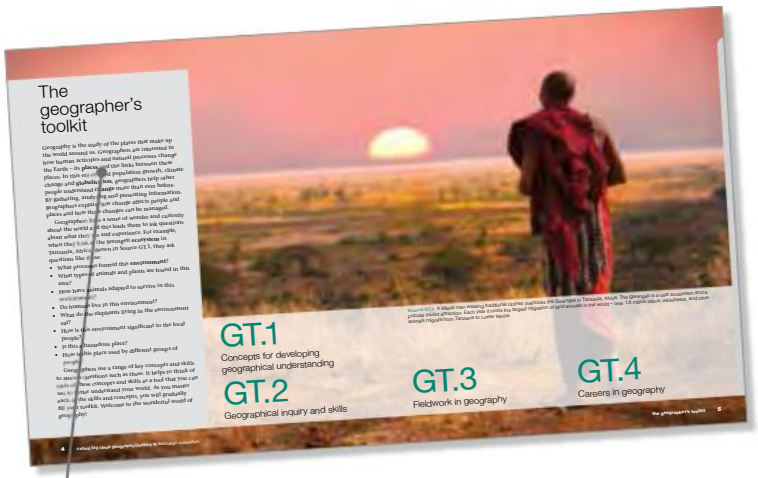
Stunning full-colour source materials inspire a sense of wonder about the world and encourage even the most reluctant learners to engage in geographical and historical inquiry.

Deep understanding

Geography syllabus content is covered in full and sequenced for depth of learning.

Focus on skills

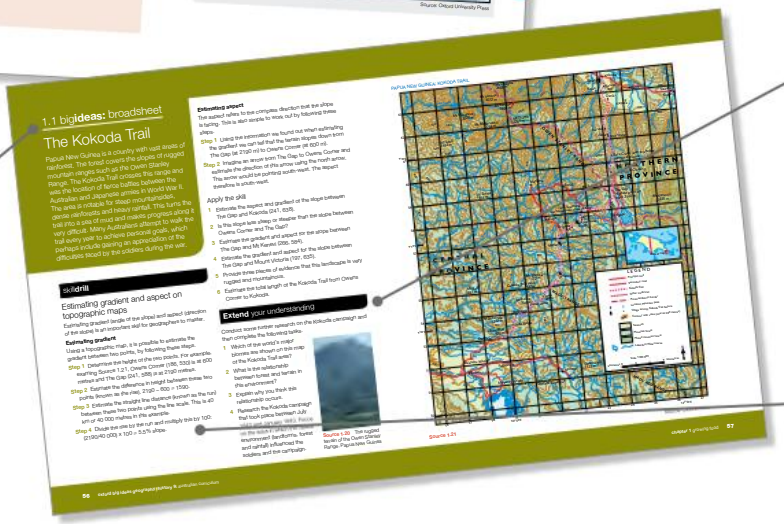
All key concepts and skills are clearly outlined in a stand-alone reference sections – **The geographer's toolkit**. This section has been purpose-written to support the *Australian Curriculum: Geography*. It can be used flexibly – as an introductory skills unit or stand-alone reference section that can be revisited throughout the year.



Every concept and skill required by students to take part in geographical and historical inquiries is introduced clearly and supported by question and activity blocks.

Key concepts are explicitly taught in both 'The geographer's toolkit', and are revisited throughout each chapter.

Check your learning question and activity blocks appear at regular intervals throughout each chapter, allowing students to consolidate and extend their understanding. These are graded according to Bloom's Taxonomy – catering for a range of abilities and learning styles.



Broadsheet activities encourage students to apply the knowledge and skills they have learned in each chapter to a new and interesting case study, event or issue.

Extend your understanding blocks present a challenge by asking students to conduct further research, or complete group work, to deepen their understanding on an issue being investigated.

Skilldrill blocks support an explicit focus on geographical skills.

Integrated teaching and learning support

obook assess

obook assess provides an interactive electronic version of the Student Book in an easy-to-read format. It features multimedia links, interactive learning objects, note-taking, highlighting and bookmarking tools and question blocks. **obook** compatible with laptops, iPads, tablets and IWBs, and also offers page view (in flipbook format) that can be used offline. **assess** provides 24/7 online assessment designed to support student progression and understanding.

obook assess TEACHER

Professional support is offered in digital format via **obook assess TEACHER**. Teaching strategies, additional worksheets, lesson ideas, planning tips, assessment advice and suggested solutions to all activities in the Student Book support the implementation of the Australian Curriculum and cater for ongoing professional development.

obook assess TEACHER also allows teachers to manage their classes by assigning work, tracking progress and planning assessment.

Australian Curriculum: Geography 9—Scope and sequence

	Level description and key inquiry questions
Level description	There are two units of study in Year 9: **Biomes and food security** and **Geographies of interconnections**. *Biomes and food security* focuses on investigating the role of the biotic environment and its role in food and fibre production. This unit examines the biomes of the world, their alteration and significance as a source of food and fibre, and the environmental challenges and constraints on expanding food production in the future. These distinctive aspects of biomes, food production and food security are investigated using studies drawn from Australia and across the world. *Geographies of interconnections* focuses on investigating how people, through their choices and actions, are connected to places throughout the world in a wide variety of ways, and how these connections help to make and change places and their environments. This unit examines the interconnections between people and places through the products people buy and the effects of their production on the places that make them. Students examine the ways that transport and information and communication technologies have made it possible for an increasing range of services to be provided internationally, and for people in isolated rural areas to connect to information, services and people in other places. These distinctive aspects of interconnection are investigated using studies drawn from Australia and across the world.
Key inquiry questions	• What are the causes and consequences of change in places and environments and how can this change be managed? • What are the future implications of changes to places and environments? • Why are interconnections and interdependencies important for the future of places and environments?

	Geographical knowledge and understanding
Unit 1 – Biomes and food security	• The distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity (ACHGK060) • The human alteration of biomes to produce food, industrial materials and fibres, and the environmental effects of these alterations (ACHGK061) • The environmental, economic and technological factors that influence crop yields in Australia and across the world (ACHGK062) • The challenges to food production, including land and water degradation, shortage of fresh water, competing land uses, and climate change, for Australia and other areas of the world (ACHGK063) • The capacity of the world's environments to sustainably feed the projected future population to achieve food security for Australia and the world (ACHGK064)
Unit 2 – Geographies of interconnections	• The perceptions people have of place, and how this influences their connections to different places (ACHGK065) • The way transportation and information and communication technologies are used to connect people to services, information and people in other places (ACHGK066) • The ways that places and people are interconnected with other places through trade in goods and services, at all scales (ACHGK067) • The effects of the production and consumption of goods on places and environments throughout the world and including a country from North-East Asia (ACHGK068) • The effects of people's travel, recreational, cultural or leisure choices on places, and the implications for the future of these places (ACHGK069)

	Geographical inquiry and skills
Observing, questioning and planning	• Develop geographically significant questions and plan an inquiry that identifies and applies appropriate geographical methodologies and concepts (ACHGS063)
Collecting, recording, evaluating and representing	• Collect, select, record and organise relevant geographical data and information, using ethical protocols, from a range of appropriate primary and secondary sources (ACHGS064) • Evaluate sources for their reliability, bias and usefulness, and represent multi-variable data in a range of appropriate forms, for example, scatter plots, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies (ACHGS065) • Represent the spatial distribution of geographical phenomena by constructing special purpose maps that conform to cartographic conventions, using spatial technologies as appropriate (ACHGS066)
Interpreting, analysing and concluding	• Evaluate multi-variable data and other geographical information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to make generalisations and inferences, propose explanations for patterns, trends, relationships and anomalies, and predict outcomes (ACHGS067) • Apply geographical concepts to synthesise information from various sources and draw conclusions based on the analysis of data and information, taking into account alternative points of view (ACHGS068) • Identify how geographical information systems (GIS) might be used to analyse geographical data and make predictions (ACHGS069)
Communicating	• Present findings, arguments and explanations in a range of appropriate communication forms, selected for their effectiveness and to suit audience and purpose; using relevant geographical terminology, and digital technologies as appropriate (ACHGS070)
Reflecting and responding	• Reflect on and evaluate the findings of the inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations; and explain the predicted outcomes and consequences of their proposal (ACHGS071)

Year 9 achievement standard

By the end of Year 9, students explain how geographical processes change the characteristics of places. They predict changes in the characteristics of places over time and identify the possible implications of change for the future. They analyse interconnections between people, places and environments and explain how these interconnections influence people, and change places and environments. Students propose explanations for distributions and patterns over time and across space and describe associations between distribution patterns. They analyse alternative strategies to a geographical challenge using environmental, social and economic criteria and propose and justify a response.

Students use initial research to identify geographically significant questions to frame an inquiry. They collect and evaluate a range of primary and secondary sources and select relevant geographical data and information to answer inquiry questions. They represent multi-variable data in a range of appropriate graphic forms, including special purpose maps that comply with cartographic conventions. They analyse data to propose explanations for patterns, trends, relationships and anomalies and to predict outcomes. Students synthesise data and information to draw reasoned conclusions. They present findings and explanations using relevant geographical terminology and graphic representations in a range of appropriate communication forms. Students propose action in response to a geographical challenge taking account of environmental, economic and social considerations and predict the outcomes and consequences of their proposal.

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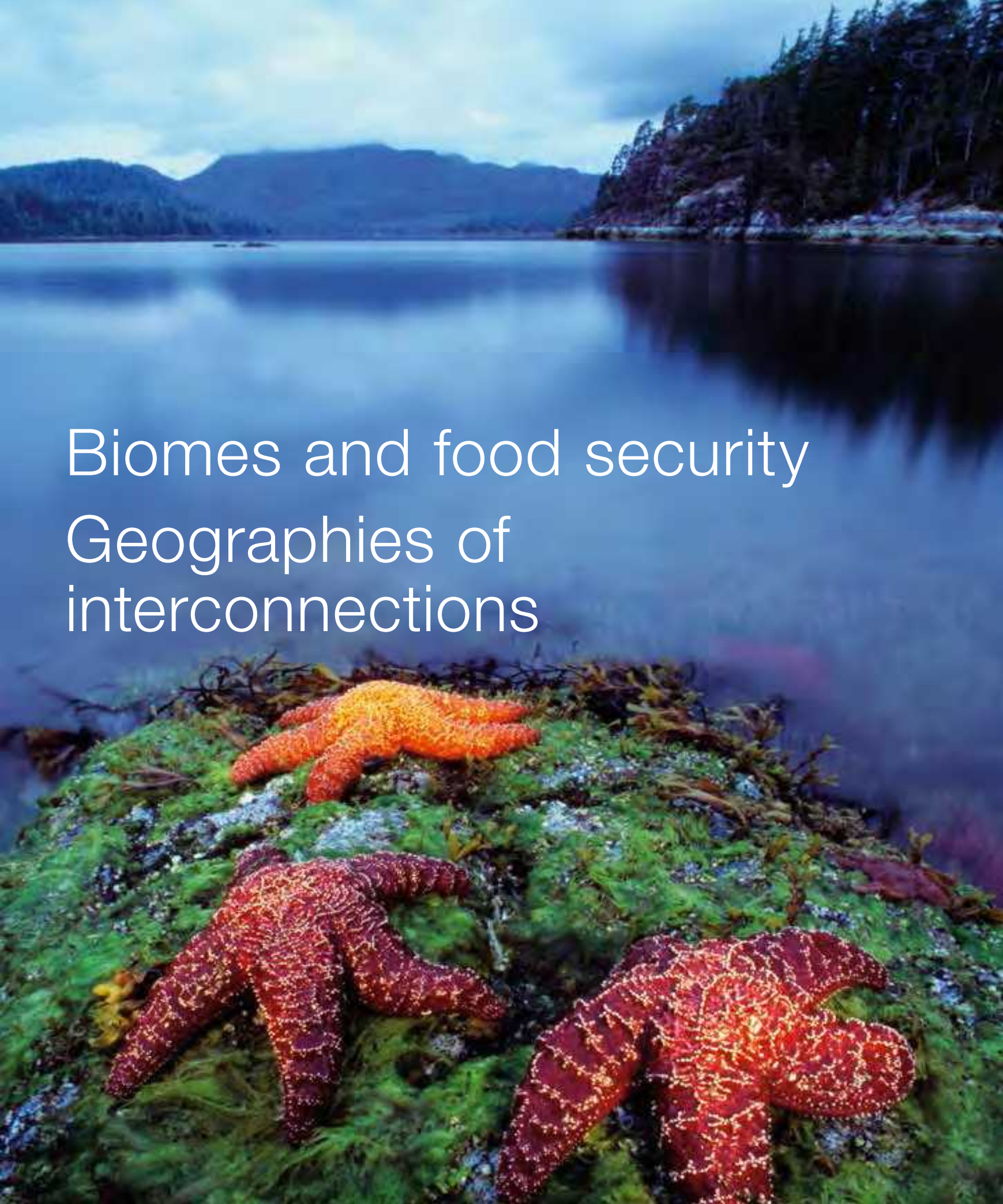


Biomes and food security

Geographies of interconnections

The geographer's toolkit

Geography is the study of the places that make up the world around us. Geographers are interested in how human activities and natural processes change the Earth – its **places** and the links between these places. In this era of rapid population growth, climate change and **globalisation**, geographers help other people understand **change** more than ever before. By gathering, analysing and presenting information, geographers explain how change affects people and places and how these changes can be managed.

Geographers have a sense of wonder and curiosity about the world and this leads them to ask questions about what they see and experience. For example, when they look at the Serengeti **ecosystem** in Tanzania, Africa, shown in Source GT.1, they ask questions like these:

- What processes formed this **environment**?
- What types of animals and plants are found in this area?
- How have animals adapted to survive in this environment?
- Do humans live in this environment?
- What do the elephants living in the environment eat?
- How is this environment significant to the local people?
- Is this a hazardous place?
- How is this place used by different groups of people?

Geographers use a range of key concepts and skills to answer questions such as these. It helps to think of each of these concepts and skills as a tool that you can use to better understand your world. As you master each of the skills and concepts, you will gradually fill your toolkit. Welcome to the wonderful world of geography!

GT.1

Concepts for developing geographical understanding

GT.2

Geographical inquiry and skills

Source GT.1 A Masai man wearing traditional clothes overlooks the Serengeti in Tanzania, Africa. The Serengeti is a vast ecosystem and a popular tourist attraction. Each year it hosts the largest migration of land animals in the world – over 1.6 million zebra, wildebeest, and other animals migrate from Tanzania to Lower Kenya.

GT.3

Fieldwork in geography

GT.4

Careers in geography

GT.1 Concepts for developing geographical understanding

Geographers use seven key concepts to help investigate and understand the world. These concepts provide a framework to thinking geographically and will help guide you through every geographic inquiry. At times you will use several of these concepts at once, while at other times you may focus on just one. The seven key concepts in geography are:

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

Place

A place is a part of the Earth's surface that is identified and given meaning by people. For example, the Serengeti – which is a vast ecosystem in Africa – is a place. It is famous for its enormous plains filled with wildlife, animals and birds. Places aren't defined by size, however. They can be very large, like a whole continent, or small, like a corner of a library. Your home and school are important places for you, because they are places where you live and spend a lot of time.

Places can be natural (that is, shaped by the environment and largely unchanged by humans), or built (that is, constructed by humans). Each place is unique with its own set of characteristics.

The life of every person and animal on Earth is influenced by place. Places determine our relationships with one another. Our closest relationships are likely to be with people in places that are physically near. The environmental and social qualities of a place all influence the way we live. Climate, landscapes, types of plants and resources, transport networks, entertainment venues and workplaces all have a major impact on our daily lives.

Geographers use the concept of place when they investigate what a place is like, and when they look for explanations for what they see. For example, a geographer visiting this village near Mount Everest would be interested in the forces that have shaped these mountains.

They would look for clues and begin to ask questions, much like a detective. Why are the sides of the mountains so steep? Why are the highest mountain peaks in a line? Why are there stripes in the mountain peaks? By seeking answers to these questions the geographer is aiming to explain, not just describe, a place.

Source GT.2 The town of Namche Bazaar lies at the base of Mount Everest.

Geographers use the concept of place when conducting any geographical inquiry. For example, a geographer visiting Namche Bazaar in Nepal (see Source GT.2) would use the concept of place to help understand why people choose to live in this challenging environment and how they overcome these challenges. They would also investigate the ways people have altered this environment, and assess the environmental and social impacts of the effects of these changes.

Space

To most people, space means the empty universe, but to a geographer it has a different meaning. Geographers use the key concept of space when investigating the way that things are arranged on the Earth's surface. They also investigate the ways people use and change the spaces in which they live.

Geographers look for patterns in the way features and structures are arranged, and the concept of space helps them to do this. It has three main elements.

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

At first, you may find you confuse the concepts of place and space, as people often use the words interchangeably. To a geographer, however, the concepts of place and space are quite separate. It may help you to remember that places can be divided and organised into spaces. Spaces also are assigned with different purposes.

For example, a place like your school is organised into different spaces, each with its own purpose. There are spaces for learning, spaces for sports and spaces to eat. Larger places, such as your **suburb**, town or city, are also organised into different spaces. There are spaces for housing, spaces for businesses, and spaces for sports and entertainment – all with their own function.

Understanding of the location, patterns and planning of spaces helps geographers to make sense of our world. A geographer would look at a photograph like this one of New York City (see Source GT.3) and might examine it by using the key concept of space in the following terms.

- Location – they would observe that Manhattan Island is located in the mouth of the Hudson river and that land is limited. Clearly, there is an open space in the centre of the city. A geographer might identify that it has been designated as a space for recreation and enjoying nature. They may ask questions like, How big is the park? When was it established?
- Organisation – they would conclude that there are many tall buildings in a confined area. Were the buildings constructed around a set perimeter, after the park was established? Are the buildings mainly used for business or housing purposes?
- Spatial distribution – the geographer may investigate how many buildings there are per square kilometre, how sparsely or densely they are situated from each other, and how sparsely or densely they are populated.

Further investigation would reveal that there is a complex network of bridges, ferries, subways and walkways that link the island to surrounding areas. In fact, Manhattan Island in New York is one of the most densely populated places on Earth, with more than 26 000 people living in every square kilometre! New Yorkers would perceive and use the space around them in quite a different way than someone living on a huge block in an outer suburban area.

Geographers also investigate the ways that people use and change the space in which they live. They recognise that different groups of people use space in different ways and that this changes over time. By examining, researching and describing how spaces are used, geographers can further our understanding of the world and help manage it into the future.

Source GT.3 Manhattan Island in New York is one of the most densely populated places on Earth.

Environment

You will have heard people talk about 'the environment' and probably studied aspects of the environment before. In geographical terms, the key concept of environment means the living and non-living components and elements that make up an area, and the ways they are organised into a system.

Geographers are interested in investigating and describing the relationships between people and the environment. In particular they examine:

- the ways in which different groups of people perceive and use the natural environment and why these perceptions differ
- the ways in which people change the environment and how these changes can be managed
- the impact of environmental hazards on people and how the impacts of these hazards can be reduced.

The world in which we live is made up of many different environments. Some environments are natural (or physical) such as deserts, **grasslands**, mountains, coral reefs, forests, oceans and ice caps. The natural environment provides us with basic resources for living such as food, water and clean air. Natural processes such as **tectonic plate** movement, **erosion** and **weathering** have formed these environments over millions of years. In order for an environment to be considered natural its soils, rocks, climate, plants and animals must remain largely untouched by humans. Today there are very few natural environments left on Earth. The Australian World Heritage listed Heard and McDonald Islands are an outstanding example of a pristine natural environment with no introduced animals and plant species, and no human impact.

Other environments have been so changed by humans – largely for settlement and economic activity – that very few natural features remain. These are known as built (or human) environments and include large cities, towns, suburbs and areas of farmland. For example, mountainous land in the Philippines has been transformed into terraced pond fields for rice farming by skilfully following the natural contours of the land.

Researching an environment also allows geographers to evaluate how people can best interconnect with that environment, and identify potential risks for people interacting with that environment. For example, examining the landscape, height, as well as the ascent of Mt Kilimanjaro (see Source GT.4) in Africa allows prospective travellers to know that, unlike with Mt Everest, they don't need to bring additional oxygen for their climb, but they do need to follow one of six official routes.

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

Source GT.4 Mt Kilimanjaro in Africa is a popular place for climbers to interact with the natural environment.

Interconnection

Nothing on Earth exists in isolation – all environments and every living and non-living thing are connected. Geographers use this concept of interconnection to better understand the links between places and people, and how these interconnections affect the environment and the way we live. These connections can be on a local level or a global level.

Natural processes link places and people. For example, the water cycle links the water in the oceans with the land. When it brings rain to inland areas, water flows across the land and into rivers and streams. Farmers rely on this natural link to provide the water they need to grow food.

Links between places and people can affect the way people live. In turn, the way people live can affect places. A relatively small change in one area can have a great impact on another it is interconnected with. The melting of ice from a glacier at the top of a mountain, for example, will affect the land at the bottom of the mountain. The extra water could potentially damage crops that are being grown there, or conversely the changed conditions may benefit farmers.

Human activities such as the movement of people, the production and trade of goods, and the flow of money within and between different countries also link places and people. Interconnection through electronic means such as mobile phone and Internet is now a part of everyday life for many of us. Being consumers in a global market place also means we are connected to many places via international trade. More than 3000 ships carrying two million containers pass through the Port of Melbourne (see Source GT.5) each year. These ships and the goods they carry link dozens of countries around the world.

Source GT.5 A container ship prepares to berth at Port Melbourne.

Sustainability

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

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

- local – recycling of paper by individuals, schools and households reduces the number of trees that need to be cut down
- national – in Australia, the government has begun to encourage sustainable use of energy by offering incentives to promote the use of solar panels
- international – organisations such as the Marine Stewardship Council (MSC) are working with fisheries and retailers to promote responsible and environmentally viable fishing practices around the world.

There can be debate surrounding the sustainability of an environment, as people or organisations with different interests may put forward different points of view. A tree-logging company may protest that their practices are sustainable, as they re-plant as much as they cut down. On the other hand, a conservation group may be equally convinced that a forest cannot sustain cutting down trees. New trees may take decades to grow, in which time wildlife has moved on and the ecosystem has been altered. Many underdeveloped countries, such as Myanmar (Burma), (see Source GT.6), face enormous challenges controlling and monitoring forest clearance.

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

Source GT.6 Logging in Myanmar (Burma) gives local communities a source of income but leaves hillsides bare and easily eroded by heavy rain.

Scale

The concept of scale is used to guide geographical inquiries. Geographers study things that take place on many different spatial levels – meaning from small areas (such as a local park) to very large areas (such as the use of oil and gas all over the world). They use the concept of scale to look for explanations and outcomes at different levels. For example, a geographic inquiry on climate change may be carried out at a range of scales (from smallest to largest) (see Source GT.8):

- local – such as an inquiry into increased electricity use (for air conditioning) in your neighbourhood due to higher than average temperatures. Increased energy consumption may result in power outages.
- regional – such as inquiry into coral bleaching on the Great Barrier Reef (see Source GT.8). Warming ocean temperatures can trigger coral bleaching often resulting in coral death.
- national – such as an inquiry into changing weather patterns and increased frequency of extreme weather events in Australia. This impacts on government allocation of resources across many sectors (water security, agriculture, emergency services, coastal communities and **infrastructure**).
- international – such as inquiry into drought in Africa. Rains have become less reliable in many places as the climate has changed and many African nations have been hit by a series of devastating droughts that have brought widespread hunger and starvation.
- global – such as an inquiry into the reduction in Arctic sea ice due to global warming. This reduction in white ice means that less of the Sun's energy is reflected back into space and more is absorbed into the earth and sea resulting in further increases in temperatures globally.

Some geographic studies investigate a large area. For example, something that affects a whole country, such as a severe drought, would involve a study at the national scale. If an event or phenomenon affects the whole world, such as climate change and rising sea levels, it would be examined at the global scale.

It may be necessary to use different scales when studying the same thing. For example, as mentioned above, climate change is occurring globally and should be examined at the global scale.

However, it can be examined at other scales too.

Source GT.7 Geographical inquiries can be carried out on a number of different scale levels.

Scale	Example of climate change inquiry
Local scale	Electricity consumption in your neighbourhood (increased use of air conditioning)
Regional scale	Coral bleaching on the Great Barrier Reef
National scale	Frequency of extreme weather events across Australia
Global scale	Reduction in Arctic sea ice; rising temperatures throughout the world

Source GT.8 The Great Barrier Reef off the coast of Queensland is the world's largest coral reef system. A geographical inquiry of the reef could be undertaken at a range of scales.

Change

The Earth is constantly changing. Some changes occur very rapidly and are easy to observe, while others take place over millions of years and are almost undetectable to us.

The concept of change is important in geography because it helps us to understand what is happening around us and to see the world as a dynamic place. Change refers to both time and space, and allows geographers to examine how environments develop, transform or disappear.

Change can be the result of natural forces. For example, the Earth has been shaped and changed by climate, earthquakes, volcanoes and running water over millions of years. It can also be the result of human activity, such as the building of a new bridge or clearing of forest for farmland.

Changes also take place on many levels, from local through to global. Local changes that happen quickly, such as storm damage in your street, are easy to observe and explain. Regional or national changes resulting from a bushfire or an earthquake can also happen quickly and their effects can be widespread with devastating impacts on places and people.

Changes that take place on a global scale can take much longer to occur. Global warming, for example, is a long-term change that happens slowly. Global warming has widespread effects that are not easily explained.

Observing and understanding changes that are natural and have occurred over time or changes that have been made by humans over time, is an important part of any geographical inquiry. Geographers need to look at different types of changes, why they have occurred, over what time period they have occurred and what further changes may take place as a result.

Sometimes changes can be positive, such as the regeneration of vegetation, while other changes can have negative consequences, such as the pollution of waterways from industry. Geographers play an important role in ensuring that change is managed in a sustainable way.

Source GT.9 In preparation for the 2012 Summer Olympic Games, Newham, in East London was transformed from a suburb of derelict buildings and polluted rivers into a vast sporting complex.

Source GT.10 The resources and buildings for the London 2012 Olympic Games were planned with sustainability as a primary concern, adopting a Zero Waste Games Vision. The Velodrome in this photo was built using 100% sustainably sourced timber.

Check your learning GT.1

Remember and understand

1 Is Namche Bazaar an example of the natural, or built environment?

2 List three natural environments and three built environments. Your answers can be drawn from the photographs in this section, or you can use your own observations.

3 At what scale would a study of Mount Kilimanjaro's glaciers take place?

Apply and analyse

4 Examine Source GT.6 of the hillside in Myanmar (Burma).
   - a What evidence of change can you identify in this picture?
   - b How might this change impact on the natural environment in this place?
   - c How might it impact on the people in the nearby village?

5 Examine Sources GT.9 and GT.10 of Newham in London.
   - a Describe the arrangement of the sporting facilities. Using the key concept of sustainability, what factors do you think would need to be considered when planning the development of this area?
   - b What examples of interconnection can you identify in these satellite images?

6 Examine Source GT.3 of New York City. With a partner, construct four questions you could ask to investigate why so many people live in such a small space. Share your questions with your classmates.

7 A geographer examining the changes that occurred at Newham in preparation for the 2012 Olympic Games would be interested in assessing the impacts and sustainability of these changes at the local scale. Describe some possible links between:
   - a environment and sustainability
   - b space and interconnection
   - c place and space
   - d scale and environment
   - e environment and interconnection.

Evaluate and create

8 Conduct some research online into the upgrades being made at the Port of Melbourne. Choose three of the geographical concepts discussed in this section that could be used to better understand this project. Jot down two points for each concept.

9 Research the host city of the next summer or winter Olympics. What changes are being made to the natural and built environments in and around the city in preparation for the games?

10 Choose one of the key geographical concepts outlined in this section. Find a photograph in a magazine or on the Internet that illustrates this concept. Explain your choice of photograph and how you think it describes the concept.

GT.2 Geographical inquiry and skills

Geographers are investigators. They explore the world around them by asking questions about what they see. These questions begin an investigation that requires them to collect and analyse information and to communicate what they have discovered. To complete an investigation they need a set of skills such as drawing **maps** and cross-sections, surveying, sketching and presenting information. To complete a full geographic inquiry there are five sets of skills. These are listed in Source GT.11.

To become a better geographer you should try to learn new skills as you continue to practice, use and develop the skills you have already learnt. It might help you to think of each of these skills as individual tools in your toolkit. For some geographical inquiries, you may only need to use one tool; for others, you may need to use many. As you develop each new skill you will have gained another important tool in explaining the natural processes and human activities that shape our amazing planet.

Observing, questioning and planning

Observe the world and its geographical characteristics

Understanding our world begins by observing the processes that are taking place all around us. Geographers look at people, land, air, water, plants and animals and the connections between them to understand what is happening. They also seek to investigate where, why and how natural, managed and constructed environments are formed and changed. These observations often include identifying any problems or issues that need to be investigated and resolved.

Observing, questioning and planning	• Develop geographically significant questions and plan an inquiry that identifies and applies appropriate geographical methodologies and concepts
Collecting, recording, evaluating and representing	• Collect, select, record and organise relevant geographical data and information, using ethical protocols, from a range of appropriate primary and secondary sources • Evaluate sources for their reliability, bias and usefulness, and represent multi-variable data in a range of appropriate forms, for example, scatter plots, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies • Represent the spatial distribution of geographical phenomena by constructing special purpose maps that conform to cartographic conventions, using spatial technologies as appropriate
Interpreting, analysing and concluding	• Evaluate multi-variable data and other geographical information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to make generalisations and inferences, propose explanations for patterns, trends, relationships and anomalies, and predict outcomes • Apply geographical concepts to synthesise information from various sources and draw conclusions based on the analysis of data and information, taking into account alternative points of view • Identify how **geographical information systems (GIS)** might be used to analyse geographical data and make predictions
Communicating	• Present findings, arguments and explanations in a range of appropriate communication forms, selected for their effectiveness and to suit audience and purpose; using relevant geographical terminology, and digital technologies as appropriate
Reflecting and responding	• Reflect on and evaluate the findings of the inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations; and explain the predicted outcomes and consequences of their proposal

Source GT.11 The five categories of skills used in a geographical inquiry.

Developing geographical questions

One of your greatest assets as a geographer is curiosity. Geographers look at the world around them and ask questions about what they see, experience or have thought about. You may, for example, see a news item about a volcanic eruption or hear a report about the world's most liveable cities. Or you may visit the centre of a large city on a field trip or a national park on holiday. As you begin to think like a geographer you will begin to ask questions about these events and places and these questions may be the starting point for a geographic inquiry.

Source GT.12 Zebras grazing on the plains surrounding Mt Kilimanjaro.

skill**drill**

Developing geographical questions

You can learn to develop geographical questions which will help you begin an inquiry about a particular topic or place. Start your questions with the words 'what', 'where', 'how', 'why', 'what impact' or 'what should' when thinking about your topic.

Your questions should examine ideas such as:

- Where is it?
- How big is it?
- What pattern or shape is it?
- Why is it like this? Is it like this because something else is at this location?
- How does it interact with other things in this place?
- How is it changing?
- How should people best manage this change?

The very best questions open up an exciting area for you to explore. Examine Source GT.12. A visitor to this place might ask a simple question, such as 'How much snow is there on the mountain?'. This is a question with a relatively straightforward answer.

A better geographical question would be to ask 'Does the amount of snow on the mountain change over time?'.

This question opens up a whole new area to explore, because the answer to that question will lead on to further questions and greater depth of understanding. Some other example questions are:

- Is this a volcano?
- Why is it green on the ground but there is snow on the mountain?
- Are the animals all eating the same things?
- Is there more or less snow than in the past?
- How do people use the mountain?

Apply the skill

1 Why is 'Does the amount of snow on the mountain change over time?' a better geographical question than 'How much snow is there on the mountain?'.

2 Examine Source GT.6 which shows forest clearing in Myanmar. Work with a partner to develop a set of geographical questions about this place.

3 Where could you begin to find the answers to your questions?

Plan a geographical inquiry

Asking geographical questions is a good way to open a range of possibilities for further research and investigation. It is usually best to narrow your investigation by selecting one of the geographical questions you have written as the basis for your inquiry. You should select a question in which you are interested and to better help you understand the environment you are investigating.

Planning an inquiry about Mount Kilimanjaro

Having chosen to investigate the key geographical question 'how does this mountain affect the climate?', it is time to consider what information you are going to need to answer this question. You also need to decide where you are going to locate the information you will need to collect. A good way to this is to use a planning table like the one below.

Source GT.13 Planning is a key stage in conducting a geographical inquiry.

Key inquiry question	Information needed	Possible sources of this information
How does this mountain affect the climate?	Climate data, particularly temperature and rainfall for places at various distances from Kilimanjaro including the summit	Atlas map to locate towns and cities at various distances from Kilimanjaro Encyclopaedia entry for the climates of Kenya and Tanzania Online search for climate data for selected towns and cities
	Observation of photographs and satellite images of the region	Photographs and satellite images of Kilimanjaro from throughout this chapter Google Earth, including historic imagery
	An understanding of the impact of landforms on temperature and rainfall	Printed resources such as geography textbooks, encyclopaedias and Bureau of Meteorology (BOM) books and leaflets BOM website

Check your learning GT.2

Remember and understand

1 What are the five sets of skills in a full geographical inquiry?

2 Imagine that while watching the news on television this evening you see an item about a large earthquake in China.
   a How could this news item be the beginning of a geographical inquiry?
   b Write a series of geographical questions about this earthquake.

Apply and analyse

3 For the geographical questions that you have written, develop a planning table similar to the one shown here for Mount Kilimanjaro (see Source GT.14).

Evaluate and create

4 Bring a copy of your local newspaper to class. Search through the newspaper, or think about your local area, and identify examples of stories or issues that could be investigated as part of a geographical inquiry. Examples may include a shopping centre extension, or a proposal for a new set of traffic lights or a pedestrian crossing. Choose one local issue and work with a partner to develop a series of geographical questions about it. Then, complete a planning table for one of your questions.

Source GT.14 Mt Kilimanjaro in Africa.

Collecting, recording, evaluating and representing

Collect, record and evaluate primary and secondary data

Good planning and preparation will ensure that your geographical inquiry will run smoothly, be relevant and give you the answers you are looking for. Once you have identified the issue, formulate your key inquiry question. You can conduct a sound, useful inquiry by following these steps:

- collect and record the information you think you will need to answer your key inquiry question
- evaluate this information and data to determine that it is accurate and relevant
- represent your findings in an interesting and appropriate way (such as tables, graphs, maps and sketches).

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

Often a geographer collects information that supports his or her inquiry but has not been specifically collected or designed by the geographer for the inquiry. This type of information is called **secondary data**. Secondary data sources include maps, graphs, statistics, and websites that someone else has developed. One of the best secondary sources of information may be photographs from newspapers and magazines and satellite images from Google Earth. It is important to always evaluate any secondary sources for reliability, relevance and bias. This is particularly true for information accessed through the Internet. Unlike a printed source such as a book or atlas it can be very difficult to establish who has written and published information online.

Reliability

When undertaking an inquiry, geographers need to evaluate the sources they use for reliability and potential bias, as well as usefulness. In the case of collecting data from primary sources, such as interviewing subjects directly on a topic, the information gathered will be reliable, as it is gathered first-hand. It is important for the geographer to keep in mind, then, any potential bias that may be influencing an interviewee's response. An interview that a geographer is conducting on the potential effects of turning local parkland into an industrial park, for instance, would have very different responses from a representative of the industrial developer, compared to a member of a local wildlife conservation group. It is important for a geographer to evaluate this kind of bias, and remember to ask questions about the motivation behind it.

When selecting secondary sources, such as maps, graphs, photographs or other data, the geographer also needs to ensure the data is reliable and unbiased. This includes evaluating the creator of the data – is the data from a recognised source like a government body, such as the Bureau of Meteorology or a research agency like the **CSIRO**? Is the data provided without bias? Or is it presented on a website for a company that might have a vested interest in influencing public opinion?

Ethics in geography

When conducting research and obtaining data for an inquiry, it is important for a geographer to be mindful of issues that are likely to raise ethical concerns. This may include being aware of privacy concerns, ensuring anonymity if required, and obtaining informed consent for research participants. Geographers may also need to outline where and how the information obtained will be used or published, and special attention may need to be given for relational data where geographical references or co-ordinates might disclose a participant's location and/or identity.

If a geographer is undertaking an inquiry that involves consulting with Aboriginal and Torres Strait Islander communities, they should be aware that there are guidelines and protocols that should be followed. While these are not necessarily rules, it is important to know that Aboriginal and Torres Strait Islander people have distinctive regional and cultural identities which require respectful consideration for meaningful consultation. This may involve preferred terminology, cues for cultural communication, and other means for making consultation harmonious and productive. If conducting such an inquiry, it is advisable to do further reading, such as the *Aboriginal and Torres Strait Islander Peoples Engagement Toolkit*, which can be found online.

skill**drill**

Evaluating the reliability of websites

There is an enormous amount of information available online, but it is important to keep in mind that not all websites provide reliable information. You must be careful not to naively accept all information published online as being from a reliable source. Websites should be critically evaluated for reliability by following these steps:

Step 1 Find out how old the information is. When was it first published? This will help you decide whether it is useful for your inquiry or not.

Step 2 Find out who published the information. Is it possible they have a bias? You can often find out more about the organisation publishing these statistics by going to their 'home' page or 'about us' page.

Step 3 Look at the extension at the end of the website address as this gives you an important clue about the origin of the information. For example .com is used by commercial organisations such as online stores, .org is used by non-commercial organisations such as NGOs and welfare groups, .gov by government departments, .edu refers to schools and universities, .biz by businesses and .mil by military groups.

Step 4 If you cannot find out when the information was published or who published it, it is probably too unreliable to use in a geographic inquiry. Look for a more reliable source of information.

Apply the skill

1 Common websites used for reference information include the CIA factbook (see Source GT.15), the Australian Bureau of Statistics, National Geographic and the United Nations Development Programme. Using the steps listed above, assess the reliability of the data found at these websites.

Source GT.15 This web page describes Tanzania. How do you know if it contains reliable information?

Evaluating and representing geographical data visually

Geographers often present the information they gather during their inquiries in a number of different ways. They make maps, create graphs and tables or even draw diagrams to help them look for patterns in the data they have gathered. These tools help the geographer analyse and interpret the information they have gathered, and also present the information to other people (the general public, the government, the media) and help them understand the geographer's findings.

Maps

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

Topographic maps

A piece of paper only shows two dimensions: width and length. However, the Earth's surface has a third dimension: height. Cartographers (map drawers) use a variety of methods to show this third dimension.

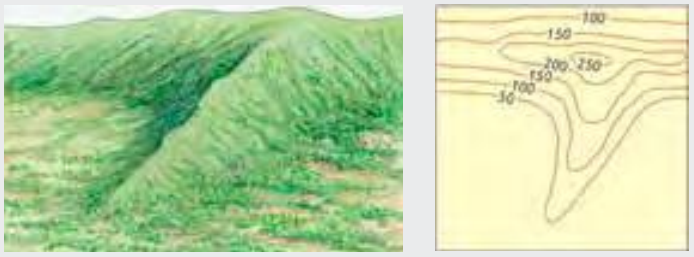
Topographic maps are one of a geographer's most useful tools. Because most topographic maps are drawn of a small region they can show that region in great detail right down to individual buildings and rocks. They also show the height of the land above sea level through the use of **contour lines** which join together all places of an equal height. By learning to interpret the contour patterns made by these lines you can work out the shape and height of the land that has been mapped (see Source GT.16).

ROUND HILL OR VOLCANO

VALLEY

RIDGE

SPUR



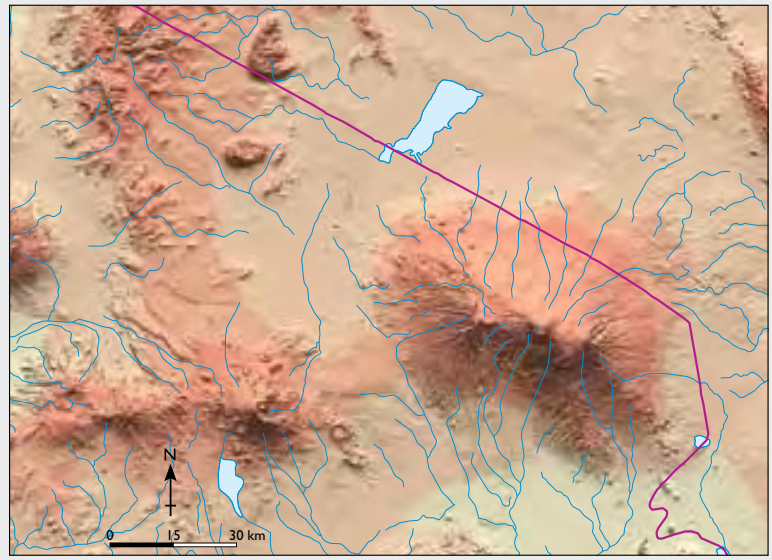
CLIFF

PLATEAU

Source GT.16 Common contour patterns

Digital maps and terrain models

There are about 6000 man-made satellites orbiting the Earth. Many of these collect digital data about the shape and height of the land and transmit it back to computers on the ground. This data is then interpreted and can be used to draw maps. Cartographers can use computer programmes to add colours to these digital maps to highlight certain aspects of the environment. In Source GT. 17, for example, the land has been shaded according to its height. The data can also be manipulated in other ways. In Source GT. 18 it has been used to create a side view of the landform being mapped. This type of illustration is known as a digital terrain model.



Source GT.17 In this digital map of the Mount Kilimanjaro region land has been shaded according to its height above sea level. Shadows have also been added to help map users understand the shape and height of the land.

Source GT.18 This is a digital terrain model of Mount Kilimanjaro and the surrounding area. The data was collected by a NASA space shuttle and an orbiting satellite. Cartographers have exaggerated the height of the landform so that it appears twice as high as it actually is.

Cartograms

You will have already seen **cartograms** in the course of your geography studies. These are the maps which look distorted and have areas that appear thinner or more enlarged than they would normally be, depending on what they are showing. Cartograms are sometimes called 'value by area' maps, which means the spaces on the maps are distorted to show a representation of a value rather than land area.

For example, while Vietnam is a relatively small country in terms of land area, it is the fifth largest rice growing country, so it would be exaggerated to a much greater relative size in a cartogram. The United States of America, which actually has a much larger land mass than Vietnam, is the 10th largest rice producer, so would appear much smaller than actual size on a cartogram.

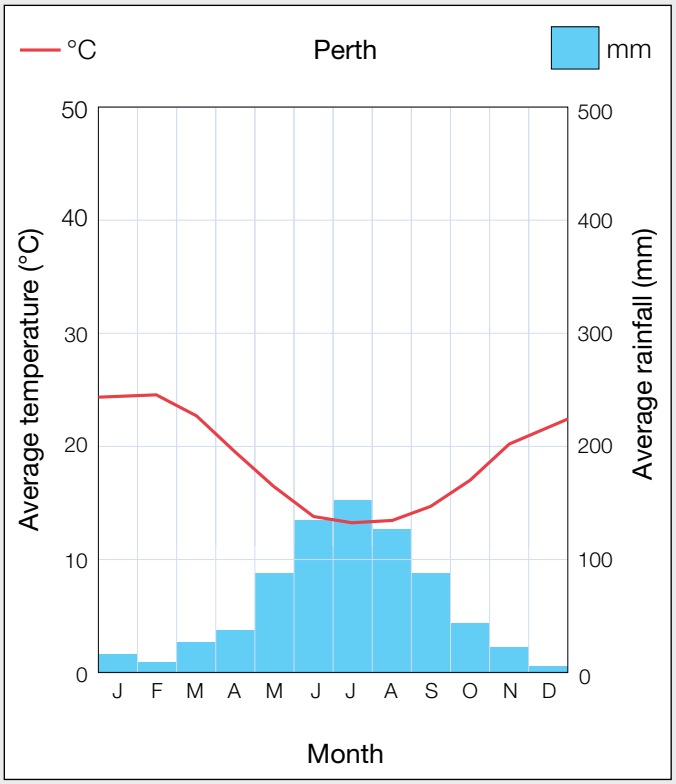
Source GT.19 This cartogram shows the percentage of the population living on more than US$200 a day. The distortion shows that the United States has many more people living on this amount than Asia does.

Graphs

In Years 7, 8 and 9 you will have learnt how to create and interpret simple graphs, such as **bar graphs**, **column graphs** and **pie charts**. In Years 9 and 10 you will be working with more complex graphs. You won't necessarily be creating these kinds of graphs yourself, but you will be learning how to interpret them and make sense of the information they provide. A range of complex graphs are described below.

Climate graphs

Climate graphs show the general climate of a place – what the weather is like overall in a certain location, graphing the average monthly temperature and over the course of a year (or other set period of time) (see Source GT.20). Climate graphs combine line and column graphs. Temperature is recorded as a **line graph** and rainfall is recorded as a bar graph.

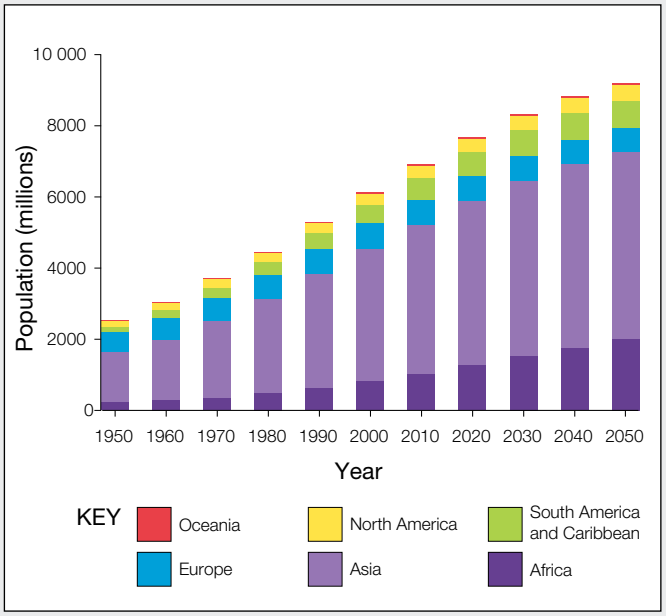


Source GT.20 A climate graph showing the average monthly temperature and rainfall in Perth.

Compound column graphs

A **compound column graph**, sometimes called a stacked column graph or stacked bar graph, is used by geographers to compare the parts of something to the whole. They are a more complex type of column graph in which each column is split into sections. The results are then stacked on top of each other, in different colours or different shades of a colour, so that results can be easily compared (see Source GT.21).

Each column in a compound column graph represents a total, and each different coloured segment represents a part that makes up that total. The graph in Source GT.21, for example, shows the total increase in world population, from 1950 projected up to 2050. Of the total increase in population, it is immediately clear that Asia, coloured light purple, has experienced and will continue to experience the greatest growth. It is also immediately clear that Oceania, coloured red, has experienced very small population growth in comparison. Presenting the information in this way means we can quickly see and compare a number of figures that contribute to a total.

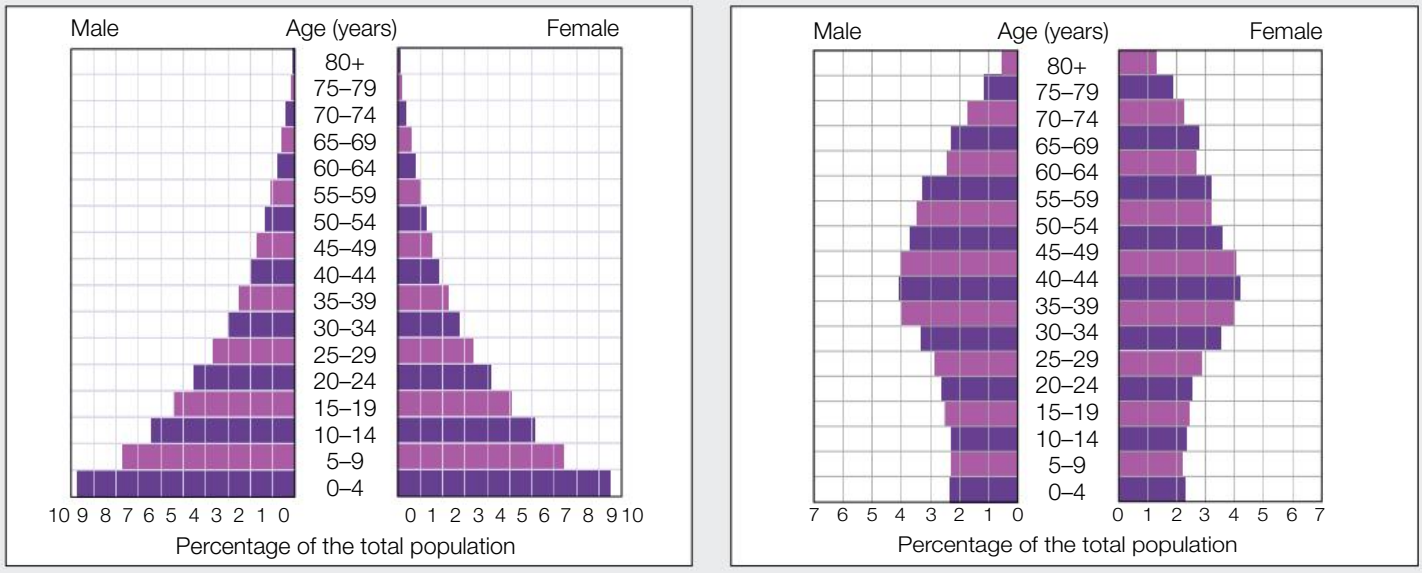


Source GT.21 A compound column graph showing the increase in world population by region, 1950–2050 (columns on the right provide projections).

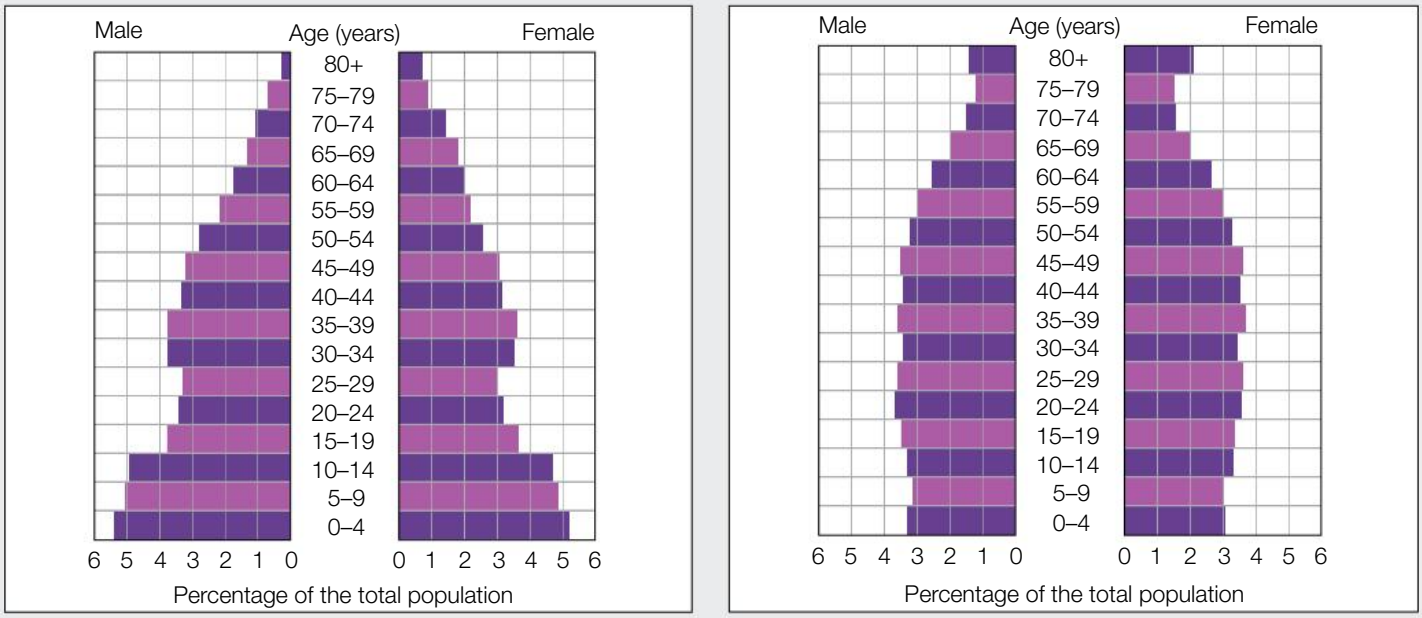
Population pyramids

Population pyramids are horizontal bar graphs that show the proportion of men and women in different age groups in a population. They can be used in a number of ways. Most commonly, they are used to compare the population structures and growth rates of different countries. A triangular-shaped graph shows a population with a high birth rate – that is, the population in that country is growing – while a graph that tapers in (is narrower) at the younger ages indicates a population that is contracting or declining (see Source GT.22).

Population pyramids can also help geographers to identify the ways in which the population in a single country is changing over time. In these population pyramids of Australia's population, for example, it is clear that the percentage of Australia's population over the age of 65 increased between 1960 (see Source GT.23) and 2009 (see Source GT.24). Geographers describe this change as the ageing of the population.



Source GT.22 Population pyramids showing growing (left) and contracting (right) populations



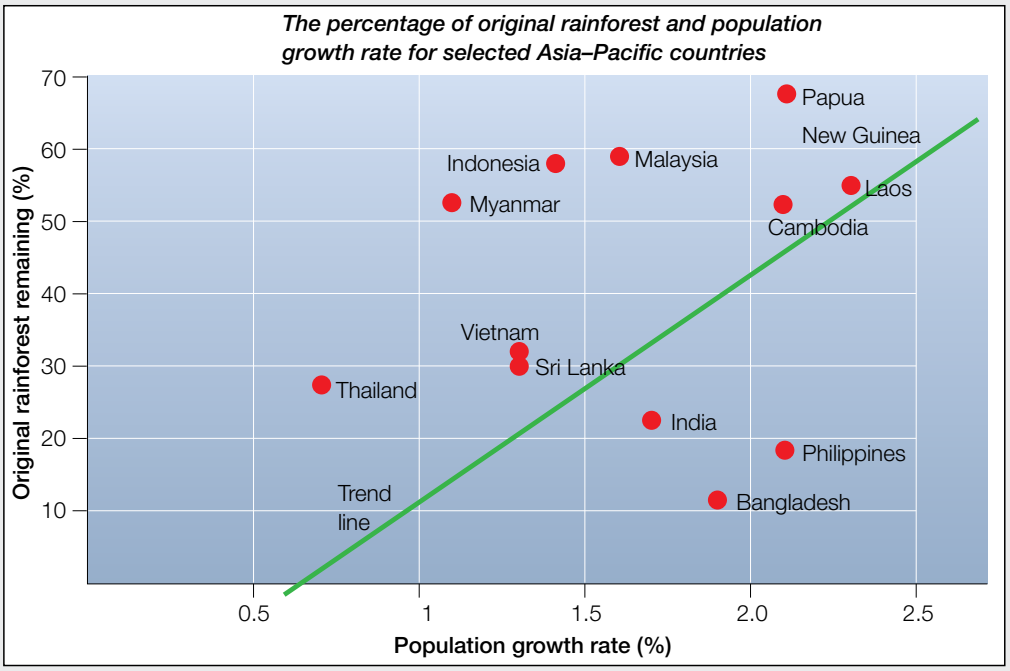
Source GT.23 Population pyramid for Australia, 1960

Source GT.24 Population pyramid for Australia, 2009

Scatter plots

Maps can be useful to show a pattern but they don't really explain that pattern. A special type of graph, called a **scatter plot**, or scatter graph, is a better way of doing this. A scatter plot compares two sets of data in a visual way so that connections between them can be easily seen. They are also called a scattergram. The following scatter graph compares the amount of original forest cover remaining in selected Asian countries with their population growth rate. It is essentially testing the theory that forests are more endangered in countries where the population is growing rapidly.

Because most of the countries lie close to the trend line in this graph it is possible to say that there is a relationship between the amount of forest in a country and the rate at which its population is growing. Countries with the fastest growing populations have the most rainforest remaining. Those countries that lie apart from the general trend such as Bangladesh are called outliers. A geographer studying this graph might use it as the beginning of a geographical inquiry into deforestation in Bangladesh.



Source GT.25 Scatter graph showing remaining forest and the population growth rate.

Check your learning GT.3

Remember and understand

1 Why is a website that ends with .edu more reliable than one that ends with .com?
2 What advantages do scatter plots have over maps?
3 What do population pyramids show? Why are they a useful tool for geographers?
4 Examine Source GT.25. In which of these countries is the population increasing most rapidly? How much original forest cover remains in this country?

Apply and analyse

5 What is the difference between primary sources and secondary sources of information? Is the CIA Factbook (see Source GT.15) an example of a primary or secondary source?
6 Using Source GT.17, describe the terrain of the region surrounding Mount Kilimanjaro. Do you think Source GT.17 is more useful for this task than Source GT.18?
7 Describe the differences between the population pyramids in Sources GT.23 and GT.24. What do these differences reveal about the populations at these two times?

Evaluate and create

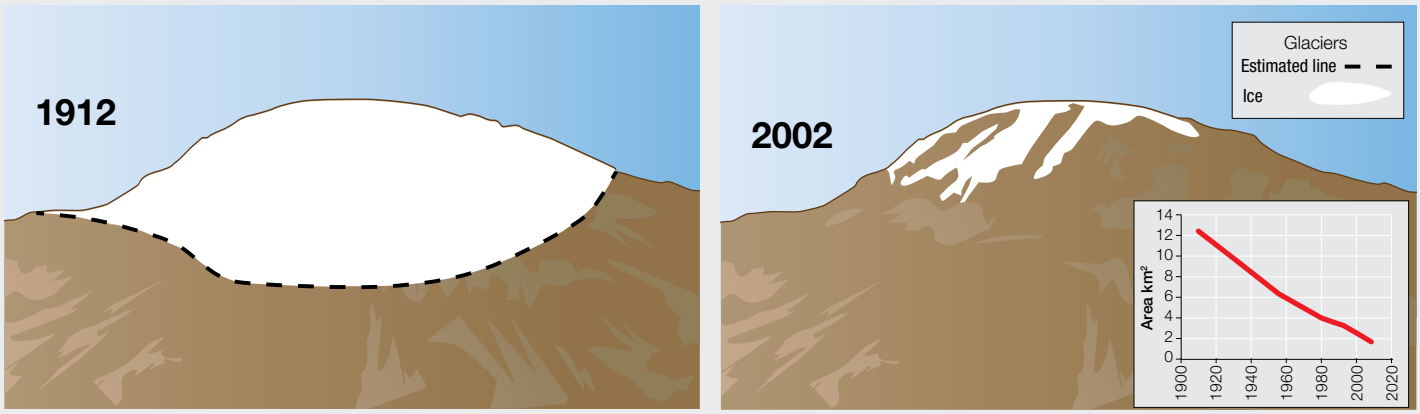
8 Examine Source GT.18. Sketch the probable contour pattern of the landscape shown. Use Source GT.16 as a guide to common contour patterns.
9 Research the size of the population of a country other than Australia over a ten-year period. Create a graph or graphs to present your findings.

Other graphic representations

In addition to maps and graphs, geographers use a range of other visual representations to communicate information they have collected. These include geographic diagrams, sketches, tables, geographic photographs and geographic information systems (GIS). These ways of presenting information allow geographers to communicate their findings in the most clear and appropriate manner.

Geographic diagrams

Geographical diagrams are simplified drawings of the real world. They allow geographers to show the features or characteristics of places or things much more directly than describing them in words. Certain interesting or complex processes can also be easily explained and demonstrated in a diagram, and communicated quickly and effectively by simple visual representation (see Source GT.26).



Source GT.26 This diagram shows the dramatic rate at which snows have melted on Mt Kilimanjaro.

Tables

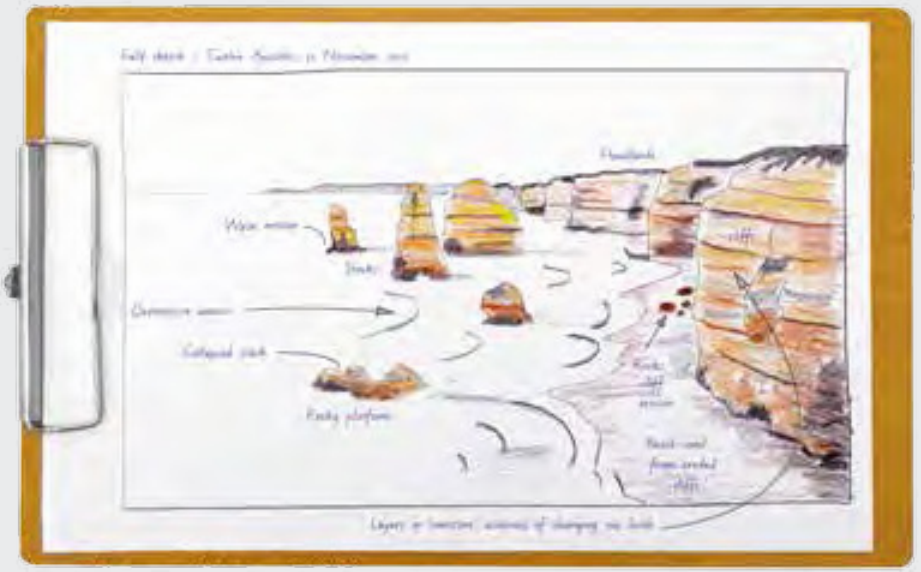
Tables allow geographers to present and compare data by organising it under different headings. Tables can be useful for presenting information over a range of time periods or locations.

Source GT.27 This table, based on data gathered by geographers in 2006, shows the change in area of seven glaciers (A–G) on Mount Kilimanjaro, 1912–2003.

Areas (10^3 m^2)	Glacier Area A	Glacier Area B	Glacier Area C	Glacier Area D	Glacier Area E	Glacier Area F	Glacier Area G	Total
1912	5676	3	27	5011	811	372	158	12058
1953	3829	0	16	2156	493	181	0	6675
1976	2440	0	0	1409	209	113	0	4171
1989	1900	0	0	1168	147	90	0	3305
2003	1304	0	0	1025	132	49	0	2510

Geographic sketches

A geographical sketch can be an extremely useful way of collecting information, and presenting it in a straightforward and immediate way. They are often completed in the field (and are known as field sketches) or are sketched from photographs. The aim of a geographic sketch is to focus on those parts of the environment that are relevant to the current geographic inquiry. For example, a geographer studying the role of waves in the erosion of a coastline would sketch the rocks and landforms of a beach (see Source GT.28) while another geographer studying tourism at the coast would sketch the buildings and roads at the same beach. Sketches allow the geographer to simplify information to make it easier to understand.



Source GT.28 Field sketches are useful for capturing information quickly and directly.

Geographic information systems (GIS)

A geographic information system (GIS) is a way of collecting, storing, presenting and using geographical data. GIS encompasses collecting geospatial data – real-world distance between landmarks, depth of sea level, height and width of buildings, layout of streets and suburbs – and presenting it through digital means. A car's GPS uses GIS data to allow you to navigate through the real world, using data that has been gathered using computer technology. GIS has many different applications and is used for planning, telecommunications, transport and logistics, to name just a few.

Source GT.29 Geographic information systems gather and present real-world geographical data using computer technology.

Geographic photographs

Geographic photographs differ from other types of photographs in that they are taken to depict and present a place or particular feature of the landscape for the purpose of demonstrating an aspect that you are studying. This is quite different from taking photos of you and your friends for fun, or even from taking an attractive picture of a landscape. Geographic photographs are used as a source of data.

Source GT.30 A geographic photograph demonstrates a particular aspect of a place or environment, like this one of the Mt Kilimanjaro glacier area.

skill**drill**

Collecting and evaluating geographic photographs

Geographers take photographs with the purpose of capturing a specific visual reference. This skill in geography is learning to capture a scene on camera that shows exactly what you want it to. You will not necessarily be taking the prettiest picture – you will be taking the picture that is relevant to your inquiry. Then, you can show the key features by adding notes or labels to your photograph. This is known as annotating the photograph. Annotating your photograph will help with your evaluation of the subject, too.

Step 1 Prepare for your session. Read the manual for your camera and get to know what your camera is capable of doing. Learn about exposure and how to frame your subject – there are plenty of tips online to help you with this. It is important to hold your camera steady, or you can practice using a tripod. This is especially useful when collecting photographs of the same place over a period of time.

Step 2 Decide on your subject and ensure you are photographing the relevant parts you want to feature. Select the features of the landscape that show important aspects of your geographic inquiry. Remember your key inquiry question. It could be something like, 'How does tourism impact on this environment?' If so, ensure you include evidence of any impact, like rubbish left along a shoreline. In the case of the photo shown here, the key inquiry question was, 'Are the glaciers becoming smaller because of natural or human factors?'

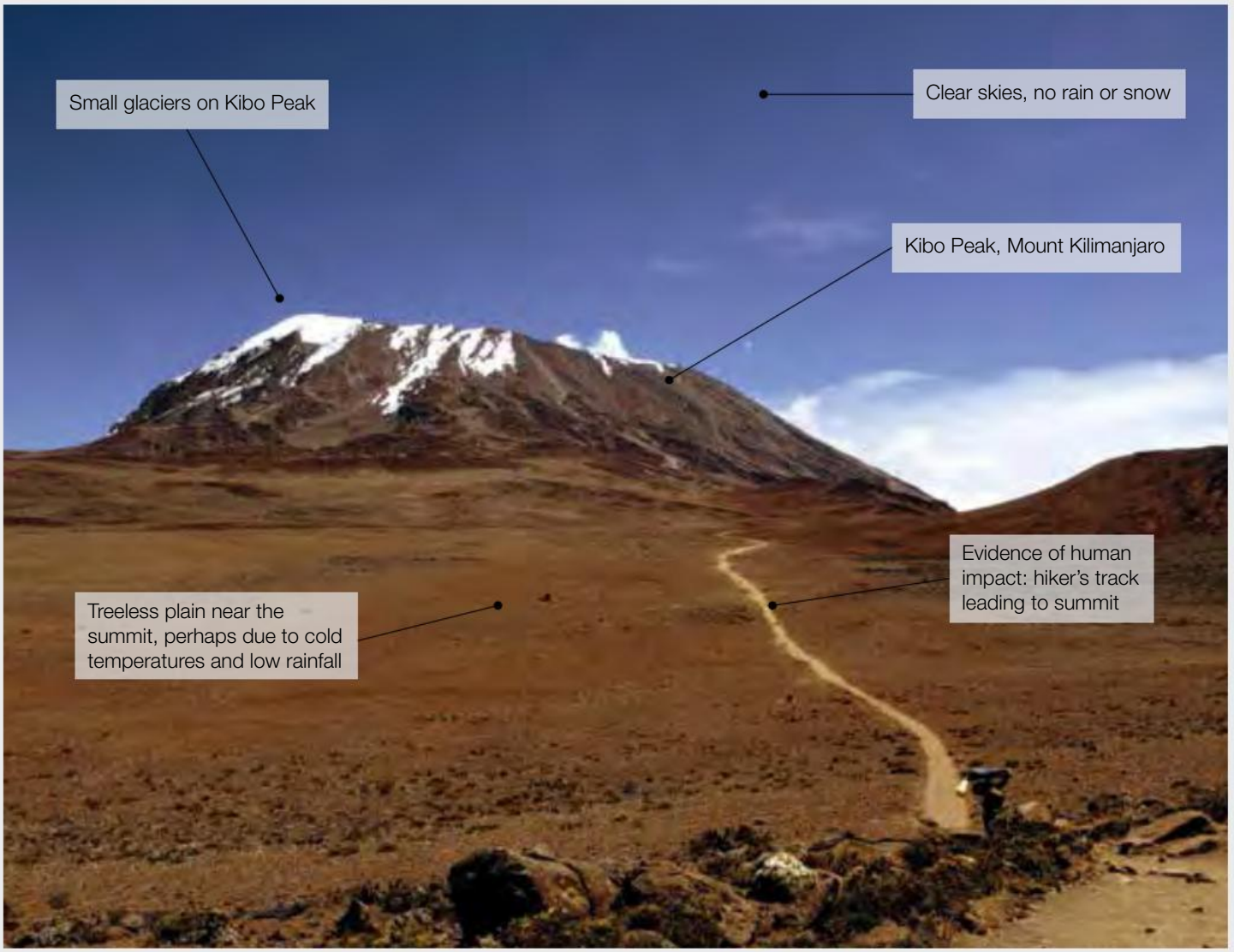
Step 3 Evaluate photo drafts as you go. Remember that your photograph is part of your geography **fieldwork** or study, and ensure that your photographs include the aspects you want to show. You might need to try photographing your subject from different angles, or from above or below it to capture what you are after.

Step 4 **Annotate** your photographs, remembering to focus on the topic of the inquiry. Write short labels that include the key features of the landscape. Keep your labels neat, relatively short and relevant to your inquiry. Note any observations you have and possible causes for changes or damage you note in the environment.

Step 5 Place your labels, taking care not to obscure important parts of the photograph. Space the labels around the photograph without making them too cluttered. Avoid having the lines from the labels crossing each other. If you think you have too many labels, go over them again and delete any you think aren't really relevant to your inquiry question.

Apply the skill

1. Prepare for a geographic photo session. Decide on a subject and head out to a natural environment such as a forest, stream or coastline with your camera. Evaluate your photographs as you go to ensure you are collecting the information you are seeking.
2. Annotate your photographs following the steps listed above. Choose your best three photos and set up a digital display on the school computer network or print them out and set up a wall in your classroom as a photo gallery.



Source GT.31 An annotated image of Mt Kilimanjaro

Interpreting, analysing and concluding

Once you have collected, recorded, evaluated and represented your information, it is time to make sense of it all so that you can reach some conclusions about the geographic questions that began your inquiry. Geographers look for order, diversity, trends, patterns, anomalies and relationships in their information. It can often help to classify information by sorting it into groups.

Using models to identify trends, patterns and relationships in geographical data

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

- PQE method
- SHEEPT method

Using the PQE method

PQE is a tool used by geographers to describe the data they have gathered (particularly on maps) and look for patterns in this data. The letters PQE stand for pattern, quantify and exceptions.

P – Pattern

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

When looking at any form of data, look for things that stand out or form patterns. A pattern may be a group of similar features on a diagram, a concentration of a particular colour or feature on a map, or a particular shape that is created by data on a column graph. For example, when looking at a map of Africa (see Source GT.32) you might say, 'the forests seem to be located mainly in Central Africa and Southern Africa'.

Q – Quantify

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

Quantifying involves using statistics, amounts, sizes and locations to give specific details. For example, rather than just saying, 'The most forest is located in the centre of the continent', you would need to quantify this statement. You might say instead, '240.3 million hectares of forest has been recorded in Central Africa, compared to 35.4 million hectares in East Africa'.

E – Exceptions

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

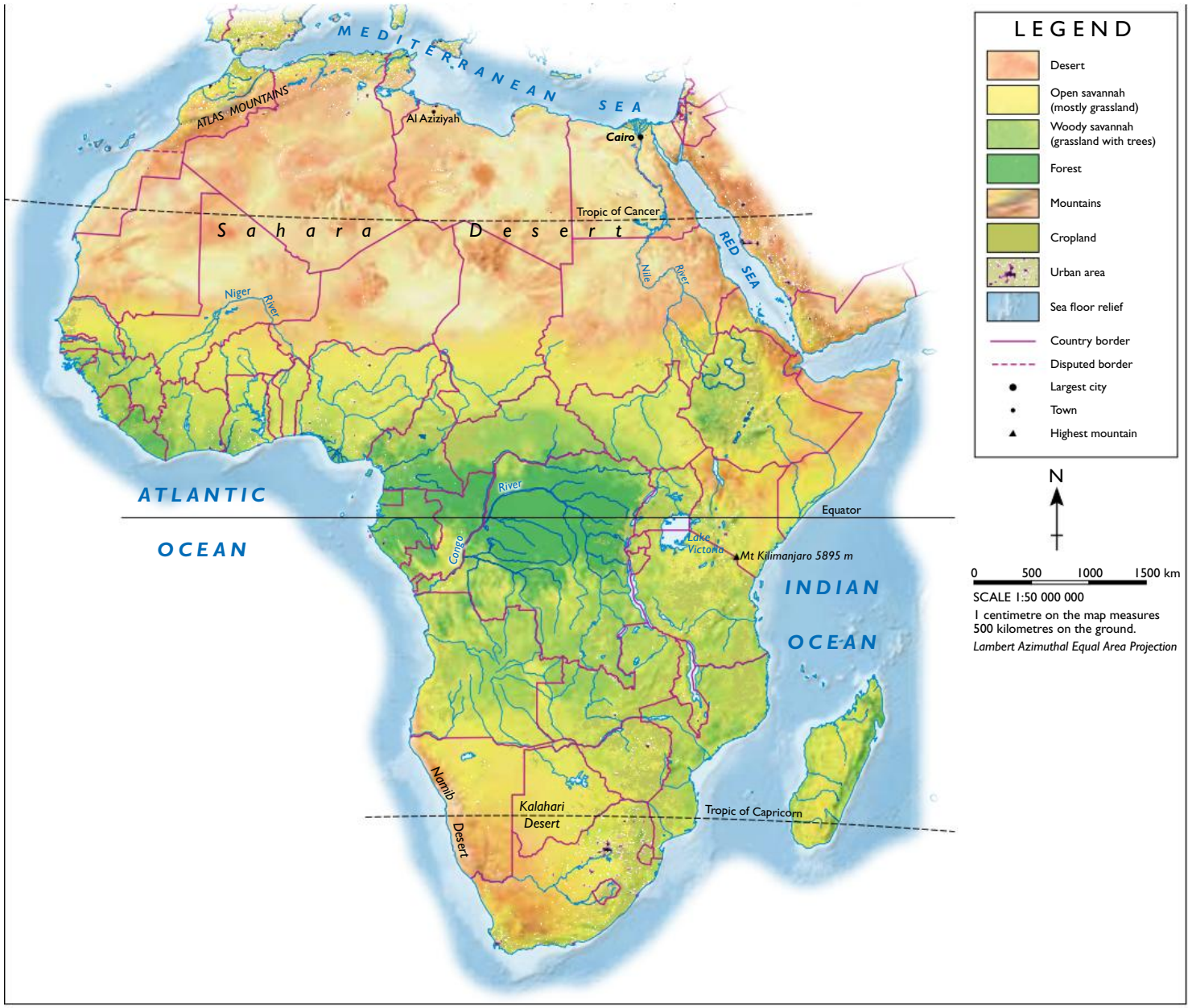
Often, you may find that there are things in your data that do not fit into a pattern you have identified. These are called exceptions. They also need to be identified and quantified. For example, you might say 'There are also forest regions located in North Africa and Western Africa'.

Using the SHEEPT method

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

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

AFRICA: ENVIRONMENTS



Source GT.32

Source: Oxford University Press

Check your learning GT.4

Remember and understand

1 What do the letters PQE stand for?

2 What do the letters in SHEEPT stand for?

Apply and analyse

3 Look at Source GT.32. Use the PQE method to think about Africa's deserts.
   - a Can you identify a pattern?
   - b Can you quantify this pattern?
   - c Are there any exceptions in this pattern?

Evaluate and create

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

5 Create a colourful and informative pictogram to help you remember what SHEEPT stands for using an image or picture for each of the 'SHEEPT' letters.

Distinguishing between quantitative and qualitative data

Primary and secondary data provide either **quantitative data** or **qualitative data**.

Quantitative data includes anything that can be recorded as numbers (for example, Mt Kilimanjaro is 5,895 metres tall and has an area of 753.5 km^2).

Qualitative data, on the other hand, includes anything that can be recorded in words (for example, Mt Kilimanjaro is the tallest mountain on the African continent).

Quantitative data

The PQE method uses mainly quantitative data.

Examples of quantitative data include:

- climate and temperature statistics
- tourist numbers
- population figures (including birth and death rates)
- types and amounts of food grown
- plant and animal species and wildlife in certain areas
- forest clearance rates
- numbers of people killed in natural disasters
- numbers of volcanic eruptions and earthquakes.

Qualitative data

The SHEEPT method uses mainly qualitative data.

Examples of qualitative data include:

- opinions
- points of view
- personal stories
- likes and dislikes
- feelings.

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

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

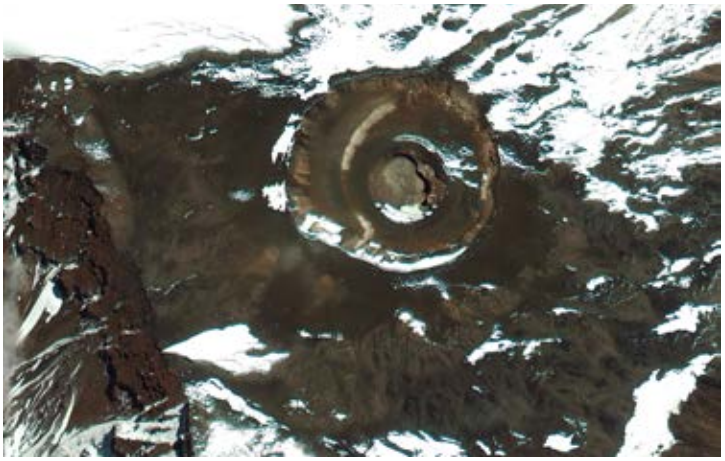
Using other methods to interpret geographical data

Analysing geographic photographs

Landscapes can be photographed from several different angles depending on the position of the camera at the time the photograph was taken. Each angle makes some features of the landscape easier to see and interpret than other features, so you need to carefully consider at which angle the photograph has been taken.

Source GT.33 This is a **ground level photograph** of Mount Kilimanjaro. The camera is being held by someone at the same level as the landscape being photographed. This angle allows you to clearly see the height of any object and the detail in vertical surfaces. However, objects such as the mountain and the tent hide the landscape behind them.

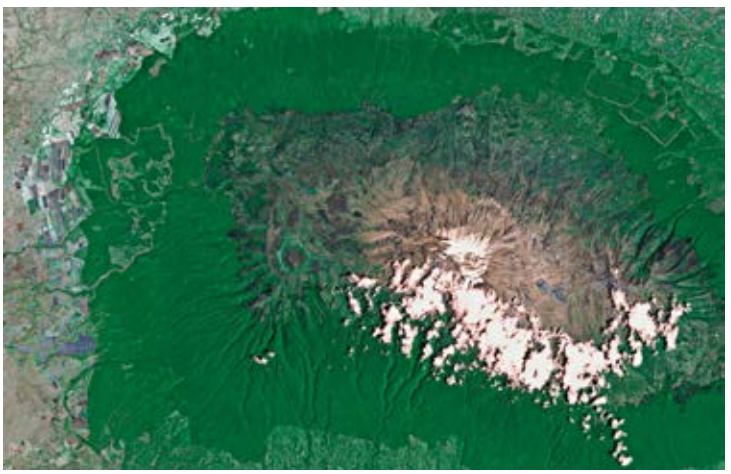
Source GT.34 In this **oblique aerial photograph** the camera is positioned above the landscape, but is angled towards the scene being photographed (oblique means 'at an angle'). This allows you to see both the foreground and the background of the scene. You can also see both the height of an object and its width or area. Objects in the background, however, seem much smaller than those in the foreground.



Source GT.35 In a **vertical aerial photograph**, the camera is positioned directly above the landscape. This vertical (or plan) view allows you to see the extent of any feature such as Kilimanjaro's crater. It is very difficult, however, to judge the steepness of the mountainside or the depth of the crater. Plan views are used for making maps, as the scale is the same over the area shown and similar objects look the same size.

Analysing satellite images

A satellite image is taken from space. It allows us to see large areas of the Earth's surface. These images are often used to investigate patterns such as the streams and rivers that radiate from Mount Kilimanjaro. It is difficult however to see smaller features of the environment.



Source GT.36 This image of Mount Kilimanjaro was taken by a satellite orbiting at 830 km above the Earth's surface.

Analysing false colour images

You may have heard the terms '**false colour image**' or 'false colour map' before. The term 'false colour' does not mean the colours used in an image are incorrect, it just means different colours have been used to make the image or map easier to interpret. The cartographer or person working on the image has chosen colours that make some aspects easier to see or understand than a normal 'natural' photograph or map would be.

The colours used in a false colour image can be quite exaggerated and unnatural-looking. This is because the colours of the natural features are too similar to demonstrate a particular point or aspect. If someone is trying to show where a muddy brown river meets a brown-coloured riverbank where there are brown rocks and some brownish shrubs, they might decide to use false colour to clearly show where the different elements are. In that case, they may decide to make the shrub areas bright green, the river a neon yellow and the rocks a bright red, leaving just the river bank brown.

You should examine the accompanying legend to interpret the colours used in a false colour map.

Check your learning GT.5

Remember and understand

1 What is an oblique aerial photograph?

2 What are some of the advantages and disadvantages of using a vertical aerial photograph?

Apply and analyse

3 Which type of photograph would you take on a field trip?

4 Some geographers are very interested in the amount of snow and ice on Mount Kilimanjaro, as it has been gradually declining for several decades. Which type of photograph do you think would be most useful to show the decline of the total area of the mountain's snow and ice?

Evaluate and create

5 The oblique aerial photograph (Source GT.34) was taken in 1991 and the ground level photograph (Source GT.33) was taken in 2009.

- a How has the mountain top changed in this time?
- b With a partner, discuss some geographic questions you could ask to investigate why the mountain has changed in this time. Don't worry about the answers; just concentrate on writing some good questions.
- c Share your questions with the class. List three questions from the class discussion that you think could be the beginning of a geographic inquiry.
- d Where could you find information to help you investigate these questions?

Communicating

During a geographic inquiry you may discover something new that other people should know about. It is important that you are able to communicate your findings clearly and effectively. There are several ways of doing this and you should select the method that best suits your audience and purpose:

- verbal methods, such as oral reports, discussions and debates
- audio methods, such as radio reports
- graphical methods, such as graphs, annotated photographs, sketches and satellite images
- visual methods, such as annotated visual displays or PowerPoint displays
- maps
- text-based methods, such as essays or paragraphs.

Check your learning GT.6

Remember and understand

1 Why is communicating an important part of a geographic inquiry?

2 List three ways you could communicate the findings of your geographic inquiry.

Apply and analyse

3 What do you most enjoy about other students' oral presentations? What do you least enjoy?

Evaluate and create

4 Imagine that you are preparing a PowerPoint presentation for your class on the decline of the glaciers on Mount Kilimanjaro. Write some notes outlining a rough plan for your presentation, including answers to the following.
   - What are some of the main points you would raise in your presentation?
   - What images from this toolkit would you use to illustrate these points?
   - What would the focus of your presentation be?

skill**drill**

Creating and delivering a PowerPoint presentation

Follow these steps to create and deliver a PowerPoint presentation with confidence.

Step 1 Gather the research for your geographic inquiry. This will include any written research materials, the sources you have used, results of any surveys or interviews, and a range of relevant images, graphs, maps or photographs.

Step 2 Plan your presentation. Decide what you would like to focus on.

Step 3 Time yourself. Your teacher will be able to tell you how long your presentation should be, so you should plan your presentation accordingly. For a 10-minute presentation you may need to include 10 slides and talk for about a minute on each one.

Step 4 Once you have worked out the length of your presentation and the content you would like to include, create your slides. If you aren't too familiar with PowerPoint there are plenty of online guides to help.

Step 5 Include a couple of bullet points on each slide. You can progress through the points quickly or take a bit more time on some points as you move through your presentation.

Step 6 Include a question caption with any photo slides. Having a question presented along with a photo helps engage the audience and promotes discussion.

Step 7 Practise your presentation. Practising will help you with your timing, and get you used to talking through your key points using the slides to support you. Make sure you are confident with the technology before you do your presentation in front of the class.

Step 8 Deliver your presentation, working through the PowerPoint slides you've prepared.

Step 9 Invite your audience to ask questions and do your best to answer them. Don't make up answers if you are unsure, just do your best.

Apply the skill

Prepare and deliver a PowerPoint presentation on an area of geography that you find interesting. It could be the local issue that you researched in the previous section, or something you have noticed in the news, such as the United Nations Intergovernmental Panel on Climate Change. Ensure you include some interesting visual elements like photographs or graphs, as well as your key points.

Reflecting and responding

Reflecting

The final steps in completing a geographical inquiry are to reflect on the results of your inquiry and the methods that you used. This is an essential step as it allows you to learn important lessons from any mistakes that you have made and apply these lessons in your next geographic inquiry. There are several ways to reflect on your geographic inquiry: looking at what you have learned, thinking about how it was learned, and asking critical questions about the way your geographic inquiry was conducted. One of the best methods to help you reflect is to complete a self-evaluation checklist.

The title of my geographical inquiry is: _____

My geographical inquiry set out to investigate: _____

GENERAL POINTS	My rating 1	2	3	4	5	Comments
I was able to complete all stages of my geographical inquiry	☐	☐	☐	☐	☐	
I was able to answer all my key inquiry questions	☐	☐	☐	☐	☐	
I was able to plan my inquiry effectively	☐	☐	☐	☐	☐	
My maps, graphs, tables and diagrams were clear and accurate	☐	☐	☐	☐	☐	
I was able to analyse my data and reach a conclusion	☐	☐	☐	☐	☐	
I was able to communicate my findings in an interesting and appropriate way	☐	☐	☐	☐	☐	

Source GT.37 A self-evaluation checklist is a very useful way of revising your geographic inquiry.

Responding

Geographers often use the information gathered and analysed in their inquiry for a specific purpose. This could be to report on an issue and educate people, to raise awareness of a potential problem, or to lobby local, state or federal government about a particular concern. This can be done via various means, from presenting official reports or studies, to using social media and starting an online petition. The work you do as a geographer can contribute to your environment, and responding and acting is an important part of this work.

If the results of your geographic inquiry lead you to recommend a plan of action, there are some important things to consider.

- Is it environmentally sustainable? Does the plan impact in a negative way on the natural environment and natural processes?
- Does it bring more economic benefits than it costs? Is it affordable in both the short term and the long term?
- Does everyone affected by this plan of action benefit from its outcomes or just a few people?

Case study

A geographic inquiry on the lower slopes of Mount Kilimanjaro found that many schools lacked a reliable supply of clean water for sanitation. Based on this inquiry, the members of several non-government organisations along with the local villagers laid hundreds of metres of new pipes and installed tanks and taps so that children at the schools could wash their hands before preparing food.

Source GT.38 Children at school near Mount Kilimanjaro using newly installed taps to wash their hands before preparing food.

Check your learning GT.7

Remember and understand

1 The self-evaluation checklist is one way to reflect on a geographic inquiry. What are two other ways?

2 Why are the findings of a geographic inquiry often useful to the community?

Apply and analyse

3 What geographic questions do you think began the inquiry that resulted in the new taps in the Tanzanian school shown in Source GT.38?

4 Why is it important that an action plan for change consider the issue of sustainability?

Evaluate and create

5 Create a checklist to assess your map-drawing skills.

GT.3 Fieldwork in geography

Why is fieldwork important?

A historian studying a period in the past will try to find primary sources of information such as letters or diaries to better understand that period. For geographers the field is an essential primary source of data. Books, websites and maps can give you some information about a particular place but they are usually secondary sources of information. To really understand a landscape or issue you need to go and see it for yourself.

A field trip can be a fun and exciting experience as you spend time with your classmates in an interesting place. As well as being fun, field trips are an essential part of your geography course. This is because **fieldwork**:

- helps you to better understand how the world 'works' as it builds a bridge between what you learn in a classroom and the world outside that classroom
- teaches you new skills, particularly in collecting information. Many of these skills, such as surveying and digital mapping, are in demand in the workplace.
- allows you to learn about the world in a new and different way. Not everyone learns well by reading books or answering questions in the classroom. Many students learn more by completing practical, hands on activities such as fieldwork.
- gives you the opportunity to discover how other people feel about their environment and to compare this to your own values and ideas about your world
- requires you to be organised and to work together with other people.

Source GT.39 You never know where fieldwork will take you! These geographers are using a drill to examine the age of the glaciers on Mount Kilimanjaro.

The skills associated with fieldwork

The aim of all fieldwork is to enable you to develop the skills of observation, information gathering, analysis and interpretation of different forms of data and communication of your results. The types of fieldwork you conduct will differ according to your chosen topic and the fieldwork site. All fieldwork is activity-based and inquiry-based. You will be:

- identifying different types of environments and the features within them
- describing what you see around you in geographic terms
- recording data from different sources
- sampling things like water quality and wind speed
- investigating why things are where they are
- comparing different features to see if there is a pattern
- calculating amounts such as water flow, number of different species of plants and animals, visitor numbers
- analysing different forms of data
- forming a more complete picture of the area you are studying
- communicating your findings.

All these activities are aimed at developing and improving your geographic skills and understanding

Fieldwork locations and inquiry questions

Fieldwork can take place in many locations and for a wide variety of purposes. The best locations tend to be where change is happening before your eyes. Rivers and coasts are popular fieldwork locations as the constant movement of water in these places changes the natural environment, often resulting in a response from people. Shopping centres, parks and city streets are also popular as the constant movement of people creates patterns, flows and changes. Source GT.40 provides examples of fieldwork locations and inquiry questions that can be the beginning of an investigation at some of these locations.

Source GT.40 Examples of fieldwork locations and inquiry questions for a range of topics

Unit	Fieldwork locations	Inquiry questions
Biomes and food security	Local farm	What crops or animals are grown on this farm? What makes this place suitable for this type of farming? How has the farmer changed the natural environment? What new technologies is the farmer using? How does this impact on the farm's productivity?
	Rural **urban** fringe	Is the city growing in this region? What are the main drivers of this growth? How has this impacted on food and fibre production in the past? What evidence is there for changing land use patterns?
Geographies of interconnections	Local business	How is this business connected to people in other places? How have new communication and information technologies changed this business? What is the size and shape of the region served by this business?
	Major shopping centre	How many businesses in this centre are foreign owned? Where are the goods offered in the shops in this centre manufactured? Where do the customers who use this centre come from? How is this shopping centre connected to people in other places?
Environmental change and management	River or stream	What natural processes are shaping this riverine or coastal environment? How do these natural processes impact on human activities? What human activities have changed the natural processes and environment in this place? How have these environmental changes been managed? How effective has this management been? What further management strategies could be used to better manage change in this place?
	Coast	
Geographies of human wellbeing	Two contrasting suburbs	What are living conditions like in these two suburbs? What are the similarities and differences? How can these differences be mapped? Why do these differences occur? How can wellbeing be improved in these places?
	Programme to improve wellbeing	What are the aims of this programme? Why does this programme exist? How successful is the programme in reducing inequalities in wellbeing? How could it become more successful? Could this programme be applied in other regions and places?

Conducting successful fieldwork

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

Stage 1 Observing, questioning and planning

Begin by looking at an issue or location and compile a set of related inquiry questions that you would like to answer. There are some suggestions in the previous table to get you started. Plan what information you will need to answer your key questions, how you will collect it and what equipment and skills you will need.

Stage 2 Collecting, recording, evaluating and representing

Plan your fieldwork so that you can collect the evidence and data that you will need. There is a range of geographic skills that are well suited to fieldwork. These include taking photos, drawing field sketches, conducting surveys and collecting data such as stream and pedestrian flows. You need to consider ethical principles such as people's right to confidentiality and the right to refuse to take part in a survey. If your class is planning a field trip to a natural environment such as a forest or beach, you will need to ensure you do not damage the environment by trampling on plants or animals, or by dropping litter.

Stage 3 Interpreting, analysing and concluding

Analyse the evidence you have collected and look for patterns or clues that will help you to answer your inquiry questions. This is usually done in the classroom where you can more easily draw maps and graphs to interpret your information and reach some conclusions.

Stage 4 Communicating

Communicate what you have found to an audience in the form of a written report, an oral presentation or an annotated visual display (AVD).

Stage 5 Reflecting and responding

Think about your fieldwork findings and reflect on ways to improve your investigation process. Finally, decide on a course of action, if this is appropriate. This should take into account environmental, economic and social factors.

A fieldwork example: Lowecroft Vegetable Farm

In the following example, the Year 9 geography class (9GEO) at Gumtree College conducted fieldwork at a vegetable farm in their local area as part of a geographic inquiry into food security in Australia. This site was chosen because it is reasonably close to Gumtree College and the farmer's children attend the school.

Stage 1 Observing, questioning and planning

The students in 9GEO discussed a range of problems and issues that they could investigate and this lead to a brainstorm based on the unit of inquiry they were completing in class. They used the ideas generated from this brainstorm to develop a list of possible inquiry questions:

- How does food production on this farm impact on the natural environment?
- How does the natural environment impact on food production?
- What technologies does the farmer use to increase his food production?
- How does the food grown on this farm reach the consumers?
- How will food production in this region change in the future?

The students decided that all of these questions could be used for a geographical inquiry but they decided to focus on the second question about the role of the environment in influencing food production. This linked with their study of 'the environmental, economic and technological factors that influence crop yields in Australia and across the world'.

While some of the students in the class were from farming families, most were not. They had only limited understanding of the importance of environmental factors such as rainfall, frosts, temperature, seasons, drainage and soil type on food production.

Students planned what information they would need in order to investigate this issue. They decided that some information about rainfall and temperature could be researched using the Bureau of Meteorology website. They decided that they would only visit the vegetable farm once and during this time they should speak to the farmer and record the ways in which the natural environment has impacted on his production of food.

Stage 2 Collecting, recording, evaluating and representing

To investigate the impact of the natural environment on food production students set out to collect and record a range of geographical information.

- Before their field trip students collected data about temperature and rainfall from www.bom.gov.au ('climate and past weather'). They also used Google Earth and maps of the region to locate the farm in relation to environmental features such as streams and hills. They used these maps to draw a sketch map of the farm.
- Based on this data students wrote a series of questions to ask the vegetable farmer about how factors such as the seasonal pattern of rainfall and temperature highs and lows impacted on his crops. They also added questions about the type of soil and soil drainage to the local creek. They emailed these questions to the farmer before their visit.
- On the field trip students asked the farmer their questions and recorded his answers in their notes.
- They took photographs of the different crops grown on the farm and added these to their sketch map along with the location of irrigated paddocks, glasshouses and other buildings.
- They recorded environmental factors such as wind speed and **direction**, temperature and rainfall during their visit. They also sketched a soil profile that could be seen where a track had been cut through a low hill. Students also collected some soil to test the clay and sand content as well as the soil pH in class.

Source GT.41 Students from Gumtree College speak to the vegetable grower about the impact of climate on his food production.

Stage 3 Interpreting, analysing and concluding

Once they had converted their primary data into a range of tables, graphs and maps, the students analysed it much more easily and looked for patterns and trends that would help them answer their key inquiry question: How does the natural environment impact on food production?

They decided to break their inquiry into different environmental factors to simplify their analysis. This

also allowed them to conclude that some environmental factors were more important than others. The key conclusions were:

- Rainfall is a key environmental factor that affects this farmer and his ability to grow food. The seasonal pattern of rainfall in this region means that he must purchase water to irrigate his crops during summer. During winter and spring he captures water in large dams and uses this water in drier times of the year.
- The air temperature influences the type of crops he grows and the times of the year in which he grows them. Leeks and parsnips are mainly a winter crop whereas his other main crop, lettuce, grows best in summer.
- The farmer has large areas of hedges that are habitat to insects and birds. These help to control harmful insect pests. He also plants crops that naturally control some soil diseases.
- This farm is part of a much larger farming region that grows large quantities of food for Australia's cities. Farmers in the region, including the vegetable farmer visited by 9GEO, have flat land with fertile soil. In the past the area often flooded during heavy rains but a system of drainage ditches and levees have reduced this hazard. The farmers and local council maintain these ditches.
- There is little natural vegetation remaining in the region as it has been cleared for farming.

Source GT.42 Students doing fieldwork

Source GT.43 A student's sketch map of the farm showing the location of crops and other key features.

Stage 4 Communicating

Students prepared individual field reports based on their inquiry. Most completed this as a display folder containing their sketch map, photographs, climate graph and written conclusions. Several students presented their field reports as an Annotated Visual Display (AVD) and two gave an oral presentation to the class. One of these students included a short film that he had made while on the field trip.

This film and several of the written reports were sent to the farmer along with a letter thanking him for his time and expertise. A group of students wrote a report on the field trip and their conclusions for the school newsletter.

Stage 5 Reflecting and responding

Following the submission of their field report students reflected on their findings and the methods they used to reach their conclusions. They decided that the key inquiry question they had chosen was a good one because it allowed them to explore a range of factors rather than just one or two. Many students felt that visiting a farm on a field trip helped them better understand how farmers use both the natural environment and their own ingenuity to produce food they eat.

Some of the students felt that they would like to have explored the impact of this farm on the natural environment, particularly the impacts of fertilisers on the soil and streams of the region. They suggested that the class who visited this farm next year could explore this in more detail.

Source GT.44 An auctioneer sells a mob of sheep in Jamestown, South Australia. Saleyards such as these can be a great fieldwork destination as you can investigate the ways in which people and places are interconnected as well as where our food comes from.

Check your learning GT.8

Remember and understand

1. Is the information collected by the geography students an example of primary or secondary information?
2. Why do you think the geography students emailed their questions to the farmer before the field trip?

Apply and analyse

3. Examine Source GT.43. What features of the farm has this student chosen to focus on in her sketch map? Why do you think she has chosen these features?
4. Why would investigating the type of soil on Lowecroft Vegetable Farm help to answer the inquiry question?
5. What other information could the students have collected on the field trip to help them answer the inquiry question?

Evaluate and create

6. Why is fieldwork sometimes better than investigating an environment through secondary sources such as books and films?
7. Students from another geography class at Gumtree College visited a sheep sale as part of their investigation into food security in Australia.
   a. What inquiry questions could they investigate at a sheep sale?
   b. Work in a small group to describe the steps you would undertake to explore one of these questions using fieldwork.

GT.4 Careers in geography

In recent years there has been a marked increase in the number and range of jobs and careers that are linked to geography. This is likely to continue well into the future as there is a growing awareness of the importance of understanding our fragile environment. Many employers are also becoming more aware of the many skills that geographers have and the usefulness of these skills in a wide range of careers. Many geographers find that their skills and expertise are in such demand that they can easily find employment all around the world. There are many jobs and careers that are linked to your study of geography at school. Some of these are listed in Source GT.45.

Source GT.45 Studying geography can lead to many different careers.

Working outdoors	Caring for the environment	Other
Geologist	Coastal zone manager	Emergency management
Hydrologist	Wildlife conservation & management	Cartographer
Forestry	Community programme organiser	GIS/geospatial sciences officer
Farming	Environmental impact analyst	Geography analyst/ strategy consultant
Landscape architect	Environmental planner/ consultant	Social data analyst
National park ranger	Zoologist	Urban planner
Freshwater scientist	Defence (e.g. military planner)	Medical geographer/ health services planner
Surveyor	Heritage officer	Foreign affairs

Working outdoors

Many geographers spend most of their working life outside. Many of them had their first experience of this while at school during geography fieldwork. They are employed in a wide range of jobs in some of the world's most interesting environments. You will find geographers on oil platforms at sea, in outback areas of Australia, national parks, farms, forests and even on active duty as members of our defence forces.

Career profile: Daniel Moore – Surveyor

Daniel Moore surveys the ocean floor to locate ideal locations for structures such as oil rigs and wind farms. He uses a variety of methods and instruments including sonar, Remotely Operated Vehicles (ROVs) and GPS systems. This work takes him around the world, to locations such as the North Sea in Europe and the Timor Sea, between Australia and East Timor. As Daniel himself states, this is an important role as 'the world uses lots of energy and having good geographic data makes it much simpler to find'.

Daniel enjoyed studying geography at school 'because it wasn't just about maps, it was about analysing and using spatial information to find answers that weren't always easily accessible'. He completed a Bachelor of Geomatic Engineering and has found geomatics to be an area that is in high demand in the workforce. Daniel advises students to continue their study of geography into Years 11 and 12 as it helps each student 'learn critical thinking skills and analysis skills that can be transferred to limitless other applications. Students will learn how the spatial aspects of any situation can help explain the world.'

Source GT.46 Daniel Moore works on a survey ship off the coast of Western Australia.

Caring for the environment

Many of the Earth's natural environments are facing pressure from human activities. As the world's population and its thirst for resources increases, environments face an uncertain future.

Many geographers work to assess the impact of human activities on the natural environment and make recommendations about lessening these impacts. They work to make our use of resources such as water, soil and land more sustainable. This is one of the fastest growing areas of employment, not only in Australia but in many places around the world.

Source GT.47 These geographers are assessing the potential impact of an oil spill on the coastal environment. Caring for the environment is an important reason many people pursue a career using geography skills.

Caring for people

Geographers are interested in issues of social justice as well as environmental issues. They are informed, responsible and active citizens with an understanding of variations in living conditions and wellbeing.

This understanding, and a desire to help other people, helps them to find employment in a range of jobs. Many of these are involved in government and non-government organisations (NGOs) that work to improve wellbeing in local communities both in Australia and in other countries.

Source GT.48 Geographers have a vital role to play in disaster recovery and in helping communities to prepare for future disasters. This AusAID disaster specialist is explaining the importance of building earthquake-resistant buildings in Indonesia.

Check your learning GT.9

Remember and understand

1 What reasons does Daniel Moore give for continuing to study geography in Year 11 and Year 12?

2 Why is the number of careers in geography likely to increase in the future?

Apply and analyse

3 What geography careers shown in Source GT.46 are connected to the concept of sustainability?

4 What skills do geographers have that make them useful in helping communities recover from natural disasters?

5 Why do you think it is important for an environmental planner to have skills in geography? What key concepts do you think might be used frequently in this kind of career?

Evaluate and create

6 Select one of the careers from Source GT.46 that interests you. Research this career and prepare a one-page fact sheet that includes at least one picture. Include answers to the following questions in your career fact sheet.

- a What qualifications are needed in this career?
- b How does someone working this career use geographic skills and concepts?
- c What aspect of this career do you think is most attractive?
- d What kinds of tasks might be included in a typical day's work for someone in this career?

Biomes and food security

unit 1

Growing food

It may surprise you to learn that most of the world's people, including you, eat grass. It has been estimated that there are about 50 000 edible plants in the world, but of these, just 15 species provide 90 per cent of the world's food. Three types of plants, in particular, make up well over half of all food eaten each year and they are all types of grass: wheat, rice and corn. Every day, foods from at least one of these types of grasses will be consumed in different countries all over the world.

These hillsides in southern China have been terraced, or had flat 'steps' cut into them, to create flat land for growing rice, which is the most important staple food for more than half the world's population. Rice, like wheat and corn, grows in the **grasslands** regions of the world. Grasslands around the world share similar climate and vegetation features and are therefore known as a single biome.

1.1

What are the world's biomes?

1 Grasslands are an important biome for producing food. There are about seven other main biomes on Earth. How many can you name?

2 Grasslands have a climate that supports the growth of grass. What do you think are some of the features of this climate?

1.2

Why do some biomes produce more food than others?

1 What features of the landscape in Source 1.1 make this a productive area for the growing of food?

2 Virtually all of Australia's rice is grown on the flat river plains of southern New South Wales. How will rice farming in this region differ from rice farming in southern China?

Source 1.1 These mountainsides in China have had 'steps' cut into them to create flat areas for growing rice.

1.3

What are the environmental impacts of food production?

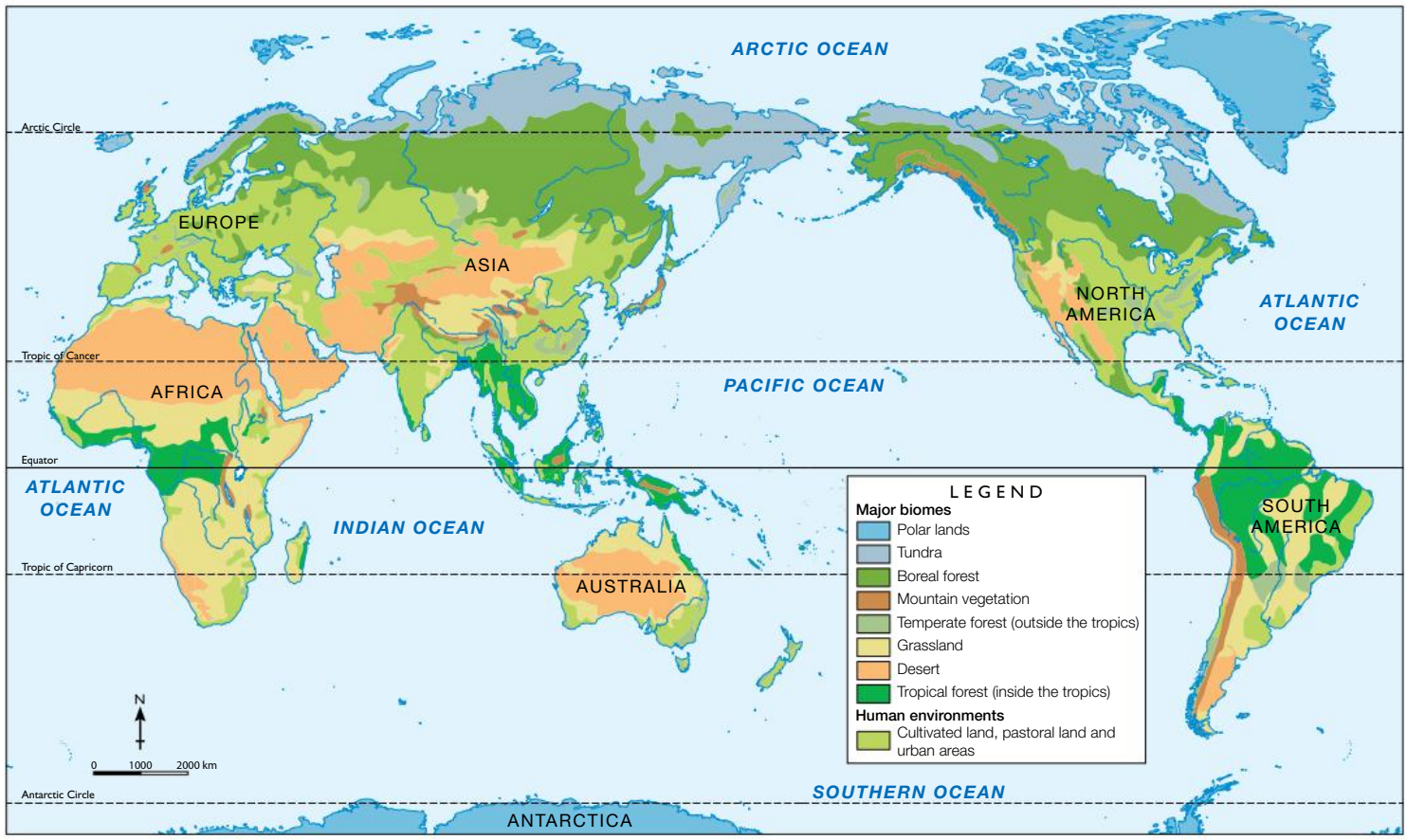
1 Describe the ways in which farming in this region of China has changed the natural features such as the shape of the land, the natural vegetation, the soil and the water.

1.1 What are the world's biomes?

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**.

WORLD: BIOMES



Source 1.2

Source: Oxford Atlas

Polar lands | Tundra | Boreal forest | Mountain vegetation | Temperate forest | Grasslands | Desert | Tropical forest

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.

In some biomes, such as **tropical forests** and **grasslands**, there is an abundance of 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 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, twice the size of Australia, 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.

Check your learning 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.

Evaluate 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, 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 'home to most species' to 'home 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 to other forests in more temperate regions or in the tropics.

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

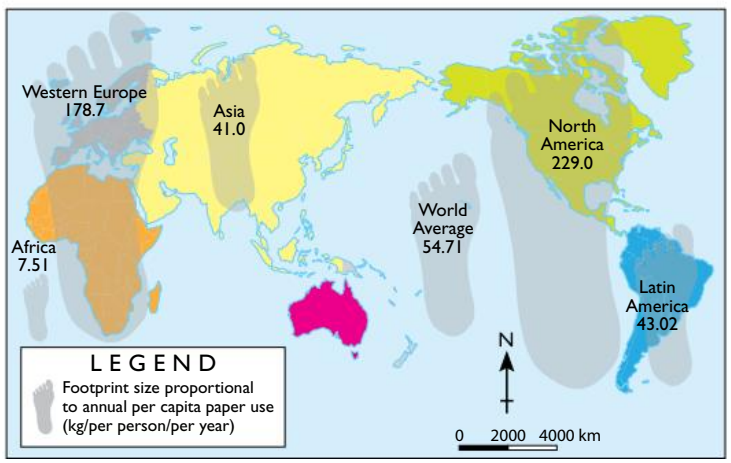
Boreal forests have provided many important resources for people both in the past and the present. Historically, wood for construction, heating and cooking came from boreal forest trees. More recently, boreal forests have supplied the increased global demand for cheap wood and paper, spurred by population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

Source 1.4 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.

WORLD: AVERAGE PAPER CONSUMPTION



Source 1.5 Source: Oxford University Press

Source 1.6 The spectacular deciduous trees in the town of Bright in Victoria's high country are mainly oaks and elms, native to England half a world away.

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.

Check your learning 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?

Evaluate and create

6 Examine Source 1.5, 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 to 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 lies 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 **savannas**. In Africa the grasslands are often referred to as savannas. In the United States of America they are often called prairies, and in parts of Siberia and south-eastern Asian, 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 which are farmed to provide meat and milk also live in the grasslands biome.

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 kind of grasslands inhabitant, 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 gray wolf which 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 1.7 Elephants on the savanna

Source 1.8 An Asian steppe

Source 1.9 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. As their main food source was bison, 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.

Source 1.10 With the arrival of the horse, tribesmen could hunt bison more easily.

Some tribes hunted bison by building fences from fallen logs, 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. However, life for Native Americans changed dramatically with the arrival of European explorers, and their horses, about 400 years ago.

Many tribes, including the Comanche, quickly realised the potential of the horse in their culture and soon became expert horsemen. As well as being faster and more nimble than a bison, the horse 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.

Source 1.11 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.

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'.

Check your learning 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 (Source 1.7, Source 1.8 and Source 1.9) from different parts of the world. In which countries do you think each of these photographs was taken? Give some reasons for your answers.

Evaluate and create

4 Compare the images of the grasslands with the pictures of deserts that appear in Source 1.19. What are some of the main differences between the two biomes? Explain why these differences occur.

The tropical forest biome

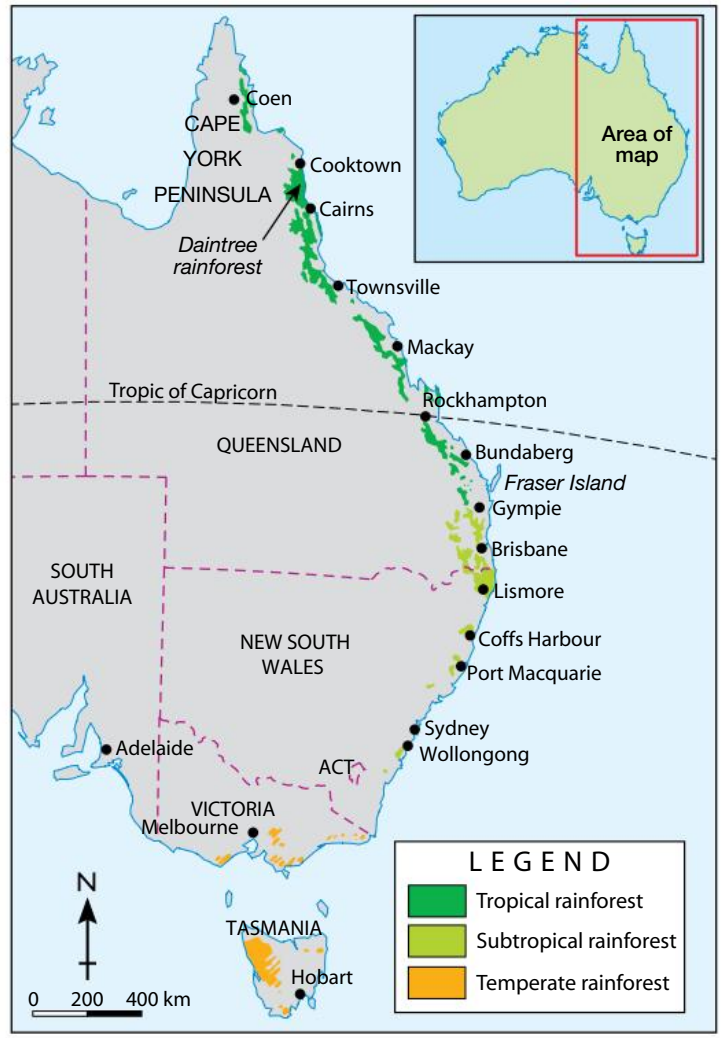
It is estimated that about half of all the plant, animal and insect species in the world live in tropical forests. Many of these are amongst the wettest places on Earth and are therefore known as **rainforests**. They can be considered to make up the world's richest biome and the abundance of life can 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 forty-three 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.

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 1.12). 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 occurred about 100 million years ago.

EASTERN AUSTRALIA: RAINFOREST REGIONS



Source 1.12 Source: Oxford University Press

Source 1.13 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.

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 1.14.

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

Source 1.15 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 amongst the world's tallest.

Check your learning 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?

Evaluate 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 1.16 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 because 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 expectation, that their plants do not thrive in these conditions as the soil provides few nutrients which 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 1.16 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.

Check your learning 1.5

Remember and understand

1 Look at the illustration of the rainforest in Source 1.16 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

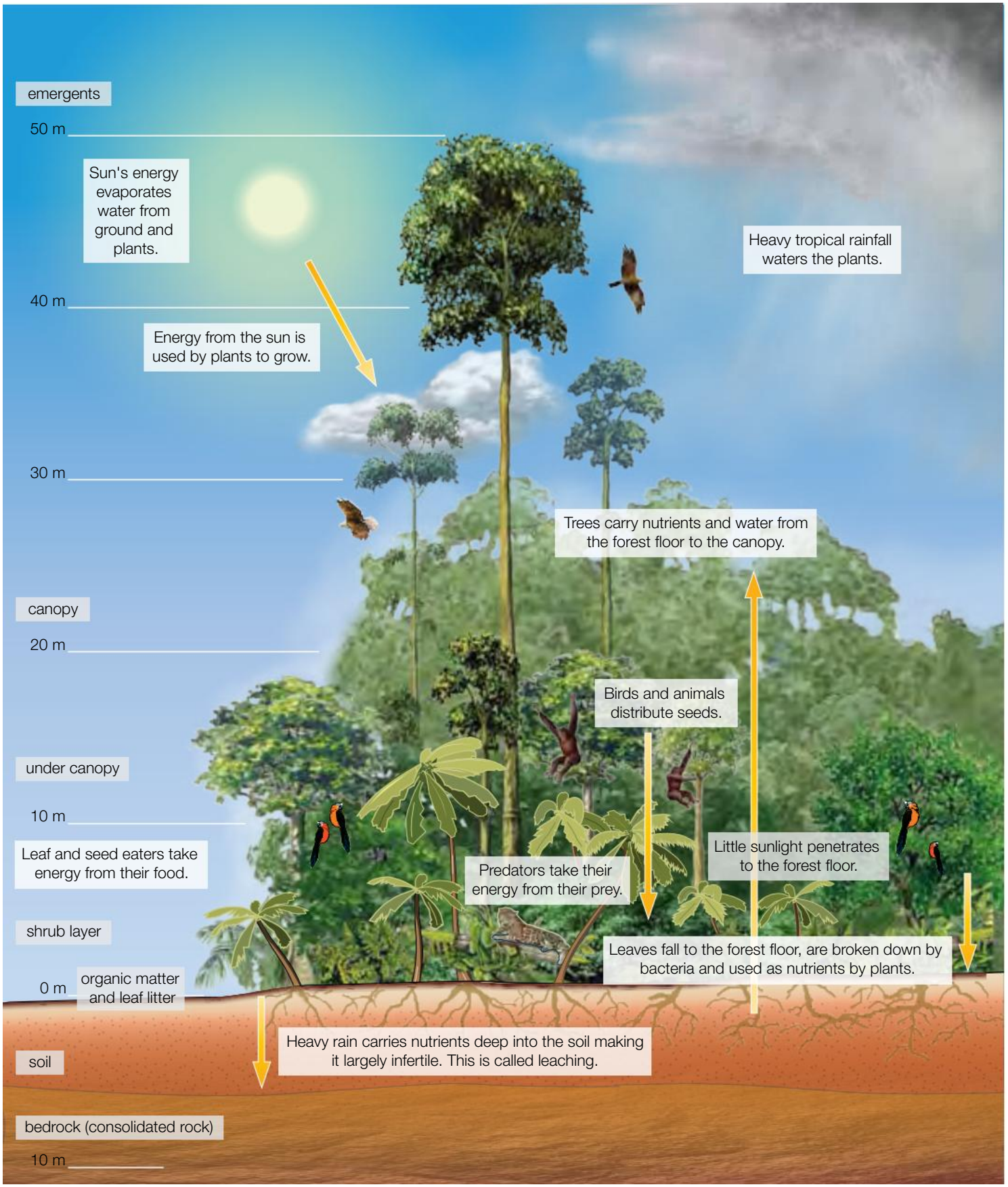
3 Why are rainforest soils poor in nutrients?

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

5 Describe how water is moved through the rainforest.

Evaluate and create

6 What changes of movement in energy and matter would result if the trees and vegetation in Source 1.16 were cleared to make way for farming land? Consider the living and non-living inhabitants of the ecosystem.



Source 1.16 Cross-section of a tropical rainforest

Australia's biomes

Australia is one of the world's largest countries. The northern part lies in the tropics, while Tasmania reaches towards Antarctica in the south. The sheer size of the land mass which spreads across much of the Earth's southern latitudes means that there is a wide variety of biomes in Australia.

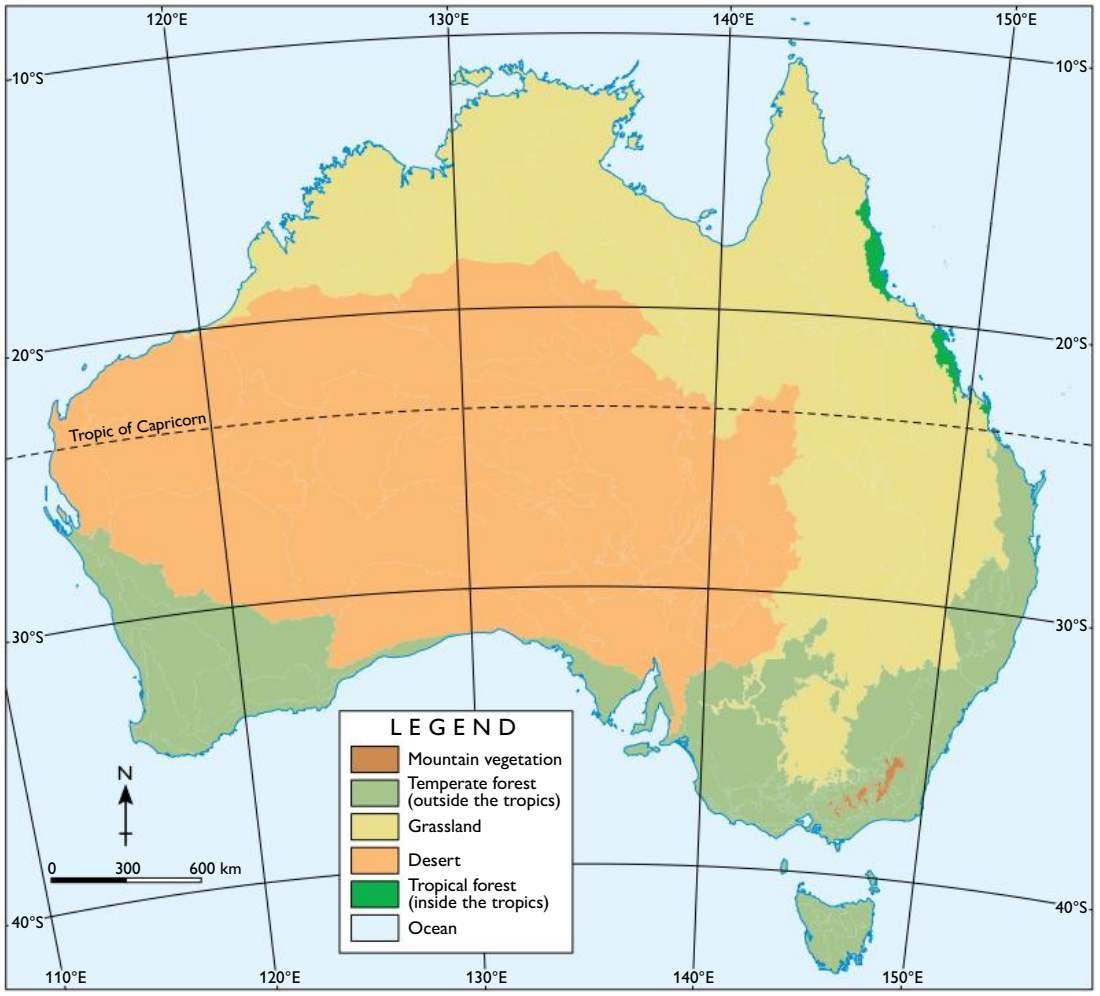
Many of Australia's original biomes have been changed by human activities. More than half of Australia's total land area is now used for food production, particularly sheep and cattle farming, covering 430 million hectares of land. This has resulted in significant changes to vegetation, land and water across much of the country. The following map 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 ten biggest Australian deserts makes up about 18 per cent of the total land area of our 'wide brown land'. We can also describe Australia as arid or semi-arid because 70 per cent of the continent receives less than 500 millimetres of rainfall each year. This low rainfall has resulted in large desert areas across much of Australia.

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

AUSTRALIA: BIOMES



Source 1.17

Source: Oxford University Press

Source 1.18 About one-third of Australia's total land area is used for cattle farming.

Source 1.19 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).

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, but some are covered in vast areas of stones, called gibber plains.

In most of Australia's desert areas, grasses and low shrubs dominate the landscape (see Source 1.19). 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 tough acacia trees, such as the mulga and witchetty bush, in evidence.

Check your learning 1.6

Remember and understand

1 Why is there a wide variety of biomes in Australia?

2 What is the dominant natural biome where you live? Describe some of the ways in which this has been altered by human activities.

Apply and analyse

3 Compare Australia's biomes in Source 1.17 with the world's biomes in Source 1.2 and answer the following questions.

- **a** Which biomes do not exist in Australia?
- **b** Give a reason for each of these biomes being 'missing' in Australia.
- **c** How has latitude influenced the distribution of biomes in Australia?

Evaluate and create

4 The world biomes map (Source 1.2) shows large areas of desert, while the three images in Source 1.19 show us that there are significant variations in landscape within the desert biome.

- **a** What are the limitations of describing places according to their dominant biome?
- **b** Why do you think there are such variations within the desert biome?
- **c** Research one of the other biomes to find out if such variations exist in that biome's regions too.
- **d** Construct a collage or create a PowerPoint display of Australia's major biomes. Include at least one image of each biome.

1.1 big**ideas:** broadsheet

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 World War II. 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.

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, examing Source 1.21, 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 (known as 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) x 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 therefore is south-west.

Apply the skill

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

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

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

4 Estimate the gradient and aspect for the slope between The Gap and Mount Victoria (197, 635).

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

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

Extend your understanding

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?

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 1.20 The rugged terrain of the Owen Stanley Range, Papua New Guinea

PAPUA NEW GUINEA: KOKODA TRAIL

Source 1.21

Source: Oxford Atlas

1.2 Why do some biomes produce more food than others?

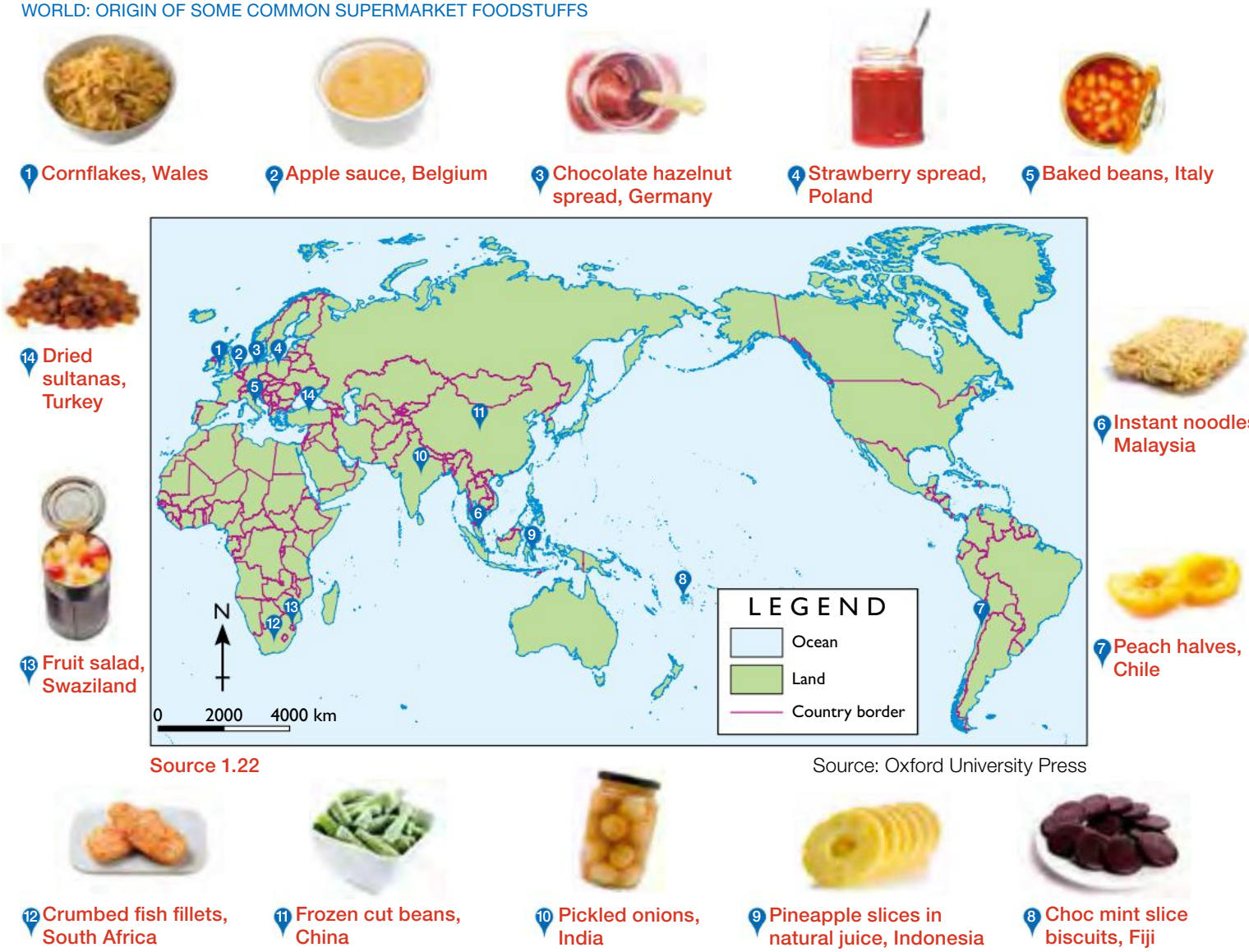
Where our food comes from

For many people in the world, the question of where their food comes from is easy to answer. Throughout the developing world, particularly in developing areas of Africa and Asia, the majority of food comes from what people grow or gather. People in these places spend much of their time planting, growing and harvesting crops or looking after a few animals, like sheep, goats or cows. These activities provide them with virtually all of their food requirements, from milk and meat to grains such as rice, wheat or corn. The crops they grow and the animals they raise are influenced by a wide range of factors but mainly by the climate in which they live.

In developed countries like Australia, the question of where food comes from is much more difficult to answer.

In fact, very few people across the developed world would be able to tell you where their food comes from.

WORLD: ORIGIN OF SOME COMMON SUPERMARKET FOODSTUFFS



Source 1.22

Source: Oxford University Press

This is because most people in these countries spend little or no time growing food. They rely on people in other places to grow food for them. Many Australians, for example, buy their food at a supermarket. But where does a supermarket get this food from? Labels on food give some indication, but these can be misleading at times.

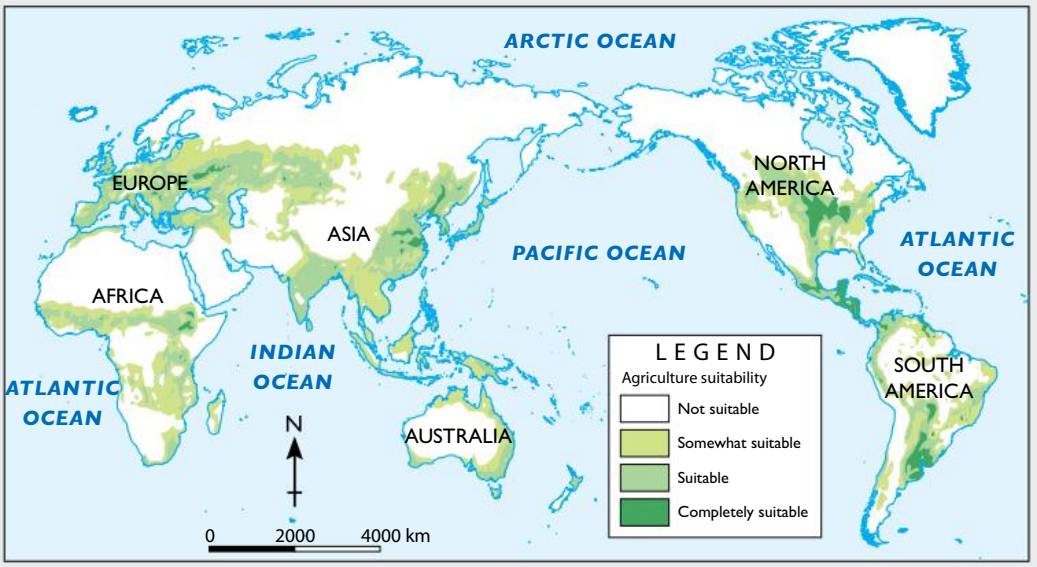
In a recent study, the origin of the home brand products sold in large supermarkets was studied in detail. The researchers found that about 50 percent of Coles' products and 38 per cent of Woolworths' products were made or grown in Australia with the rest coming from overseas. Source 1.22 shows the origin of some common foods sold in Australian supermarkets.

key**concept:** space

Agricultural suitability

Limitations of climate such as extremes in temperatures or low rainfall mean that many regions cannot support farming. Other areas may have low soil fertility, be covered in rainforest, be too mountainous or covered in ice caps. This means that the world's farms are concentrated in certain areas where the soil, climate and availability of water make farming possible. Source 1.23 ranks regions of the world in terms of their suitability for agriculture (i.e. completely suitable for agriculture to not suitable at all). Geographers use the key concept of space to better understand the patterns formed by agricultural use to make recommendations for the future.

WORLD: AGRICULTURAL SUITABILITY



Source 1.23

Source: Oxford University Press

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

Check your learning 1.7

Remember and understand

1 Why is it difficult for people in developed countries to know where their food comes from?

2 Using the scale provided, work out which supermarket item shown in Source 1.22 has travelled the furthest distance to be sold in your town or city.

Apply and analyse

3 Examine Source 1.23 carefully.

a Explain why each of the white areas in the following regions and countries may be unsuitable for agriculture: Australia, South America, North Africa, Central Asia.

b Compare the map showing areas of the world suitable for agriculture to the world biomes map (Source 1.2). Make some general statements about which biomes are most suitable for agriculture. Explain why you think this is the case.

Evaluate and create

4 What factors would be considered when making a map like Source 1.23 that show areas that are most or least suitable for farming?

5 Conduct research online to work out why Australian supermarkets source a large proportion of their products from overseas.

Making decisions on a farm

Every year, famers in different countries around the world make decisions about what crops they will grow and what animals they will raise on their properties. Before they make any decisions, they must consider a number of competing factors. They need to consider their own level of experience as a farmer, the types of machinery and help they have available, the cost of grain, the amount of rain forecast, the quality of the soil, the estimated price they will be paid for the crops they produce and how they will transport them to market. Broadly speaking, all of these competing factors can be divided into two main categories:

- environmental factors
- technological and economic factors.

Examples from each of these categories are provided in Sources 1.24 and 1.25.

Source 1.24 A range of environmental factors that need to be taken into account when making decisions on a farm.

Source 1.25 A range of technological factors that need to be taken into account when making decisions on a farm.

Check your learning 1.8

Remember and understand

1 How does the climate in a particular place influence farming practices there?

2 Name three soil properties that might influence successful crop growth.

Apply and analyse

3 Most farmers continue to practise the same type of farming year after year. Why do you think this is the case?

4 Select one of the environmental factors discussed in Source 1.24 and explain how an individual farmer may improve or adapt to this factor on his or her farm.

Evaluate and create

5 Consider all of the environmental, technical and economic factors discussed in Sources 1.24 and 1.25. Rank the factors a farmer needs to take into consideration from most to least important. Give a reason for each of your three top-ranked factors.

The importance of climate

More than any other factor, climate (especially rainfall and temperature) determines the type of farming that is practised in a given location. Some crops, such as rice and sugar cane, require warm temperatures and a reliable supply of water. Other types of farming, such as sheep and camel farming, can tolerate a wider range of temperatures and water supply (see Source 1.26). Farmers who share a similar climate, therefore, tend to practise the same type of farming. This leads to large regions of the Earth's surface being farmed in the same way.

In some places, farmers are able to use technology to overcome some of the limitations of climate. Many Australian farmers, for example, use water from rivers and dams to **irrigate** their crops rather than relying on natural rainfall. Others pump water from natural underground water storages called **aquifers**. Others use greenhouses so they can control the temperature and humidity, allowing crops such as flowers and vegetables to grow throughout the year.

Source 1.26 A nomadic farmer herds his camels in Ethiopia.

skill**drill**

Comparing patterns on maps

One of the most common ways that geographers analyse and explain the world around them is by looking for patterns in geographical data. For example, comparing patterns on maps they can examine the relationship between climate and farming.

To compare patterns on two maps, follow these steps:

Step 1 Look carefully at the first map, particularly the title and legend, so that you understand exactly what it shows.

Step 2 Repeat this for the second map.

Step 3 Look at each map carefully and note regions where there seems to be a correlation (relationship). For example, in Sources 1.27 and 1.28 one correlation would be: 'little or limited agricultural use' on the agricultural regions map (Source 1.28) relates to hot desert on the climate zones map (Source 1.27).

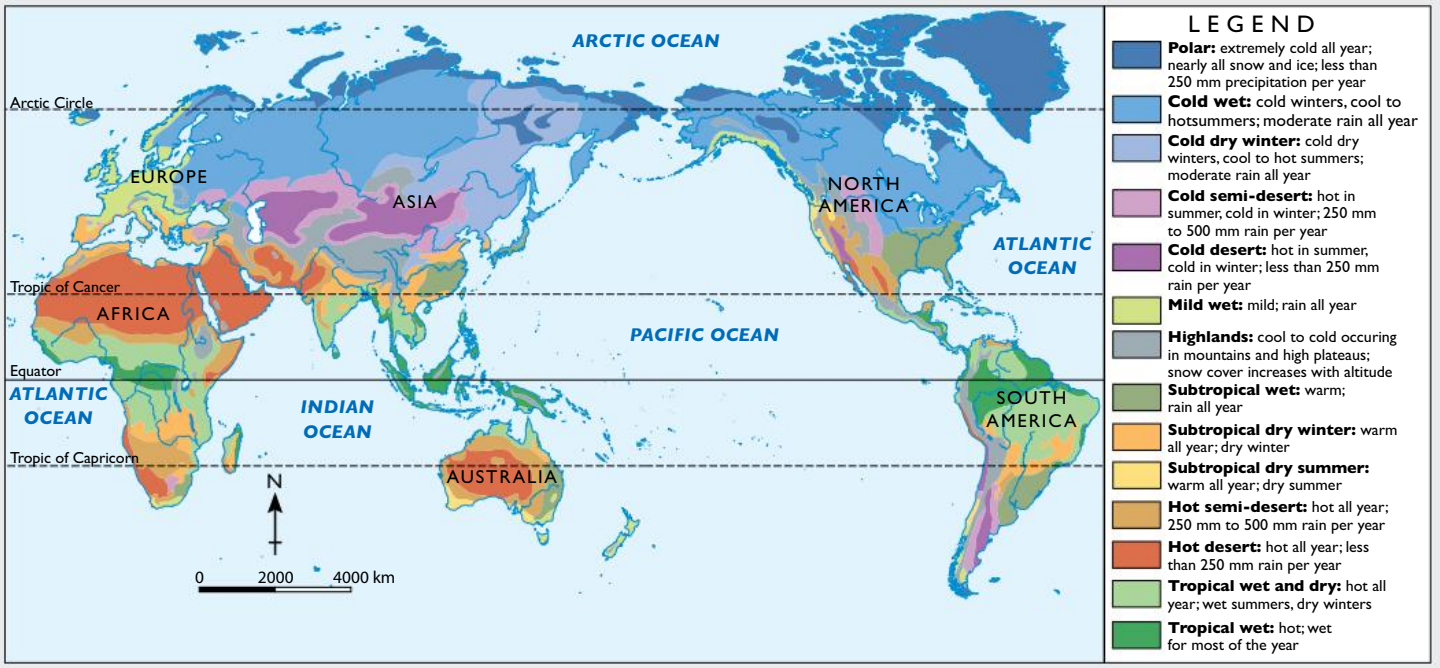
Step 4 Use an atlas map to find out the names of the places where this association occurs.

Step 5 Make a statement that sums up your associations. For example, rice farming is dominant in places with a subtropical climate such as north-east India and southern China where it is warm all year and has a dry winter.

Apply the skill

1 Use Sources 1.27 and 1.28 to account for the distribution of:
   - **a** dairy farming
   - **b** commercial – extensive livestock farming
   - **c** the pattern of agriculture in South America.

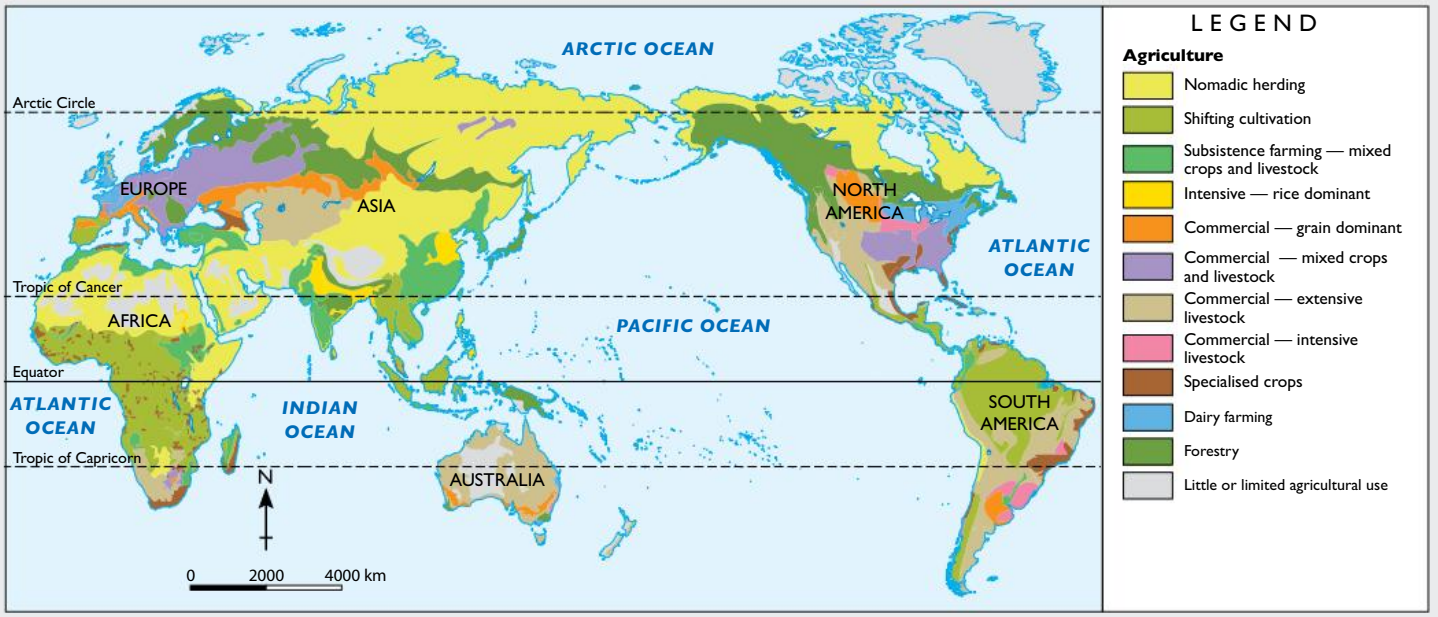
WORLD: CLIMATE ZONES



Source 1.27

Source: Oxford University Press

WORLD: AGRICULTURAL REGIONS



Source 1.28

Source: Oxford University Press

Check your learning 1.9

Remember and understand

1 How does the climate of particular places influence the type of farming practised there?

2 How do some farmers overcome the limitations of climate?

Apply and analyse

3 How might a farmer overcome the limitations of frost?

4 Describe the distribution of nomadic herding in the world. Account for this distribution using Source 1.27.

Soil – more than just dirt

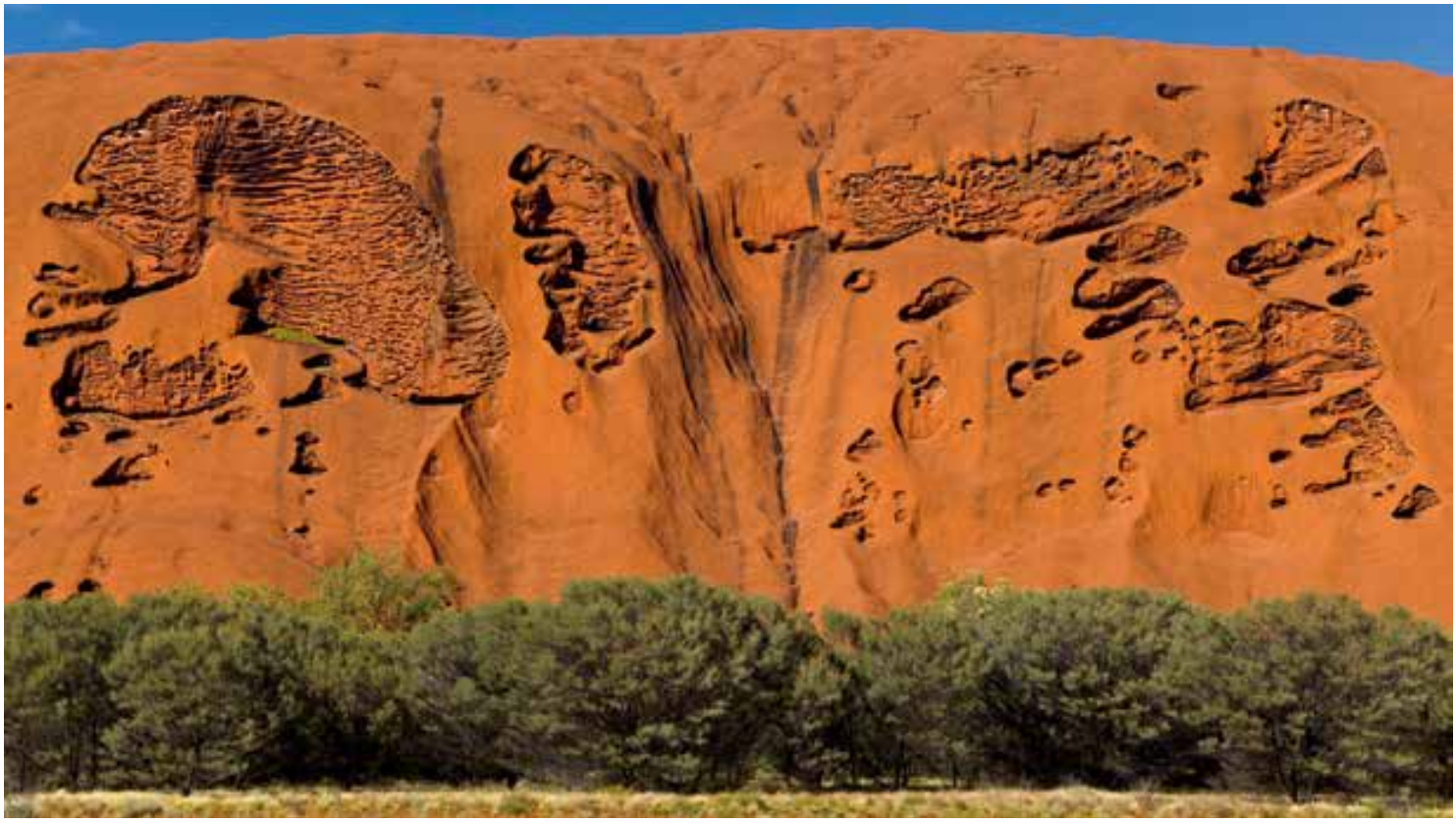
Many parts of the Earth's surface are covered in a thin, fragile layer of soil. Plants grow in this soil that feed every animal on Earth, including you. But what is soil and how are plants able to use it to grow?

Soil is a mixture of air, water, broken-down rock, and organic material such as tiny animals and plants. Soil is a non-renewable resource – it takes thousands, even millions of years to form. The first step is the gradual breaking down or weathering of rock. Rock weathers because it is subjected to physical forces and processes such as freezing and thawing, the expansion of roots, or because the rocks rub against each other in a stream or river. Movement of ice in a glacier, the flow of water in a river or ocean, or the force of wind can all cause rocks to weather.

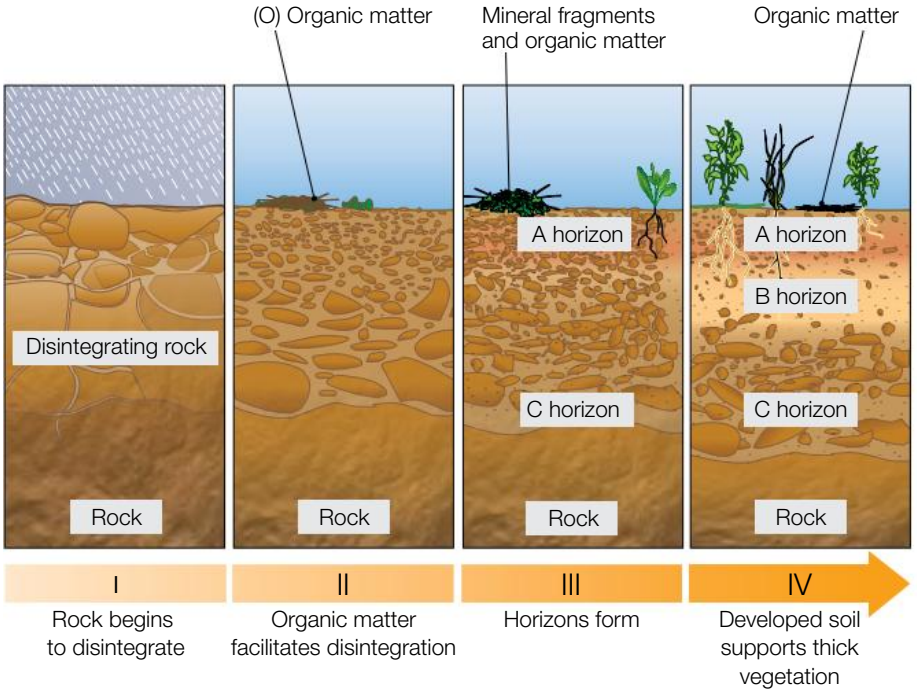
Rocks are also weathered by chemical changes that occur. Water can dissolve minerals found in rocks, reacting and forming new minerals which may then break down the rock itself. Oxygen also combines with some minerals to wear away rocks and the slightly acidic nature of rain can also help to dissolve rocks (see Source 1.29).

As rocks break down into finer and finer particles the minerals within them become available to plants. Seeds carried onto weathered rock by wind, water, animals and birds are able to germinate and send roots down into the new soil. As plants die and leaves fall onto the soil they decompose and add to the fertility of the soil. This allows other plants to flourish in the soil.

Over time, soils form layers known as **horizons**. These can be seen where a road has been cut through a hillside. By examining the horizons, soil scientists and farmers are able to determine how best to farm different areas. The horizons are labelled using letters so they can be easily identified and compared. From top to bottom, the horizons are O (organic matter), A, B, C and Rock (see Source 1.30). Some soils may have all the horizons, while others may have only one or two horizons. By identifying which of the horizons are missing in the soil, the farmer will know how and when to treat it. For example, if the soil is lacking organic matter, **mulch** can be added to increase mineral content and prevent water loss through evaporation.



Source 1.29 Like all rocks, Uluru is under attack from physical and chemical weathering. The desert soil in the foreground would be partly made up from weathered rock particles. Only shrubs and grasses are able to grow in this soil.



Source 1.30 The development of soil horizons over time

Source 1.31 Fertiliser containing nutrients such as nitrogen and phosphorus is usually spread using a tractor or truck.

Australia's soils

Australian farmers have to overcome the many challenges of a variable climate, with its extremes of droughts and floods. Perhaps the greatest challenge faced by Australian famers is the condition of the soil. As one of the world's oldest continents we also have some of the oldest soils on Earth. The constant weathering over millions of years has washed away many of the important nutrients and minerals and our soils are amongst the world's poorest.

As well as being much less fertile than other soils around the world, many of our soils are also much saltier than in other places. This is because much of the continent was once covered by ocean, and though the water has receded, the salt remains. Much of our soil is also composed of clay either at the surface or just below the surface. This restricts water drainage into the soil and makes it difficult for the roots of plants to penetrate.

Australian soils therefore are generally low in nutrients, thin and easily eroded. Australian farmers have developed many ways of dealing with these limitations. The most obvious of these is adding nutrients and chemicals to the soil that are missing (see Source 1.31). Farmers regularly test their soil and will add fertiliser containing those chemicals that their plants need. As crops grow they draw these nutrients from the soil and so farmers must continue to replace them, often applying fertiliser annually.

Check your learning 1.10

Remember and understand

1 Why are Australia's soils generally low in nutrients?
2 Why is soil an important natural resource?
3 Why do many farmers need to replenish the nutrients in the soil with fertiliser annually?

Apply and analyse

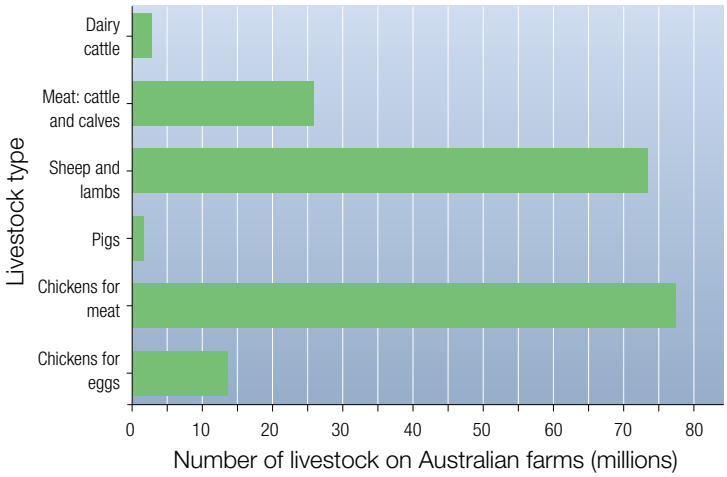
4 Look at Source 1.29. What physical forces do you think are weathering Uluru?
5 Is soil a renewable or non-renewable resource? Give some reasons for your answer.

Evaluate and create

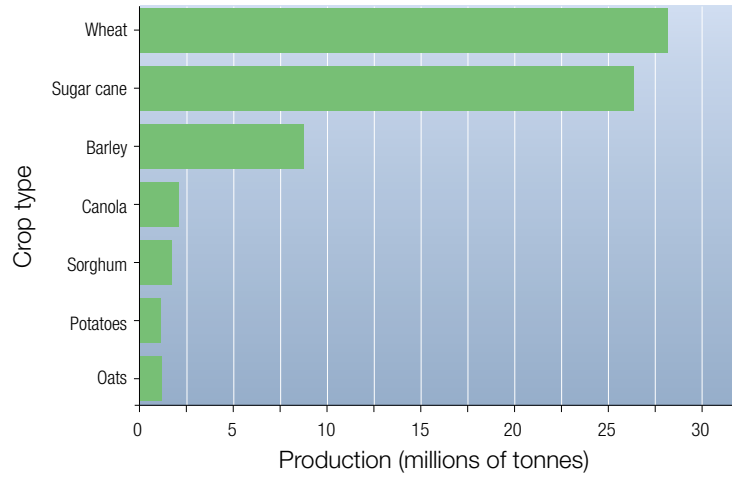
6 Construct a flow diagram with boxes and arrows describing how soil is formed.
7 Explore the soil profile in your local area. Look for a place where a stream has cut down into the soil or a cutting has been made for a road or railway. Sketch the soil profile and see how many of the horizons you can identify. Compare your profile to stage IV in Source 1.30. What are the similarities and differences?

Food production in Australia

There are more than 135 000 farms in Australia. They can be classified in many different ways, for example those that grow crops and those that raise livestock. Another way a farm can be classified is by how large it is in relation to the amount of food or fibre it produces. Farms that require large areas of land – to provide pasture for sheep or cattle, for example – fall under the classification of **extensive farming**. On the other hand, farms such as poultry farms or those that grow vegetables, can produce large volumes of food or fibre in a small area, and are classified as **intensive farming**.

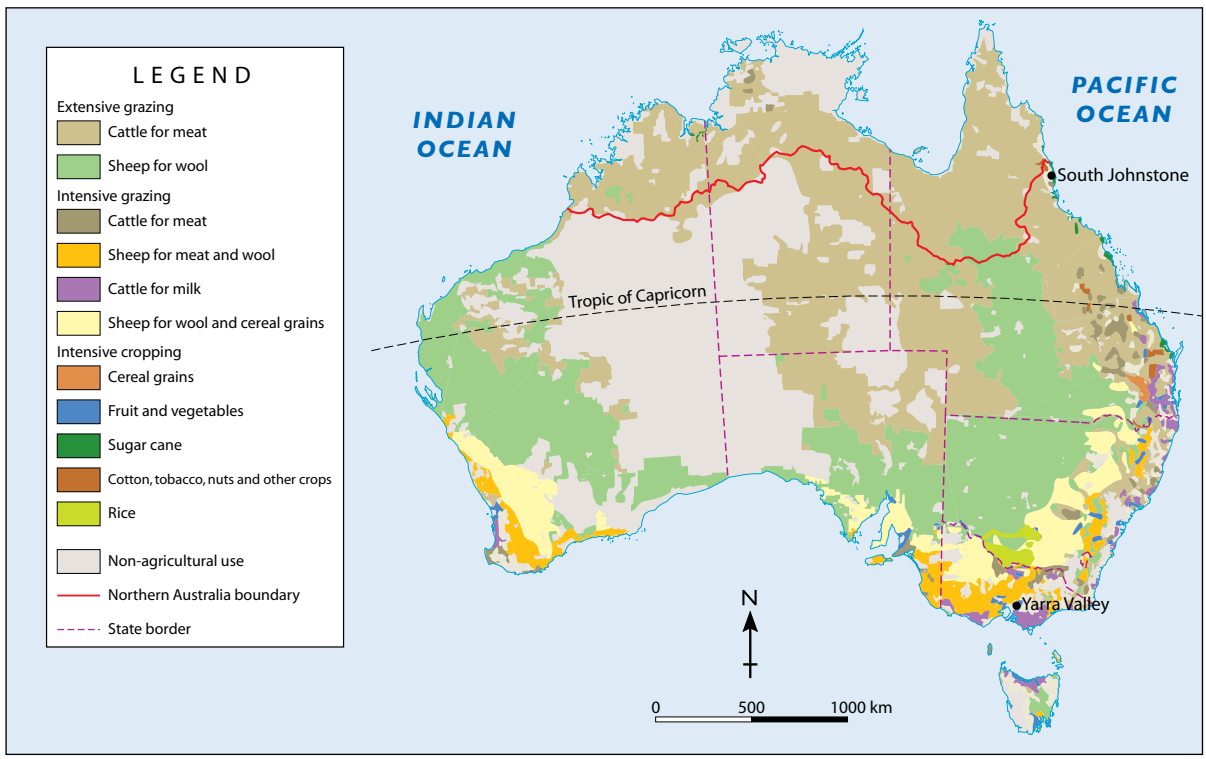


Source 1.32 This graph shows the number of livestock on Australian farms by type.



Source 1.33 This graph shows the crops grown on Australian farms by type each year.

AUSTRALIA: LAND USAGE



Source 1.34

Source: Oxford University Press

Should we grow more food in northern Australia?

Farming in northern Australia, like farming everywhere, is determined by environmental factors, particularly temperature, soil fertility and water. The soils in the north are among the world's oldest and have been subject to monsoonal downpours for millions of years. This has **leached** many important minerals out of the soil making them relatively infertile. Much of the soils of the north are arid or semi-arid and the rain that does fall tends to be seasonal rather than all-year round. These factors make intensive farming difficult. Cattle farming, therefore, dominates in northern Australia, covering 90 per cent of the land area and accounting for 30 per cent of the nation's total cattle.

Several government task forces have identified the water that lies in rock layers (known as aquifers) beneath northern Australia as the key to expanding intensive agriculture. They have suggested that small-scale intensive farming using groundwater has the potential to triple the amount of cropland in the north from the current 20 000 hectares. An example of this type of farming (known as mosaic agriculture) is shown in Source 1.37.

Source 1.35 Cropping of sugar cane is carried out near South Johnstone in north Queensland.

Source 1.36 Victoria's Yarra Valley is a significant sheep grazing area.

Source 1.37 These circular fields in northern Australia are an example of the result of pivot-circle irrigation using groundwater from aquifers.

Check your learning 1.11

Remember and understand

1 Describe the main differences between intensive and extensive farming.

2 What are some of the limiting factors for further intensive farming in northern Australia?

Apply and analyse

3 Examine Sources 1.36 and 1.37. Classify each of these farming types as either intensive or extensive farming.

4 Select one of the farming types shown in Source 1.34.

- a Describe its distribution in Australia.
- b Brainstorm the environmental factors that help to explain this distribution.

5 Using Source 1.34, explain why you think fruit and vegetables are often grown near large cities.

Evaluate and create

6 Describe the current distribution of farming types in northern Australia.

7 Using the information provided, together with additional research, classify each of the livestock types in Source 1.32 and crop types in Source 1.33 according to whether they are examples of extensive or intensive farming.

High-tech farming

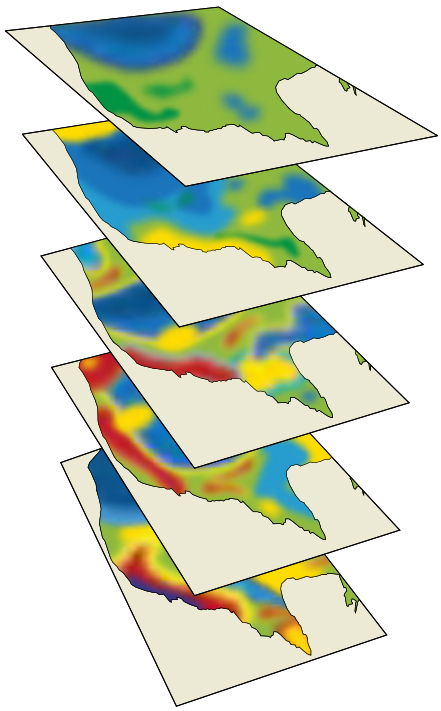
Modern technologies have changed farming methods and made many farms in Australia and around the world more efficient and more productive. The use of technologies such as computers, satellites, remote sensors, geographic information systems (GIS) and global positioning systems (GPS) has allowed some farms to go 'high-tech'. Some Australian farmers are using pilotless planes (known as drones) to keep watch on their soils, plants and water, while others are tracking their sheep and cattle with sensors implanted in the animals' ears or in electronic collars. Technology continues to advance farming operations, increasing the fruitfulness and longevity of crops and improving the breeding conditions of cattle.

Precision farming

On every farm there are wide variations in natural features such as slope, soil fertility, soil moisture and drainage. There may also be different soil conditions in different spots on the farm – past farming practices may have taken minerals from some parts of the farm but not others. Each farm and each field is therefore a patchwork of different soil and water features. Often, however, all parts of the field or farm are treated in the same way, despite being a 'patchwork' of different conditions and levels. This means that some parts of each farm are less productive than other parts.

A new farming system known as **precision farming** is beginning to change this old method to bring about better economic and environmental outcomes. Sensors mounted on satellites, planes and helicopters collect large amounts of data on many aspects of the environment including rates of plant growth, minerals in the soil and soil moisture. Using GPS, this data is then converted to detailed maps of each farm showing, for example, areas of high crop yield and areas with a lower yield (see Sources 1.38 and 1.39).

This information is then available to the farmer to make decisions about better and more precise irrigation and fertilisers and the choice of crops and the times to plant and harvest them. Using precision farming tools such as layered maps and GPS, farmers can determine precisely the best places to plant. They can identify where the soil is richer in minerals, so they can grow better crops. Rows of soil used in previous years where minerals have been depleted can be avoided.



Source 1.38 Layered maps using GPS data can clearly show farmers different elements they need to consider.

Source 1.39 Using precision farming tools such as layered maps and GPS, farmers can determine precisely the best places to plant their rows of crops.

Source 1.40 Milking time at Gala dairy farm near Deloraine, Tasmania and not a farmer in sight!

Case study: Robots on the farm

Gala dairy farm near Deloraine in Tasmania may look like most other dairy farms in Australia – cows contentedly munch on green grass for most of the day and then head to the shed to be milked. But this farm is like no other dairy farm in the world because these cows milk themselves, with help from a robot or two. Once the cow arrives in the dairy, overhead cameras and a Wi-Fi linked sensor guide robotic arms to clean the cow's teats and attach suction cups. An electronic collar identifies each cow and allows their milk production to be monitored and recorded.

The cows stand on a rotating circlular platform while being milked and are rewarded for coming to the dairy with a small feed of grain and access to a paddock of fresh grass. Because cows can choose when and how often they wish to be milked, milk production on the farm is up 20 per cent from the traditional method of milking cows twice a day.

Check your learning 1.12

Remember and understand

1 What is precision farming?
2 Why are the cows in Source 1.40 wearing electronic collars?

Apply and analyse

3 Is Gala dairy farm an example of precision farming? Give some reasons for your answer.
4 Why is GPS an essential part of precision farming?
5 What are some of the advantages of robotic milking for the farmer and what are some of the disadvantages?
6 Explain why precision farming can help to make farming more sustainable.

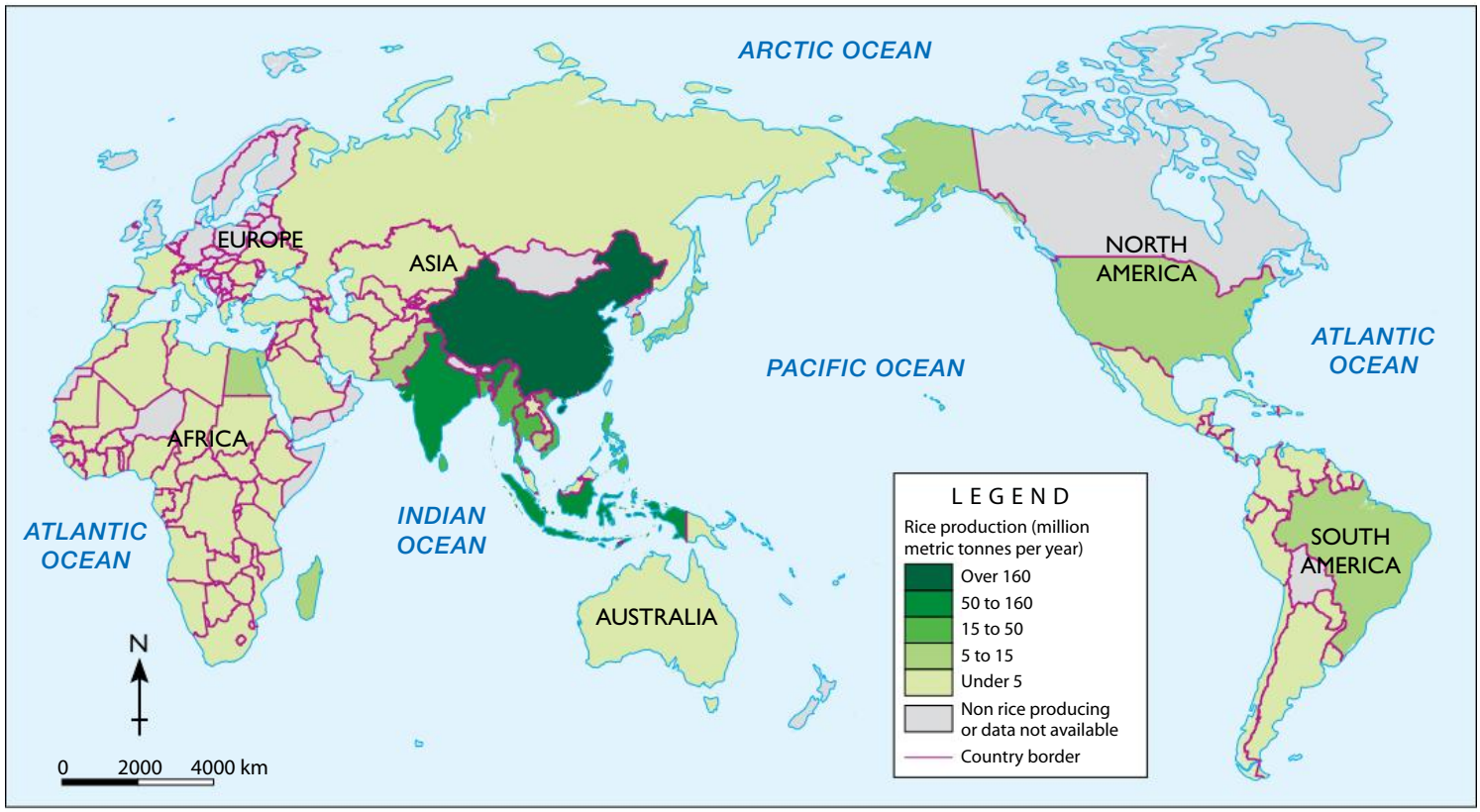
Evaluate and create

7 Using ideas from Source 1.40 and online research, invent a machine that shears sheep. Remember that each sheep is slightly different from every other sheep so your machine needs to take this into account. Draw a labelled sketch of your shearing machine.

Rice – the grain of life

Rice is one of the world's most important crops. It supplies about one-fifth of all **calories** consumed by humans and is the main food eaten in more than 30 countries. About 700 million tonnes of rice are produced around the world every year. Around 90 per cent of this is grown in Asia. China's production of rice alone accounts for almost one-third of the world's total annual rice production.

WORLD: RICE PRODUCTION



Source 1.41

Source: Oxford University Press

skilldrill

Describing patterns on choropleth maps

The map in Source 1.41 is a **choropleth map**. Geographers use choropleth maps to give a quick impression of a spatial pattern by using dark and light shades of the same or similar colours. Darker shades usually show 'the most' and lighter shades show 'the least'. You can describe the pattern on choropleth maps by following the PQE (Pattern–Quantify–Exceptions) method. For more information on the PQE method refer to section GT.2 of 'The geographer's toolkit'.

Step 1 Read the title and examine the legend carefully so that you understand what the map is showing.

Step 2 Describe the general pattern that is apparent on your map. Use the names of continents and large regions.

Step 3 Quantify your description of the pattern by giving the names of specific countries and the mapped data related to these countries.

Step 4 Point out any exceptions to the general pattern that you have described. For example, this may be a country that produces a lot of rice despite being far away from any other major rice-producing country.

Apply the skill

1 Describe the pattern of global rice production using Source 1.41 and the PQE method.

Rice growing methods

Rice growing occurs in many different environments – from the sides of the world's highest mountains to coastal river deltas. Rice is grown in areas that flood every year and in other places where rain is far from reliable. Because of these variations in climate and environments, it is possible to identify four main systems of rice growing.

1 **Irrigated rice:** Irrigated ecosystems account for about three quarters of global rice production. Irrigated rice is grown in fields, called rice paddies, where series of embankments and terraces are built to control the flow of water across the fields. This system is most common in East Asia, particularly Indonesia, Vietnam, the Philippines and Thailand.

2 **Rainfed rice:** Many farmers in low-lying areas in countries such as Bangladesh, Myanmar (Burma) and Thailand rely on natural rainfall rather than irrigation to water their rice crops. Annual monsoonal rains may cover their fields with 50 centimetres of water into which they plant their crops. This is known as the rainfed lowland system of rice growing. These farmers face many challenges to produce a reliable crop, notably poor soil quality and unreliable rain.

3 **Upland rice:** In West Africa, Central and South America, and highland regions of Asia, upland rice growing dominates. Usually grown beside other crops, productivity is generally low as soils are often poor and little or no fertiliser is used. Rainfall may be unreliable and erosion of the hillsides may be a problem in some areas, as the rice fields do not usually have embankments to control the flow of water.

4 **Flood-prone rice:** In some flood-prone zones in Cambodia, Vietnam and Myanmar (Burma) a rice crop may be grown in areas characterised by periods of flood and drought. The rice grown is tolerant to being covered by water but yields tend to be low and unreliable.

Source 1.42 In upland areas many farmers first clear the land, often by slashing and burning.

Source 1.43 Rice paddies near Longsheng, China

Source 1.44 A comparison of the productivity of four different rice systems.

System	Yield (tonnes/ hectare)	Crops (per year)	Productivity (tonnes/ hectare/year)
Irrigated rice – rice grown using irrigation systems for water	5.0	2.5	12.5
Rainfed rice – rice growing system that relies on rainfall for water	2.5	1	2.5
Upland rice – rice grown in rainfed lowland fields that is prepared and seeded when dry	1.0	1	0.12
Flood-prone rice – rice grown in areas prone to extreme flooding and drought, typically low-yield	1.0	1	1.0

Check your learning 1.13

Remember and understand

1 What type of rice growing system is being used in Source 1.43?

2 How would the farmers in these fields control the flow of water to their crops?

Apply and analyse

3 Which is the most productive system of rice growing? Why do you think this is the case?

4 Why do you think upland rice growing is not as productive as the other systems?

Evaluate and create

5 In small groups, discuss the environmental impacts of growing rice. Present a report of your conclusions, using headings such as 'Impacts on water, soil, landforms and natural vegetation'. Which of the four rice growing systems do you believe impacts the natural environment the most?

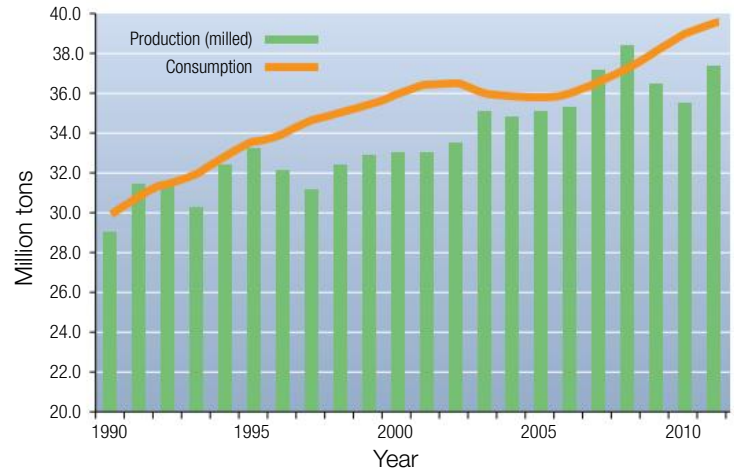
Rice growing in Java

The Indonesian island of Java is one of the world's most populated islands and one of the most densely populated places on Earth. It is home to almost 150 million people. The Javanese people have developed a way of life that uses the island's natural resources to provide them with ample food. Java is a volcanic island with abundant rainfall, and eruptions over millions of years have produced fertile soil for the growing of crops such as rice.

In fact, Java is home to some of the world's most productive rice fields. Over three-quarters of Javanese farmers grow rice, mostly in small family-owned fields of less than one hectare (0.01km^2). Farmers tend to live in villages and towns and walk every morning to their rice fields. Everyday tasks are determined by the season. Most rice farmers in Java are able to grow two crops throughout the year but on more fertile ground some farmers are able to grow three. Fertiliser is usually added to the soil to complement its natural fertility.

In recent years, Java's population has grown faster than increases in rice production and this has meant that the island has had to import rice from other Asian countries. As Java's population continues to grow there is greater pressure on the rice farmers to become more productive. There is also an increased competition for land. Agricultural scientists are working hard to find solutions to Java's stalled increases in crop yields but they face serious issues:

- Farmers tend to be poorly educated and have little money to invest in new technologies.
- Farm sizes are declining because land is divided between family members after the death of a farmer.
- 100 000 hectares (1000km^2) of rice paddies have been lost, they have been used to grow other crops such as palm oil, or to build houses and factories.
- Little government money is spent on improving and repairing irrigation systems.
- There are few qualified experts to advise farmers how to increase crop yields through the introdcution of new varieties of rice and pest control.



Source 1.46 Rice production and consumption in Indonesia between 1990 and 2011.

JAVA: RICE GROWING AREAS

Source 1.45

Source: Oxford University Press

Source 1.47 Mount Merapi is one of Java's 45 volcanoes.

skill**drill**

Constructing an annotated field sketch

Geographers use field sketches as a way of capturing impressions immediately and directly. While on a field trip to examine an environment in detail you may be asked to complete a field sketch. It is often a good idea to practise field sketching from a photograph before the field trip. The method for drawing a field sketch is the same as sketching from a photograph. Follow these steps:

Step 1 Draw a border of the correct shape.

Step 2 Using a pencil, lightly sketch the main landscape lines. If there is a horizon in the scene put this about one-third from the top of the frame.

Step 3 Add detail to your sketch. Annotate or label those parts of the scene that you consider most important.

Step 4 Add some shading and colour. Don't try to copy every subtle colour of nature, just give a hint of the right colour.

Step 5 Label your sketch with the location and date.

Apply the skill

1 Follow the steps provided to complete a field sketch of Source 1.47. On your sketch, label key natural and managed features of the environment.

Check your learning 1.14

Remember and understand

1 How is the island of Java able to support so many people?

Apply and analyse

2 Examine Source 1.46.
   - a Describe the pattern in Indonesia's rice production between 1990 and 2011.
   - b Describe the pattern in consumption over the same period.
   - c Explain why Indonesia has become a rice importer in recent years.
   - d What relationships are there between the natural environment and the growing of rice in Java?

3 The farmer in Source 1.47 is using water buffalo rather than a tractor to plough his fields. What would be the advantages of using buffalo? What would be the disadvantages? How might his methods of farming change if he were given a tractor?

Evaluate and create

4 Imagine that the Australian Government has decided to give aid to Indonesia to increase its annual rice yield. Write a letter to the Foreign Minister outlining how you think this money should be spent.

Growing rice on the world's driest inhabited continent

There are about 1600 rice farms in Australia and virtually all of them are in southern New South Wales and northern Victoria. This region is suitable for the growing of rice because of several key environmental factors. The most important of these is the availability of water. Rice farmers in the region irrigate their crops with water from nearby rivers – the Murrumbidgee and the Murray. The soil is also ideal for rice growing as the heavy clay that is present stops water from seeping away. Year-round warm temperatures help the rice to grow and the flat land makes flood irrigation possible.

Although Australian rice growers are the most productive in the world, rice is a controversial crop in this country. Some people feel that growing rice is not a sustainable use of Australia's river water. They argue that the natural environment is suffering because water is being taken from the rivers. Supporters of the rice industry believe that rice is a valuable export crop and that Australian rice farmers are becoming better at using less water to grow more rice.

skill**drill**

Estimating the size of features on a map

Estimating the size of features on a map is an important skill for geographers. You can use the scale of maps to estimate the area covered by certain features. If the feature is a regular shape such as a triangle, circle or rectangle you can apply the skills and formulas you have learnt in mathematics.

If the shape of the feature you are studying is irregular, a grid can be used to estimate its size. For example, on Source 1.50, a grid with squares representing 20 km x 20 km has been drawn. If your map does not have a grid like this already, you can draw your own. You might like to do this onto a piece of tracing paper that you can then place on top of the map.

Step 1 Count the number of grid squares in which the mapped feature you want to estimate fills the entire square. Write this number down.

Step 2 Now count the number of grid squares that contain some, but not all, of the mapped feature. Take this number and divide it by two.

Step 3 Add these numbers (the result from Step 1 and the result from Step 2) together.

Step 4 Multiply this number by the area of each square. In the following map each square is 20 km x 20 km, or an area of 400 km^2.

Source 1.48 These formulas can be used to estimate the size of differently shaped features on a map.

Shape of feature	Formula
Triangle	The base x the height, divided by two
Circle	π (approximately 3.14) x radius squared. The radius is the distance from the centre of its circle to the edge.
Square and rectangle	Width x length

Apply the skill

1 Follow the steps provided to estimate the areas of the three main rice-growing regions shown in the map in Source 1.50.

Source 1.49 Rice fields and the main irrigation canal near Leeton, NSW.

NEW SOUTH WALES: RICE GROWING REGIONS

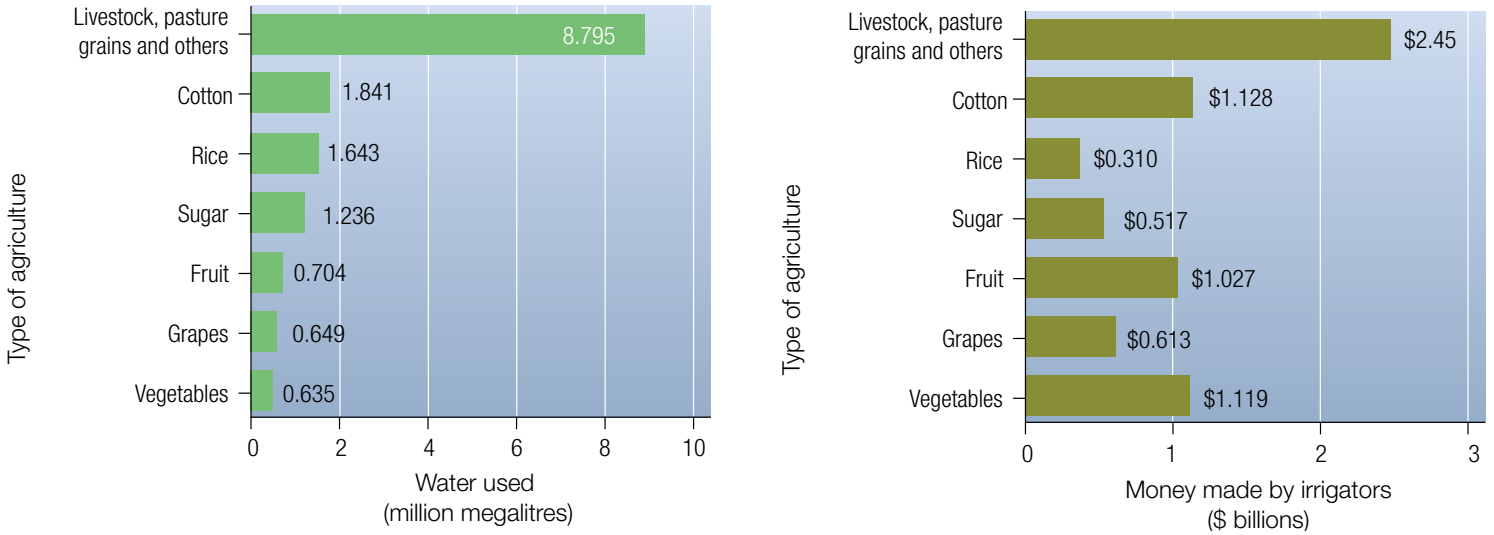
Source 1.50

Source: Oxford Atlas

Extend your understanding

Conduct some further research on rice growing in Australia and then complete the following tasks.

1. Describe and account for the relationship between rivers and rice-growing regions.
2. Compare the photograph of the rice-growing area in Java (Source 1.47) with the rice-growing region of Australia (Source 1.49). Make a list of all of the differences that you can find. Discuss with a partner why these differences occur. Consider both natural and human factors in your discussion.
3. Examine Source 1.51. What do these two graphs tell you about the relationship between rice crop profitability and water usage? What questions could you ask to assess if Australian rice growers are using water sustainably? Write a few paragraphs exploring the link between rice growing and water usage in Australia.



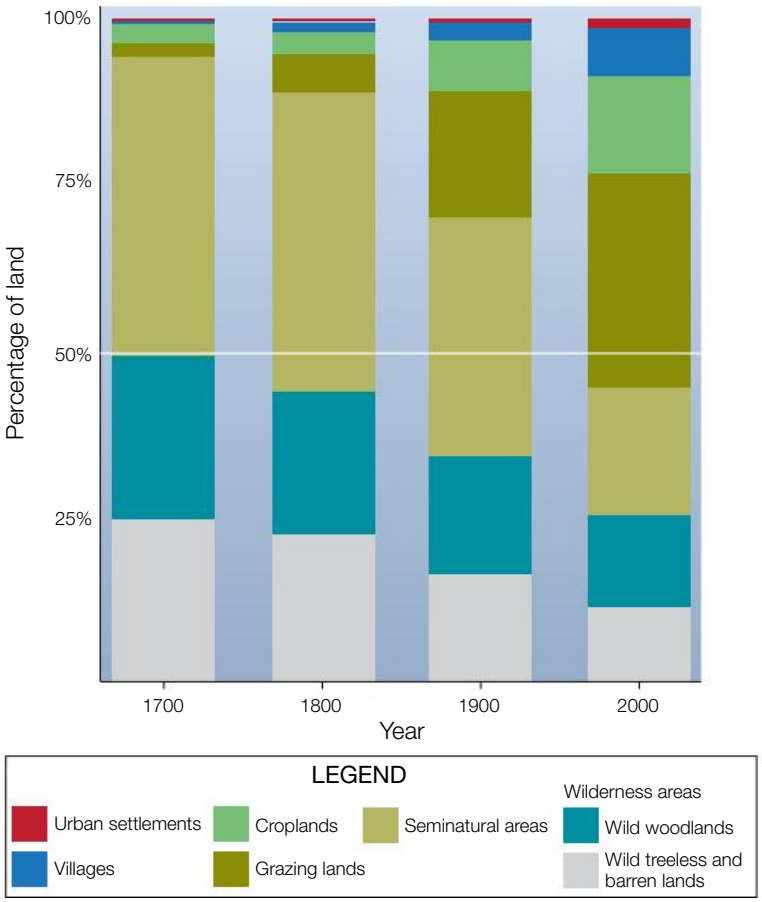
Source 1.51 Graphs showing the amount of water used for agriculture in Australia (left); and the money made from these types of agriculture (right).

1.3 What are the environmental impacts of food production?

Changes to the natural environment

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 1.52 shows the extent of biome change around the world since 1700.



Source 1.52 Changing land use patterns worldwide between 1700 and 2000.

Source 1.53 Some of the changes made to a landscape in China that is being used for farming.

Check your learning 1.15

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 1.53 that involve altering irrigation practices.

Apply and analyse

4 Examine Source 1.52.

- **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 1.53 are in four different colours. Suggest a title for each colour.

Evaluate and create

Do some further research on the Internet to complete these tasks.

5 Examine the image of a Chinese farming landscape as shown in Source 1.53. 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 Compare the changes made on the farm in Source 1.53 with the technology used in Source 1.40. What differences in productivity do you think the two farms might experience?

Changing vegetation

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 five 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 to 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 began.

In the developing world, there is a strong link between **deforestation** and poverty. 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.

Source 1.54 A woman in Madagascar plants a food crop on a burnt hillside.

MADAGASCAR: DEFORESTATION AND POVERTY LEVELS

Source 1.55 Source: Oxford University Press

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 rain fall 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 1.56 and 1.57 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 one 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 1.56 Satellite image of the Saudi Arabian desert in 2000.

Source 1.57 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.

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 are 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 1.58 Fields of wheat have replaced native grasslands across much of central USA.

Source 1.59 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 savanna	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

Check your learning 1.16

Remember and understand

1 Describe the link between poverty and deforestation in your own words.

2 Is the scene in Source 1.58 a natural or human environment? Give evidence from the source for your answer.

Apply and analyse

3 Carefully examine Source 1.54.
- 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 to the likely motivations of the farmer who has changed the grasslands environment shown in Source 1.58.
- d Examine Source 1.55. Describe the variations in forest cover between regions of low poverty and regions of high poverty.

4 Examine Source 1.58.
- 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.

Evaluate and create

5 Use an ICT chart tool such as Microsoft Excel to construct pie graphs for the conversion of grasslands in Australia, North America and Sub-Saharan Africa. Describe the differences between these three regions as shown in your completed pie graphs.

Changing 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.

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 killing the plants that create their habitats.

Source 1.60 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.

Changing natural water flows

In many places, rivers are dammed to create a large reservoir of water which 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 for 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 water has been extracted for farming that the river cannot flush out the naturally occurring salt.

Check your learning 1.17

Remember and understand

1 How might the farmer shown in Source 1.60 impact on the quality of fresh water?

2 How can fertilisers that are used on a farm eventually reach and kill fish?

Apply and analyse

3 Examine Sources 1.56 and 1.57.

- a Each of the agricultural fields in these images is about 800 metres squared in area. Estimate the 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?

Evaluate and create

4 Draw a sketch of a river flowing through a farming region. On your sketch show five different ways in which the farms impact on the quality or quantity of water in the river.

5 Discuss some ways in which the impacts shown on your sketch could be reduced.

Wearing out the soil

Source 1.61 The most highly erosion-prone soil in the world is said to be found at China's Loess Plateau.

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 two 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 impact on 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 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 1.61). 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 impacts on the environment. There are two types of soil salinity:

- primary salinity, which is a natural condition that develops in the landscape over time,
- secondary salinity, which is 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. 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 1.62).

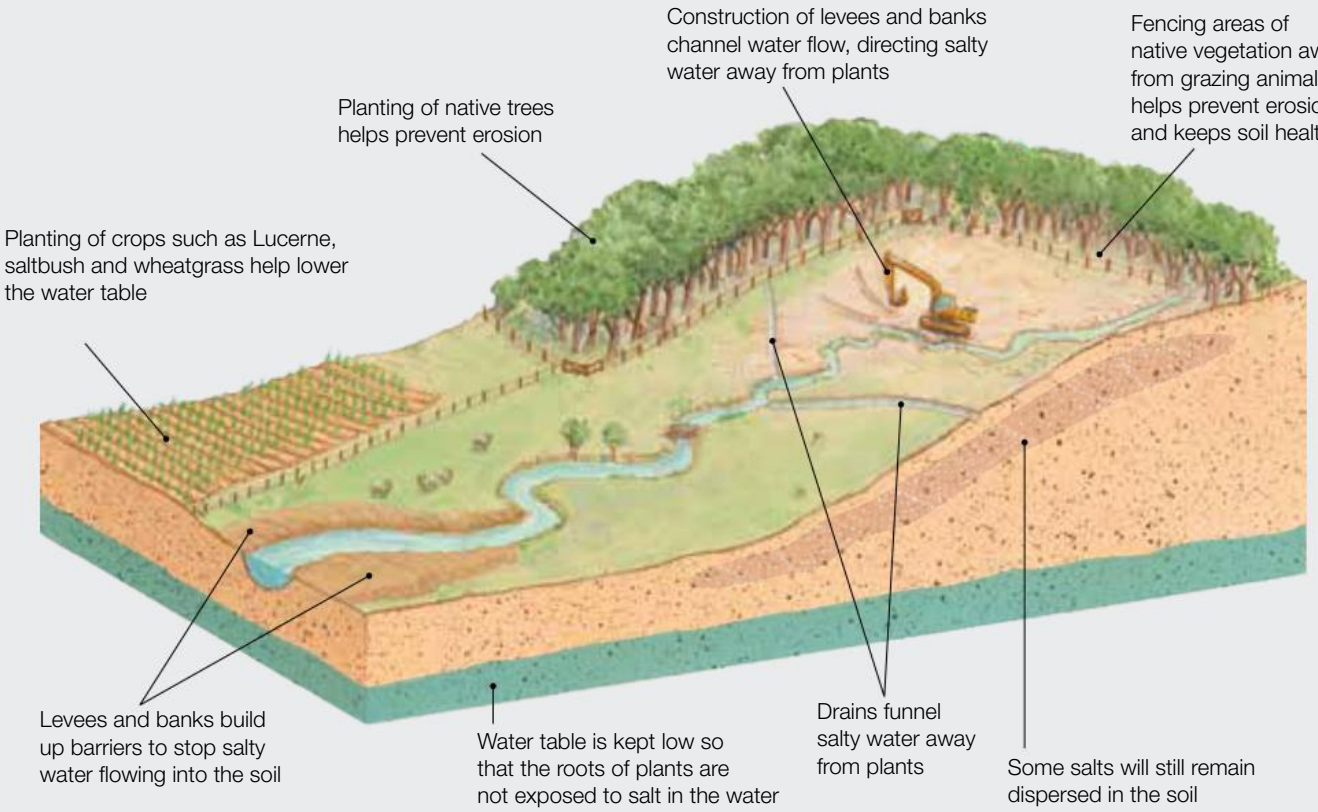
Source 1.62 Soil salinity near Renmark, South Australia

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 1.63 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 1.63 A range of responses and strategies can be used to tackle salinity.

Check your learning 1.18

Remember and understand

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

2 How does forest clearing lead to soil degradation?

Apply and analyse

3 How has the farmer in Source 1.63 managed salinity on his farm?

4 Select one of his strategies and comment on its potential effectiveness.

5 Examine Source 1.61 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 to the image of rice terraces seen in Source 1.47. 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.

Evaluate and create

6 The eroded soil in Source 1.61 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.

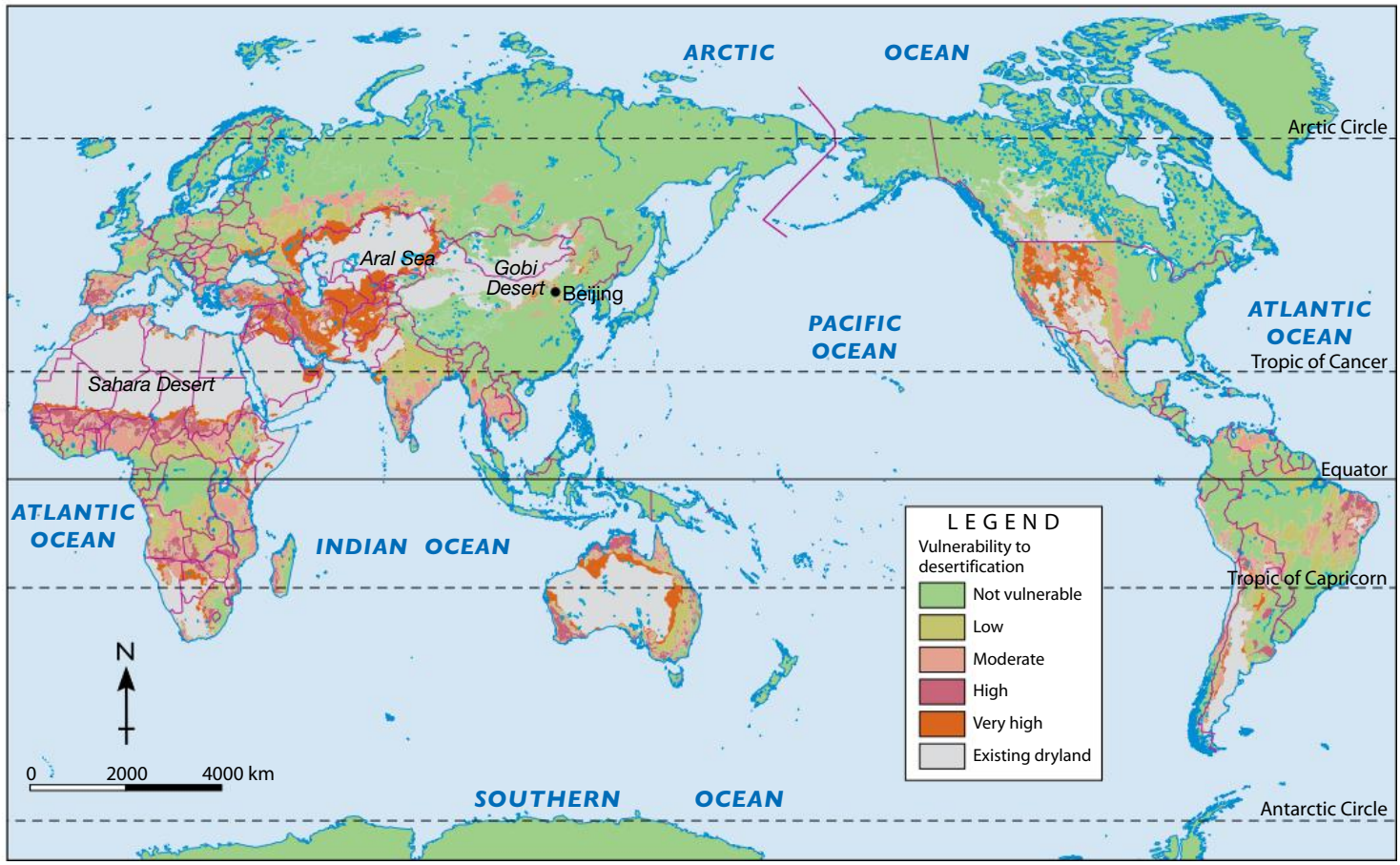
Spreading deserts

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 the 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 which 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 tons of grain. Most of this occurs in developing regions in Central Asia and Sub-Saharan Africa, further contributing to food insecurity in those regions.

WORLD: DESERTIFICATION VULNERABILITY



Source 1.64

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

Check your learning 1.19

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 1.64, 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?

Evaluate and create

7. In what ways might climate change be a leading cause of desertification in some regions of the world?
8. How effective do you believe the line of trees shown in Source 1.65 will be in stopping the advancing sand dunes of the Gobi Desert? Give some reasons for your answer.

The environmental impact of changing diets

The diets of many people around the world is 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 is gradually changing. With greater wealth, many people in India and China 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 new and growing demand.

Source 1.66 A new KFC store opens in China at the rate of about one per day.

skill**drill**

Analysing secondary geographical data and drawing conclusions

It is important for geographers to be able to correctly interpret data that has been collected and represented by other people. They often need to use secondary data sources to draw conclusions about what they have found. By following these steps you will learn to interpret a range of secondary data sources (e.g. graphs, tables, reports) and use it to reach conclusions about your investigation.

Step 1 Once you have gathered a range of secondary data sources for your investigation, look at each source carefully.

Step 2 For each source of information, write down two or three key facts that are presented.

Step 3 Try to summarise the key focus of each data source in one or two sentences. Identify any patterns or exceptions that you notice.

Step 4 Pay particular attention to the title, the date of the data and its source. Is the information contained in the source already dated, is it still relevant, or is it commenting on a situation or place at a particular point in time?

Step 5 Remember to 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? If the figures in one source are in kilograms and in tonnes in another, you will need to convert the figures to the same units of measurement in order to understand and compare them.

Step 6 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 7 Compare the facts and figures you have summarised. It may be helpful to use the PQE method to do this.

Step 8 Use your notes to reach your own conclusion about the key question or issue that you are exploring. Support your conclusion with information from the data.

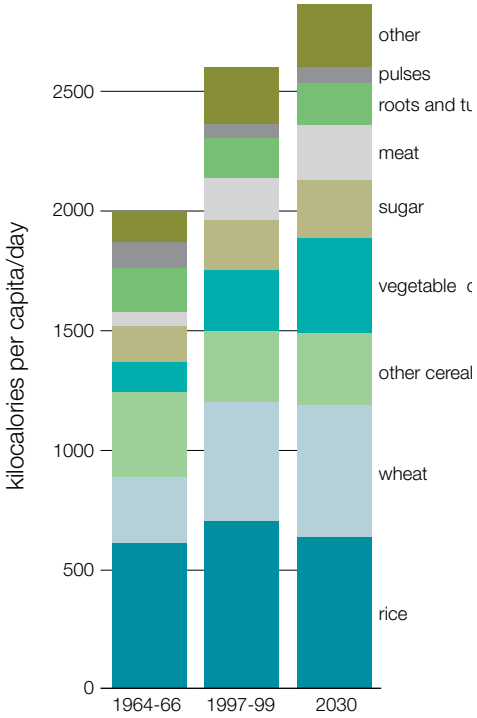
Step 9 Present your conclusion to an audience. This may be done verbally, graphically or in a written form. Whatever form you choose, make sure you use the evidence you have gathered to support your conclusion.

Apply the skill

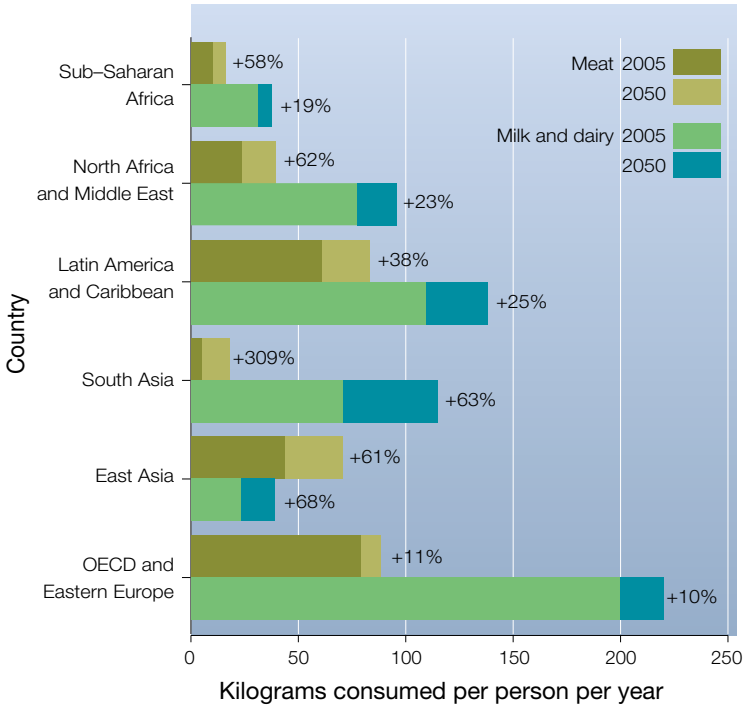
1 Examine the information presented in Sources 1.67, 1.68 and 1.69 and follow steps provided to draw a conclusion about the environmental impact of changing diets.

2 Which information best supports your conclusion?

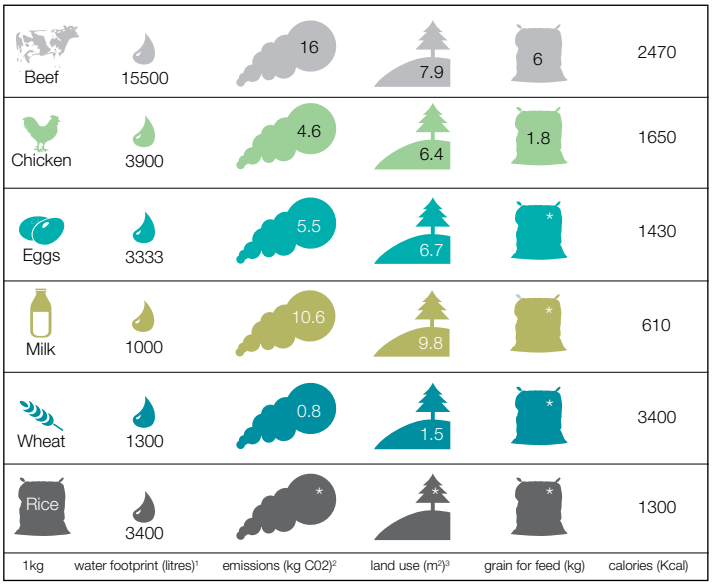
3 What other information would you need to further support your conclusion and where could you find this information?



Source 1.67 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



Source 1.69 Projected changes in meat and dairy consumption from 2005 to 2050.
Source: http://ccafs.cgiar.org/bigfacts/dietary-change/



Source 1.68 The ecological footprint of different food types

Extend your understanding

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.

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

Here are some facts you might consider:

- Meat consumption is expected to increase from 39 kg/person/year in 2009 to over 52 kg/person/year by 2050 (FAO, 2006).
- By 2050 50% of cereal grown may be used to feed animals for human consumption (UN report, 2011).
- Currently, 33 per cent of total farming land is used for producing animal feed (UN report, 2011).
- The production of animal protein must be more than tripled if the projected global population of 9 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).
- 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 occur in cities of developing countries (World Health Organisation, 2013).

Source: Oxford University Press

Food security: Feeding a hungry world

Compared with people living in many countries around the world, most Australians have very reliable access to a wide variety of different foods. High wages and a strong economy mean that many Australians can afford to purchase and prepare the food they need and rarely worry about where their next meal is coming from.

Unlike people in Australia, these Somali women are waiting in line to receive food from a local aid organisation in their country's capital city, Mogadishu. They are victims of a food shortage that affected 10 million people in African nations in 2011–2012. A widespread shortage of food such as this is known as a famine and can be caused by many factors including drought and war. Food experts are warning that famines are likely to become more severe and widespread as the Earth's climate changes and the human population continues to grow. Some argue that food security is the greatest single issue facing the world today.

2.1 What is food security?

1 Make a list of the different things you have eaten in the last 24 hours.

2 How different do you think your list would look compared with one of the women shown in Source 2.1?

2.2 What are the main threats to food security?

1 Brainstorm some of the ways in which food security is threatened around the world, including in Australia.

2 Some areas of the world, such as the Horn of Africa, are more at risk of famine than other places. Why do you think this is the case?

Source 2.1 These people are victims of the famine in the Horn of Africa. Drought, conflict and restrictions on delivery of food aid caused the famine – one of the world's biggest humanitarian emergencies – in 2011–2012.

2.3

How can we improve food security?

1 What is being done in Somalia to improve the food security of people affected by famine?

2 The United Nations has set the target of halving hunger by 2015. Do you think this is possible? Give some reasons for your answer.

2.1 What is food security?

Food security

Food security is a state where all people at all times have access to enough safe, nutritious food to sustain a healthy life. For a person, community or country to have a secure food supply they must have three things:

- **food availability**
- **food accessibility**
- **the ability and resources to use the food appropriately.**

People who do not have food security suffer from hunger and illnesses related to lack of food, such as malnutrition. About 870 million people around the world do not have food security – the majority of them live in developing countries.

Source 2.2 In many coastal communities in Arnhem Land, the ocean provides food security. Local knowledge ensures the catch will be prepared in a safe and appropriate way.

Food availability

Food availability means people have enough food of appropriate quality available on a consistent basis. This may include production, storage, distribution and exchange of foodstuffs, provided reliably and regularly. People whose food availability relies solely on the production of a single crop, for example, may find themselves at great risk of food insecurity if that crop fails.

Many countries have strategies in place, such as growing a variety of crops, to maximise their food availability and ensure food security. Management of fishing and fishing industries is also used by some communities to ensure a constant supply of fish is available to sustain them. Food availability alone, however, does not guarantee food security.

Source 2.3 Australia is a country that has a high level of food accessibility – many people enjoy good access to a wide variety of food.

Food accessibility

Food accessibility means physical and economic access to food. That is, there needs to be enough food available and it must be in reach of those who need it. Many food researchers believe that the world's farmers produce more than enough food to meet the needs of every person on Earth. However, the food is not distributed evenly. **Developed countries** have more food than they need and high levels of wastage, while many people in **developing countries** struggle to access enough food to meet their daily needs. The reasons for this uneven distribution are many and complex. They include social, political and economic factors, such as rising prices, trade agreements and quotas set up between countries.

Source 2.4 Deep fried scorpions ready for sale at a Beijing street market.

Using food appropriately

Appropriate use of food means using food safely and applying knowledge about nutrition, clean water and sanitation when preparing food.

What is appropriate use of food varies between different places and cultures. What is appropriate and usual to eat in one part of the world might be viewed as unusual somewhere else. In many Asian countries, for example, insects and other invertebrates such as scorpions and spiders are regularly eaten as part of a balanced diet. (See Source 2.4) Local cultural knowledge means these insects are prepared properly, making them safe to eat and nutritious. This is an example of appropriate use of food. Knowing how to use such foods appropriately could potentially stave off the incidence of food insecurity. In fact, the United Nations has identified insects as the 'forgotten food crop' as they could help alleviate food insecurity, particularly in developing countries.

Check your learning 2.1

Remember and understand

1 What are the three factors that contribute to food security?

2 Describe and explain food security in Australia with reference to these three factors.

Apply and analyse

3 Where does most of your food come from? How would your answer differ if you lived in another country, for example, Vietnam? Explain the reasons for your answer.

4 Quentin, the boy in Source 2.2, shows that he has food availability and food accessibility. To have food security he now has to use the food appropriately and prepare it ready for eating. Do you know how to prepare his food? Do you think that he does? What does this tell you about food security?

Evaluate and create

5 Find images of foods from around the world and display them on your classroom wall. Use your examples to explain why food preferences and food security differ between places and cultures.

6 It is estimated that about 870 million people suffer from hunger due to poor food security. Of the three factors that contribute to food security which do you believe is most important? Discuss your thoughts with a partner and then share your thoughts with the class.

Levels of food security in different places

People living in different parts of the world experience different levels of food security. People in developed countries including North America, Western Europe and Australia, for example, generally have very high levels of food security. Food is available, accessible and appropriate to a high proportion of the population in these places. At the other end of the scale, many people in developing countries, particularly throughout Asia and Sub-Saharan Africa, do not have food security.

Forces impacting on food security

Poverty and food insecurity are closely linked. Individuals who suffer from poverty struggle to meet their basic daily food needs and spend a greater percentage of their income on food than those in wealthier countries. This makes them highly vulnerable to forces that change the availability and accessibility of food. If the price of food suddenly increases, for example, food which they could previously afford becomes unaffordable.

Other forces that can impact severely on those who do not have food security include natural disasters, such as drought or flood. Many people in poor areas rely on local agriculture for food, so food sources can be left damaged or destroyed following natural disasters. Human activities can also affect food security in many places. Armed conflicts may interrupt usual markets and food supply lines, or land used for growing crops may be repurposed for other uses, which results in local food supplies being affected. Those without food security are much more vulnerable to change that is caused by outside forces.

Source 2.5 The people of Zimbabwe in Southern Africa have one of the lowest levels of food security. This girl is scavenging for food in a rubbish dump near the capital, Harare.

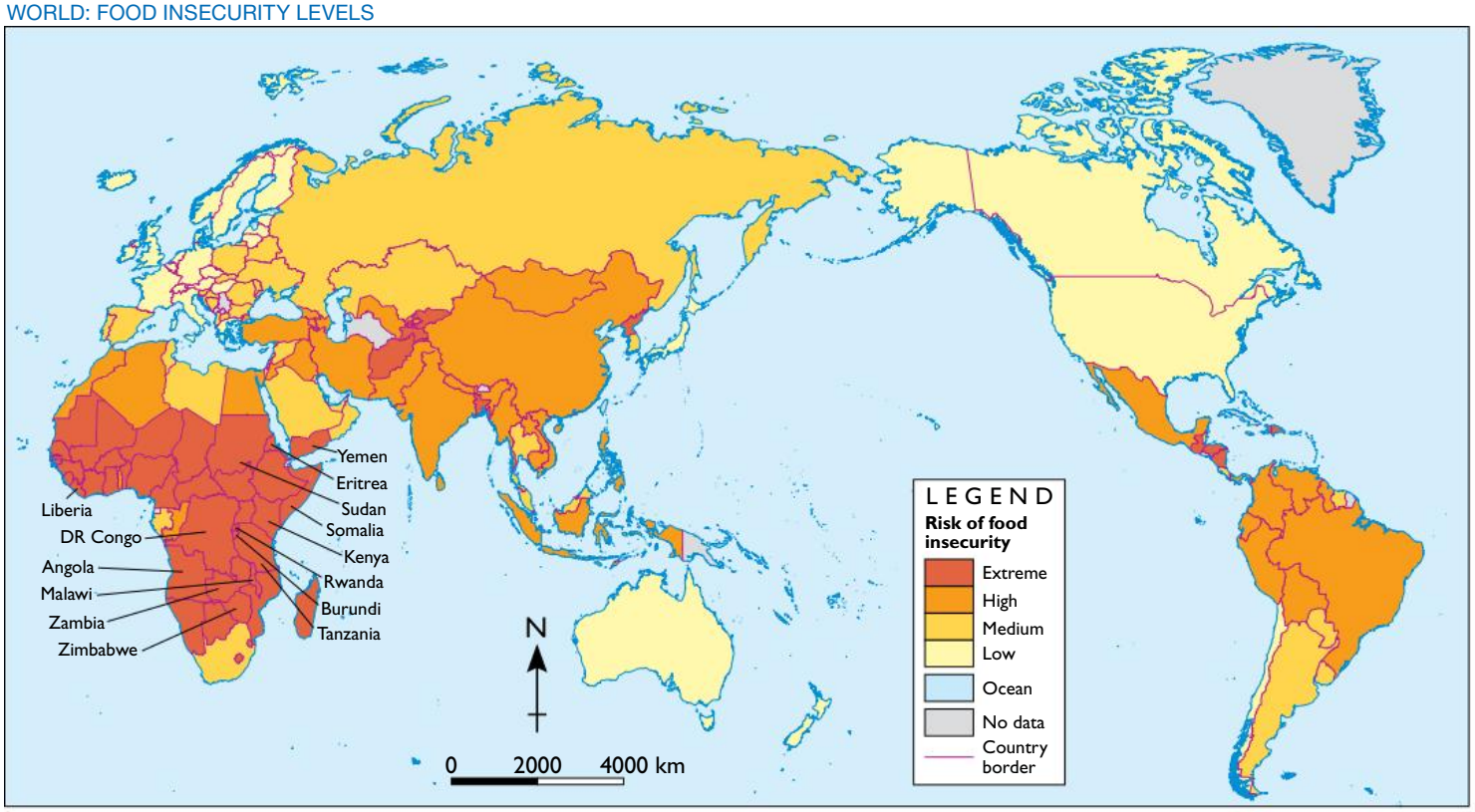
Source 2.6 One of the most food-secure nations in the world is the United States, where the majority of people have access to a reliable, safe and nutritious food supply.

Global patterns of food security

Source 2.7 shows the global pattern of food security and insecurity. Scores for each country were calculated using 18 different indicators, including the nutrition and health status of the population, the availability of food staples such as rice, wheat and corn, and access to these foods. Countries were then grouped into four categories according to their risk of experiencing widespread food insecurity.

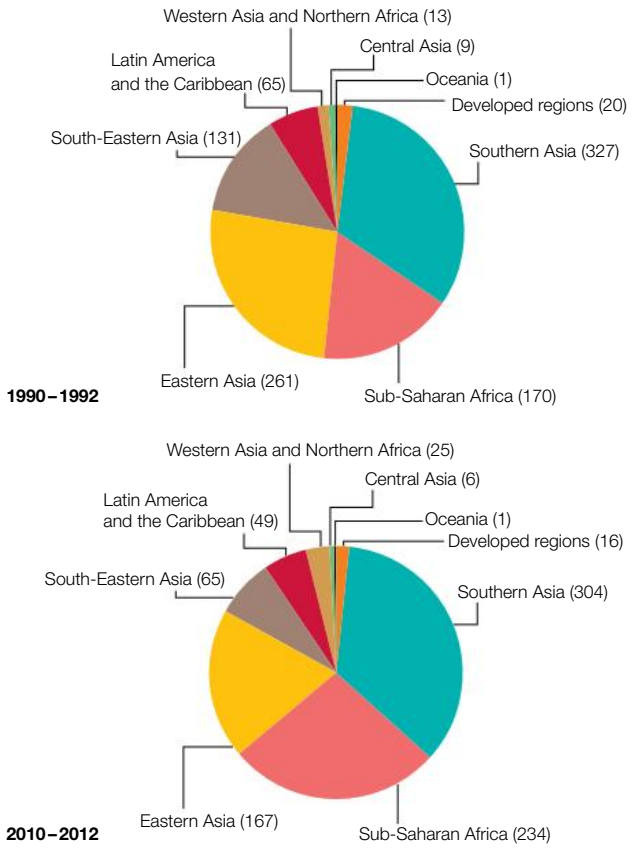
The global distribution of food security is not static. The number of **undernourished** people in the world, for example, has fallen by more than 130 million in the last 20 years, despite the world's population growing by more than 1.5 billion in the same period. The distribution of undernourished people in the world has also changed (see Source 2.8).

WORLD: FOOD INSECURITY LEVELS



Source 2.7

Source: Oxford University Press



Source 2.8 The distribution of hunger in the world is changing. These charts show the number of undernourished by region, 1990–1992 and 2010–2012, in millions.

Check your learning 2.2

Remember and understand

1 How are poverty and food insecurity linked?

2 Compare the food security of the two individuals shown in Sources 2.5 and 2.6. Comment on the food availability, accessibility and appropriateness for each of these people.

Apply and analyse

3 Examine Source 2.8 which shows the 1990–1992 distribution of undernourished people in various parts of the world compared with the 2010–2012 distribution.
   - a What has happened to the overall number of undernourished people over the past 20 years?
   - b Which regions have seen an overall increase of undernourished people?
   - c Is this change reflected in Source 2.7?

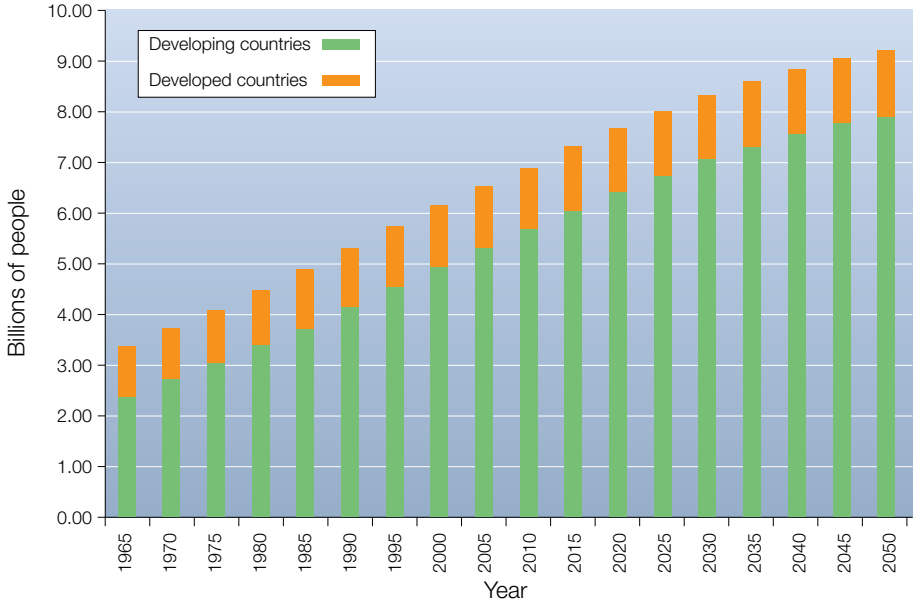
4 Describe the distribution of global food insecurity using the PQE method (for more information on the PQE method, refer to section GT.2 in 'The geographer's toolkit').

5 Discuss the factors that may be responsible for the pattern you have described.

6 Australia is described as having a low risk of experiencing food insecurity. Why do you think this is the case?

Food security into the future

Source 2.9 Will the world's growing population mean there will less food security in the future?



Source 2.10 Population growth in developing and developed countries, 1965–2050.

The world's population increases by about 200 000 people per day. At this rate, food will need to be grown to feed an extra 2.5 billion people by 2050. Virtually all of this population growth will occur in developing countries (see Source 2.10) where much of the population already struggles to meet their daily food requirements. Asia's population will increase by more than 1 billion by 2050 and Africa's population is projected to increase by 1.3 billion. Food experts estimate that global food production will need to increase by about 70 per cent by 2050 to meet the food requirements of the growing population.

There are two schools of thought regarding the impacts of population growth on food security:

1 Some researchers believe that the world's population is growing faster than the world's farmers are able to feed it. The result will be widespread food insecurity, starvation and famine. Those who support this scenario point to the degradation of existing agricultural resources such as fresh water and soil. They also point out that most of the population growth is occurring in areas already at risk of food insecurity, such as parts of Africa.

2 Other researchers are more optimistic. They point out that food production over the last few centuries has largely kept pace with (and even exceeded) population growth. This has been largely due to the use of new technologies, referred to as the Green Revolution (see Source 2.11). They also focus on the slight slowing of the world's population growth rate in the last few years and the ability of humans to adapt to changing situations through research and innovation. Many believe that new developments in **genetic modification** of plants, for example, hold the key to increasing farming productivity and crop yields in the future.

key**concept:** environment

The Green Revolution

The Green Revolution refers to sweeping and widespread changes that occurred in farming regions across the world over the period 1950 to 1979. Beginning in Mexico and spreading through North America and much of Asia, these changes brought food security to hundreds of millions of people. The key changes were:

- the development and planting of new and improved varieties of grains, including wheat and rice, that produced much higher yields
- the widespread use of fertilisers and pesticides to increase farm productivity
- the adoption of mechanical vehicles and systems, such as tractors, pumps, sprays and irrigation systems.

As these and other related changes swept through countries such as India and China, many farming practices changed from small, **subsistence farms** to larger, more efficient farms. Although the Green Revolution has its critics, it is important to note that many of the African countries most at risk of food insecurity have yet to adopt many aspects of the revolution.

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

Source 2.11 Farm workers in the Punjab region of India use a tractor to pull a load of grain. Part of the Green Revolution in India has been the introduction of high-yielding seed varieties, such as wheat, to encourage self-sufficient farming.

Check your learning 2.3

Remember and understand

1 What was the Green Revolution? What were the key changes it introduced?
2 How could the Green Revolution help to increase food security in Africa?
3 By what number is the world's population increasing each day?
4 By the year 2050, by how much do food experts estimate food production will need to increase to feed the world's population?

Apply and analyse

5 Examine Source 2.10 and answer these questions.
   a What evidence is there that the most population growth is occurring in developing countries?
   b Why is this important when considering global food security in the future?
6 List the arguments for and against the theory that there will be increasing food insecurity due to population growth. Which arguments and evidence do you believe have the most solid basis? Give some reasons for your response.

Evaluate and create

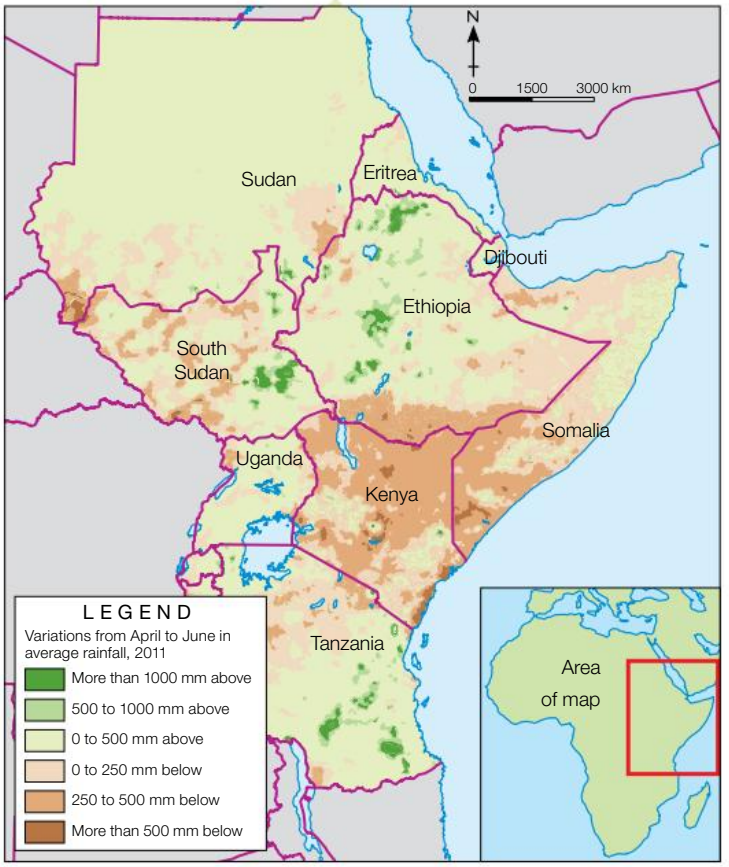
7 While there are many supporters of the Green Revolution there are also many critics. As a class, brainstorm what these criticisms might be. Use this brainstorming session to develop some inquiry questions and use these to research this issue further.
8 Conduct research on the Internet into the genetic modification of plants.
   a In your own words, explain what is meant by genetic modification.
   b Outline three main arguments in favour of genetic modification of foods.
   c Outline three main arguments against the use of genetically modified foods.

Food insecurity in the Horn of Africa

The Horn of Africa refers to the countries in the north-east of the African continent. Ethiopia, Eritrea, Somalia and Djibouti are the four countries that officially make up the Horn, but Kenya, South Sudan, Sudan, Uganda and even Tanzania are sometimes considered to be part of the Horn of Africa. It covers an area of approximately 2 million km^2 and is home to around 100 million people.

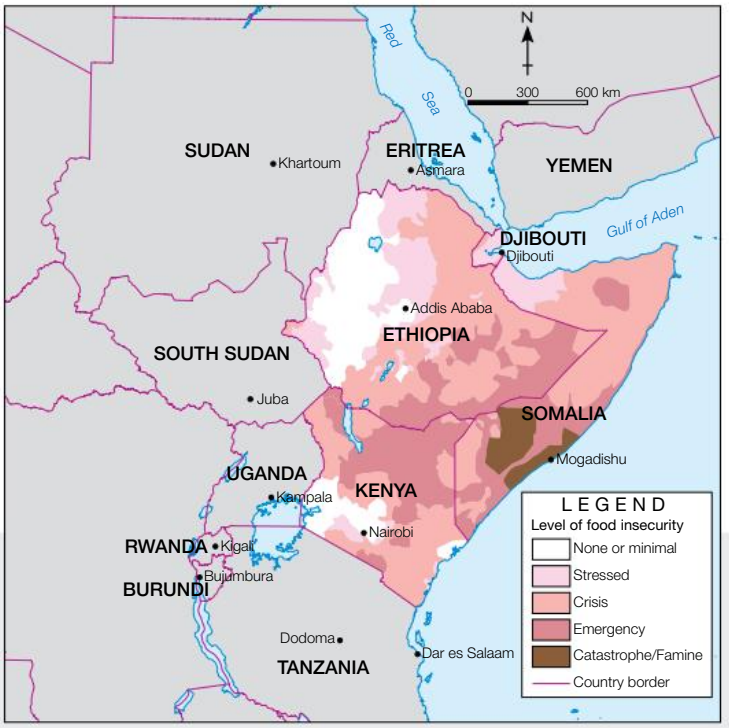
People who live in countries on and around the Horn of Africa often experience food insecurity. This is mainly due to a combination of natural processes and human activities. In 2011–2012, the area experienced the worst drought in decades. It caused the widespread devastation of millions of hectares of vital food crops and led to the deaths of hundreds of thousands of people by starvation and malnutrition. The United Nations declared the area to be in the grip of a famine, the first announcement of its type in nearly 30 years.

THE HORN OF AFRICA: VARIATIONS FROM AVERAGE RAINFALL, 2011



Source 2.12 Source: Oxford University Press

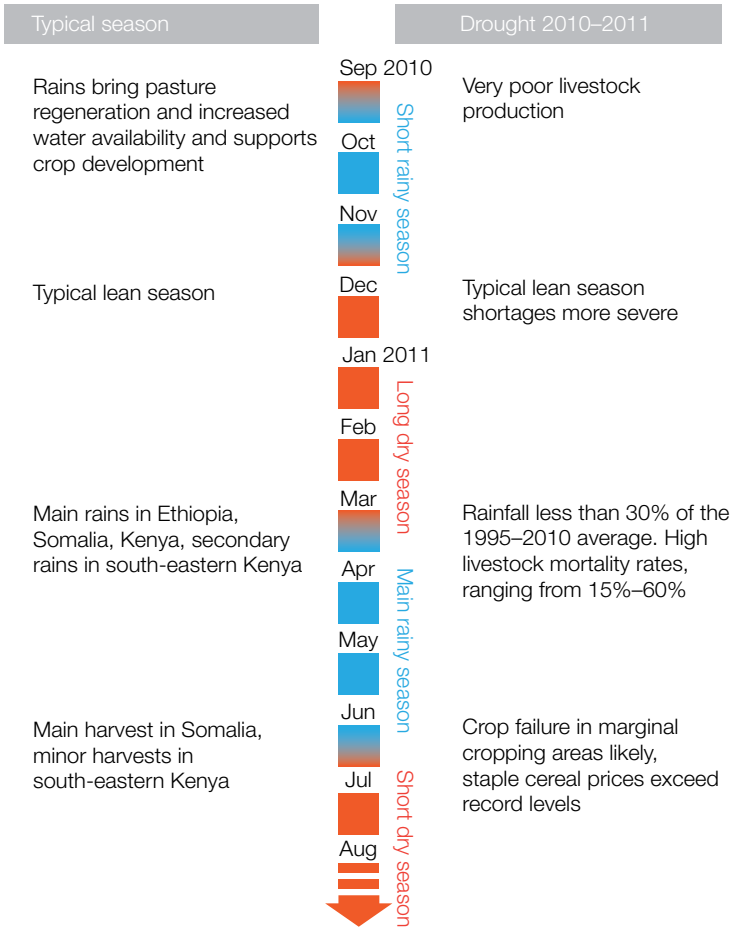
THE HORN OF AFRICA: FOOD INSECURITY SNAPSHOT, 2011–2012



Source 2.13 Source: Oxford University Press

At its most severe, the drought and subsequent famine brought food insecurity to more than 13 million people in the Horn of Africa as well as in neighbouring countries, including Kenya, Uganda and South Sudan. The situation was worsened by an ongoing conflict in southern Somalia that made it difficult for aid agencies to deliver food to the communities in need. As many as one million people fled the affected areas causing a further humanitarian crisis as refugee camps struggled to accommodate the flood of new arrivals.

Local people in need of assistance as at 5 September 2011	
Ethiopia	4.6 million
Djibouti	146 600
Somalia	4 million
Kenya	3.8 million



Source 2.14 This timeline shows the rainy season failure of 2010–2011, compared to a typical season.

skill**drill**

Developing geographical questions

It is important that geographers ask lots of questions. These questions can be simple or complex, and can guide understanding of places, events, and the causes and effects that various factors have on an environment.

For example, in the case of an event such as a famine, a geographer may start the process of understanding the situation by asking a simple question such as, 'How many people died in the famine?' Often a simple question will look at the more quantitative aspects of a situation (i.e. facts that can be expressed in numbers).

Then, to investigate further and deepen their understanding, a geographer may ask a more complex question, such as, 'Was there a change in climate that caused food crops to fail?' Often, a complex question will look at the more qualitative aspects of a situation (i.e. things that can be expressed in words not numbers).

The best complex questions can open up a whole new area to explore and result in an in-depth understanding of the situation.

The following steps will help you generate a range of simple and complex questions.

Step 1 Select an event that you would like to investigate.

Step 2 Construct some simple questions to guide your initial investigation. The key words 'who', 'where', 'when', and 'what' should help you get started.

Step 3 Investigate the questions you have listed and note down your answers.

Step 4 Expand your investigation by forming some more complex questions. Words such as 'why', 'what caused', 'who interacts' and 'what impact' will help you to construct these types of questions.

Step 5 You may also develop some of the questions from Step 2 into more complex ones. For example, you could develop 'What?' into 'What will the effect of … have in the future?' to allow for further discussion.

Apply the skill

Use Sources 2.12, 2.13 and 2.14 together with the information provided to complete the following tasks.

1. Develop a set of five simple questions about the famine in the Horn of Africa in 2011–2012. Use your answers to list some main facts about the situation.
2. Now investigate the famine more deeply by constructing three complex questions which focus on its causes. You may want to develop a complex question that focuses on the political situation in the region and the effects this had on the countries that suffered.
3. Prepare a brief report explaining the famine based on your answers. Check that you have included causes as well as effects in your report to give a well-rounded viewpoint.

Extend your understanding

Conduct some further research and then complete the following tasks.

1. How did the ongoing conflict in southern Somalia contribute to the famine?
2. Research the ways in which organisations such as Caritas, UNICEF, AusAID, Mercy Corps, World Vision and Oxfam helped bring food security to this region during 2011 and 2012.
3. What means do you think can be adopted to establish long-term food security in a region that experiences famines?

2.2 What are the main threats to food security?

Food security risk factors

Source 2.15 The melting of glaciers and icebergs is a well-known example of climate change. Another effect of climate change is the threat to food security in many parts of the world.

As we have learned, food security (the consistent access and availability of an adequately nutritious food supply) depends on a number of factors. In some places, these factors are in a state of flux, and food security is under constant threat.

There are six main threats to food security which are outlined here, and which will be explored in more depth in this section of the chapter. The main factors that come into play and put food security at risk are: water scarcity; climate change; threats from non-native plants, animals and insects; competition for land; the use of land for fuel instead of food; and armed conflict.

Water scarcity

Water scarcity is the lack of access to enough safe water. The supply of clean, safe water is important not only for people to drink, but for the safe growing of crops for food. As the world's population continues to grow, water becomes an even more important resource, and its management becomes more crucial. Water is needed for people to drink, wash and cook with on a household level; however, massive amounts of water are also needed for agriculture, industry, manufacturing and leisure activities. This competition for water can lead to shortages, and when there is not adequate water, food security is put at risk.

Climate change

The term 'climate change' refers to long-term changes in weather events and patterns worldwide. The effects of climate change include rising global temperatures and changes in levels of rainfall. Such changes impact on the environment and the sustainability of agricultural production. Places that are able to grow certain crops because of the reliable rainfall, for example, may find that increases or decreases in rainfall affect the viability of that crop. Climate change may also cause more frequent droughts or floods in some regions, both disastrous to crops. The effect on crop growing is just one example of the way climate change can directly impact on food security.

Threats from non-native plants, animals and insects

The introduction of non-native plants, animals or insects into an area can have devastating effects on the natural environment. This, in turn, can develop into a situation where food security is put at risk. Pests such as the Khapra beetle that live and breed in stores of grain, can destroy up to 70 per cent of a store and make it inedible. A native of South Asia, the Khapra beetle is now one of the top invasive species globally. In countries where rice is a food staple, the damage caused by this beetle puts food security at risk.

Competition for land

In many places around the world, agriculture is being threatened by competition for land. Food security may come under threat by people or corporations who want to use land for purposes other than growing food crops. Land that was once productive farmland is being converted into housing, mines, golf courses, shopping complexes and factories (see Source 2.17). This competition for land, partly to service and house growing populations, means that there is less land available to grow food.

The use of land for fuel instead of food

One of the biggest emerging threats to food security in recent years has come from the growth in the amount of land being used to produce crops used to feed cars, not people. These crops are used in biofuels – fuels that are produced, or partly produced, by some types of plants. Researchers, trying to reduce carbon emission caused by traditional fuels, developed biofuels. This has meant that land previously used to grow food crops has been taken over in order to supply the produce for biofuel (see Source 2.18).

Armed conflict

Armed conflict is another complex and severe threat to food security. Armed conflicts have the potential to affect the food security of entire regions and may even result in famine. In cases of armed conflict, the food security of a population can be affected in various ways. Food may be stolen from the local people by armed forces, land used for growing food crops may be destroyed, or the young men – even children – who would normally tend fields may instead go off to fight. The effect of armed conflict on food security, and how to deal with it, is a major global concern to organisations such as the United Nations and UNICEF.

Source 2.16 Swarms of locusts, that will eat any plant material in their path, are another pest that can quickly destroy crops, resulting in food insecurity.

Source 2.17 Increasing competition for land to use for purposes other than growing food poses a threat to food security in some regions of the world.

Source 2.18 The practice of using land to grow crops for fuel, not food, puts food security at risk for many people.

Check your learning 2.4

Remember and understand

1 Why is there growing competition for water and land resources?

2 Name some of the competing uses for land around the world.

Apply and analyse

3 The use of biofuels can help reduce the carbon emissions that cause climate change, but growing crops for fuel can also increase food insecurity.

- **a** In this instance, do you think it is more important to provide enough food for people or to help stop climate change?
- **b** How would you suggest balancing the potential risks of climate change against people's need for food?

Water scarcity

Agriculture uses about 70 per cent of all fresh water taken from rivers every year. From the rice terraces of China to the orchards of Australia's Murray–Darling Basin, river water is used to irrigate farms and feed billions of people around the world.

River systems and the water they capture, store and distribute are among the most threatened natural environments on Earth. The level of threat to the ongoing supply of fresh water available for agriculture varies from place to place, but an increasing demand for water is by far the most common threat to food security around the globe. In many places, population growth – particularly in cities – puts increased demand on nearby rivers and lakes. This increased demand and usage then threatens the water supplies that farmers rely on.

Economic factors

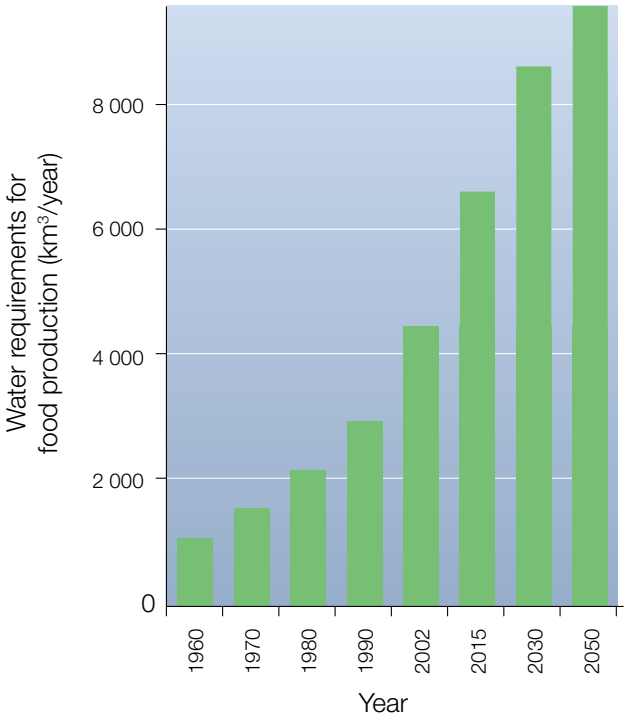
Greater prosperity and socioeconomic development also places greater demands on water supplies. Industrial development and an increase in the number of individual households means increased water consumption. At current usage rates water needed for industry around the world is predicted to at least double by 2025.

Rapid economic growth and Westernisation in countries such as China and India is also affecting water usage. According to environmentalists and academics, water scarcity and quality is the most pressing environmental issue facing China today. Currently water is being used at an unsustainable rate. Changing tastes in places like China are also increasing the demand for certain foods, such as meat, which requires more water to produce than traditional rain-fed crops. This is putting an added strain on water resources.

Environmental factors

Environmental factors also affect the amounts of water used for growing food (see Source 2.20). Changing rainfall patterns and warmer temperatures as a result of climate change are seriously affecting water supply in some regions of the world. The rapid melting of glaciers in places such as South America and Central Asia is of particular concern.

Source 2.19 A farmer searches for water in the Mekong river basin.



Source 2.20 The historic and projected changes in water consumption needed for agriculture, 1960–2050.

Glaciers have historically acted like reservoirs. As the glaciers have slowly melted, water has flowed down the mountains into the rivers, providing water to millions of people. This water has been used to grow a significant amount of the food to meet the requirements of 2.5 billion people in Asia, and 53 million people in Peru, Bolivia and Ecuador. As the glaciers shrink, however, this water flow is declining. A lack of water to grow crucial crops is predicted to have a severe impact on food security for people in these regions.

Case study: The Mekong Basin

The Mekong River begins on the northern slopes of the Himalayas and crosses six countries before reaching the South China Sea. On its journey it is dammed for electricity and diverted for irrigation, providing water to meet the needs of more than 60 million people. Forty-eight million people rely directly on the Mekong River basin for their food supply (see Source 2.21).

THE MEKONG BASIN: LAND USE

Source 2.21

Source: Oxford University Press

Check your learning 2.5

Remember and understand

1 List the ways in which the supply of river water for farming is threatened. Highlight those that apply to rivers in Australia.

2 Explain how water scarcity and food security are linked.

Apply and analyse

3 Use an atlas and Source 2.21 to describe the route taken by the Mekong River from its source to the mouth. Explain how changes near the source could bring about food insecurity for communities near to the mouth.

4 Estimate the area of rice paddy cultivation in the region shown in Source 2.21. Describe the spatial association between the river and the rice paddies.

5 Describe the changes in the amount of water used, and projected to be used for food production from 1960 to 2050.

Evaluate and create

6 The Mekong River crosses six countries. How might this cause problems and conflicts between countries who rely on it? In particular, how might downstream users such as the rice farmers of Vietnam be affected?

Climate change

Much debate surrounds the subject of climate change, but there is now considerable evidence and consensus that the main cause of global warming is the rising carbon dioxide levels in our atmosphere from burning **fossil fuels**. Gases produced by human activities are being added to the atmosphere at such a rate that they are changing the Earth's climate. The most obvious change is a rise in global temperatures but there are other changes too. Some places are becoming wetter, while others are becoming drier. Glaciers and ice caps are melting, causing sea levels to rise. Extreme weather events such as droughts, floods and cyclones are becoming more serious and frequent.

Source 2.22 Climate change is projected to impact significantly on food, water and ecosystems.

Global temperature increase	Projected effect
0°–1°	• Small mountain glaciers disappearing, impacting on water supplies • Extensive bleaching and damage to coral reefs leading to widespread death of coral and attached species • Risk to some ecosystems • Increase in extreme weather events – increased damage from floods and storms
1°–2°	• Up to 30% of species at increasing risk of extinction • Failing crop yields in many areas, particularly developing regions • Cereal-growing productivity to decrease in some regions • Risk to some ecosystems increases
2°–4°	• Significant decrease in water availability in many areas, including the Mediterranean and southern Africa • Increasing level of extreme weather events – increased number of human deaths due to floods, heatwaves, droughts, etc. • Many ecosystems now at risk • About 30% of global coastal wetlands to be lost
4°+	• Very high risk of irreversible environmental damage • Very high risk of abrupt changes to global environments • Sea level rise threatens major cities • Falling crop yields in many developed regions • Significant number of extinct species around the globe • Increasing levels of malnutrition, diarrhoea and infectious disease

These and other changes are already impacting on food production, and climate scientists warn that these impacts will become more severe in the future depending on global temperature increases (see Source 2.22).

Changes in the atmosphere affect water and land that is used for growing crops. Droughts mean there is not enough water for successful crop growing, while a drastic increase in the amount of rain falling on a region means crops may be flooded and destroyed. These changes in climate pose a significant threat to food security.

Impacts on Sub-Saharan Africa and Asia

The impacts of climate change on food production are likely to be greatest in Sub-Saharan Africa and Asia. Many farming areas in Africa are expected to become drier. As the soil dries, causing plants such as trees and shrubs to die, the possibility of Africa's deserts spreading into areas currently being farmed is expected to increase. Infestations from plants and animal pests such as locusts are also expected to become more severe, as are droughts.

Asia's river deltas, such as the Mekong, Ganges, Indus and Yangtze, are sometimes referred to as the world's rice bowl. Due to farming improvements introduced during the Green Revolution, these river deltas now help provide food security to over one billion people. This food security, however, is under threat from several impacts of climate change. Changes in rainfall patterns are making it difficult for farmers to know when to plant their crops. Severe rainfall variability is damaging crops and affecting food security. Thailand, for example, suffered a severe drought

Source 2.23 This rice field sits on a low island near the mouth of the Ganges River in Bangladesh. A sea level rise of a few centimetres would cover the crop in salty water, destroying it.

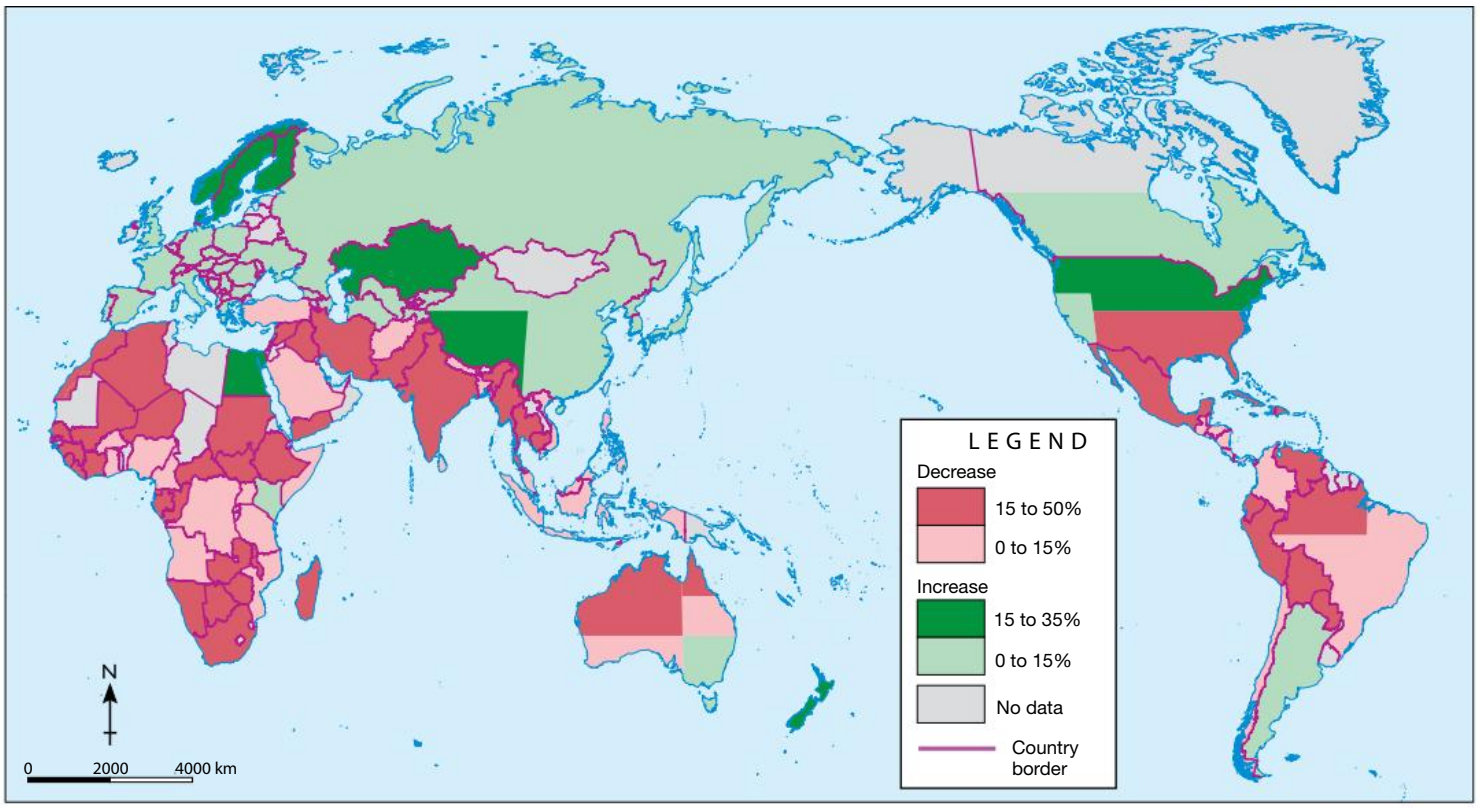
in 2010 that damaged crops across the country. A year later, devastating floods swept through Thailand leaving behind a $40 billion damage bill.

It is the impact of rising sea levels, however, that has the greatest potential to damage food security in these river delta regions. Rice is grown in the fertile soil of low-lying river deltas. As sea levels rise, ground and river water become saltier, killing rice crops and depositing more salt in the soil.

Predicted changes in food production

The effects of climate change on food production will vary across the world. Some regions may even be able to increase food production with the changes in climate. However, for most parts of the world, and most significantly, for the most populated parts of the world, climate change will cause a decrease in potential food production (see Source 2.24).

WORLD: PREDICTED CHANGES IN FOOD PRODUCTION BY 2080



Source 2.24

Source: Oxford University Press

Check your learning 2.6

Remember and understand

1 Why are many rice paddies in river delta regions at risk from climate change?

2 Explain the link between human activities and climate change.

Apply and analyse

3 Examine Source 2.22 showing some predicted effects of climate change. Select five of the effects listed and describe how they may threaten food security.

4 Examine Source 2.24. Which regions of the world are predicted to lose between 15 per cent and 50 per cent of their food production by 2080?

5 Compare Source 2.7 with Source 2.24 and complete the following tasks.

a Which regions that currently have stable food security are predicted to experience significant change by 2080?

b Which regions currently at risk of extreme food insecurity are predicted to lose more than 15 per cent of their food production by 2080?

Evaluate and create

6 Compare the predicted changes in food production for Australia and New Zealand. Which impact of climate change do you think will most affect their food security in the future? Give some reasons for your answer.

Threats from non-native plants, animals and insects

One of the greatest threats to natural ecosystems and to food security is the arrival or introduction of non-native plants, animals or insects into an area. Known as **invasive alien species** (**IAS**), they cause billions of dollars of crop loss and damage throughout the world every year. Vast sums of money are spent trying to control and contain these invaders.

Virtually all farming communities are under threat from invasion. In Australia, for example, it is estimated that about 15 per cent of all plants growing throughout the country are weeds. Weeds affect food security as they compete with crops for water, sunlight and soil nutrients. The number of invading plant species in Australia is also growing by about 10 new species per year. These new species are spreading faster than they can be controlled.

Invading plants and animals are mainly spread through human activities. In some cases, the spread is accidental. The most successful invader in the world, for example, is the black rat. Native to north-east China and India, rats were carried around the world as stowaways on ships. Most modern invaders, however, now hitch rides on planes rather than ships. Seeds carried accidentally on shoes, or insects in clothing can now travel from place to place across the world in a matter of days, even hours.

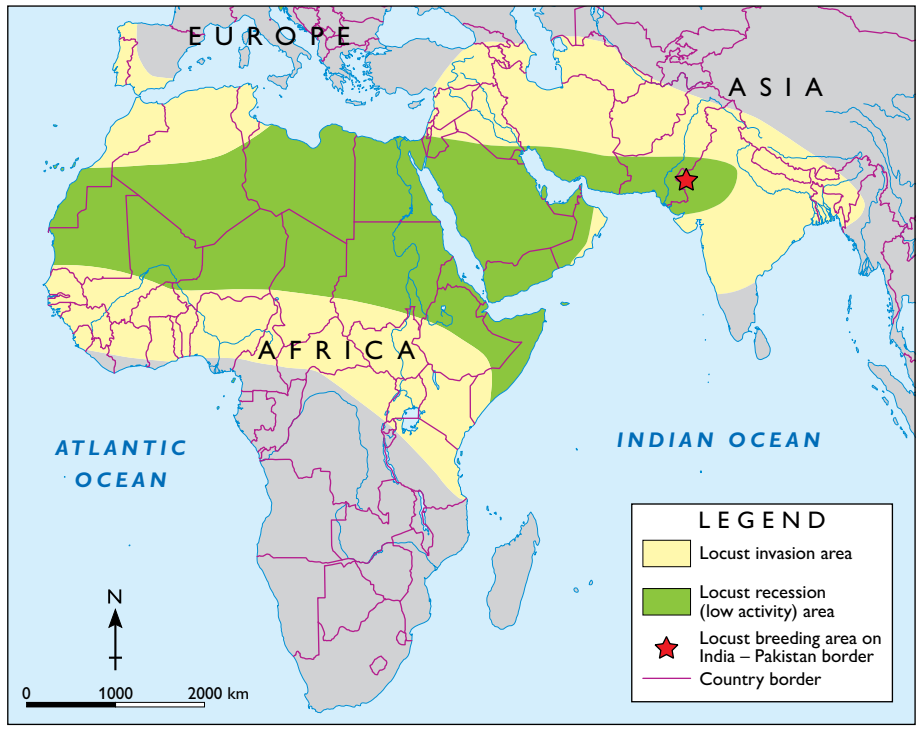
In other cases, alien invaders are introduced to native environments deliberately. Humans have, at different times, purposely brought non-native species into an environment, usually to tackle an existing problem with another species. Unfortunately, in the past there has been a failure to predict the level of negative consequences that the introduction might have on the local ecosystem as a whole. The cane toad and Indian Myna bird were both introduced to Australia to control pests. They have, however, now caused massive destruction to the natural ecosystem, native species and the food chain.

Case study: Desert locusts

Desert locusts are usually solitary insects causing no great harm to farmers' crops. When conditions are right for them, however, they become one of the world's most

Source 2.25 A swarm of locusts can devour a vast area of crops in a stunningly short period of time.

AFRICA AND SURROUNDS: LOCUST AREAS



Source 2.26 Source: Oxford University Press

destructive pests, bringing widespread food insecurity to communities in Africa, Asia and the Middle East. Drought conditions in their usual recession area (the area where they normally withdraw and are not active) combined with good rains in their breeding area cause the locusts to form vast swarms that invade surrounding areas (see Source 2.25). A swarm may cover 1000 square kilometres, with up to 80 million locusts per square kilometre. Travelling up to 100 kilometres per day, they devour entire crops in minutes. One swarm in Ethiopia, for example, is believed to have consumed enough grain to feed a million people for a year.

Case study: The larger grain borer

Two of the most important food crops in Sub-Saharan Africa are maize (a type of corn) and cassava (a root plant). **Subsistence farmers** – those who grow only enough for their household needs – grow small fields of maize and cassava and pick and store them during harvest time, providing some food security throughout the year. However, their stored crops are under attack from an unwelcome invader, the larger grain borer.

Accidentally introduced into Tanzania from its native Central America in the late 1970s, the larger grain borer has now spread throughout West and East Africa. Feeding on the stored maize and cassava, it can quickly reduce stores to piles of dust unfit for human consumption. Farming families are then forced to try and buy food from other farmers. In many cases, however, all the stored crops in a region have been destroyed.

Source 2.27 Maize is the staple food of millions of people. An invasive alien species such as the larger grain borer can pose a very serious threat to the food security of people who rely on a maize crop for food every day.

Check your learning 2.7

Remember and understand

1 How do weeds impact on food security?
2 How are invasive alien species spread?

Apply and analyse

3 Examine Source 2.26. Describe the spread of desert locusts from recession areas into invasion areas. Use the names of regions, countries and compass directions in your description.
4 Why are desert locusts a threat to food security in some regions?

Evaluate and create

5 From its discovery in Tanzania in the late 1970s, the larger grain borer has spread throughout much of the African continent. Here is a list of countries where the larger grain borer has been found with the year of its detection:
Kenya (1983); Togo, Benin and Burundi (1984); Guinea (1987); Ghana (1989); Burkina Faso (1991); Malawi and Nigeria (1992); Rwanda and Zambia (1993); Niger (1994); Namibia (1998); Mozambique (1999).
   a Using the list of the countries above, as well as the years of detection, map the spread of the larger grain borer from its discovery in Tanzania in the late 1970s on an outline map of Africa. Use labelled arrows to show the progression of the spread.
   b Describe the movement of the borer as shown on your map.
   c Which countries do you believe are most at risk from the future spread of this invader? Why do you think this would be the case?

Competition for land

In addition to environmental factors, food security can also be threatened by individuals or corporations taking over productive land and using it for purposes other than growing food. In many places around the world, land that was once farmland is being converted for housing, mines, golf courses, factories and other uses. This competition for land is being driven partly by the increase in the world's population and partly by the desire to make more money from the land.

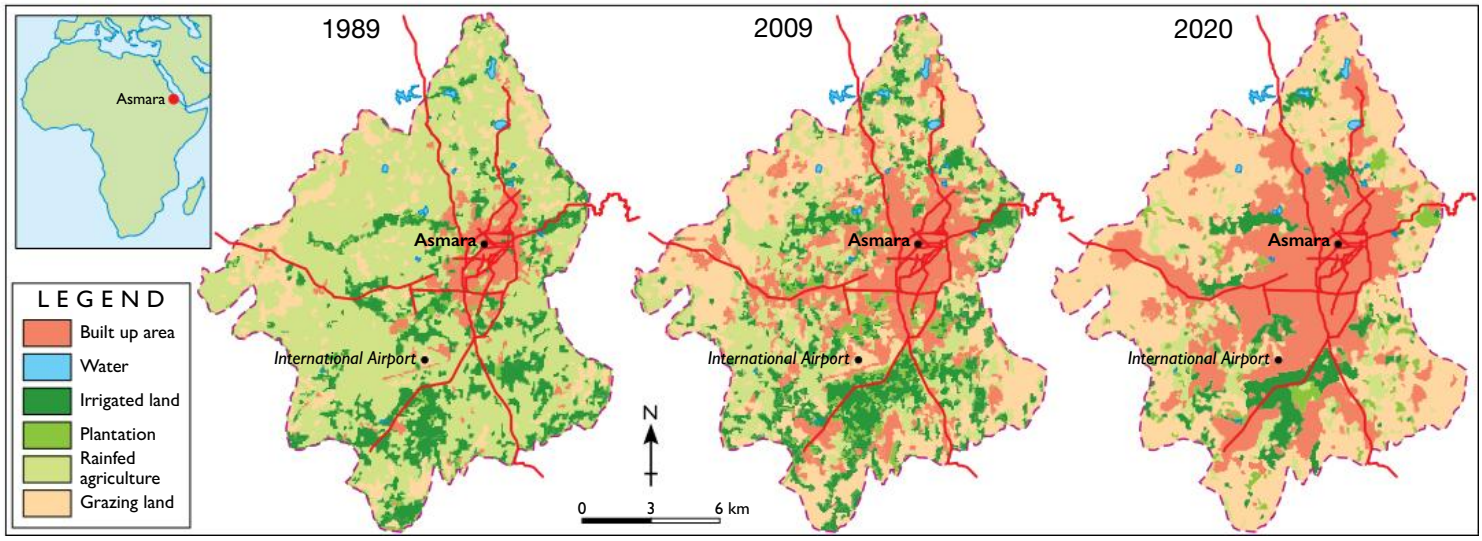
Source 2.28 New suburbs sprawl into existing farmland north of Asmara, the capital of Eritrea, in Africa.

Land for housing

The development of rural areas for housing is one example of competition for land use. Urban areas cover only about two per cent of the world's total land area. They are often built, however, on the best land – flat, fertile and well watered. Farming areas on the edges of cities provide food to the city dwellers. As cities grow in population, however, they also grow in size, and farmland and rural spaces are taken over and developed into new suburbs for the growing population. The spread of a city outwards is known as **urban sprawl**. In this process, farmland is taken over for housing, and farmers are pushed further out onto land that may not be as suitable for growing crops. Their ability to produce food may fall, putting at risk the food security of the people in the city.

The city of Asmara in Eritrea, for example, has tripled in size in the last 20 years and now sprawls across land that was previously prime farmland. Source 2.29 maps the rapid growth of Asmara. This growth is expected to continue at its current rate, and may even accelerate in the next few decades, absorbing more productive farmland. This same process has been experienced by many places around the world, including in Australia, where urban sprawl has seen productive farmland converted to suburban living spaces.

ASMARA: URBAN GROWTH 1989–2020



Source 2.29

Source: Oxford University Press

Land for tourism and recreation

In some places, productive farmland is also being converted into tourism and recreation facilities. Many developing countries, for example, recognise that attracting tourists provides them with a reliable source of income. These tourists, most of them from developed countries such as Australia and the USA, are drawn to these countries for a range of factors including climate, stunning scenery and unique cultures. But tourists often also want a high standard of accommodation and recreation facilities like hotels, pools and golf courses (see Source 2.30).

A study of the impact of golf course development in Thailand found that 250 courses in the country together consume about 200 square kilometres of land. About three-quarters of these courses were built on existing farmland, the rest on land that was previously forested. This area represents a loss of about 89 000 tonnes of rice every year. Furthermore, golf courses put great pressure on the freshwater resources of the local area. Each Thai golf course consumes the same amount of water as 60 000 Thai villagers would.

This trend is not confined to Thailand. In other Asian countries such as Indonesia, Cambodia and Vietnam, as well as in island nations throughout the Caribbean, productive farmland and scarce fresh water resources are being consumed by golf courses and other recreation facilities.

Source 2.30 A rice field has been converted into a golf course to attract tourists, an increasingly common use of agricultural land in many places in Asia. This poses a significant threat to food security – not only is the land for crop growth taken away but golf courses consume massive amounts of water.

Check your learning 2.8

Remember and understand

1 What is urban sprawl and why is it a threat to food security?

2 How does the growth in global tourism impact on food security?

Apply and analyse

3 Use Source 2.29 to describe the growth of Asmara from 1989 to 2009. Which type of farming was most affected by this growth? What is predicted to happen by 2020?

4 If golf courses threaten food security, why do many countries around the world build them on productive farmland? Explain the underlying causes of this problem.

5 The golf course shown in Source 2.30 has caused the loss of productive farmland and created other problems. It has also brought some benefits. Brainstorm the potential costs and benefits of this golf course to the local region and community.

Evaluate and create

6 Research the growth of a large Australian city. Find out if its development has resulted in urban sprawl and the loss of productive farmland. If so, explain what the impacts of this have been for food production in the region.

The use of land for fuel instead of food

Brazil is one country where the use of land for growing fuel rather than food has increased dramatically. Despite offering many advantages, this change has the potential to put food security in Brazil at risk in the future.

Case study: Brazil's biofuel industry

Biofuels are fuels made from organic matter rather than fossil matter. They are often made from biomass (i.e. plant materials high in sugar, starch or oil) such as sugarcane, corn, soya beans or sunflowers.

Brazil has gradually developed a booming biofuel industry. Biofuels such as ethanol and biodiesel are an example of how countries can develop 'home-grown' renewable energy sectors. The establishment of a biofuel industry has been part of wider long-term initiatives to change the way Brazilians produce and use energy, including adopting integrated food–energy systems (IFES). IFES combine the production of food and energy into one system. Other measures include:

- the introduction of new 'flex-fuel' vehicles which run on any blend of petrol and ethanol
- new land zoning laws that identify suitable areas for biofuel production (avoiding using land with high biodiversity, such as rainforests)
- efficiency improvements to increase the productivity of biofuels
- social and environmental safeguards to address any concerns.

Around 15 per cent of Brazil's total domestic energy supply now comes from biofuels made from sugarcane.

skill**drill**

Analysing complex maps

Complex maps contain more than one set of information. Geographers use complex maps to analyse different features, reveal patterns and explain links between features in a given area. You can analyse a complex map by following these steps.

Step 1 Look carefully at the map and read its title to make sure you understand what is being shown.

Step 2 Examine the map's legend. Complex maps can have more than one part to a legend, and these parts will be represented on the map in different ways. For example, in Source 2.31 areas of colour are used to show the location of soya bean and sugar cane crops. Different coloured symbols are also used, to show biodiesel plants, ethanol plants, and pipelines.

Step 3 Train your eyes to look for one set of information at a time. For example, look at solid blocks of colour on the map and work out what they tell you.

Step 4 Move to a different set of information by selecting another symbol or block of colour from the legend. Examine the map to identify the symbol or areas of colour.

Step 5 Look for concentrations of the same symbol in areas to see if patterns exist.

Step 6 Note any patterns you can find on the map between different features and locations.

Step 7 Describe the degree to which patterns are connected.

Step 8 Try to suggest reasons for the connection between the two patterns.

Apply the skill

Look at the map of South America (Source 2.31) showing biofuel infrastructure.

1 Find the symbol for ethanol and biodiesel plants in the legend then locate these on the map. Describe the concentration of these.

2 What relationship is there between the concentration of ethanol plants and the location of sugar cane crops?

3 What does the location of the ethanol pipelines tell you about the production and consumption of biofuels?

BRAZIL: BIOFUEL INFRASTRUCTURE

Source 2.31

Source: Oxford University Press

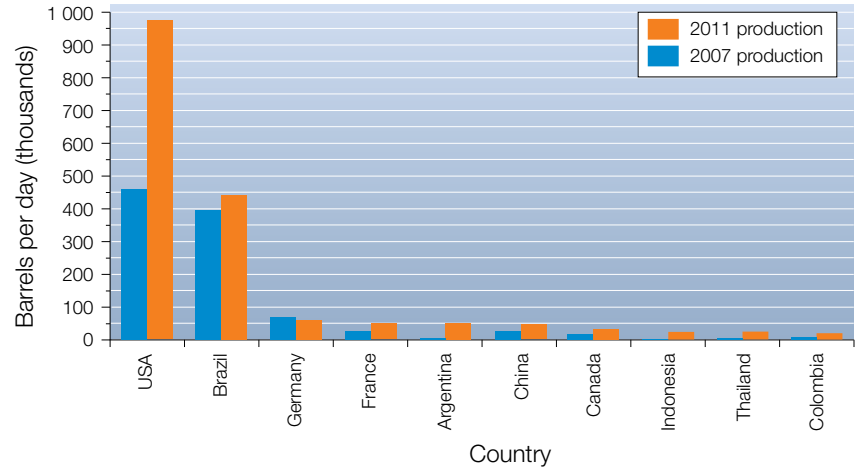
Biofuels as a threat to food security

Although waste products of food crops such as corn and sugarcane can be used to provide some of the raw material for the production of biofuels, greater production of biofuel needs bigger crops. In some places, fuel crops are replacing food crops and this has raised concerns about food security in these countries.

While the amount of biofuel produced and used has grown rapidly in recent years, it still provides only three per cent of the total energy used to power vehicles worldwide. Despite this, biofuel production threatens the food security of many communities, particularly in South American countries such as Brazil, Argentina and Colombia, that are boosting their biofuel production.

Biofuel production poses a threat to food security in two main ways. Firstly, marginal farming land (land that is situated on edges of arable land) is the land most likely to be converted for growing biofuel crops. This is often the land that poorer farmers use to grow the food needed to feed their families. Secondly, growing crops for fuel rather than food pushes up the price of food, making it less accessible. As people on lower incomes spend a much greater proportion of their income on food than wealthy people do, it is the poor who suffer most when food prices increase.

Source 2.32 Political cartoonists often rely on simple images to convey a complex message – this cartoon comments on the competition between using land for food and using land for fuel.



Source 2.33 The top ten biofuel producers in the world, 2007 and 2011

Check your learning 2.9

Remember and understand

1 What are biofuels? What are they produced from?

Apply and analyse

2 Examine Source 2.32.
   - a What point is the cartoonist making about biofuels?
   - b How effective is this cartoon in communicating this point?

3 Examine Source 2.31.
   - a Compare Source 2.31 with Source 1.2 (World biomes). Which biomes are most threatened by the expansion of Brazil's biofuels industry?
   - b Some new ethanol plants are planned for construction across Brazil (shown as 'Proposed ethanol plant'). Describe the distribution of these new plants. How might the construction of these new plants lead to land use changes in the near future?

4 Who benefits from the growth in biofuel production? Who loses?

Evaluate and create

5 Use the data in Source 2.33 to construct a proportional circles map of the world's major biofuel producers in 2011.

6 One type of plant being used for biofuel production is jatropha. Jatropha is a flowering plant whose seeds are high in oil. In India, there are more than one million hectares of jatropha plantations. Research this plant and list the advantages and disadvantages of using it as a biofuel to replace fossil fuels. When finished, state your opinion on this use of farming land in India.

Armed conflict

Armed conflict – war between different countries, or civil war between groups within a single country – also has the potential to affect the food security of millions of people. It can result in widespread food shortages, and even long-lasting famines. While armed conflict results in deaths from battle, in some conflicts many people also die from a lack of access to food. Food insecurity caused by an armed conflict can kill more people than are killed by the fighting itself. Most at risk are people in developing countries, where many people rely on their own small farms to provide their family's food.

Several countries in Africa have experienced the devastating effects that armed conflict can have on the food security of the population. In an area where food security is already a serious concern – currently 75 per cent of the continent's countries are considered at high or extreme risk of food insecurity – the added turmoil of armed conflict brings an extra threat to a situation which is already critical. Many African countries, including Somalia, have endured decades of armed conflict and the resulting decrease in food security.

International aid

While international aid agencies such as the Red Cross and United Nations work hard to address the lack of food security in these war-torn areas, the environment can be very dangerous. In Somalia alone, 14 employees of the United Nations World Food Program were killed while distributing aid between 2008 and 2011 (see Source 2.35). Corruption, theft and a lack of law enforcement all contributed to the terrible situation.

Transporting food and farming supplies by road in these countries is risky, with aid often being seized by fighters for their own use. In Somalia, sacks of grain, peanut butter and other foodstuffs meant for starving Somali people were often stolen. Some families receiving aid were even forced to give it back after journalists taking photos of them with the food had left. With local food supply markets disrupted, food aid that has been stolen is often sold on in markets, taking relief efforts away from the starving and needy (see Source 2.35).

Distributing food aid is also often complicated by difficulties in reaching war-torn areas. Groups in remote areas can be difficult to locate and delivery of food aid to these places may be slow.

In such situations, hunger can be used as a weapon. The government can deliberately keep food away from opposition fighters and the local people who support them.

Source 2.34 Western armed forces distributing food aid in Somalia

Source 2.35 Food supply is affected as local markets are targeted. In Mogadishu, the capital of Somalia, relief aid was commonly looted at the distribution points and then sold at the markets.

Source 2.36 Somali children waiting in line for food aid.

Source 2.37 In war-torn areas, water is a precious resource. These women wait at a water distribution area for their empty containers to be filled.

Impact on local farmers

During times of war, such as those experienced by Somalia, food shortages are common. There are many reasons for this. Some food shortages are caused by the disruption of food markets and food aid. Land mines are planted, causing lasting danger (see Source 2.40). Some are caused by the fact that apart from the conflict that is happening, there are ongoing harsh climate conditions to deal with. The effects of war combined with climate can go on for years (see Source 2.39).

Crops cannot be planted, weeded or harvested. Farmers cannot plant new crops, which extends food insecurity even when the conflict is finished (see Source 2.39). Irrigation systems are destroyed and other water resources, such as wells, are sometimes poisoned as an act of war.

Animals are killed and taken for food by armies and rebel fighters. As well as a food supply, farmers lose manure for their crops as well as animal power to work their fields. Crop stores are often raided by rebel fighters as well.

Young men are often forced to fight. This seriously affects the agricultural output by reducing the available hands to work on farms. The amount of food and income for the family is diminished.

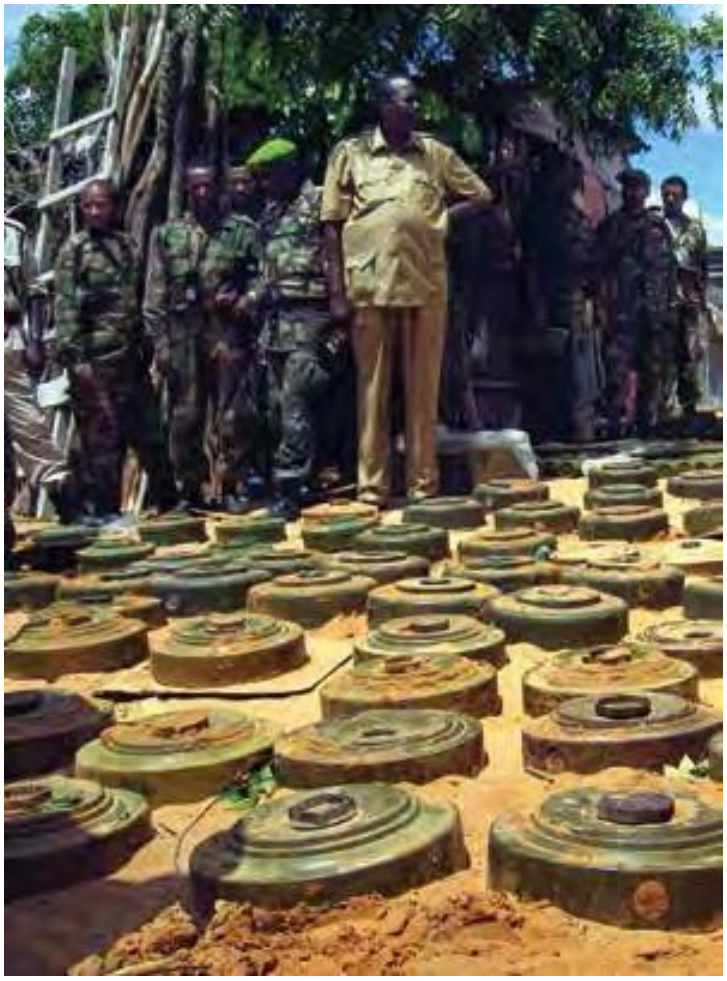
Farms may also be completely destroyed by the armed forces. Native scrub is burnt, and wild sources of food, such as wild fruits and honey, are destroyed. Many farmers abandon their farms.

In the Democratic Republic of Congo in Africa, at least 400 000 people were displaced from their fields during the harvest period. This affected not only their short-term food security, but their long-term food security as well.

Particularly for countries that already experience other threats to their food security, such as weathering the effects of climate change or battling plagues of locusts, the effects of an armed conflict on their food security can result in life-or-death situations.

Source 2.38 Amnesty International reported that in Somalia, children as young as eight years old were recruited to take up weapons and fight in the conflict.

Source 2.39 Food security can be threatened for years, as the land bears the ravages of war.



Source 2.40 Due to landmines, land previously used to grow food becomes inaccessible for years. Harvests are destroyed and fields cannot be cultivated.

Check your learning 2.10

Remember and understand

1 Why is there often a shortage of farm labour during armed conflicts?

2 How can hunger be used as a weapon during times of war?

Apply and analyse

3 Why are subsistence farmers – farmers who grow just enough to feed their own family – most at risk of food insecurity during armed conflict?

4 Describe three ways in which food security for local people would improve if peace was reached in an area that had been experiencing armed conflict.

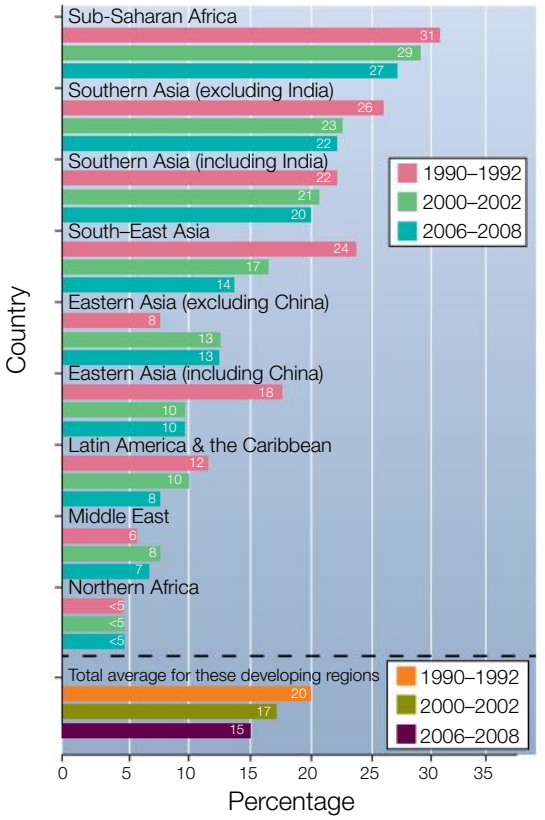
Evaluate and create

5 List the effects of armed conflict mentioned here. Rank them in order from the one that you think will have the most severe lasting impact on food security to the one you think will have the least serious lasting impact. Explain the reasons for ranking them in the order you chose.

6 How would the conflict in Somalia impact on the food security of people in other areas of the country or in neighbouring countries? Discuss this with a partner and then with your class.

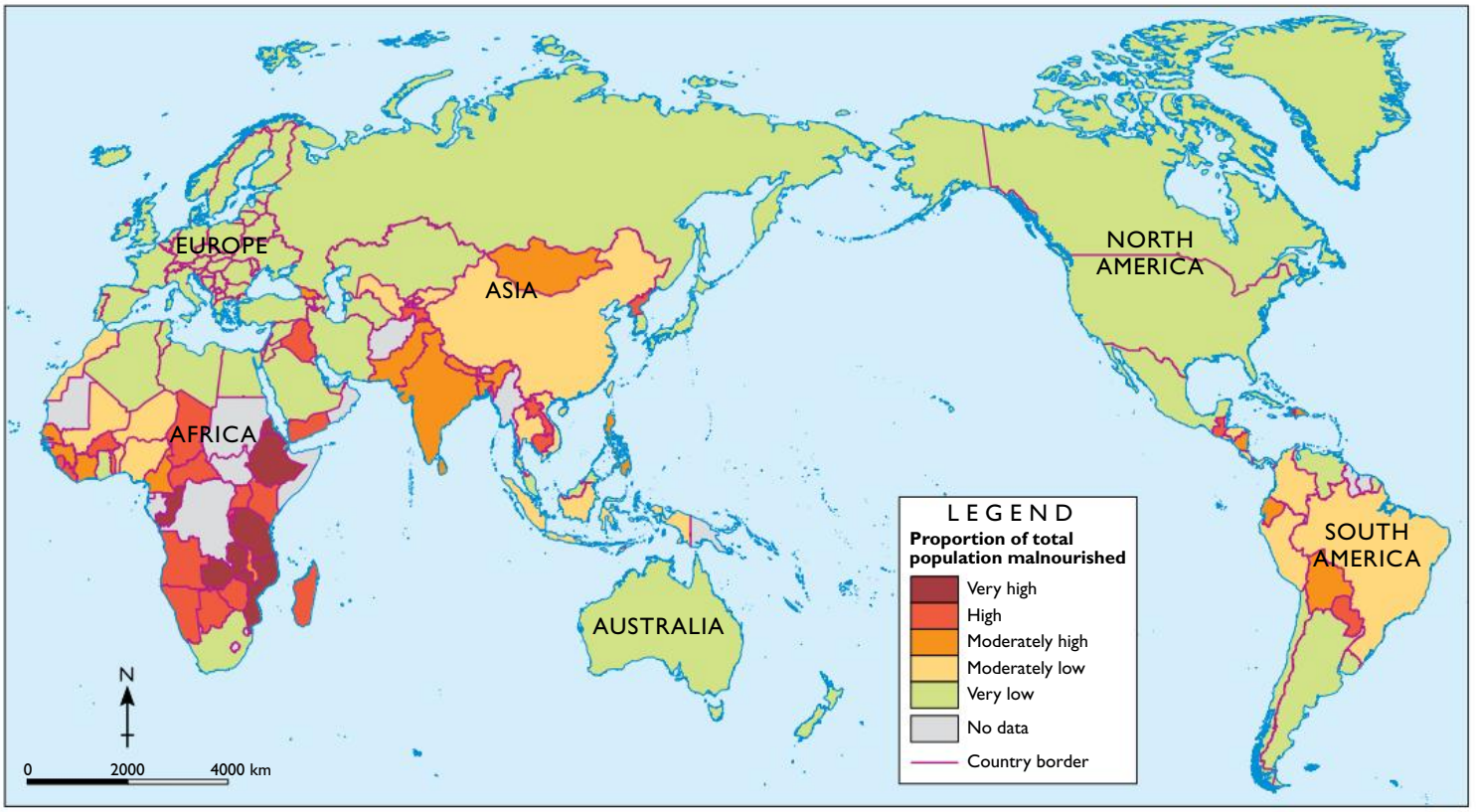
Halving hunger

At a meeting of the United Nations in 2000, representatives of 189 member countries agreed on a set of goals designed to improve the living conditions of people in developing countries. Eight goals, known as the Millennium Development Goals (MDGs), were developed. One of these goals was to eradicate extreme hunger and poverty, with the specific target of halving the proportion of people who suffer from hunger by 2015. Some of the 2015 targets have already been reached and many others are likely to be met. However, reaching the target of halving world hunger by 2015 seems unlikely.



Source 2.41 Proportion of undernourished people.

WORLD: HUNGER LEVELS 2012



Source 2.42

Source: wfp.org

skill**drill**

Presenting an oral report to an audience

Geographers often present their findings to an audience by giving an oral presentation.

You may find giving an oral presentation a little daunting at first, but if you follow these steps you will be able to confidently deliver a successful report.

Step 1 Decide on a topic that will interest both you and your audience. Consider your audience and think about what they already know about the topic. What would you like them to understand by listening to your presentation?

Step 2 Research your topic. Geographers start with inquiry questions and then seek to answer them. Collect information from a wide variety of sources and keep a bibliography of these sources. Try to find images, visual material and audio that may add variety to your presentation.

Step 3 Organise your findings into a draft outline of your report. It should have a clear introduction and conclusion. In your introduction it is often a good idea to use something to 'hook' your audience. It may be a question, a personal story or a challenging image. After your introduction, develop your report in a series of clearly defined sections (like paragraphs in a written report). Your conclusion usually summarises your key points. If your report is going to be assessed, make sure you have fulfilled the criteria for assessment.

Source 2.43 Practise with your memory cards before your presentation.

Step 4 Support your verbal report with clear visual material. This may be a set of graphs, maps or images. The trick is not to overdo your visual material but to think of it as supporting what you are saying. It gives your audience something to focus on and allows you to refer to features such as places on a map. Do not use your written report as visual material or read it to your audience.

Step 5 Practise your presentation. Make sure that you do not exceed the time limit and that you know your information well enough to avoid having to read it. It may be a good idea to have some memory cards with key words or ideas written on them. Avoid holding a single piece of paper if you are prone to nerves – memory cards are sturdier and won't tremble. If you are worried about being nervous, practice will help. Are you nervous because you are not properly prepared? Have you practised? Do your visuals work to support your report?

Step 6 Deliver your presentation. Make sure that you speak clearly and vary pitch and tone. Stand up straight, keep your hands out of your pockets and don't lean on a desk. If you become nervous while presenting, take a few deep breaths to calm yourself and then pretend that you are speaking to only one person.

Step 7 Invite your audience to ask questions and do your best to answer them. If you are unsure of an answer don't make something up, just do your best.

Apply the skill

1 Prepare and deliver a verbal report on an aspect of the Millennium Development Goal target to halve hunger by 2015. Your report must be supported by visual material and include responses to questions asked by the audience. Here are some possible topics to choose from, or you may like to develop your own.
   - There will always be hungry people in the world.
   - It is possible to halve hunger in some places but not others.
   - The solution to halving hunger is to …
   - If we address the causes of poverty we will meet the goal of halving hunger.
   - The proportion of hungry people in the world is more likely to rise than to fall.

Extend your understanding

Do some further reading on the Millennium Development Goals before answering the following questions.

1 Describe the distribution of hunger on a global scale.

2 Which regions of the world seem least likely to reach the 2015 goal? Which seem most likely? Why do you think these differences exist between world regions?

3 Research the other Millennium Development Goals and find the latest report. What are the goals, which have been achieved and which are the furthest from being achieved?

2.3 How can we improve food security?

Looking for answers

Over the course of human history, the world has seen dramatic and far-reaching changes. Humans have adapted to changes in the natural environment as well as building and changing the environment themselves. People have changed from being hunters and gatherers living in small communities to living as farmers and city dwellers. We have also improved our way of life through a series of remarkable revolutions: the **Agricultural Revolution**, the **Industrial Revolution** and the **Green Revolution**. These revolutions have allowed our populations to grow at an astonishing rate. In the rush to provide enough food and other raw materials to support our way of life, however, we are in danger of causing permanent damage to the very systems that support us – the soil, water and climate.

There are solutions, however, and some of them can be found in unusual places. Some solutions are based on developments at the forefront of technology, such as manipulating the genes of living organisms. Others come from the distant past; techniques used by Indigenous people who worked more closely with the natural systems of the Earth.

Looking after the soil

Soil is perhaps the farmer's most important resource. Many farming practices, however, such as ploughing, fertilising, clearing natural vegetation, irrigating and draining have degraded soil to such an extent that the soil can no longer support the same growth of crops as it did in the past. Many farmers are now changing their techniques to minimise their impact on the soil structure and nutrients by reducing ploughing, adding protective layers of organic material (mulch) and growing plants that help return nutrients to the soil.

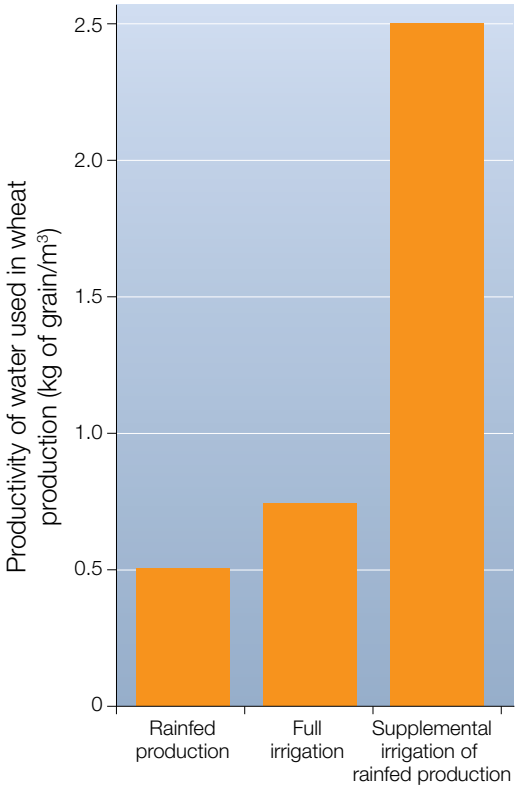
Source 2.44 Maize crops planted beneath Acacia trees in Africa are three times more productive than others nearby as the shade reduces evaporation and the falling leaves provide a natural fertiliser and mulch.

Water management

Modern techniques of measuring soil moisture and delivering water to plants and animals are helping to reduce poor water management techniques and improve results in yields. Measuring distribution of water not only conserves the resource, but avoids over-watering, which can lead to salty soils. Storing rainwater in dams and adding it to crops during critical growing times, for example, can triple the amount of wheat grown compared to irrigation systems that water the crops all year round (see Source 2.46).

Pest control

The Green Revolution promoted the use of pesticides such as chemical sprays that helped to increase the amount of food grown in many places. Some of the side-effects of using these pesticides, however – such as build-up of chemicals in the soil, loss of biodiversity and an immunity of some pests to the chemicals – have damaged some of the natural processes on which farmers depend. A range of techniques are now being developed and put into place around the world to reduce reliance on pesticides. Using natural pest controls such as ladybirds to reduce numbers of aphids on crops, for example, has been highly successful in many places (see Source 2.45).



Source 2.46 Productivity of wheat production under various irrigation techniques, including supplemental irrigation.

Source 2.45 These Cambodian schoolgirls are learning how some insects can be used to control pest species in their rice crops.

Check your learning 2.11

Remember and understand

1 What are the advantages of growing crops in fields where trees are present? What might be some disadvantages?

2 List the ways in which using chemical pesticides may be harmful to the environment.

Apply and analyse

3 In Australia, adding mulch to the soil is a common practice for gardeners and farmers alike. What is mulch and how does it help look after soil and water?

4 Using Source 2.46, describe the advantages of adding water to wheat crops at the right time of the year.

Evaluate and create

5 Find an example of an animal species that has been successfully introduced to control another species.

6 Cane toads were brought to Australia to control pests but now cause more problems than the pests they were supposed to control. Research the introduction and spread of the cane toad. What lessons can be learnt from these experiences?

Lessons from Indigenous farmers

In many countries around the world, Indigenous peoples have farmed the land successfully for centuries. They have developed techniques that work with the natural cycles of nature to maintain the soil and water resources of the area. In some of these places, the arrival of mechanised farming and the introduction of chemical fertilisers and pesticides have begun to degrade the soil and make it less productive. Researchers are now learning that the ancient farming practices of Indigenous peoples have valuable lessons to teach modern farmers about working with, rather than against, nature.

Traditional South American practices

Many South American food crops such as potatoes, tomatoes, peanuts and cocoa are now farmed throughout the world. While these plants started to be grown in countries all around the world, the traditional methods used to farm them were not used. South American farmers are experts at improving and protecting their soil and using water sustainably. The methods they use today are the result of hundreds of years of working with the natural cycles of the area in which they live.

In the Amazon forest, heavy rains leach nutrients from the soil making it almost impossible to farm. The Indigenous people of the region therefore created their own soil by building up layers of charcoal, human waste, river silt, shards of pottery and plant material. They also built garden beds above the flood levels of the region's rivers. Modern-day soil researchers have found that these garden beds are still highly fertile more than 500 years after they were constructed.

Indigenous farmers on the high plains and slopes of the Andes Mountains solved another common problem – variable rainfall. They terraced thousands of hectares of mountain slopes to collect water and provide flat land for growing crops (see Source 2.47). In the high plains, areas that were dry for half the year and covered in water for the other half were successfully farmed by building raised platforms and constructing irrigation and drainage canals, as well as man-made islands. The Aztecs farmed floating platforms on the lake that covered much of what is now Mexico City.

Source 2.47 These terraces were built by the Indigenous Inca people of Peru to grow and supply food to the people of Machu Picchu.

Source 2.48 Kenyan farmers are now planting fields of indigenous bambara nuts – once considered a food of last resort during famine, now a potential wonder crop.

Traditional African practices

In many communities in Sub-Saharan Africa, food insecurity and hunger are constant problems. Many people see modern techniques such as adding chemical fertilisers and pesticides as the best way to improve food security in the region. However, some Kenyan experts believe that an important clue to solving food supply problems lies in the past. They are promoting the growing and harvesting of indigenous plants such as sorghum, millet and bambara nuts, as they are better able to cope with the natural soil infertility and cycles of flood and drought than introduced plants such as maize and wheat (see Source 2.48).

As Kenya's population is growing at around one million people per year and there is limited arable land for growing food crops, exploring options for agriculture, including traditional methods, is crucial for Kenya's food security.

Check your learning 2.12

Remember and understand

1 How did farmers in the Amazon forest overcome the problem of soil infertility?

2 Why did Indigenous farmers in the Andes build terraces?

Apply and analyse

3 Why do indigenous plants sometimes grow better than introduced plants?

4 Why do you think Amazonian farmers added broken pieces of pottery to their soil?

Evaluate and create

5 Conduct research online in order to write a step-by-step guide to building terraces on steep mountainsides such as those shown in Source 2.47. Use sketches to illustrate some of these steps.

6 Compare the soil improvement techniques used by Indigenous farmers in the Amazon forest to those described earlier in 'Soil, more than just dirt' in Chapter 1.2. What are the differences and similarities? Which techniques are more sustainable?

Genetically modified food

Farmers have taken advantage of natural genetic processes in their farming for generations. Dairy farmers, for example, will choose the most productive cows to breed with carefully selected bulls in order to produce offspring who produce the most milk. This is known as selective breeding.

Some farmers, using modern scientific discoveries and techniques, have taken this selection process a step further. All living things are made up of cells containing genes. These genes determine how each organism grows, acts and looks. Scientists are able to change the genes of plants and animals to give them certain desirable qualities known as traits. This is known as **genetic modification** (**GM**). In one example of genetic modification, scientists developed a cotton plant that produced a natural insecticide. This has resulted in a 90 per cent decrease in the amount of chemicals used to control insect pests on many Australian cotton farms since 1996.

Source 2.49 Some canola crops in Australia are genetically modified to produce larger yields and require fewer sprayings of herbicide. Canola is present in many foods such as margarine, bread, mayonnaise and potato chips.

The main benefits of GM food production

Pest resistance
Crops can be modified so that they can resist pests such as insects.

Disease resistance
GM can help plants resist fungi, viruses and bacteria.

Nutrition
Minerals lacking in human diets can be introduced into food plants making them more nutritious.

The main benefits of GM food production

Cold tolerance
Plants affected by frost can be modified to help them survive the cold.

Drought resistance
Genes from plants that grow in arid areas can help make other plants survive droughts.

Source 2.50 The five main benefits of producing genetically modified food

Opposition to GM foods

Many people are opposed to the genetic modification of food. They are concerned that GM foods are gradually becoming a part of our everyday diet without us knowing very much about the long-term effects. They are also concerned about the possible impacts of GM crops on other organisms such as the animals that eat the crops, which are then used for human consumption.

Environmentalists are worried about the impacts of GM crops on the environment and on the balance of ecosystems. They believe that some characteristics from GM plants, such as a resistance to herbicides (weed killers), may be passed onto other plants within the environment and even the weeds themselves.

GM foods in Australia

In Australia, many foods containing GM plants are already available on our supermarket shelves. You have probably eaten some GM foods today. These foods are checked for their safety and must be labelled as being genetically modified (see Source 2.52).

Source 2.51 Genetically modified foods that are available in Australia. The name of the GM crop (see column 1) differs from the way it appears on food labels (listed in column 2).

GM crop	The way it appears on ingredients lists	Examples of foods in which it may be used
Canola	• Vegetable oil, canola oil	Cooking oil, margarine-type spreads, mayonnaise, bread, cakes, biscuits, snacks (such as potato chips)
Corn	• Glucose/glucose syrup/dextrose	Cakes, biscuits, muffins, muesli bars, breakfast cereals
	• Fructose	Cakes, muesli bars
	• Maltodextrin	Simmer sauces, cake mixes, snacks, breakfast cereals, peanut butter
	• Modified starch/ thickener	Cakes, biscuits, muffins, muesli bars, sauces, breakfast cereals
Cotton	• Vegetable oil/ cottonseed oil	Cooking oil, margarine-type spreads, mayonnaise, snacks (such as potato chips), simmer sauces
Soya bean	• Soy oil/vegetable oil	Mayonnaise
	• Soy protein/ vegetable protein	Breads, cakes, biscuits, snack foods
	• Soy lecithin/ emulsifier (322)	Breads, cakes, biscuits, chocolate, margarine-type spreads, sauces

Source 2.52 In Australia, foods with genetically modified ingredients must disclose this on the label.

Check your learning 2.13

Remember and understand

1 What are the main benefits of genetically modified foods?

2 Examine Source 2.51. Did you know that so many foods in Australia contain GM ingredients? Do you eat any of these foods regularly?

Apply and analyse

3 Check the food labels of five foods you eat often. How many of them contain GM ingredients? Compare this to your classmates' results and work out a percentage of these foods that are partially GM.

4 Why is it beneficial for farmers to reduce their use of chemicals such as pesticides and herbicides?

Evaluate and create

5 How do you feel about GM foods? Write a 250–300 word piece explaining your point of view and the reasons behind it.

6 Which of the benefits of GM food production do you think has the greatest potential to increase global food production? Give some reasons for your answer and discuss them with the class.

7 Research one of these GM crops: Golden rice, Bt cotton, Fortuna potatoes, Flavr Savr tomatoes or GM bananas. How, why and where have these crops been modified?

Conservation agriculture

Geographers and environmental scientists classify different farming and agricultural practices in terms of the impact they have on the environment. At one end of the scale is the type of farming that relies heavily on human intervention with nature, using technology. Turning over the soil with machinery (tilling), and adding chemical fertilisers and pesticides are characteristics of this type of farming.

At the other end of the scale is the type of farming that requires only minimal human interaction with nature and disturbance of the natural environment. Known as 'minimum impact farming' or '**conservation agriculture**', this type of farming is seen by many experts and farmers as the best way to increase food production while protecting and restoring the natural environment.

Conservation agriculture is the practice of adopting resource-saving production methods – adding elements such as water, seed and fertiliser that complement natural processes. This aims to achieve high and consistent levels of production, while conserving the environment at the same time. Australian farmers are leading the world in the adoption of this type of farming. A 2008 survey of Australian grain farmers found that about 80 per cent were using conservation agriculture techniques compared with less than five per cent in 1980.

The three key principles of conservation agriculture are:

- Principle 1 – Do not disturb the soil by tilling (see Source 2.53).
- Principle 2 – Keep the soil covered with organic material (see Source 2.54).
- Principle 3 – Grow a range of plants, not a single crop (see Source 2.55).

Source 2.54 Principle 2: Keep the soil covered with organic material such as stalks from the previous harvest as mulch.

Source 2.55 Principle 3: Grow a range of plants including trees, shrubs, crops and pastures. This encourages natural biodiversity and crop nutrition and aids resilience to pests.

Source 2.53 Principle 1: do not disturb the soil by tilling (turning it over). Plant crops by drilling seeds instead. Tilling leads to soil erosion and disturbs the microorganisms in the soil that are crucial for fertility.

key**concept:** sustainability

Farmer-managed natural regeneration

A well-known form of conservation farming is called **permaculture**. This type of farming brings together the resources of the natural environment and the people who use those resources for their food, energy, shelter and other needs. The emphasis is on the careful and thoughtful use of nature to ensure the sustainability of Earth's ecosystems – using nature to support the farming rather than working against nature.

Farmer-managed **natural regeneration** is a form of permaculture used to combat poverty and hunger among poor subsistence farmers in developing countries. It uses old methods of management to encourage continuous growth of trees on farmland. When woodland management techniques are followed, trees are integrated into crops and grazing pastures. As a result there is an increase in crop yields and soil fertility and a decrease in wind and heat damage, and soil erosion.

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

Source 2.56 This area of Jordan is a garden developed by an Australian permaculture expert, which uses natural regeneration techniques.

Regreening the desert in Niger

The country of Niger in Western Africa lies in the Sahel, a vast arid belt of savanna that crosses Africa, south of the Sahara Desert (see Source 2.58). This zone is considered to have the highest levels of food insecurity in the world. A combination of poor rains and overuse of the land and water mean that crops regularly fail there. In the last 25 years, however, there has been a remarkable transformation across much of Niger.

Five million hectares of degraded land have become productive again, increasing the amount of food grown in some areas fivefold. This produces an extra 500 000 tonnes of grain each year, feeding an extra 2.5 million people. Vast areas that were once infertile dust bowls incapable of supporting any farming are now green croplands, returning food security to one of the world's poorest nations.

This dramatic change is due largely to the work of an Australian, Tony Rinaudo, and a simple discovery he made in Niger. For generations Niger's farmers had seen trees in their fields as a source of wood for fuel and a nuisance to farming. Millions of trees had been cleared from the landscape to make way for small farms.

'An underground forest'

When Rinaudo arrived in Niger in 1981 he began planting new trees but they kept dying. He noticed, however, that the roots of the trees that had already been cleared still lay in the ground and were soon sending up new growth in the form of saplings. He called these roots an 'underground forest.'

Source 2.57 Thanks to the trees in the background this farmer in Niger grows lettuces in land that was once desert.

He convinced a few farmers to carefully prune this new growth rather than clear it completely. The trees soon returned to the landscape bringing shade and wind protection to crops and animals, preventing erosion, providing firewood for the farmers and adding organic matter and nutrients to the soil. The crop yields of those farmers who pruned and protected their trees increased dramatically. Other farmers soon followed their example. It is estimated that around 200 million trees have been protected in Niger and the technique is now being used across the Sahel to help increase food security for millions of people.

skilldrill

Analysing satellite images

A satellite image is a photograph taken from space. Satellite images have become one of the most useful tools for geographers, as they provide a snapshot in time of a large area of the Earth's surface. This allows us to identify patterns and changes over time, and to better understand the causes and effects of these patterns and changes.

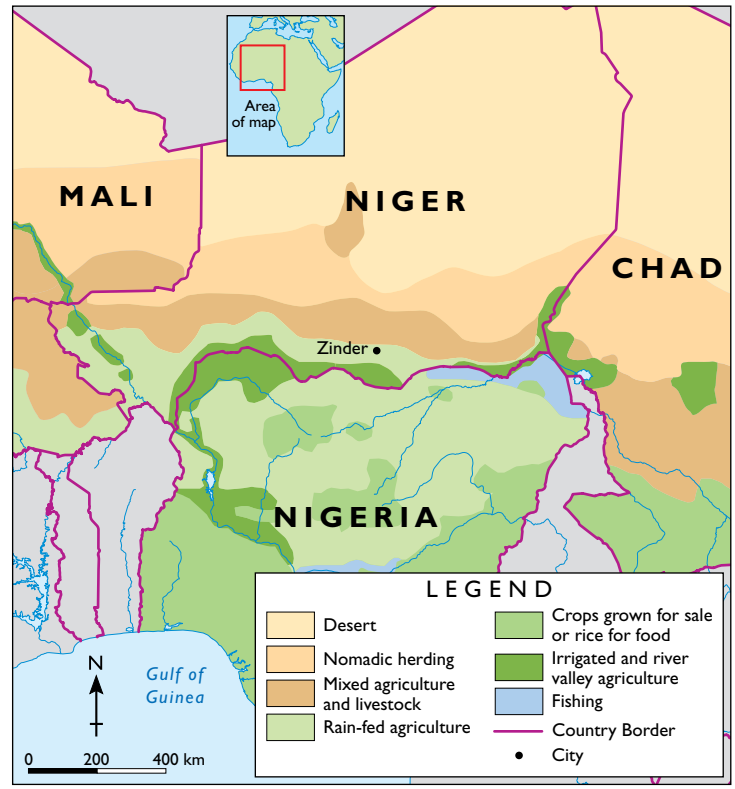
When analysing a satellite image or set of images follow these simple steps.

Step 1 Identify the exact area shown in the image or images. Use an atlas to verify where they were taken. Take note of other features in the region such as international borders, mountains and cities.

Step 2 Look closely at the image for features you can identify. A satellite image is taken from directly above (**plan view**) so objects appear in their correct location and size relative to each other.

Step 3 When comparing two satellite images of the same places taken at different times note the dates when the images were taken. Look for changes that have occurred between these two dates.

AFRICA, NIGER: LAND USE IN THE SAHEL REGION

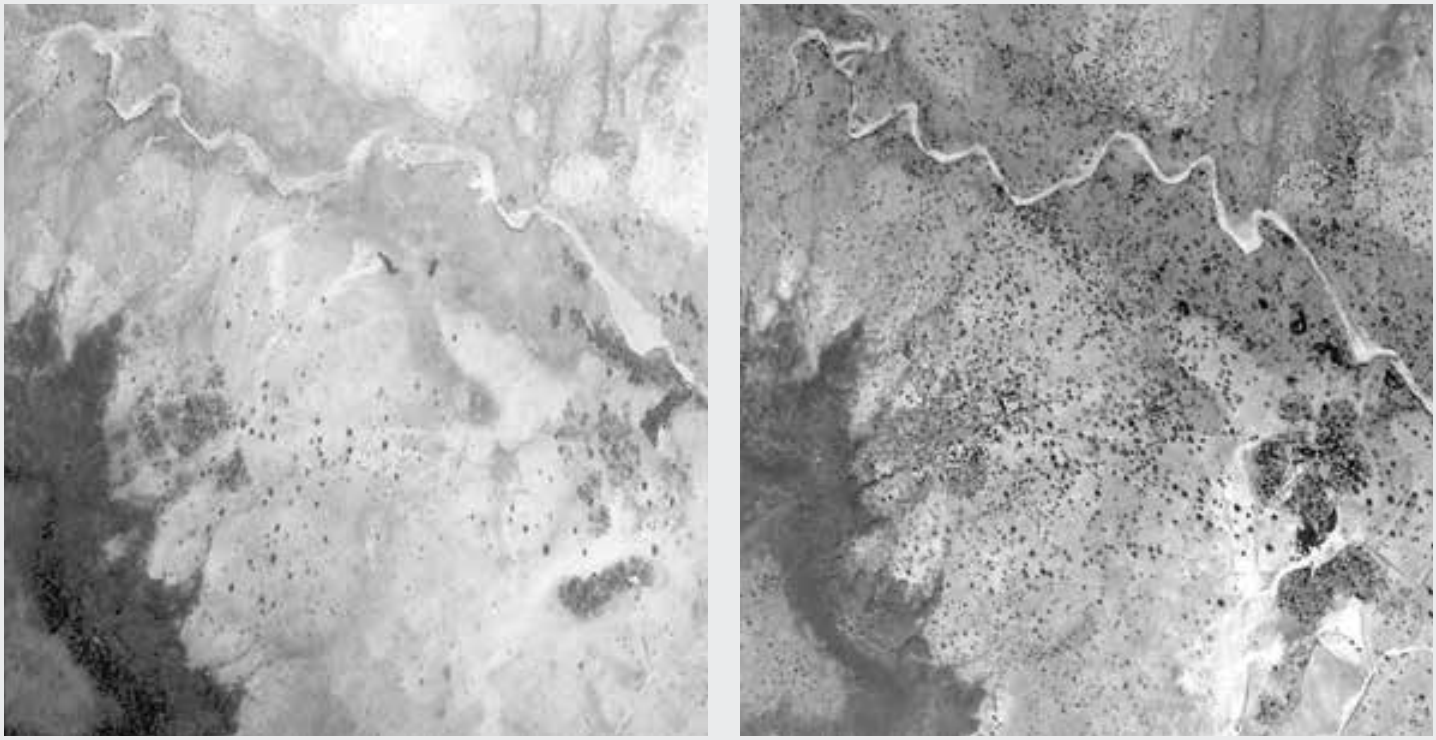


Source 2.58 Source: Oxford University Press

Apply the skill

1 Describe the landscape in the 1975 satellite image in Source 2.59. Each dark grey dot is a tree. Estimate the number of trees.

2 Describe the changes between 1975 and 2005 in Source 2.59. Include an estimate of the number of trees and also their distribution.



Source 2.59 Dual satellite images of the Zinder area of southern Niger in 1975 (left) and 2005 (right).

Check your learning 2.14

Remember and understand

1 What is tilling?
2 What are the three key principles of conservation agriculture?
3 What is permaculture?
4 Describe the method of revegetation developed by Tony Rinaudo.

Apply and analyse

5 Why is drilling seed directly into the soil better than tilling the ground and then planting seed?
6 How does using a variety of plants (principle 3) help to reduce pests such as weeds and invasive insects?
7 How does covering the soil with organic material (principle 2) help to conserve water? How would it benefit the soil?
8 Examine Source 2.58. Describe the location of the Sahel.
9 Describe land use patterns in Niger from north to south. Why do these variations in land use occur in this country?

Evaluate and create

10 The permaculture garden shown in Source 2.56 shows what is possible on a local scale. Do you think permaculture principles could be applied on a national or global scale? Discuss this with a partner and then with your class.
11 Permaculturalists limit their use of chemical fertilisers and pesticides. How do you think they achieve this?
12 You can use the historic imagery feature on Google Earth to explore satellite images and aerial photographs of Niger. Find a region that has changes similar to those in Source 2.59.
13 What lessons from the experience in Niger could be applied to other places struggling to maintain food security?

2.3 big**ideas:** broadsheet

Food waste and loss

It has been estimated that around one-third of all food is lost or wasted around the world every year. **Food loss** refers to the amount of food lost during the growing or production process. In developing countries, most food tends to be lost during production because of problems in harvesting, storing, cooling, packaging and marketing by producers. This equates to around 1.3 billion tonnes.

Food waste refers to the amount of food thrown away during the consumption process. In developed countries most food waste is carried out by consumers and retailers rather than food suppliers. Consumers tend to reject food that is not perfect in appearance. They also tend to buy too much food which spoils or passes its 'best-before' date. Reducing food waste and food loss would help increase food security in many places.

Source 2.60 Australians tend to buy more food than they need, leading to a high level of food waste.

Source 2.61 This Mongolian boy is transporting milk without refrigeration, which could lead to a high level of food loss.

skill**drill**

Preparing an infographic

An increasingly popular way for geographers to present their findings and data is to prepare an infographic. Infographics use pictures and symbols to represent complex ideas and data so that information is clear and quickly accessible. Follow these steps to produce your own infographic.

Step 1 Decide on a topic and the message that you want to communicate to your audience. In the infographic in Source 2.62, for example, the key message is that people waste a huge quantity of food.

Step 2 Research your topic and collect data that helps to communicate your key idea. Try not to have too much data; don't include more than 10 key facts or numbers.

Step 3 Use a simple picture to communicate each of your key facts. The digger and hole in Source 2.63, for example, communicates that food is being dumped in landfill.

Step 4 Lay your graphics out in a logical way that links together the key ideas. Make sure your infographic is not too cluttered. Give your infographic a catchy title that communicates your message – something like, 'From Farm to Plate', 'Waste not, want not' or 'Starve the landfill'.

Source 2.62 Food waste is a serious issue for many countries around the world. This infographic shows the percentage of waste worldwide each year for different food groups.

Apply the skill

1 Design and present an infographic on an aspect of food waste. Here are some facts that you can use to help you get started. Many of these come from a UN report, *Global Food Losses and Food Waste*.

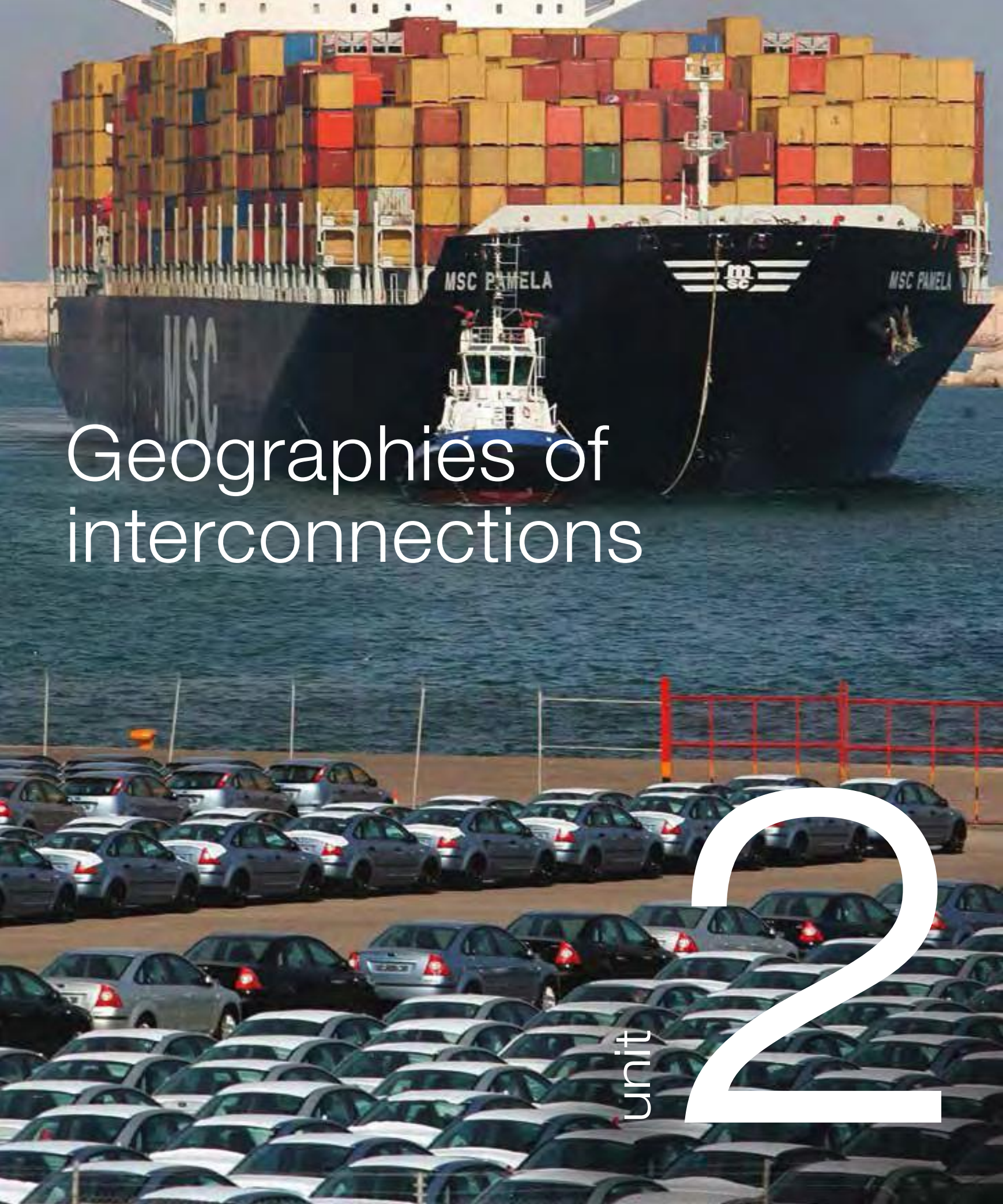
- One-third of all food is wasted or lost.
- Up to 50 per cent of fruits and vegetables are wasted every year.
- Total food wasted and lost in North America, Oceania and Europe is 280–300 kilograms per person per year. The amount of this that is food wasted by consumers is 95–115 kilograms.
- In Sub-Saharan Africa 120–170 kilograms is wasted or lost, about six kilograms of it by consumers.
- In developing countries more than 40 per cent of food loss occurs in harvesting, transporting and processing. In developed countries more than 40 per cent of losses occur at the retailing and consuming stages.
- The total amount of food wasted every year in developed countries is about the same as the total amount of food produced in Sub-Saharan Africa, which supports close to 900 million people.
- One-third of all fish and seafood produced in North America and Oceania is wasted by consumers.
- The cost of wasted food in Australia is about $239 per person per year, or $5.2 billion as a nation.

Source 2.63 Infographics can be used to convey a lot of information in a clear way so that it can be quickly understood.

Extend your understanding

1 Keep track of your household's food waste for a week. This means taking note of all edible food that is not eaten, and includes food that is wasted during meal preparation (such as peelings), food served but not eaten, or food that is spoiled and discarded. This could be placed into a bucket and weighed every day. Multiply the total amount by 52 to find out the amount of food wasted per year at your house. Compare this result to those of your classmates.

2 One of the main reasons why food is wasted in Australia is linked to consumer demand for fruit and vegetables that are pleasing in shape and appearance. Blemished items such as curved carrots or spotted apples are often taken out by the food producer, discarded by the retailer or not chosen by the consumer. Design an advertising campaign to reduce this aspect of food waste. Your campaign may take the form of a television, newspaper or social media advertisement, or a combination of these.



Geographies of interconnections

unit 2

Connecting people and places

This is Gibraltar, an English territory that lies on the southern tip of Spain in a body of water that connects the Atlantic Ocean to the Mediterranean Sea. This means it is strategically significant for shipping between Europe and the rest of the world. For this reason, disputes over the territory have resulted in many wars over the last 500 years. Though once heavily fortified to protect its inhabitants from invasion, Gibraltar is now highly accessible. It has a busy international airport, container port, a cruise ship harbour and is connected by road to Spain. Now home to almost 30 000 people, it receives almost 12 million tourists a year.

Connected to the world by trade, tourism, transport technologies and communications, Gibraltar illustrates how every place on Earth is connected to every other place more than ever before.

3.1

How do people perceive places?

1. Gibraltar is famous for a 426-metre high rock, known as the Rock of Gibraltar, which is a popular drawcard for tourists. Do you think the people that live within sight of the Rock every day would regard it differently than a visiting tourist would?
2. In what ways might a resident feel differently about Gibraltar compared to a tourist?

3.2

How do people connect to different people and places?

1. Describe some of the ways in which Gibraltar is connected to other places around the world using evidence from this picture. Are there other likely connections that are not shown in this picture?

Source 3.1 Gibraltar is a compact country at the southern tip of Spain. Its coastal location and access to many countries means it has been a highly sought-after territory over the course of history.

3.3

How does trade connect people and places?

1 Gibraltar has little land that is suitable for farming and food production. Where do you think the people who live there get most of their food from?

3.1 How do people perceive places?

What is place?

Everyone has places that mean something special to them. You can probably think of a place right now that has a particular significance for you. It could be a corner of your room where you listen to music, or a local sports ground where you train with your friends – somewhere that you identify with and attach meaning to. Indeed, this is what places are – parts of the Earth's surface that are identified and given meaning by people. A place can be as small as your bedroom or as large as a continent. It can be a constructed feature, such as a building, or a naturally existing feature such as a freshwater lake.

The key concept of place is essential to geographers. By dividing the Earth's surface into a series of identifiable places, geographers can better understand the natural processes and human activities that shape and change our world.

People may be attached to different places for different reasons, and places can mean completely different things to different people. The tourists in Source 3.2, for example, might perceive this place as an opportunity to see something unique and to photograph it. The bus driver who brought them here and the owner of the resort where they are staying may see it quite differently – as somewhere that provides them with employment and an income. For the Indigenous people of the region, the Anangu, this place has a very different meaning. Different parts of the landscape contain stories of their origin and creation and are regarded as sacred sites which they have a duty to care for and protect.

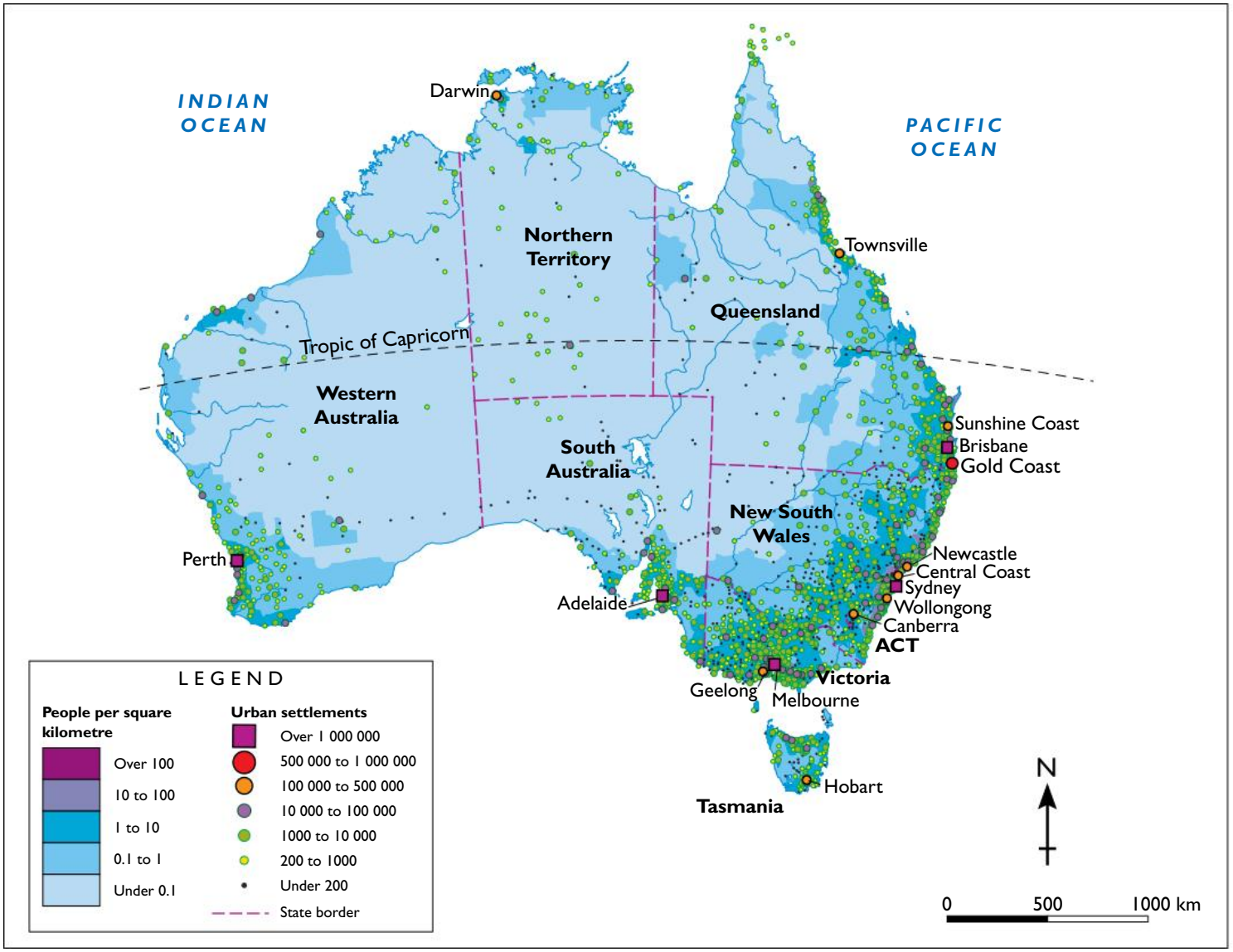
What are spaces?

Space refers to the way in which features are arranged on the Earth's surface. The key concept of space helps geographers to explain the way things are arranged by applying the elements of location, organisation, and spatial distribution – the shapes and patterns in which things are arranged on the Earth's surface.

Geographers often use maps to explore and explain the arrangement of the Earth's features. Maps allow us to see patterns and try to explain why these patterns occur. Source 3.3, for example, shows the distribution of Australia's population. It shows us that Australians tend to live near the coast in large cities, particularly in eastern Australia. A geographer studying this map would note the pattern. They may also ask questions about it, and perhaps ask about the line of small towns between Adelaide and Perth. Why are the towns arranged in this way? How are they connected? These kinds of questions are applying the concept of space.

Source 3.2 Uluru is a place that has been identified and given meaning. Like all places it has both tangible (able to be touched) and intangible (not able to be touched) characteristics. The rock, the plants and the soil are all tangible while the scenic beauty, cultural significance and economic value are intangible.

AUSTRALIA: POPULATION DENSITY AND DISTRIBUTION



Source 3.3

Source: Oxford Atlas

Interconnections between places

We all create places of our own by defining them and giving them meaning, and all of these places are interconnected. Geographers use different ways to understand and explain these interconnections.

No place exists in isolation. Not even a rock in a mountain riverbed or a single tree is isolated. Every place is interconnected with another. The place where you live is connected to a neighbourhood, the road outside the school connects it with different suburbs, and entire continents are connected to each other in many ways, too.

Some of the interconnections between places are the result of natural processes. The rock in the riverbed mentioned above, for example, may be connected not only to the other surrounding rocks but also to other areas entirely. Fast-flowing rivers, for example, wear down rocks into tiny pieces and then carry these pieces to the coast, where they are shaped into new features such as sand dunes and sandbars. This process links together the mountains and the coast.

Other interconnections are the result of human activities such as trade, transport and communication. These move people, goods, services and ideas between places, linking them together.

There are various ways that geographers explain how and why we connect to place, and these will be examined in the material to follow.

key**concept:** place

Comparing different perceptions of place

How you perceive and use a place can be influenced by various factors. The same place can be perceived in different ways by different people – a historian might perceive a museum as a fascinating place to visit, for example, while another person might think it is quite boring. The same place can be used in very different ways, too. The steps outside the museum could be used as a place to go skateboarding, or at other times as a backdrop for wedding photos. A park that is filled with families on a bright sunny day might seem like a safe, enjoyable place to go with a friend, but the same park might seem very different to you if you found yourself there in the middle of the night alone. Factors that influence how you perceive places include:

- your age
- your ethnic origin
- your gender
- the time of day or night you are visiting the place
- whether you are travelling to the place alone or in a group
- whether you have a disability or are able-bodied.

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

Source 3.4 There are many factors that might influence the way someone perceives a place.

Check your learning 3.1

Remember and understand

1 Write a definition of the term 'place' in your own words.
2 Think of a place that you know well. Describe this place in terms of its tangible and intangible characteristics.
3 Explain how new technologies have helped to create greater links between people and places.

Apply and analyse

4 Examine Source 3.3.
  a Describe the spatial distribution of Australian cities that contain more than 100 000 people.
  b Why are maps often used to show the concept of space in geography?
5 Examine Source 3.4. How do you think the people in these photos feel about the places shown? How might a different person feel about each of the places?

Evaluate and create

6 Give an example of a place in your area that is used for more than one purpose. Design a poster showing the different ways in which it is used. Try to think of as many people as possible that might use the place, the different ways they might use it, and what their perceptions of the place might be.
7 Write a tweet or start a meme that helps the person who receives it to understand the concept of place, space or interconnection. You may want to find a picture on the Internet to inspire you, or you could even give an existing meme a new geographical twist.

Explaining different ways we connect to place

Geographers are interested in how people are connected to different places, and how each of these different places is interconnected. They also interpret people's perception of places. Perception refers to the way in which we regard, understand or interpret things, including places.

Geographers use different models, tools and strategies to understand and explain some of the ways people perceive place. Here, we will examine three of these methods:

- Asking questions
- Using a geographical model
- Applying a set of geographical criteria

Asking questions

As you know, geographers ask lots of questions, and this is certainly the case when it comes to examining the key concept of place. Because we connect to places in many different ways, geographers need to ask a range of questions in order to understand and explain these interconnections.

For example, a geographer visiting the rock formation of the Bungle Bungle Range in Western Australia might investigate why the rocks are such a distinctive and unusual shape. They would look for clues and ask questions. Why are there stripes in the rocks? What outside forces might have caused them? How are the rocks connected to the surrounding landscape?

As the concept of place involves many different aspects (in addition to physical appearance), a geographer would then go on to ask a range of other questions about the area's cultural, spiritual and economic aspects. Do people live in the area? If so, how long have they lived here? Do other people come to visit? Is the place used for spiritual or religious purposes?

Asking such questions often reveals that people view the same place very differently. One place may be nothing more than pretty scenery to a passer-by, while to someone else it could be a sacred site or even burial ground. This difference in perception can lead to very different opinions about what might be a suitable way to treat or use a place.

Source 3.5 To a visiting tourist, the Bungle Bungles might just be another pretty landscape. To the traditional owners, the Kija peoples, it is perceived very differently.

Using a geographical model

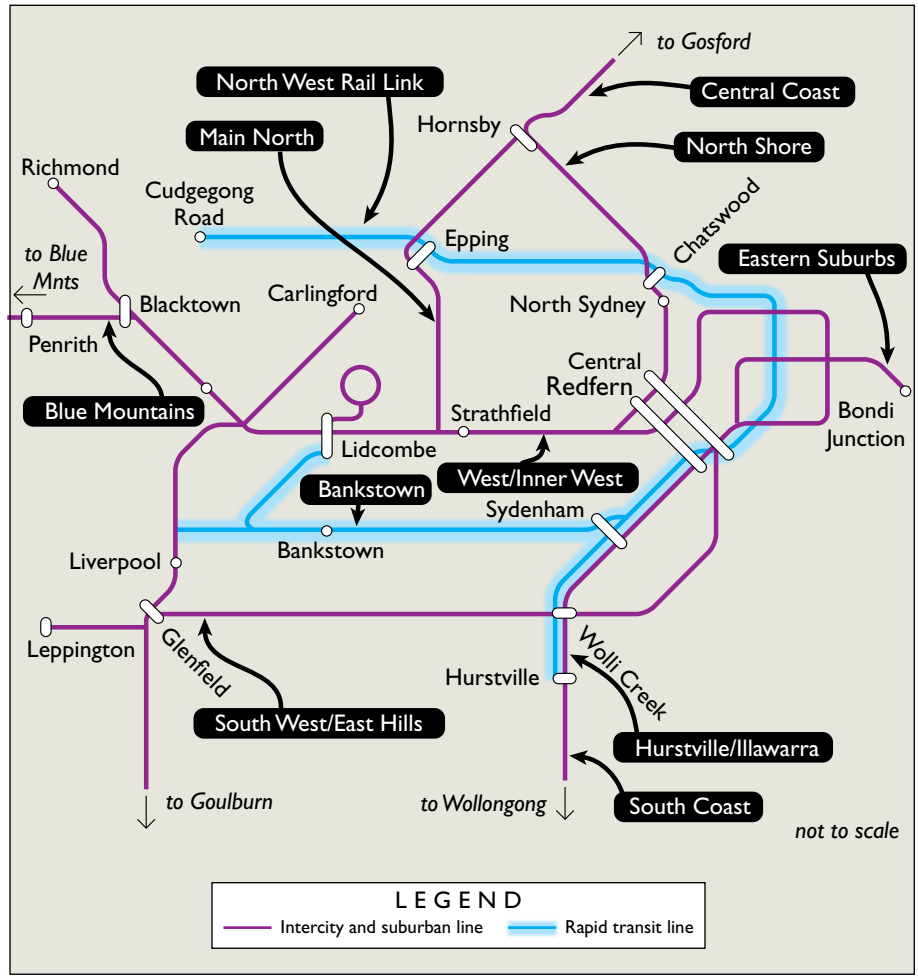
Geographical models are used by geographers to explain patterns and analyse their significance. The networks that connect people and places together can be very complex and confusing. Geographers often simplify complex networks by using a range of models such as a **hub and spoke** model. A 'hub and spoke' model is a way of representing connections in a way that can be more easily understood. They look and function a bit like a bicycle wheel, where the hub is the centre of the 'wheel', and each spoke is connected to it.

Complex connections between places like the suburbs of a city can be viewed using a hub and spoke model, where the city centre is the hub, and the roads and public transport connections that bring people to it are the spokes.

A hub and spoke model is also useful when explaining the interconnections of the complex networks we access every day, such as transport and communication networks. These networks allow people to connect with each other and provide access to vital services such as schools, hospitals, shopping centres and other community facilities. While most established Australian communities have well-developed networks, not everyone finds them easy to access. People with disabilities, for example, may find it difficult to use some forms of public transport and this can limit their connectedness with their local community.

Applying a set of geographical criteria

There are many different reasons why people feel connected to particular places. Geographers try to understand these reasons by grouping them into similar categories according to a set of criteria. By doing this, they can start to identify patterns in the data they collect and draw conclusions



Source 3.6 This image shows how lines of a public transport network act like spokes, connecting places to the central hub. A place can have more than one hub, and many spokes.

based on these patterns. For example, you might feel connected to a particular street because you wrote your initials in wet cement there when you were a kid. Another person might feel connected to that street because their church is located there. A third person might also feel connected to the street because they work in a shop there. Although all three people feel a certain connection to this place, they each perceive it in a different way because of the different experiences they had there and the meaning they attach to them.

By classifying these reasons, or sorting them into groups, geographers can better understand important interconnections to place. Most reasons for a feeling of connection to place can be grouped under the following four criteria:

- **Spiritual**: factors related to a person's beliefs
- **Economic**: factors related to employment and income
- **Cultural**: factors related to the shared characteristics of a group of people
- **Historical**: factors related to past experiences and events.

Source 3.7 Westfield Chadstone is a shopping and entertainment hub in Melbourne's south-east. It is the largest shopping centre in the country and receives about 20 million visitors a year. It is linked to other parts of Melbourne by an extensive network of road and public transport 'spokes'.

Check your learning 3.2

Remember and understand

1 List two methods geographers use to explain how people connect to place.

2 Examine Source 3.7 and write down how a hub and spoke model could be used to describe it. It may help to first identify the hub and what facilities it provides, and then describe the spokes when thinking about your answer.

Apply and analyse

3 Write a short paragraph about a place that is important to you. Can you identify the main reasons why you perceive it as being important?

4 What are some of the important hubs in your local community? Select two or three hubs and write a paragraph on each, explaining how they service and support different members of the community.

5 Examine Source 3.5. Brainstorm reasons why people might have different opinions about appropriate ways of using or developing important sites such as the Bungle Bungle Range. Create a table in your notebook to classify these reasons under the following four criteria: economic, cultural, historical or spiritual.

6 Examine Source 3.6. Why is a network such as this one important for a community? In what ways does it connect people and places?

Evaluate and create

7 Choose a city you have read about or visited and explain the different ways in which people there are interconnected.
You may want to think about the reasons people visit, what the transport system and road network are like, and any historical factors.

Connections to place

As discussed, the different ways in which peole connect to place can be categorised according to four main criteria – spiritual factors, economic factors, cultural factors and historical factors.

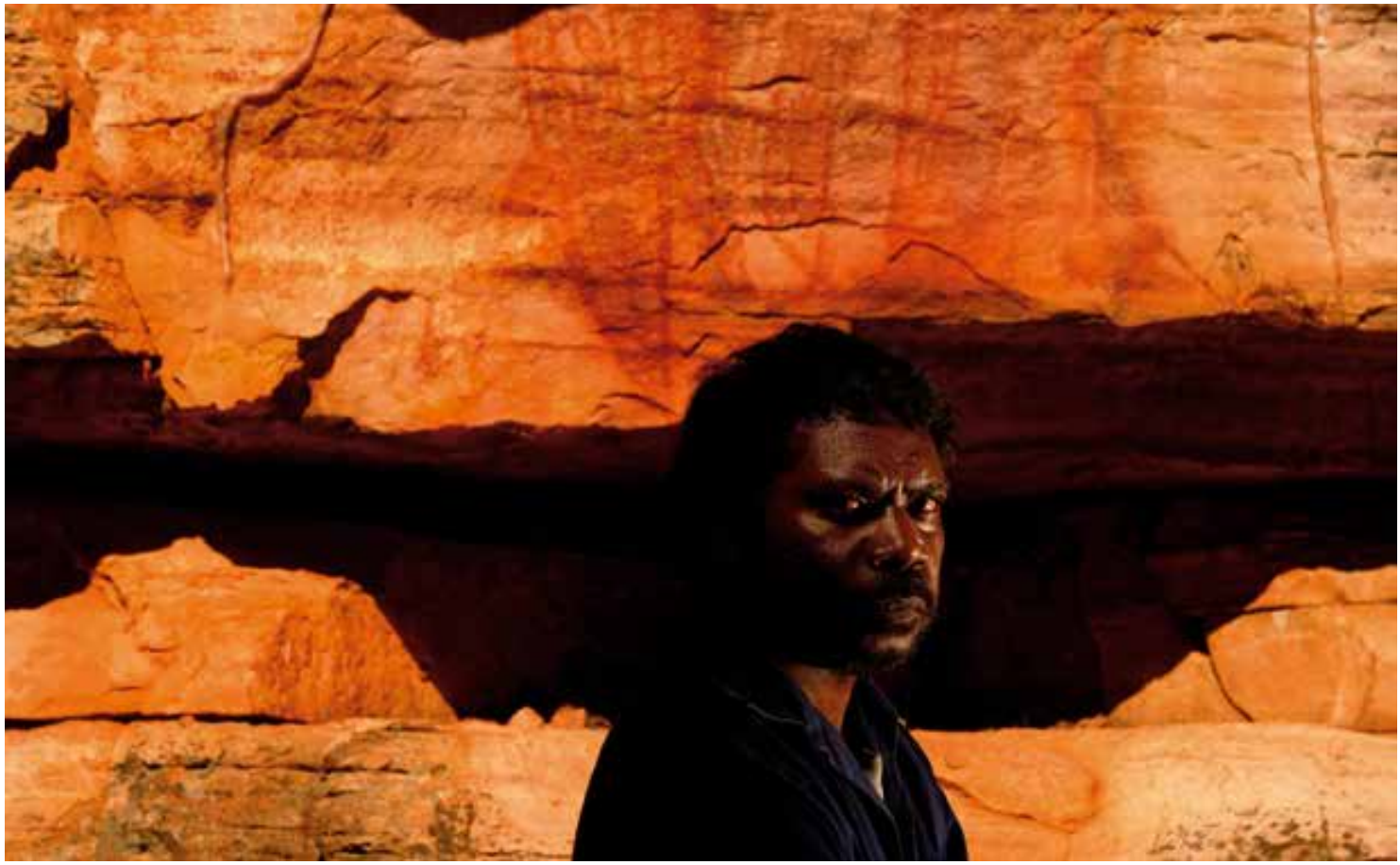
Spiritual factors

Many people feel connected to particular places because of their beliefs or the way a place makes them feel. Sometimes this connection can be difficult for other people to fully understand but this does not make the connection any less real or important. For example, many Aboriginal and Torres Strait Islander people have a deep and complex spiritual connection to places in the natural world that other people in the wider community do not have.

Jeffrey Lee, the sole survivor of the Djok clan in the Northern Territory, could have become one of Australia's richest men (see Source 3.8). He is the custodian of land that contains vast deposits of uranium. However, when a French energy company offered him millions in royalties to allow them to mine the uranium, he declined.

Instead, he offered the land to the Federal Government so that it would be included as part of Kakadu National Park, and therefore protected from mining.

'When you dig 'em hole in that country, you're killing me. Money don't mean nothing to me. Country is very important to me,' he told newspaper reporters. Mr Lee believes that it is his responsibility to look after the land and that digging into the ground would disturb the spirits that live within it. 'There are sacred sites, there are burial sites and there are other special places out there which are my responsibility to look after. I'm not interested in white people offering me this or that … it doesn't mean a thing. I'm not interested in money. I've got a job; I can buy tucker; I can go fishing and hunting. That's all that matters to me.'



Source 3.8 For Jeffrey Lee, the spiritual importance of the land far outweighs any potential monetary gain.

Source 3.9 A 2011 protest in Illawarra against the mining of gas in New South Wales farming areas shows how the economic connection to place can be at odds with those who have other factors which influence their connection.

Economic factors

Many people feel a connection to particular places because these places provide them with employment or a source of income. In the previous example of the proposed uranium mine in the Northern Territory, the French mineral company was interested in connecting to this place because of economic opportunities. In the same way, a farmer will feel connected to the place in which he or she farms and a tourism operator will feel connected to the place that tourists come to visit.

In countries where personal wealth is viewed as a desirable goal, economic connection to place may take precedence over less tangible reasons for connection, such as spiritual or historical factors. Different reasons for connecting to place can cause disagreement, protest and even conflict between individuals and groups.

In parts of Queensland and New South Wales, for example, there is widespread disagreement about mining gas from the rocks beneath farming areas (see Source 3.9). Many farmers believe that the process used to extract the gas degrades their land and water but mining companies point out that the gas is needed by many people for heating and cooking. Many protests have been held to try and influence state and federal governments to more closely control or stop the mining of this gas.

Cultural factors

Connections to place can also be strongly influenced by a range of cultural factors. This can include the perceived historic value of a place, and how that is meaningful for people in the present, the past and even into the future. The notion of cultural heritage can be an important motivating factor for connection to place.

People with similar interests, backgrounds and heritage often connect with each other to form communities. Immigrants to a new country, for example, tend to live close to other recent arrivals from the same country. This allows them to connect more easily to people with the same language and culture and therefore, to fit more easily into their new community.

This happens all around the world and creates areas of ethnic concentration. In New York, for example, there are neighbourhoods known as Little Italy, Chinatown, Little Manila, Le Petit Senegal, Jamaica, Koreatown and Spanish Harlem. The residents of these places may feel connected to the area in which they live because of their cultural connections (see Source 3.11).

Source 3.10 The Bright Moon Buddhist Temple in Springvale acts as an important hub for many Vietnamese people who have made the suburb their home.

Case study: Vietnamese in Springvale, Melbourne

The Melbourne suburb of Springvale is an example of ethnic concentration in Australia. Many of the residents were born overseas, with eight out of 10 Springvale residents speaking more than one language. While the area has seen several waves of migrants from Europe and Asia over the last century, it is now the Vietnamese who dominate.

As a result of the Vietnam War in the 1960s and 1970s, millions of Vietnamese fled the country to find refuge elsewhere.

Source 3.11 Springvale in Melbourne is home to communities of Chinese, Cambodian, Thai and Greek families and has a strong Vietnamese population – Vietnamese people make up 21.3 per cent of the population.

Many Vietnamese refugees crammed into small boats to escape and became known as 'boat people'. More than 112 000 Vietnamese came to Australia in the 20 years after 1975 and Melbourne is now home to more than 67 000 people who were born in Vietnam.

Many Vietnamese refugees also settled in the suburbs of Cabramatta in Sydney and Richmond in Melbourne. Springvale originally became a popular place for Vietnamese people because a migrant hostel was located there and cheap housing was available. In Springvale, new arrivals from Vietnam joined a large and growing migrant population from many other places.

Historical factors

Events that happened in the past can also result in people forming special connections to particular places. These may be recent events or events from hundreds of years ago, but they can form powerful links between people and places. For many people, the places they visited on holidays as children remain special places well into their adulthood because of the memories these places hold.

On a wider scale, important historical events can give particular places a special meaning. Such historical events could include a war or battle such as Gallipoli (see Source 3.13), a terrorist attack such as the Bali bombings, or the birthplace or burial place of a famous person. In some towns and cities, places of historical significance might be marked with a statue or other commemorative marker. In London, for example, many places which are connected

with historical events and people are marked with blue memorial plaques (see Source 3.12).

The strong connection some people feel with a place for historical reasons can explain why many people feel strongly about the demolition of old buildings or the development of a site for a new apartment block. It also helps to explain why people may have a special connection to battle sites thousands of kilometres away or to the wharf where they first arrived in Australia as a refugee.

Source 3.12 Blue plaques in London mark places where people may feel a historical connection due to an event that occurred or a person that lived at that place.

Source 3.13 Many Australians and New Zealanders feel a special connection to Gallipoli in Turkey because of battles fought there a century ago. These people are attending an Anzac Day dawn service at Gallipoli.

Check your learning 3.3

Remember and understand

1 Why might people sometimes find it difficult to understand another person's spiritual connection to a particular place?

2 Why do people with similar cultural backgrounds often live close to each other?

3 Why would some farmers in Queensland and New South Wales protest about gas mining in the places where they live?

Apply and analyse

4 Re-read the information relating to Jeffrey Lee.
   - a Describe the connection he has to the place in which he lives.
   - b Why does he have this connection?
   - c Is this the same way you feel about the land? Why or why not?
   - d Account for the similarities and differences between his connection to the land and yours.

5 What might be some of the important hubs for Vietnamese people in Springvale? Are there similar hubs in your local area? Are you connected to these places for similar reasons?

Evaluate and create

6 Many people feel a connection to places where important events occurred in the past. Find out why many Australians have a special connection to Gallipoli in Turkey, or to Kuta in Bali.

7 The Yasukuni Shrine in Tokyo, Japan, is an example of a place that inspires strong feelings in people. Research the shrine and investigate why people might have different connections to this place. Design a poster that shows the results of your research.

Source 3.14 Yasukuni Shrine in Tokyo, Japan, is a place that inspires a range of different reactions in people.

3.1 big**ideas:** broadsheet

Mental maps versus GPS

A **mental map** is a map that we keep in our heads, rather than on paper or in our phone. We all carry a map in our head of our local area. This allows us to find our way quickly and easily between places. We tend to know the places we use often and the spaces between them much better than the places and spaces we rarely use or visit. As we all use different places, we each have a unique mental map of our local area.

Is GPS ruining our mental maps?

Many Australian cars and mobile phones are fitted with a GPS device. GPS or **Global Positioning Systems** use satellites to accurately pinpoint the location of the car or phone. By adding data in the form of a digital map, GPS devices can be used to help us find our way around. For many people, their GPS device has replaced printed maps and written directions as the main way of navigating around an area. Using GPS devices can be extremely helpful, but has using them ruined our own mental maps?

Source 3.15 GPS devices can translate complex three-dimensional places into a series of lines and instructions that make it easy to navigate.

A study published in the *New York Times* in 2012 found that using a GPS rather than our internal mental map reduces the ability of our brain to build up a mental picture of our environment. While our brains build up layers of information to develop mental maps, a GPS device reduces all of the information to a simple list of distances and directions. By not using the mental maps we have stored, we may risk losing the ability to create them in the first place.

The report concludes with this advice:

'Next time you're in a new place, forget the GPS device. Study a map to get your bearings, then try to focus on your memory of it to find your way around. City maps do not tell you each step, but they provide a wealth of abstract survey knowledge. Fill in these memories with your own navigational experience, and give your brain the chance to live up to its abilities.'

skill**drill**

Putting a mental map down on paper

A mental map is a simple but effective tool people use to perceive, remember and analyse an area. You can record the mental map you have of an area into hard copy, for yourself or for another person to use, by following these simple steps:

Step 1 Choose an area you know well that you wish to map.

Step 2 Starting with a blank piece of paper, jot down the main places you can remember in the area. Do not refer to street directories or other professionally drawn maps. Remember that there is no 'right' answer for a mental map.

Step 3 Fill in the main roads, pathways and any railway lines that connect places in the area.

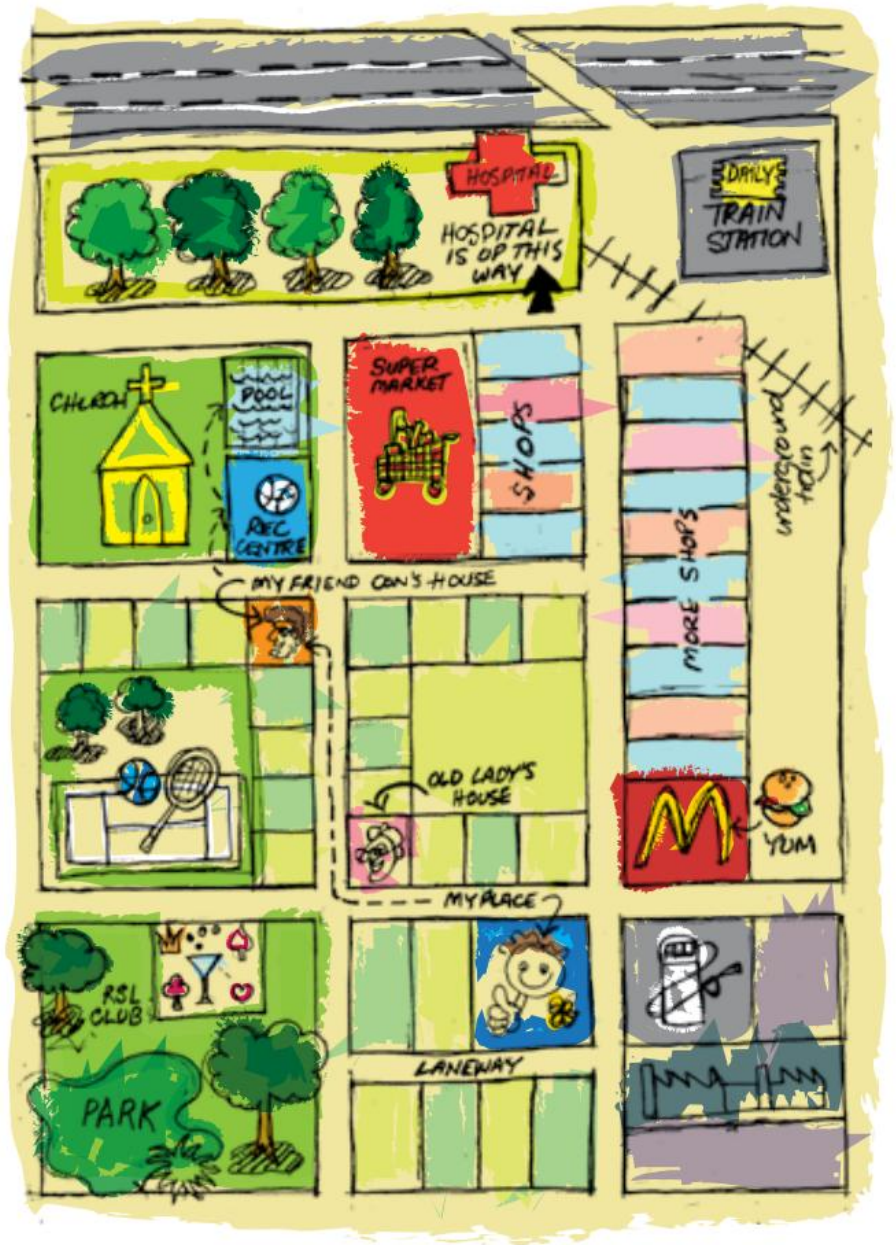
Step 4 Include any parks, ovals or reserves, or any significant natural features you can remember.

Step 5 Mark down any significant landmarks or buildings. These might include a statue on a corner, a church or school, shops or even a wall that features some graffiti art.

Step 6 Continue plotting features, roads, and landmarks until you are satisfied that all the things you can remember as being significant are added to your hard-copy map.

Apply the skill

1 Make a hard copy of your mental map of the area in which you live. It could cover a couple of blocks or more – the size will depend on how much information you keep in your head. Label features that are important to you. This might include shops, your sports club, or a friend's house.



Source 3.16 Everyone has a mental map of their home area whether they realise it or not. You may be surprised at how much detail you can readily recall about the area where you live and how often you use your mental map.

Extend your understanding

1 Swap your map with another person in your class.
   a Note down any similarities and any differences in what you chose to include in your mental map. What were some of the main differences between the two mental maps?
   b Discuss with your partner what their mental map revealed about them and their perception of their local area. What did the features they included tell you about them? For example, if they included a football field, oval and gym, you could safely say they had an interest in sports. What did they think your mental map revealed about you?

2 Look closely at the mental map in Source 3.16.
   a What are some of the places in the local area that are important to this person?
   b What does this mental map reveal about the person who drew it?

3 List the pros and cons of keeping a mental map versus using a GPS. Are there any aspects of a GPS that might limit your understanding of an area? Do you think you would prefer to rely on a GPS or a mental map? Why do you think this?

4 Ask a primary school student to draw a mental map of their local area and display them on a classroom wall along with the completed maps from your own class.
   a What were some of the main differences between the two sets of mental maps?
   b Why do you think the mental maps of primary school students differ to those of secondary school students?
   c What has this activity taught you about the ways in which different people perceive their local area?

3.2 How do people connect to different people and places?

The things we do, see, use and consume

'No man is an island Entire of itself, Every man is a piece of the continent, A part of the main.'

The English poet John Donne wrote these words way back in 1624. In these lines he expresses the idea that every person is connected to someone else. This is as true today as it was nearly 400 hundred years ago. The more we learn about our amazing planet and the people who live here the more we come to realise that everyone and everything is connected to everyone and everything else.

We are connected to people and places all around the world in many ways. This includes being connected by the food we eat, the clothes we wear, the goods in our homes, the sport we play, the music we listen to and the movies we watch.

We are also the most mobile generation in history, travelling for work and for leisure more often and more quickly. As well as these physical and cultural connections there are the rapidly growing digital connections that break down barriers such as language and distance that once separated people and places.

Global citizens

Each of us is an example of the connected world in which we live. This is true even when we are just sitting at our desk at school – we don't have to physically travel to be connected with other places in the world.

Source 3.17 Australia's Cadel Evans (right) wins a stage in the 2011 Tour de France. He is followed to the line by cyclists from Spain, Kazakhstan, Colombia, Belgium and Norway. The race was televised in 190 countries and watched by an estimated 3.5 billion people around the world.

Some people, however, are true global citizens and are linked in many different ways to places all around the world. Cadel Evans, the famous Australian cyclist, is one example of a person who is interconnected globally on many levels (see Source 3.17). Perhaps best known as the first Australian to win the Tour de France cycling race, Evans was once asked how it felt to be an Australian whose sport has taken him around the world. He replied, 'Chiara's [his wife] Italian, we're living in Switzerland and I'm Australian riding for an American registered team sponsored by a Swiss company.' He could also have added that he and his wife have adopted an Ethiopian child and that his teammates are from 10 different countries.

The life and career of Cadel Evans is a clear example of the many ways we can be connected with many different places.

key**concept:** interconnection

How submarine cables connect the world through communication

In the past, most countries used their own resources to feed and clothe their own populations. Today, however, all nations increasingly rely on each other to supply goods and services to their populations. We are more connected to the rest of the world than we have ever been before. This increasing interconnection between countries is referred to as globalisation.

Globalisation has increased rapidly over the last 50 to 60 years. In 2008, for example, the same amount of trade took place in one day as in a whole year in the 1940s. This increase is largely due to rapid improvements in information and communications technology (ICT) such as the Internet. Virtually all of the world's Internet connections are made through submarine cables on the ocean floors that link together the world's land masses. In total, there are about 885 000 kilometres of submarine cables around the world and the latest cables carry signals 12 000 kilometres across the Atlantic Ocean in 0.00072 seconds. The latest submarine cables are about the thickness of a garden hose but contain enough bandwidth for 20 million Internet users.

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

WORLD: NETWORK OF SUBMARINE TELECOMMUNICATION CABLES

Source 3.18 Source: Oxford University Press

Check your learning 3.4

Remember and understand

1 How do the lines of John Donne's poem relate to the principle of interconnection? Do you think this poem is relevant to today's world? Why or why not?

2 In what ways do submarine cables connect different places around the world?

Apply and analyse

3 Write a list of some of the ways in which you link to other countries.
   - a Share your links with your classmates and build up a class list of these links.
   - b Show these links on a world map. You may need to develop a legend to show different types of links.
   - c Describe the pattern shown on your class map.

4 Examine Source 3.18.
   - a Which regions and countries are the most connected by submarine cables?
   - b Which places are important hubs for submarine cables?

Evaluate and create

5 Re-write the section of John Donne's poem in your own words as a tweet. How many people would his poem have reached when it was published in 1624? How many people could the Twitter version reach? Describe how both the poem and the tweet are examples of interconnection.

How geographical features influence interconnections

The distribution of the world's land masses and physical features has always been a key factor in making connections between people and places easy or difficult. Some physical features, such as high mountain ranges, deserts and stormy seas, have been natural barriers to trade and communication for thousands of years.

Others, such as rivers and mountain passes, act as natural corridors for connecting people and places. All around the world, people have attempted to cut through mountains, build bridges over valleys, and even construct underwater tunnels to overcome some of the natural barriers that inhibit transport and trade.

The Khyber Pass: A natural corridor

Some of the world's greatest natural barriers are the massive mountain ranges of Central Asia including the Himalayas and Hindu Kush ranges. Transport links across the ranges are limited to a few high mountain passes. The most important of these is the Khyber Pass. Carved by mountain rivers and streams, the pass allows road and rail connections between Afghanistan and Pakistan. The pass is one of the world's most significant natural corridors and was part of the fabled Silk Road that linked traders in Africa, Europe and Asia from the 2nd century BCE to the 16th century CE. Military leaders such as Genghis Khan and Alexander the Great also used the Khyber Pass during their military campaigns.

Source 3.19 Narrow gorges near the Khyber Pass in Northern Pakistan have acted as natural barriers to trade and communication.

skill**drill**

Interpreting false colour satellite images

You may have heard the term 'false colour' before. The term means different or exaggerated colours have been used or added to make an image easier to interpret. Satellite images have become one of the most useful tools available to geographers. They are taken from special cameras mounted in orbiting satellites and show a large area of the Earth's surface. While some satellite images are shown in natural colour others are altered by computers and use false colours to highlight particular features. The cartographer or person working on the image applies colours that make the range of features easier to see or understand than they would be on a 'natural' photograph or satellite image. The colours used in a false colour image can be completely unrelated to the feature being highlighted – a forest may be coloured pink, for example.

This change to colour is done when the colours of the natural features are too similar to demonstrate a particular point or aspect clearly. If someone is trying to show where a muddy brown river meets a brown-coloured riverbank where there are brown rocks and some brownish shrubs, they might decide to use colour to clearly show where the different elements are. In that case, they might make the shrub areas green, the river bright yellow and the rocks a bright red, leaving just the river bank brown.

When interpreting false colour satellite images, you should examine the accompanying legend if there is one to interpret the colours used in a false or simulated natural colour image.

Follow these steps to interpret a satellite image that uses false or simulated colour.

Step 1 Use an atlas to locate the area shown in the image on the Earth's surface.

Step 2 Compare the false or simulated natural colour satellite image with the map of the same area. Use the atlas to identify natural and human features of this environment.

Step 3 Then look closely at the satellite image and, guided by the false or exaggerated colours, identify key features of the environment such as rivers, mountain ranges and valleys. Follow the legend on the satellite image if it has one and you are not sure at first what features you are looking at.

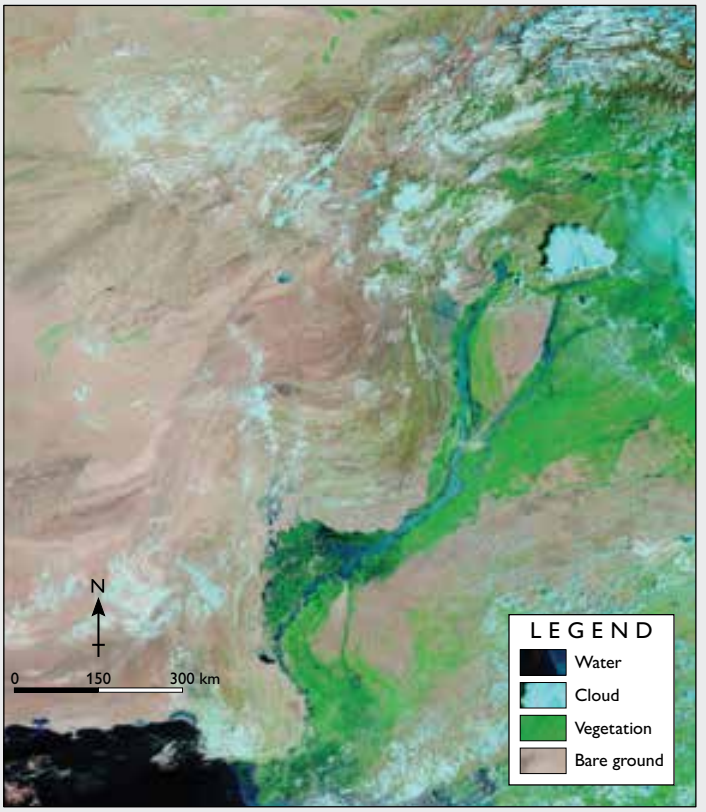
Step 4 Continue to compare the map with the satellite image to deepen your understanding of the area shown.

Step 5 Describe any relationships between features of the environment that you can identify on the satellite image. You can also use your atlas to help you add the names of features to your description.

Apply the skill

1 Find a map that shows the area around the Khyber Pass. Use it to help you describe the landscape around the Khyber Pass shown in Source 3.20.

2 Compare Source 3.20 with a map of the Khyber Pass. What geographical features do you think have made the Khyber Pass a significant feature of the region?



Source 3.20 This is a false colour satellite image of the Khyber Pass region with the Indus River in flood. The image uses exaggerated colours to make it easier to detect the various natural features in the area.

key**concept:** change

Reopening the Northwest Passage

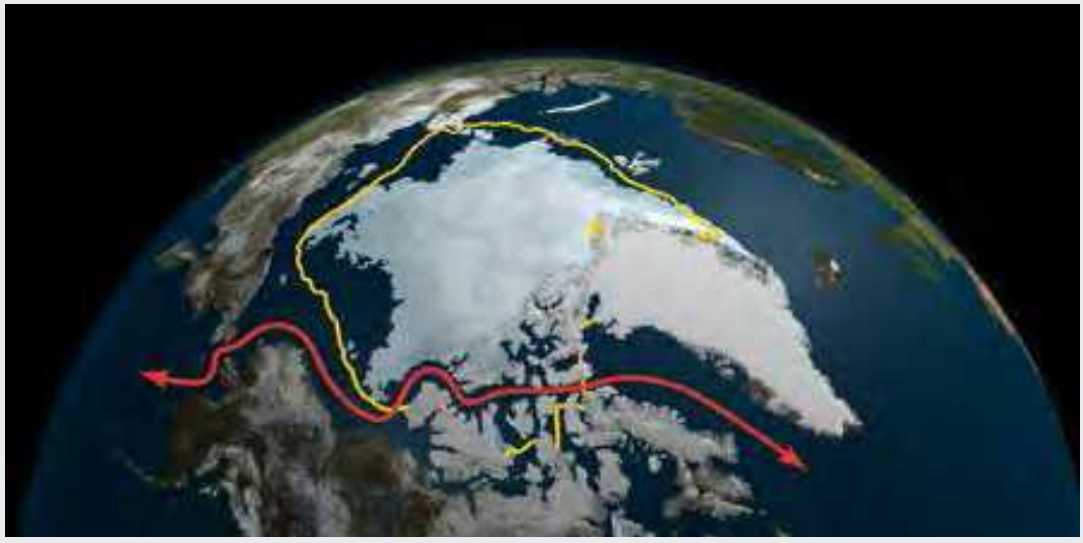
As the economies of the world become more closely linked due to globalisation, shipping companies are looking for ways to reduce the relative distance between trading countries. The Americas have always been a physical barrier between Western Europe and East Asia, two of the major trading areas of the world.

Before the completion of the Panama Canal in 1914, ships were forced to brave the dangerous waters around Cape Horn on the southern tip of South America. Today, around 40 ships a day pass through the Panama Canal but some large ships now exceed the size limits of the canal.

The preferred route for ships would be the Northwest Passage around the north of North America. However, the Arctic sea ice is unpredictable and hazardous, even in summer when much of the ice covering the Arctic Ocean melts.

Climate change, however, is now opening up the Northwest Passage. Each year the sea ice shrinks by about 70 000 square kilometres, and many researchers now believe that the passage could be completely ice-free all year within decades. Many shipping companies around the world won't wait that long, however, and have begun building ships that can withstand the reduced Arctic sea ice.

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



Source 3.21 NASA satellite data in 2011 showed that Arctic sea ice had retreated to a level far smaller than the 30-year average (marked in yellow), opening up the Northwest Passage shipping lanes (in red).

Check your learning 3.5

Remember and understand

1 Where is the Khyber Pass and why is it important?

2 What are the similarities between the Khyber Pass and the Northwest Passage?

Apply and analyse

3 Describe the relationship between sea ice and shipping shown in Source 3.21. Use the correct names of seas and countries in your description.

Evaluate and create

4 Use an atlas to examine the area between Tokyo, Japan and London, United Kingdom.

a Estimate the distance a ship would sail between Tokyo and London if passing through the Northwest Passage compared to the Panama Canal.

b Container ships travel at about 40 kilometres per hour and use about 200 tonnes of fuel a day. Estimate the savings in time and fuel for a Tokyo–London ship using the Northwest Passage.

5 Research other natural barriers and corridors to trade such as deserts, rainforests and rivers. Make a list of these and locate them on a world map. How have new technologies helped to overcome natural barriers?

How people influence interconnections

Geographical features, including both natural and man-made structures, can pose many challenges for humans and their activities. Trade in particular, has been affected for centuries by physical geographical barriers. Among these are rivers, mountains, forests and deserts. Exploration and building efforts have often been directed at building bridges, tunnels, canals and other structures to close the gap between places and increase the level of interconnection between places.

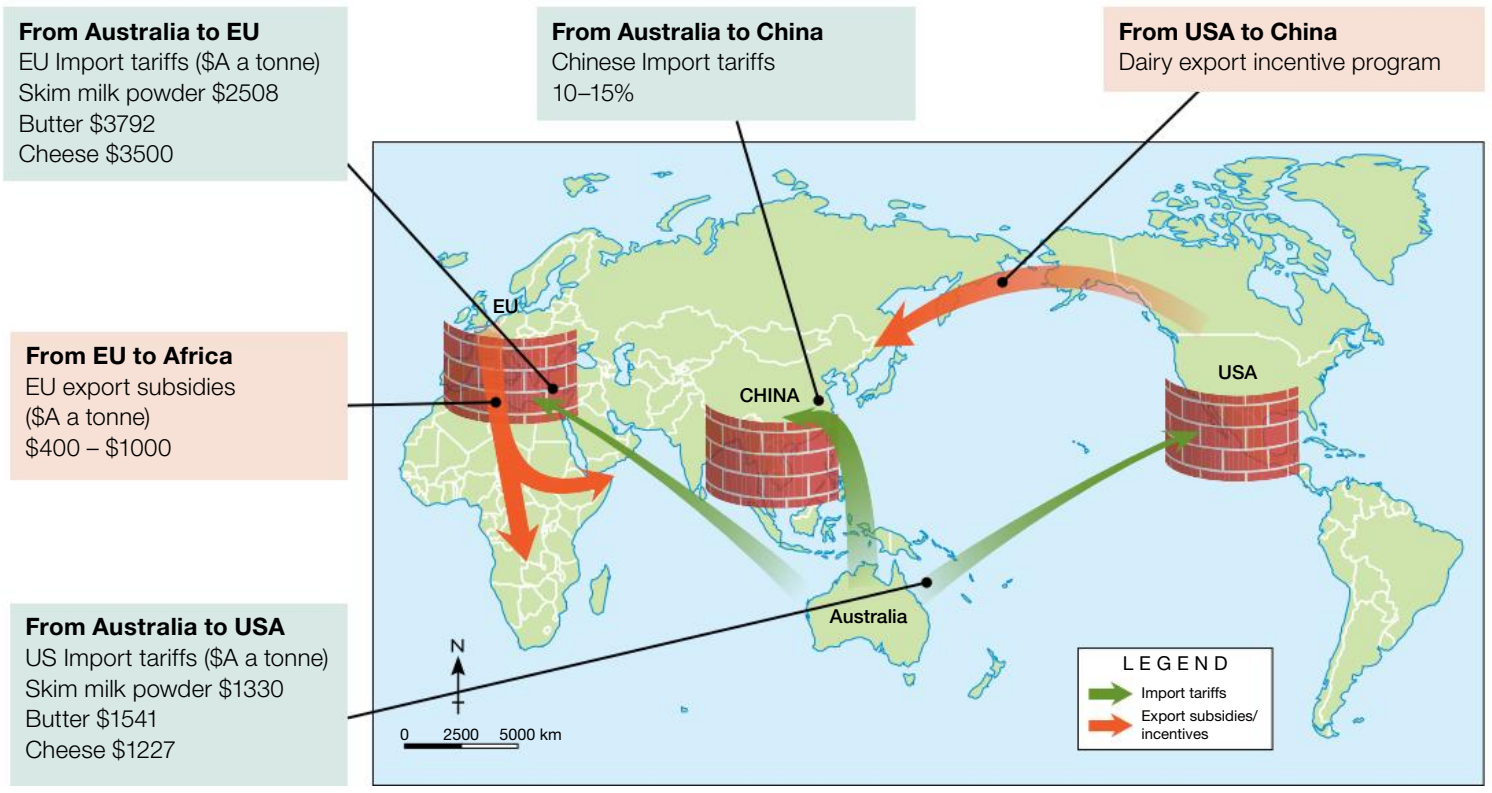
Some geographers believe that the greatest barriers to connections between people and places are not caused by physical features such as oceans and mountain ranges but by human activities and decisions.

For example, there are many barriers put in place to limit and control the movement of people and goods across international borders (e.g in the way of taxes and **tarrifs**). These exist to protect the interests of individual countries but the end result is often a restriction to trade and communications. Economists have estimated that removing trade barriers would add about $168 billion to the world economy every year. The biggest winners in the removal of these barriers would be people in developing countries as the price of food would fall and they would find it easier to export goods they produce.

Tariffs and non-tariff barriers

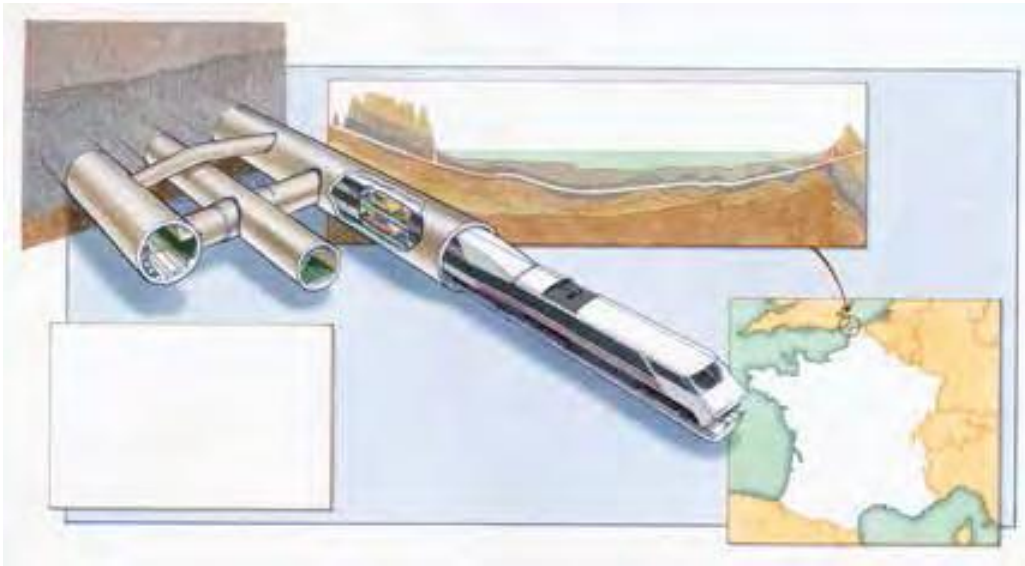
To protect local industries, governments in many countries impose a tax, known as a tariff, on imported goods. They also restrict trade by imposing import limits on some goods, and negotiate complicated trade agreements with other countries. Australian farmers often face trade barriers when trying to export their goods (see Source 3.22). Many countries apply tariffs to imported goods, while also providing incentives such as lower taxes to their own farmers to help them export their goods.

WORLD: TRADE TARIFFS AND INCENTIVES



Source 3.22

Source: Oxford University Press



Source 3.23 The construction of the Channel Tunnel was a massive undertaking to bridge the physical barrier of water between France and England (known as the English Channel). The works took a total of seven years.

While these official procedures can be a barrier to free trade between countries so, too, can unofficial practices such as bribery and corruption. Imagine, for example, ordering the same product to be delivered to your home in Australia from two different places: one from the United States and one from Sub-Saharan Africa. Both suppliers pack the goods into a shipping container and contact the shipping company on the same day. Six days later, your container leaves the port in the United States and starts on its journey to you. The African container takes six times longer to pass through the port and reach a ship and you will pay twice as much to the port officials. Though labour costs are much lower in Africa, your extra money has been used to pay bribes to the shipping agent, customs officials, security agents, drivers and crane operators to keep your container moving through the system.

Source 3.24 The port of Maputo, Mozambique. Corruption, in the form of bribery, added 14 per cent to shipping costs and increased the salary of some port officials at Maputo by 600 per cent.

Source 3.25 A flock of sheep is driven through a tunnel beneath the streets of Rafah.

Case study: The tunnels of Gaza

The city of Rafah in the Middle East lies across an international border. The southern part of the city lies in Egypt while the north is in the Gaza Strip, a Palestinian territory. The neighbouring country of Israel, concerned that guns and ammunition are passing from Egypt into Gaza, maintain tight control of the border in Rafah.

The people of the city have responded by digging an extensive network of tunnels beneath the border to connect the two sides of the city. Up to 15 000 people were involved in digging the tunnels which are used to smuggle virtually everything that people and the government need. Machinery, livestock, fuel and steel pass through the tunnels daily. The political party that controls the Gaza Strip even taxes the goods that pass through the tunnels and are rumoured to raise as much as $750 million a year in this way. Some people living in Gaza even boast that they can order fast food from Egypt and have it home delivered!

Check your learning 3.6

Remember and understand

1 In what ways can trade and communications be restricted between countries?

2 Why do countries restrict connections in this way?

Apply and analyse

3 Imagine that you have ordered goods from Africa and the United States and they were delivered as described above.

- a How would your experience change the way in which you make purchasing decisions in the future?
- b Who suffers and who benefits from your decision?
- c Imagine that Maputo is the only place from which you can buy the goods you need. Brainstorm some ways in which you could receive your goods more cheaply and quickly.

4 Examine Source 3.22. What are some of the restrictions placed on Australian farmers exporting their produce? Use the names of specific products and places in your answer.

5 Why do the people of Rafah dig tunnels? What would be some of the risks in digging and using tunnels such as these?

Evaluate and create

6 Use Google Earth to explore the city of Rafah. Describe the border region and any differences you can identify between the two parts of the city.

7 Examine Source 3.23. Do some extra reading on the Internet and then write two to three paragraphs outlining the reasons for building the tunnel and the challenges that were encountered.

How technology influences interconnections

The Internet allows people to connect with other people in different places more quickly and conveniently than ever before. Today, we use the Internet for a range of activities and purposes that link us to many places all over the world. Your after-school activities are probably connecting you to places all over the world without you even realising it. In the space of half an hour sitting at the computer, you might have logged into Facebook, connecting with friends who live in the same area, others who live interstate or some who live in another country. You might listen to some British or American songs on YouTube while you do your homework, or stream an international sports game. The Internet allows you to make all these connections to different places without physically leaving your desk.

Communicating with people in different places

We use the Internet to play games, to shop, plan activities, find directions, read, research, complete homework and more than ever before, to communicate with each other.

Using the Internet for emails remains the most popular activity with 98 per cent of people online having sent an email in the last 12 months. The Internet has, in many ways, become the most dominant form of social interaction on the planet.

- There are 2.1 billion Internet users in the world and 3.1 billion email accounts.
- There are about 100 million active Twitter users sending 250 million tweets a day.
- There are 2.4 billion social networking accounts worldwide.
- There are more than 1 billion Facebook accounts. This is greater than the total world population 200 years ago.
- Every minute a further 48 hours of video content is added to YouTube.
- There are more than 500 million Google searches made every day. This rate has doubled in the last three years.
- About 250 billion emails are sent every day.

Source 3.26 This map of the world was created not by drawing borders, but by marking the connections between 10 million Facebook friends.

Access to news and information

Developments in information and communications technologies (ICT) have meant that people can now access a wide range of global news and information services quickly and easily. You can get American basketball scores in real-time, for example, or you can see photos from a collection at Paris fashion week on the same day it is shown. This information might be trivial, such as finding out what everyone was wearing at last night's music awards, or it might be something that could potentially save a life.

During the Black Saturday bushfires which swept through Victoria in 2009 many people were alerted to the threat via social media, not by traditional news forms. Following Twitter allowed people to get real-time updates from others who were tweeting from areas nearby the flames, information which traditional news services did not have access to. You may be able to think of other examples where Twitter or other social media have broken stories before traditional news providers.

Access to services in other places

Do you watch your favourite programs on free-to-air TV or do you prefer to live-stream or download? Do you prefer to shop for clothes online or do you go and try things on in store before you buy?

Entertainment and shopping are two areas of your life where information technology connects you to other places on a regular basis. You probably take it for granted that you can download new music the same day it is released in the United States. In the past, you would have had to wait for CDs to arrive in shops here. You can also shop online, and often purchase things more cheaply than if you were buying them in a physical store. Almost $8 trillion a year changes hands through e-commerce, and half of all Australians have shopped online in the last three months. Access to services and goods in other places is an aspect of globalisation that many of us now enjoy as a matter of course.

Case study: Offshore call centres

When people call up to complain about mobile phone service, book an airline ticket, or pay a bill, chances are they speak to someone in the Philippines or India rather than in Australia. Many Australian companies have moved their call centres to these other countries to take advantage of the lower wages. The call centre industry, which currently employs around 400 000 Filipinos and 350 000 Indians, is expected to grow quickly as Internet speeds increase and new companies take advantage of the cost savings.

Source 3.27 Developments in technology and increased Internet speeds mean that it is possible for overseas companies to use call centres in India or the Philippines.

Check your learning 3.7

Remember and understand

1. In what ways do you think an online news service might be more useful than a traditional television or print-based news service?
2. Name three ways that the Internet facilitates interconnections bewtween people in different places.
3. How are offshore call centres an example of interconnection?

Apply and analyse

4. Compare the Facebook map shown in Source 3.26 to an atlas map of the world.
   - a Name six countries that are very active Facebook users.
   - b Name four countries where there appears to be relatively little Facebook usage. Suggest some reasons for this.
   - c Describe the pattern of Facebook usage in Australia.
5. Do you use online shopping for any purchases? If so, which items do you tend to buy online? Do you know where the items you purchase are coming from?
6. In what ways does online shopping affect:
   - a the consumer?
   - b the environment?
   - c local shop owners?
   - d postal and delivery service providers?

Digital access around the world

The digital divide

During your lifetime, the Internet and other digital technologies have become the most powerful tools of connection the world has ever known. As a result, many experts argue that we are currently experiencing a digital revolution. In many places it now seems easier to be connected to other people and places than not to be. However, this high level of connection is not experienced equally by everyone. In some places there are more computers and mobile phones than there are people, while in other places these devices are still uncommon. These differences are known as the **digital divide**.

Using indicators such as the number of mobile subscribers, the price of Internet access, adult literacy, bandwidth and the number of Internet users, organisations such as the International Telecommunications Union (part of the United Nations) award each country a score based on its level of digital access (see Source 3.30). The lighter the shade of green, the greater the digital access enjoyed by that country. The darker the shade of green, the more limited the digital access.

Digital access in developing nations

While access to communication technologies is greatest in developed nations the rest of the world is beginning to catch up. The people in the Sub-Saharan African nation of Niger, for example, are identified in Source 3.30 as having the least access to ICT. In 2000, only one resident of Niger in every 5000 had a mobile phone subscription. By 2013, this had become one in every three.

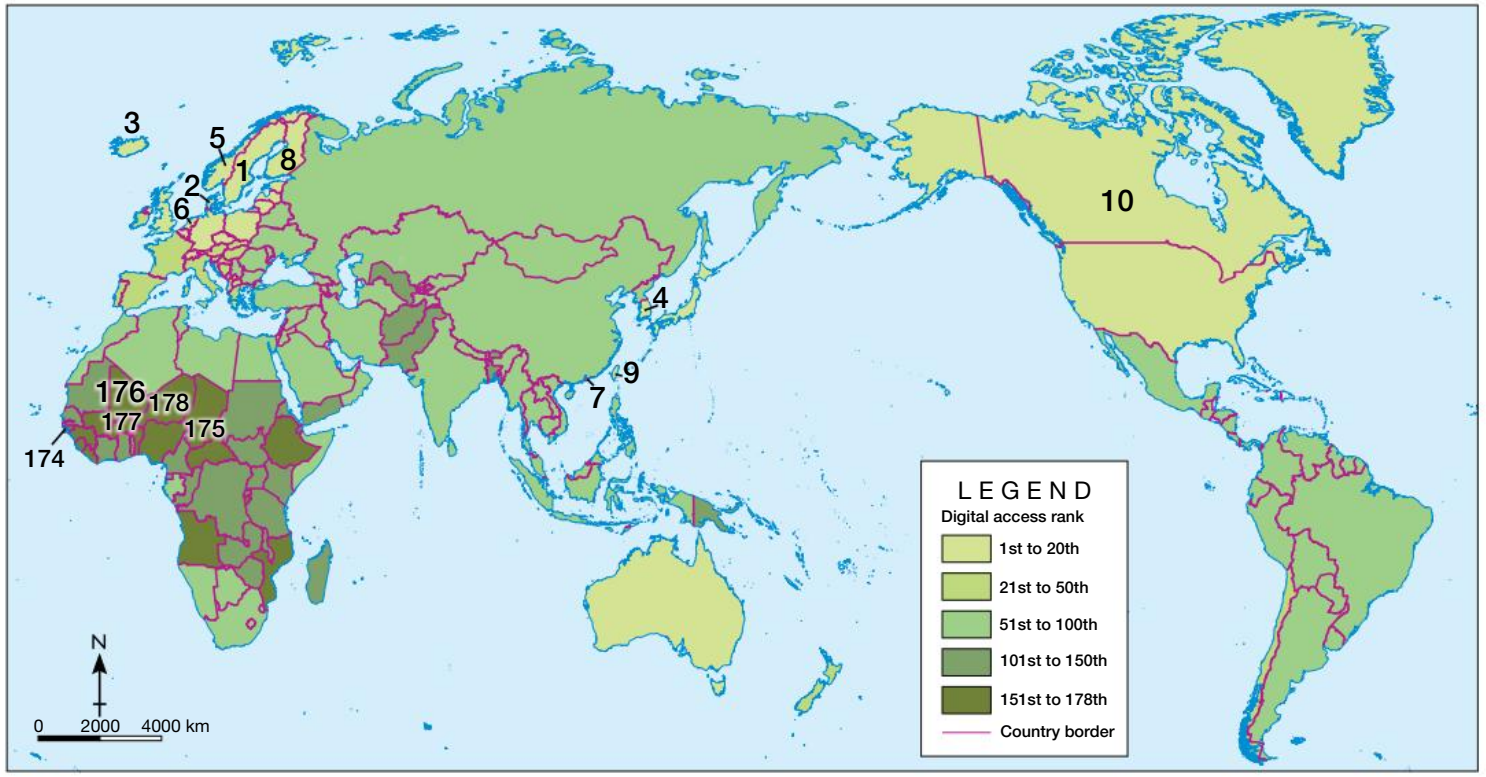
For many people in developing countries, the Internet and mobile phone have become a way to access the promise of a better future for themselves and their children. This promise grew following large scale protests against governments in many Middle Eastern and North African countries that began in 2010 and resulted in the overthrow of several governments. Known as the Arab Spring, it showed the power of social media, as people used sites such as Facebook and Twitter to organise protests and broadcast acts of violence by the police and armed forces.

Source 3.28 This amazing image uses the digital traffic created by the social network site Twitter and the photo-sharing site Flickr to map the use of digital technologies in Europe and North Africa. The red dots show places where Flickr pictures are uploaded and the blue dots where tweets were sent. White dots are locations that produced posts to both websites.

Source 3.29 This data is from the International Telecommunications Union, a specialised branch of the United Nations, and shows the developing rates of mobile and Internet use in developed and developing nations as a percentage of the population.

		2005	2006	2007	2008	2009	2010	2011	2012	2013
Mobile phone subscriptions	Developed	82.1	92.9	102.0	108.3	112.5	115.0	119.0	123.6	128.2
	Developing	22.9	30.1	39.1	49.1	58.3	69.0	78.3	84.3	89.4
Homes with Internet	Developed	44.7	48.2	53.4	57.7	62.6	66.3	70.2	74.0	77.7
	Developing	8.1	9.6	11.2	12.5	14.1	16.4	20.2	24.0	28.0
People using the Internet	Developed	50.9	53.5	59.0	61.3	62.9	67.3	70.5	73.4	76.8
	Developing	7.8	9.4	11.9	14.7	17.5	21.2	24.5	27.5	30.7

WORLD: LEVELS OF DIGITAL ACCESS



Source 3.30 Source: Oxford University Press

Check your learning 3.8

Remember and understand

1 What is meant by the 'digital divide'?

2 What are some of the likely consequences of this divide?

Apply and analyse

3 Examine Source 3.30.

- a Describe the distribution of those countries with very high digital access.
- b Describe the distribution of those countries with very low digital access.
- c Account for the differences in digital access as shown on this map.

4 Examine Source 3.29 and describe the general pattern of changes in digital access in developing countries.

5 Examine Source 3.28 and compare this to a political map of the same region.

- a Which countries send the most photos and tweets?
- b Which countries send the least?
- c Account for the spots of white in areas of darkness.
- d How does this map reflect physical features such as oceans, mountains and deserts?
- e How does this map reflect human features such as cities, wealth and population density?

Connecting with remote areas

While many of us live or spend most of our time in towns or cities, there are significant numbers of people who live in, or travel to, more remote areas. In the past, the physical distance that separated places posed significant issues, even risks. Alerting someone located in a remote area of an incoming violent storm, for example, may have been difficult, even impossible. Even now, restricted mobile phone coverage and slow Internet access can still make connecting with some places decidedly challenging.

People travel to remote places for many reasons. There are scientists who go out into the field to research and explore, religious missionaries or educators who might visit or do short stays in an area to help or teach a language, and those who simply want to tackle the frontiers of places that are still relatively unchartered. Here, we will look at how people who travel to remote areas as well as how those who live in such places interconnect with the world.

Changing the ways explorers interconnect

Antarctica is the most remote place on Earth. Explorers in the 1900s such as Robert Falcon Scott and Ernest Shackleton effectively disappeared once they sailed away from their last port in New Zealand or Argentina. Their families and supporters knew that it would be years before they would see them again.

Source 3.31 Alone but connected: Felicity Aston sets off across Antarctica.

Communication with the 'outside world' was simply not possible. This was the case throughout many remote places on Earth, including vast areas of inland Australia, until only recently.

Source 3.32 This picture shows the positions of the 6000 artificial objects currently orbiting the Earth. Note: that they are shown as much larger than their actual sizes.

Explorers still travel to Antarctica and although this extreme environment is as challenging as ever, they are no longer as isolated. In 2012, British adventurer Felicity Aston skied alone for 1477 kilometres across Antarctica, becoming the first woman to do so (see Source 3.31). Among the equipment she carried in the two sleds she dragged behind her were a satellite phone that gave her coverage for the complete 59-day journey and a solar panel to recharge it. Connecting to a series of satellites orbiting the Earth 780 kilometres above her allowed Felicity to chat to family and friends, make a daily safety call, take part in live radio interviews, maintain a blog and Facebook page and tweet to hundreds of thousands of followers daily.

The technologies that allow people in remote places to connect to other places all rely on a system of satellites that orbit the Earth. These receive signals from devices such as satellite phones and bounce them back to Earth or to another satellite. There are about 6000 of these satellites currently in orbit and this number increases by about 200 a year. These are used to relay messages to devices you probably have in your home, such as televisions and GPS receivers.

Connections in the Outback

Australia is one of the world's largest countries and some people live vast distances from the goods and services they need. This has resulted in unique problems that require unique solutions. The Royal Flying Doctor Service and School of the Air, for example, have helped to bring medical services and schooling to some of the world's most remote communities.

The Northern Territory Aboriginal community of Mungalawurru lies 90 kilometres north-west of Tennant Creek. In 2011, there was little contact between the community and people in other places. There were no home phones or mobile phone coverage and the pay phone was usually out of order. This situation is typical of many remote communities but an experiment in Mungalawurru may be about to change connections in the outback forever. A partnership between several technology providers and social researchers has seen computers with Wi-Fi and satellite connections installed in most homes, and education given to the local community about their use. Within months they became widely used, particularly for music downloads, online banking and emails.

Source 3.33 The Internet is providing connections in remote places where there was previously little contact with other communities.

Check your learning 3.9

Remember and understand

1 Why do some people travel to remote areas?

2 How are explorers in Antarctica able to connect to people in other places? How does this differ from explorers in the past?

Apply and analyse

3 Research shows that the percentage of people in Australia who are connected to the Internet declines the further away people are from the centres of Australia's largest cities. Use a key geographic concept to explain why this is the case.

4 How do you think the new technology in Mungalawurru will change this community?

5 Have you ever lost your phone or had the Internet cut out at home? How did you feel, or how do you think you would feel if you lost your usual access? Discuss how your life would change if all systems of digital communication such as mobile phones and the Internet were cut. Consider how you would overcome any problems this might create for you.

6 What factors might you need to consider if you were to travel to an area that had limited mobile network coverage? What things might you need to pack or prepare that you would not normally have to consider?

Evaluate and create

7 Examine Source 3.32 in light of the issue of waste management. Research the amount of space junk that is currently in the atmosphere.

- a What problems could having so much space junk floating unregulated in the atmosphere cause in the future?
- b Are there any ways you think this should be addressed or strategies that you think should be implemented to tackle this potential problem?

3.2 big**ideas:** broadsheet

How the Internet connects you to the world every day

Over a short period of time, we have come to rely on the Internet to connect us to the world in many ways throughout our day. We use it to play games, shop, research, find directions, work, read books, plan activities, complete homework and more than ever before, to communicate with each other.

Some of the ways in which we use the Internet every day include:

- online banking
- downloading podcasts and apps
- finding out sports results
- playing online games
- sending or reading email
- streaming music, movies and TV programs
- getting news updates
- checking weather reports
- buying clothes, groceries and presents
- completing and submitting homework.

Source 3.34 Many people today would feel lost without the Internet.

skill**drill**

Conducting a survey and presenting the results

Geographers use surveys to explore people's opinions, ideas and activities. By analysing the results they can gain valuable insights into personal and social behaviour. The key to finding useful information from a survey is asking the right questions. Try to ask closed questions (yes/no questions or questions that provide a limited selection of options to choose from) as much as possible. Closed questions in surveys are commonly multiple-choice and ask people to choose their reply from a set of answers that you provide. Open questions (a question that doesn't give options to select from but encourages an individual's own thoughts to be expressed) are sometimes important too, but because you may receive a huge range of replies you may not be able to use the data so easily. Follow these steps to design a survey and present the results.

Step 1 Decide on the focus of your study.

Step 2 When you have decided what your study will be about, work out what information you are interested in finding out. For example, your study might be about the Internet, and you may want information on how often people use it.

Step 3 Decide what people you will survey. You will need to talk to at least 10 people to get data you can report on. Make sure that you have enough forms for all of the people you intend to survey. The more people you survey, the more useful and reliable your results will be.

Step 4 Write a series of closed questions about your study. A closed question might look like this:

How often do you use the Internet at home?

- At least once a day ☐
- At least once a week ☐
- At least once a month ☐
- No Internet at home ☐

Step 5 Once you have your questions written, go over them to ensure that they are all focused on the subject of your study and are geared to find out the information you want. Make sure they are clearly worded and cannot be misinterpreted by people completing the survey. Ask a friend to read over your questions if you are unsure.

Step 6 Conduct your survey. Ask the questions and fill in the forms yourself, or you can get your participants to fill them in. Make sure the responses have been entered correctly and that you have accurate records.

Step 7 Once you have completed your surveys it is time to put the results together into a form you can use – this is called data analysis. This is often best done in a table like the one shown here.

Source 3.35 Data can be presented in a visual format like a table so the researcher can access information quickly and easily.

How often do you use the Internet at home?	Number	Percentage (%)
At least once a day	14	58.3
At least once a week	7	29.1
At least once a month	1	4.2
No Internet at home	2	8.4
Total	24	100

Step 8 Present your survey results in a way that make them easy to understand. Rather than a lot of numbers and writing, use graphs. Make sure you clearly label each graph with the question you asked and below each graph write a short summary of the results.

Apply the skill

1 Design and complete a survey about the ways in which people in your class and members of your family use the Internet. Include a minimum of 10 questions. Survey a minimum of five classmates and five family members (or other people you know outside of class). You might want to include questions like:

Do you watch television shows online?

Yes ☐

No ☐

If yes, how many hours a week would you watch on average?

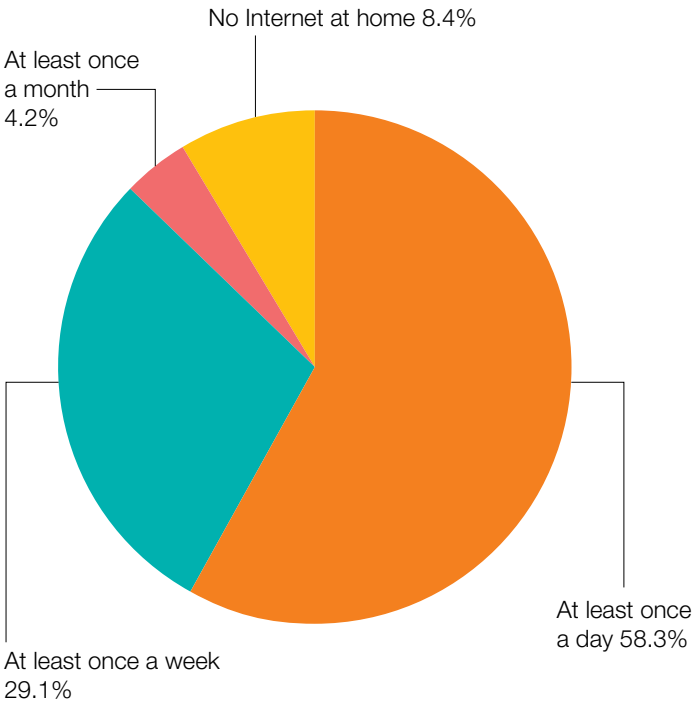
0–2 hours ☐

2–6 hours ☐

6–10 hours ☐

10 hours or more ☐

2 Once you have completed the survey analyse the results and present them in table and graph formats.



More than 90 per cent of the people in my class have access to the Internet at home. More than half the class use it at least once a day.

Source 3.36 How often do you use the Internet at home?

Extend your understanding

1 Compare your findings with those of a classmate. Write a report based on both sets of results explaining how often and in what ways you used the internet.

2 Present the results of your study to the class. Use your table or graph from the previous question as a visual aid, and talk through the most popular websites that people used, as well as the differences or similarities between the ways your family members and classmates used the Internet.

3.3 How does trade connect people and places?

Global trade connections

In the last 50 years or so there has been an explosion in the amount and value of goods traded within and between nations. When your grandparents were your age they probably ate food grown and processed in their local area. Most of their clothes were probably made locally, and they most likely bought things they needed from local shops. Communication with other places in the world would have come through the letterbox.

Today, homes contain many items made in other countries and we tend to shop globally. Today, trade between nations is valued at about US$18 trillion a year and international trade links people and places around the world. To make these connections there are:

- approximately 6000 planes in the air right now
- approximately 17 000 cargo ships crossing the world's seas and oceans
- pipelines transporting gases, oil and water a total distance of about 2 million kilometres
- more than 1 million kilometres of railway track.

Source 3.37 About 90 per cent of international trade in goods is carried out by ship. Bulk shipping of goods such as oil, gas and grain accounts for most of this. These ships are waiting to load or unload in Hong Kong Harbour, one of the busiest ports in the world.

Source 3.38 This is the world's second largest cargo plane. It can carry 150 tonnes of cargo over 3 000 kilometres.

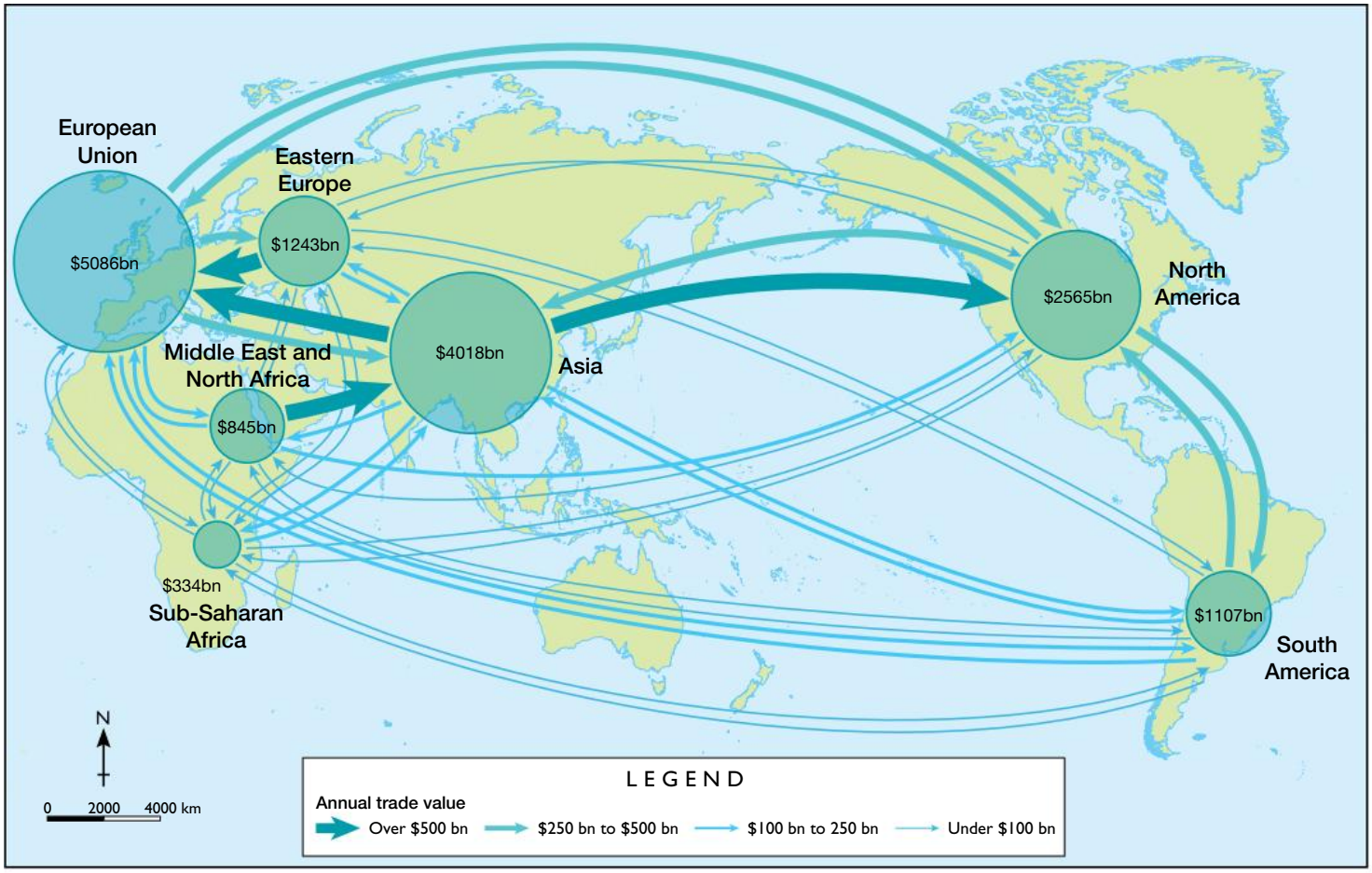
The global flow of trade

Source 3.39 shows the amount of trade that flowed between the different economic regions worldwide in 2012. Imports and exports have a huge economic value for countries and the amount of trade taking place between countries grows bigger each year.

International trade is dominated by a few big players. The United States, Germany and Japan together account for about one-quarter of all exports and have done so for several decades. This dominance is threatened, however, by the rapid growth in emerging economies, particularly China, India and Brazil. In 2011, Brazil had record trade figures, with its exports market reaching around $US 256 billion, and trade between India and China also grew to a record level of $US 73.9 billion in the 2011–2012 period.

Australia accounts for about 1.5 per cent of global trade and is ranked 21st in a list of the world's biggest exporters.

WORLD: GLOBAL FLOW OF TRADE IN 2012



Source 3.39

Source: Oxford University Press

Check your learning 3.10

Remember and understand

1 How are most of the world's goods transported?

2 Which countries have dominated global trade in the past?

Apply and analyse

3 Examine Source 3.39.

- a Rank the seven regions of the world shown in the map, from the largest trader to the smallest.
- b Describe the destinations of exports from Asian countries.
- c Which region is the smallest exporter? Why do you think this is the case?
- d Which region exports much more than it imports? Why do you think this is the case?

Evaluate and create

4 Discuss with someone older than you (say, a parent or grandparent) about ways in which their links with other places have changed in their lifetime. Develop a set of questions about means of communication, travel, and buying goods and services to help in your discussion. Report back to your class about what you found out from your discussion.

5 Think of one product that you (or someone you know) recently bought over the Internet and one product bought from a local shop. Find out where each product came from and map the journey taken by each to reach you. To help in your task, you can look up shipping routes at http://www.sailwx.info and airplane flight information at http://planefinder.net/. You might want to research some local trucking or delivery companies too.

Australia's mining connections

Source 3.40 A gold mine near Kalgoorlie (now known as Kalgoorlie–Boulder) in Western Australia

Australia's mining boom

Australia is linked to many places in the world through the goods and services produced here that are exported to other countries. Over 60 per cent of our exports are minerals and fuels such as iron ore, coal, gold, crude oil and aluminium. In recent years, there has been a rapid growth in the amount of minerals exported from Australia (see Source 3.41). Known as the mining boom, this rapid growth is driven by three main factors. These are discussed below.

Increases in demand for Australian minerals from China and India

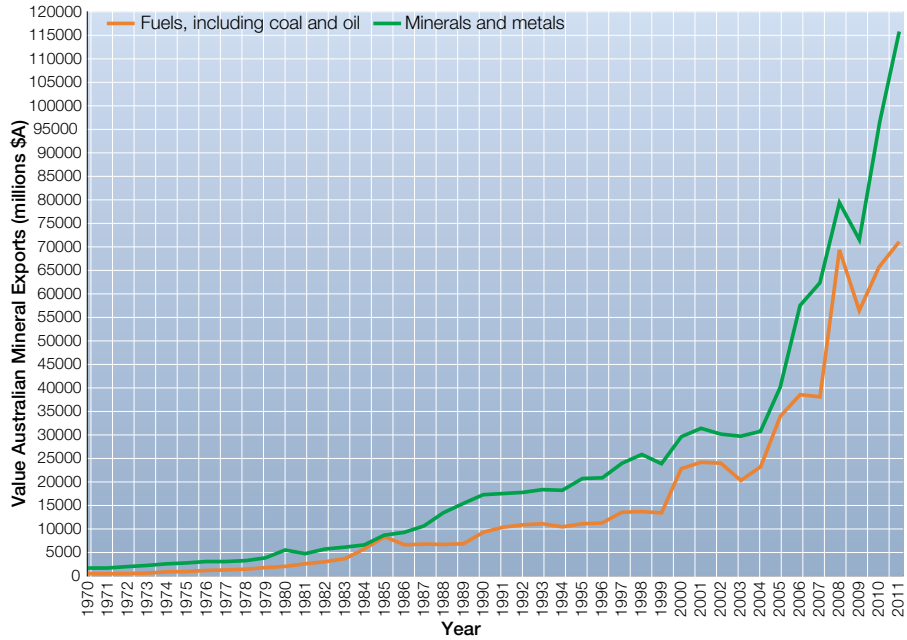
As China and India move from being rural societies to modern, urban and industrialised ones, they require vast amounts of raw materials. In particular, they need iron ore to produce steel for building projects. They also need a cheap source of energy, such as coal to generate electricity, needed to power homes and businesses. In the last few decades, Chinese industries have developed enormous factories producing goods such as machinery, ships and cars, all of which require steel made from iron ore. India has large reserves of iron ore but few coal reserves, whereas Australia has large quantities of both. This demand has seen a huge increase in the value of coal and iron ore.

Australia's vast mineral wealth

Australia is one of the world's biggest suppliers of many metals and minerals used around the world. For example, Australia has the largest reserves of lead, nickel, silver, uranium, zinc and zircon on Earth. Australia has the world's second-largest iron ore deposits – about 28 billion tonnes – almost all of which are located in Western Australia. It also has some of the world's largest coal deposits, which are used to provide about 80 per cent of our electricity. Large amounts of coal, mainly from the Bowen Basin in Queensland, are exported to Asian markets. Queensland has become the world's largest exporter of coal by sea.

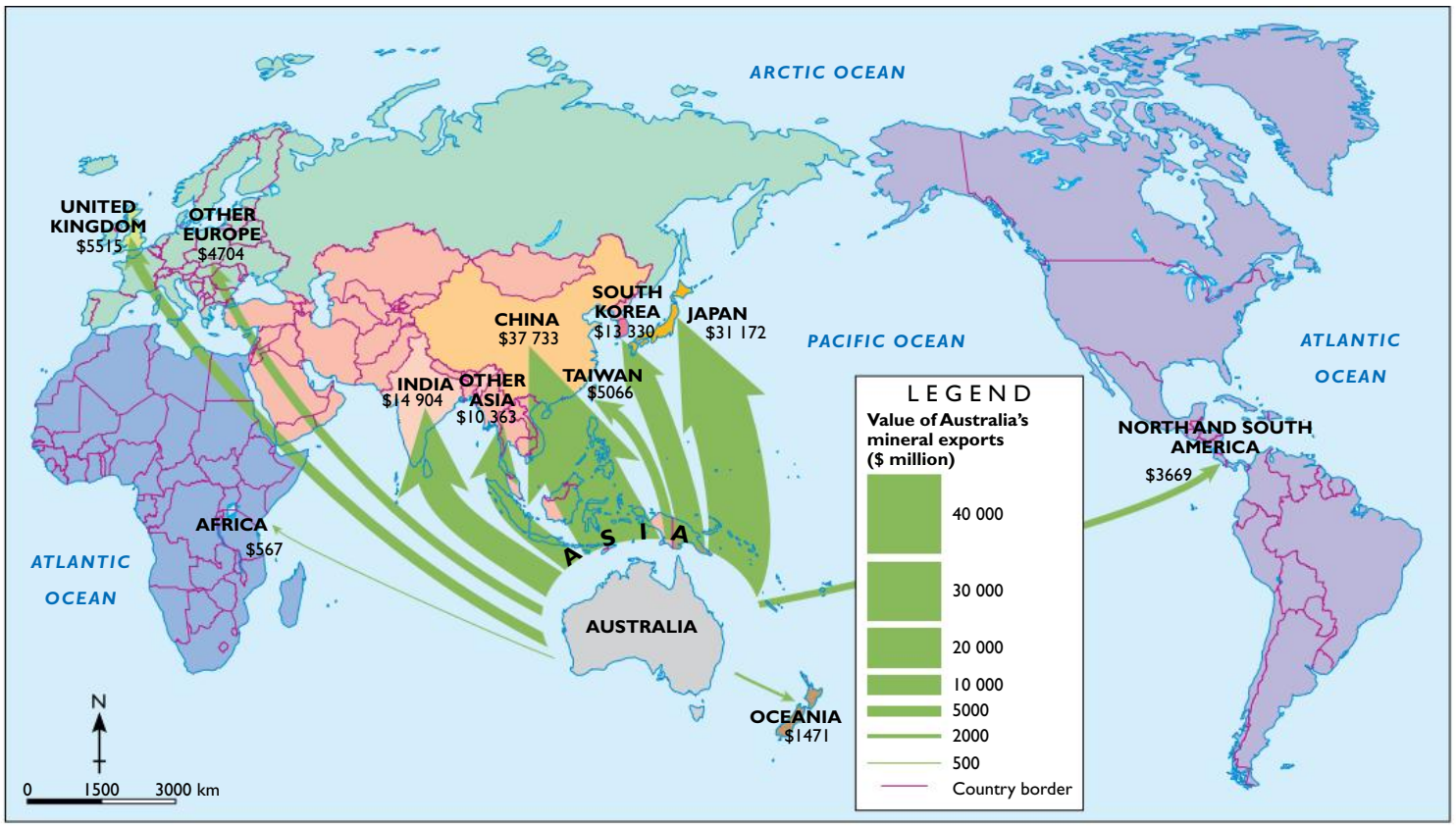
Australia's willingness and ability to export minerals

Since the 1850s, when miners began digging up gold in New South Wales and Victoria with picks, shovels and their bare hands, Australians have regarded minerals as a resource to be mined and sold. The mining sector is now Australia's largest export earner, accounting for nearly half of our total exports. Each day, about 1 million tonnes of iron ore leaves Australia on ships; this is expected to double within the next five years. Over 200 000 people are employed directly in the mining industry and they enjoy some of Australia's highest wages.



Source 3.41 Growth in Australia's mineral exports, 1970–2011

WORLD: VALUE OF AUSTRALIAN MINERAL EXPORTS, 2010



Source 3.42

Source: Oxford University Press

Source 3.43 BHP Billiton is Australia's biggest privately owned business and the world's largest mining company. It operates mines in 25 countries and employs around 41 000 people. This ship is being loaded with iron ore at the BHP Billiton facility in Port Hedland, Western Australia.

Check your learning 3.11

Remember and understand

1 Why are coal and iron ore in such demand in China and India? What are they used for?

2 How have changes taking place in India and China resulted in changes in Australia?

Apply and analyse

3 Use the key concept of interconnection to explain Australia's mining boom.

4 Using Source 3.41, describe the growth in mineral exports since 1970.

5 Examine Source 3.42, showing the destinations of Australia's mineral exports.

- a To which region do most Australian minerals go?
- b What is the current value of Australian mineral exports to India? How and why might this value change over the next 10 to 20 years?
- c Why do you think Japan imports so many of Australia's minerals?

Evaluate and create

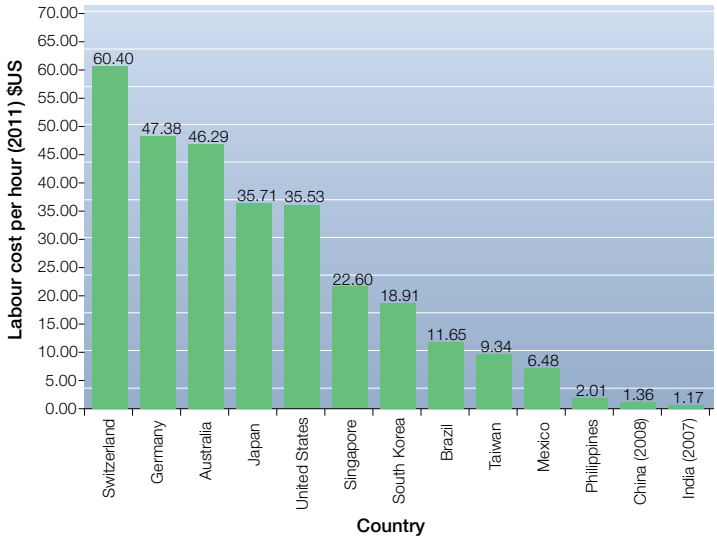
6 Which individuals and companies benefit most from the mining boom?

7 Conduct research to discover how the mining boom might result in inequalities in wealth between different groups in Australian society.

Multinational companies

As you have learnt, one of the most common factors linking us around the world to people in different places is the movement of goods and services. In the last few decades, many large businesses based in wealthy developed countries have chosen to manufacture their goods in poorer developing countries. Because these businesses operate in more than one country, they are called **multinational companies** (**MNCs**). Some of the largest, most profitable and most recognisable brands in the world are produced by MNCs. These include Coca-Cola, Apple, IBM, McDonalds, Louis Vuitton, Adidas and Nike.

MNCs choose to base their manufacturing in developing countries for a variety of reasons, but the main one is cost. Labour costs are much lower in many of these countries (see Source 3.44) and this allows MNCs to spend less on manufacturing and thereby increase their profit.



Source 3.44 Hourly rates of pay (including all benefits) for manufacturing workers in different countries

Case study: Apple – a global giant

Apple is one of the world's largest and most profitable multinational companies in the world today with annual revenues of over US$150 billion. The company began in 1976 and at the time proudly boasted that all of its computers were made in the United States. Now virtually all of the 159 million products it sells every year are made outside the United States, mostly in China. While the cost of labour was a major factor in moving to China, other considerations were also important.

Source 3.45 Thousands of Chinese job-seekers queue outside the Apple manufacturing plant in Shenzhen city, keen to become part of the global giant.

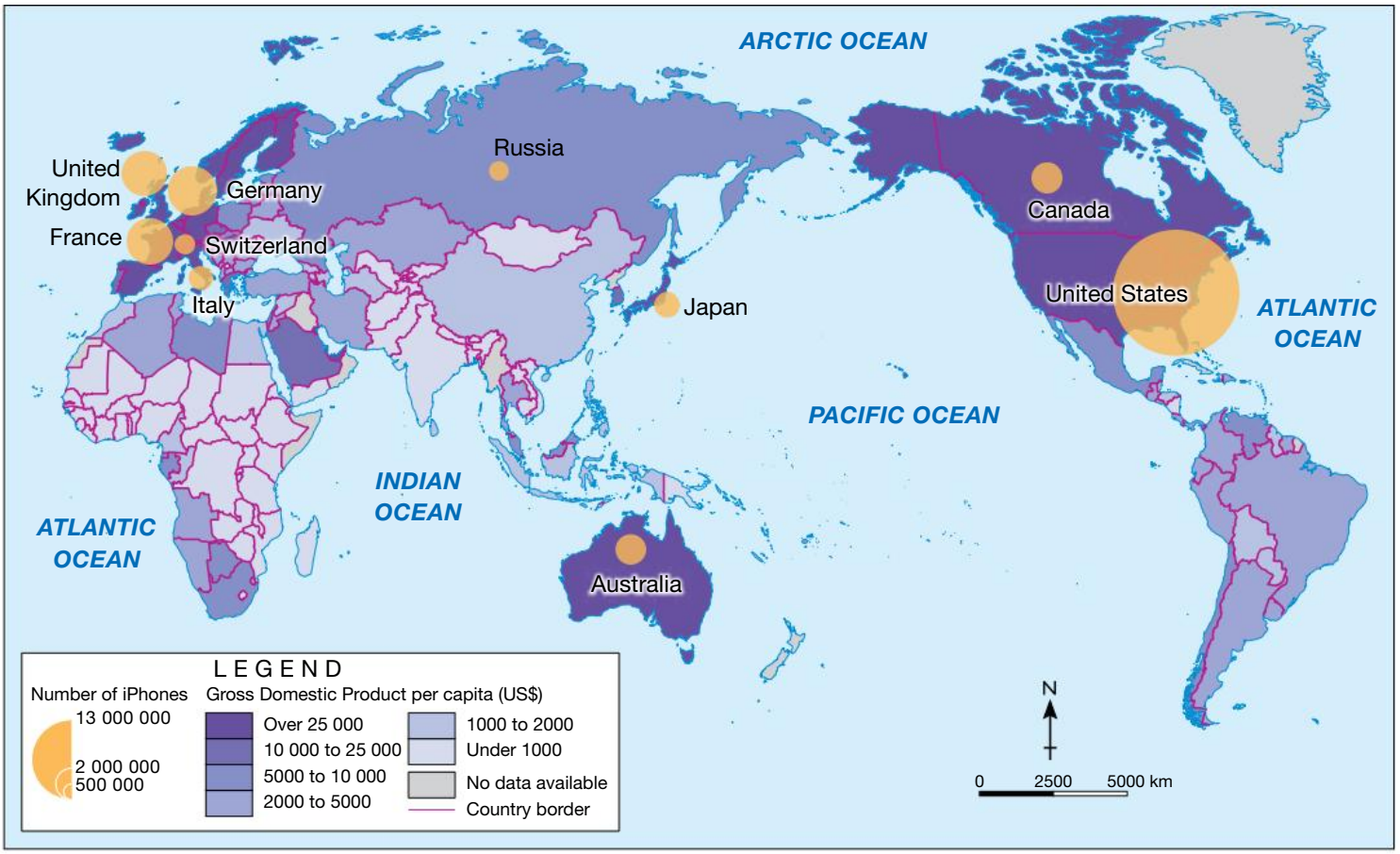
Virtually all of the components used in Apple products such as glass screens and computer chips are also made in China so it made sense to locate the assembly plant in the same place. Apple also found that Chinese plant owners and workers were much more flexible and willing to change than their American counterparts.

This is very important in a rapidly changing business such as electronics. The end result is that Apple can make an iPhone in China for about $8 in labout costs. The same phone would have labour costs of $73 in the U.S.

Source 3.46 Estimate of iPhone market share by country as at June 2009

Rank	Country	Estimated number of iPhones sold
1	United States	13 250 216
2	Germany	1 937 824
3	France	1 793 753
4	United Kingdom	1 682 491
5	Canada	805 594
6	Australia	762 161
7	Japan	525 658
8	Italy	490 451
9	Switzerland	334 649
10	Russia	326 458
	Other	4 490 745
	Total	26 400 000

WORLD: GROSS DOMESTIC PRODUCT



Source 3.47

Source: Oxford University Press

Check your learning 3.12

Remember and understand

1 What is a multinational company?

2 Explain why Apple is described as a multinational company.

Apply and analyse

3 According to Source 3.44, which two countries pay workers the highest hourly wages? Which two countries pay the lowest? Why do you think this might be the case?

4 Why did Apple decide to move its manufacture of iPhones from the USA to China? Use evidence from Source 3.44 to support your answer.

5 Examine Source 3.45. What does this photograph tell you about the supply of labour in China?

6 Examine Sources 3.45, 3.46 and 3.47 and answer these questions.

a In which Chinese city are iPhones made?

b Where are iPhones sold?

c What is the relationship between wealth (measured as Gross Domestic Product) and the purchase of iPhones?

d Compare the **Gross Domestic Product** of the USA and China.

Evaluate and create

Complete some further research to do the following activity.

7 With a partner, discuss who benefits from the business activities of MNCs in different countries around the world. Consider consumers and the labour force in your discussion. Collate your ideas and report back to the class.

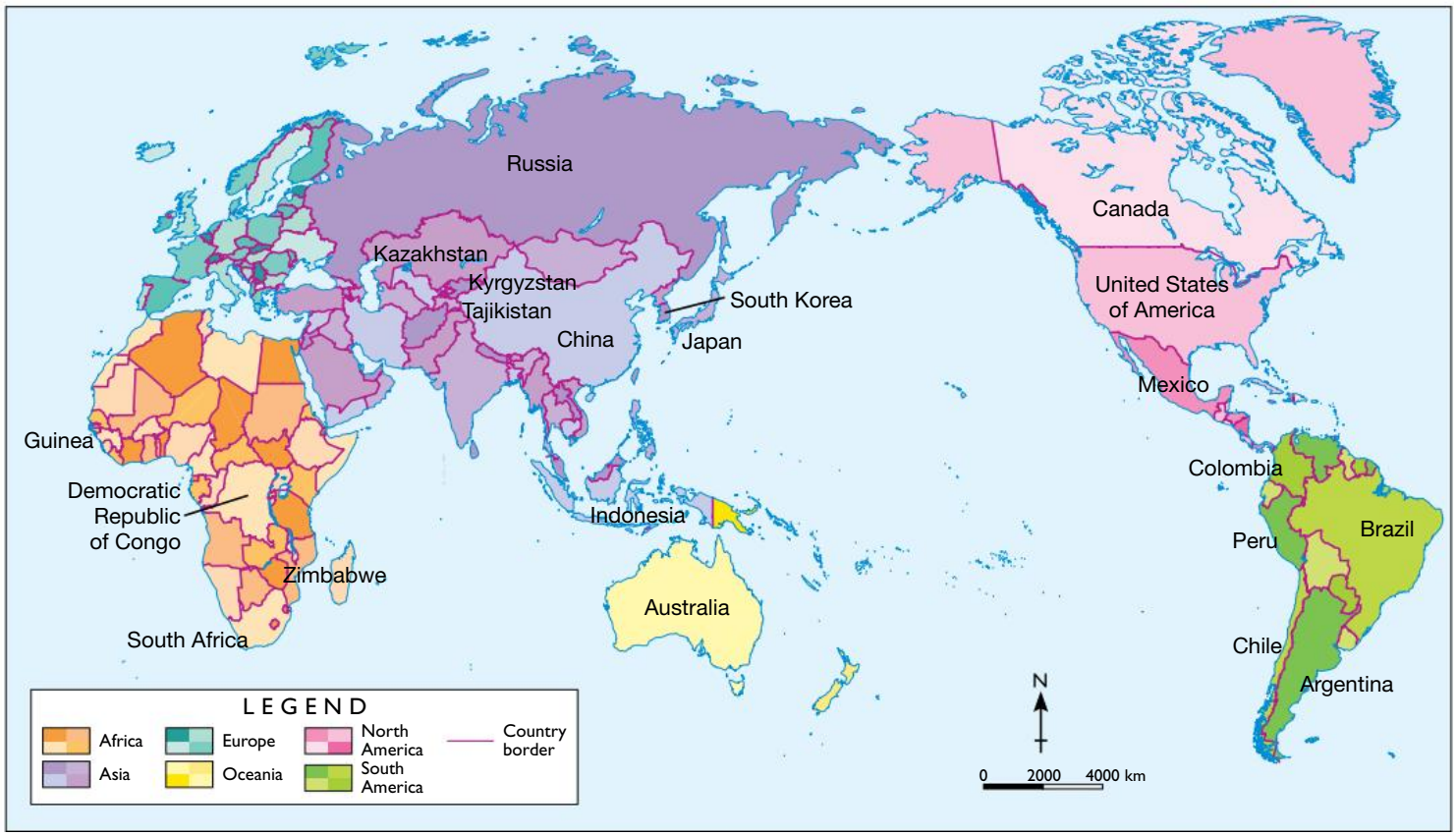
The global connections inside your laptop

Hidden inside many of the items that you use every day are bits and pieces from all around the world. A modern laptop computer, for example, contains materials and components from at least 20 different countries located on every continent except Antarctica. A complex series of networks and supply chains produce these components, transport them, process and assemble them, then package and deliver the finished laptop to a store near you.

Sources 3.49 and 3.50 show the locations of a range of materials used inside every laptop computer. The actual origin of each piece inside a computer is difficult to determine as manufacturers constantly change the source of their raw materials. This can cause problems for communities who rely on supplying these materials to provide employment and income.

Source 3.48 Virtually all of the world's laptops are assembled in Chinese factories owned by Taiwanese companies. In 2011, 244 million laptops were made in China.

WORLD: SOURCE COUNTRIES OF MATERIALS USED IN LAPTOPS



Source 3.49

Source: Oxford University Press

Source 3.50 Materials used in laptop construction and their country of origin. At least 20 different materials from at least 10 different countries go into making a laptop computer.

Country of origin	Materials supplied for laptop construction
Canada	Europium, Aluminium
United States	Beryllium, Palladium, Phosphorus, Silicon, Copper, Europium, Boron
Mexico	Bismuth, Silver
Peru	Indium, Silver
Chile	Copper, Arsenic
Brazil	Silicon, Tantalum, Niobium, Aluminium
Argentina	Lithium
Colombia	Platinum, Guinea Gallium
Democratic Republic of Congo	Cobalt, Tin, Tantalum, Titanium, Gold
Zimbabwe	Lithium
South Africa	Chromium, Gold, Manganese, Cadmium, Platinum
Australia	Titanium, Lead, Nickel
Russia	Ruthenium, Ferrite, Steel
Kazakhstan	Vanadium
Kyrgyzstan	Mercury
Tajikistan	Antimony
Indonesia	Tin
South Korea	Glass, Cadmium
Japan	Selenium, Steel
China	Germanium, Terbium, Magnesium, Rhodium, Yttrium, Plastics

The little pieces of Australia in every laptop

Australia is one of the most mineral-rich countries in the world. Australian minerals are found in many common household items used all around the world. All laptop computers, for example, contain zinc, lead, gold and titanium, and Australia is amongst the world leaders in the mining of all of these minerals. The rocks near the town of Mt Isa, for example, contain some of the richest deposits of lead and zinc found on Earth. Settled in the 1920s, the town is now home to over 22 000 people – virtually all of whom rely on the town's mines for their employment and income.

Lead is mined and processed near the town. Lead ore is crushed and heated until it becomes a liquid so impurities can be removed in a process known as smelting. This process releases harmful gases and lead particles into the air. Recently some concerns have been raised that this is creating health risks for Mt Isa residents, particularly children. A study in 2008 found that 11 per cent of children tested had higher-than-normal lead levels in their blood.

Source 3.51 The lead mine at Mt Isa in north-west Queensland is one of the most productive in the world.

Check your learning 3.13

Remember and understand

1 Describe the interconnection between people in Mt Isa and the factory workers shown in Source 3.48.

2 Why are some people concerned about lead mining and smelting in Mt Isa?

Apply and analyse

3 Examine Source 3.50.

- a What is Australia's role in the production of laptop computers?
- b Most laptops are assembled in China. Imagine that each material used in the computer reaches China by ship. On a world map sketch the route taken by each material listed using the shortest sea route to Southern China. Estimate the total distance travelled by these materials.

4 Why do you think most laptops are assembled in China?

Evaluate and create

5 Brainstorm the impacts of the laptop production process on people and the environment. Try to think of both positive and negative impacts.

6 Research the mining of cobalt in the Democratic Republic of Congo and write a short report on it including any impacts it has on people and the environment.

Connecting through food

Many countries around the world, including Australia, produce more food than they consume. As a result, some of that food is exported to other countries.

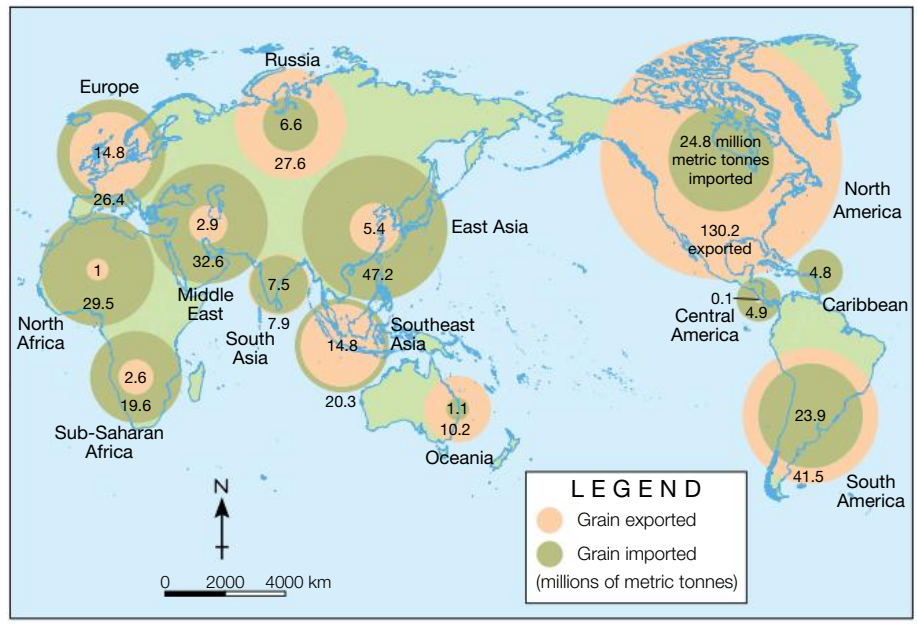
We can get an idea of the global connections made through food by looking at one type of basic food product and its movement around the world. Source 3.52 shows worldwide grain imports and exports over a year. Not all grain that is produced by countries is traded, in fact only a small proportion of the grain is. Only about 18 per cent of world wheat production and 10 per cent of maize production is traded globally.

Advantages and disadvantages for Australia's food producers

Over the last few decades, governments around the world have begun to reduce trade barriers between countries and this has resulted in some advantages and some disadvantages for Australia's food producers and consumers. For example, consumers now have access to a wider range of foods from around the world. This has created business opportunities for food suppliers such as grocers and restaurants, as well increased choice for consumers. On the other hand, Australian farmers now have to compete with other countries who may be able to provide produce at cheaper prices.

Australian farmers have responded to these challenges by producing food more efficiently, or by specialising in foods that are in high demand in other countries, such as organic foods. As a developed country, Australia also has the advantage of using innovations and new technologies in food production. Australia's proximity to Asia, with its large and increasingly wealthy markets, could also provide Australian farmers with new export opportunities.

WORLD: GRAIN IMPORTS AND EXPORTS



Source 3.52

Source: Oxford University Press

keyconcept: interconnection

Live animal exports

Most Australian meat that is exported to countries overseas comes from sheep and cattle that are killed in Australian abattoirs. Before export, the meat is processed, frozen and carried in refrigerated containers to ports around the world. Some sheep and cattle, however, are transported on special ships while they are still alive and are killed and processed in other countries. This type of animal export earns about $1 billion a year for Australia and employs about 10 000 people in rural and regional areas.

Many Australians are opposed to live animal exports as they believe it is cruel to the animals. This is because they feel the importing countries may have lower standards of animal welfare than in Australia. In 2011, the Australian Government temporarily stopped the export of live cattle to Indonesia following concerns raised about the inhumane treatment of Australian cattle there. Following the Australian 2013 election, however, as Indonesia was unable to supply enough of its own beef, live exports were recommenced.

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

skilldrill

Constructing a flow map

Geographers use flow maps to describe the connection between events and show how things move between different places. Source 3.42 is an example of a flow map.

A flow map is a particularly useful tool for displaying information about the movement of goods and services between places. Follow these steps to construct a flow map.

Step 1 Locate an outline map that displays all of the countries represented in your data, including the country of origin.

Step 2 Develop a scale to be included in the legend for the arrows you will put on your map. The size or amounts of the flows between the country of origin and the destinations are shown by the different widths of the arrows. The smaller the amount shown on the scale is, the narrower the arrow is, the larger the amount, the fatter the arrow.

Step 3 Join the country of origin with each destination using an arrow of the correct width according to the scale you have drawn. Plot these out in pencil first – you may need to try a few different designs to make all of the arrows fit neatly.

Step 4 Shade each destination and label each with its name and the relevant data.

Step 5 Finish your flow map with **BOLTSS**.

Apply the skill

1 Complete a flow line map showing the destinations of Australia's live sheep exports. Use the figures in Source 3.53 and an outline map of the world as your base map.

Source 3.53 The destinations of live Australian sheep exported in 2010.

Destination country	Live sheep exports from Australia
Bahrain	498 731
Israel	42 000
Jordan	265 986
Kuwait	1 076 455
Libya	75 026
Malaysia	14 764
Mauritius	150
Oman	69 073
Qatar	321 415
Saudi Arabia	262 500
Singapore	6 438
Turkey	215 038
United Arab Emirates	78 747

Check your learning 3.14

Remember and understand

1 Why does Australia export food to other countries?

2 Why do some governments make it difficult to import food into their country?

Apply and analyse

3 Examine Source 3.52.

- a Is Oceania a net exporter or importer of grain?
- b Which region is the largest exporter of grain and which is the largest importer?
- c Examine your completed flow line map.
- d Describe the distribution of the countries that import live sheep from Australia.
- e In small groups, discuss the possible reasons for the distribution you have noted. Consider a range of factors by using the SHEEPT (social, historic, economic, environmental, political and technological) method in your discussion. For more information on SHEEPT refer to section GT.2 of 'The geographer's toolkit'.

Evaluate and create

4 Research the live animal trade further and list the arguments for and against this trade. Identify groups who support the trade and those who oppose it. What is your opinion, and what information did you base it on?

Source 3.54 A ship is loaded with Australian sheep in Adelaide before heading to the Middle East.

Connecting through sport

Many aspects of our daily lives are now influenced by globalisation. For example, the way in which we play, watch and connect through different sports and sporting codes has changed dramatically over recent years. In the last few decades, elite sportsmen and women have become global superstars, instantly recognisable around the world. The athletes, the sports they play, the teams they play for and the clothes and equipment they use have become commodities to be bought and sold by the highest bidder.

There are many factors driving the globalisation of sport, most of them connected to money. These include higher salaries for athletes and increased spending on leisure and entertainment. Perhaps the biggest driver, however, is the media and the global reach of sporting events that are broadcast live. Many companies, such as clothing and electronics manufacturers, have seized these new opportunities to advertise their goods to a global audience.

Put simply, sport is big business. It is predicted that by 2015, sport will generate $US 145 billion in revenue annually. While $US 44 billion of this will come from tickets sold to sports fans, the rest will come from media companies that buy the rights to broadcast events and companies that sponsor events or promote their products through sport.

Sport's 'golden triangle'

The close links between sport, business and the media are sometimes called the 'golden triangle' as each uses the other to advance their aims.

Business
Companies marketing their goods through sport

Advertise products to a massive audience, often in hard to reach places
Buy advertising time during sports broadcasts

Provide sponsorship money
Increased visibility of products

The media
Media companies broadcasting sport and advertisements

Use money to produce a better product for broadcast
Provide money in the form of broadcasting rights

Sports
Sporting organisations providing sponsorship deals

Source 3.55 The relationship between sport, business and the media is often referred to as the 'golden triangle'.

Case study: Maria Sharapova – a global brand

Like many sports stars, tennis player Maria Sharapova links together people and places all around the world. She has won tournaments in Britain, France, the United States, Australia, Japan, Switzerland, Qatar, Italy, Canada, South Korea, Germany and Luxembourg. She once travelled 77 000 kilometres in a two-month period to reach all of her tournaments in time.

Sharapova has been the world's highest paid female athlete every year between 2006 and 2013. This is due largely to the $23 million she receives in endorsements from a range of companies around the world.

She has her own website and there are many fan websites dedicated to her as well. Maria Sharapova's fans all around the world can connect to her wherever she is by watching her play when her games are broadcast, following her on Twitter and Facebook, and buying the products she endorses.

Source 3.56 Maria Sharapova's many product endorsement deals and brand ambassadorships illustrate how people and places can be interconnected globally through sport.

Check your learning 3.15

Remember and understand

1 Explain how athletes and sportswear companies are linked.

2 Explain the links between media companies and sporting organisations.

Apply and analyse

3 Conduct a quick survey in which you ask 10 people to name one golfer, one basketball player, one tennis player, one soccer player and one racing driver. Combine your results with those of your classmates.
   a What percentage of the athletes named are Australian?
   b What countries were well represented in the answers?
   c What does this tell you about the globalisation of sport?

4 Examine Source 3.55. Explain how these photographs show how the golden triangle of sport works.

Evaluate and create

5 Create a map of the world that shows the ways in which Maria Sharapova links different places together.

6 Use the principles outlined in the golden triangle of sport to discuss why male athletes are usually paid more than female athletes.

7 Who are the potential winners and losers from sport's golden triangle?

3.3 big**ideas:** broadsheet

The geography of you

You are a global citizen, and the things you use and consume come from different places all over the world. The decisions you make about the things you buy link you to people and places both near and far. This connection means that your decisions can impact on these people and places in both positive and negative ways. This broadsheet contains a series of activities that will make you more aware of the ways in which you are connected to producers of products and services from all around the world – and how they are connected to you.

Source 3.57 Do you know where the things you use and wear come from?

skill**drill**

Collecting, recording and representing primary data

During any geographical inquiry, geographers will ask questions, collect a range of data and information, record their findings and represent them so they can be interpreted more easily. By following a process of geographical inquiry like this, geographers can be sure that the conclusions they reach will be accurate, useful and reliable.

Geographers often collect their own data by interviewing people, carrying out research, conducting surveys, taking photographs, or drawing field sketches. This kind of information is known as primary data. They record this primary data carefully before representing it in different ways (e.g. as diagrams, tables, charts, graphs, maps or a combination of these).

Collecting, recording and representing your own primary data is a great way to practise your skills as a geographer. Follow these steps to collect, record and represent a range of primary data about the clothes you wear, the stuff you own and the ways you connect to other people – in other words, the geography of you!

Step 1 Construct a key inquiry question to begin your investigation, for example, 'Where do my clothes come from?'. Select 20 different clothing items from your wardrobe and record where each item was made. Try to select a range of clothing made from a variety of fabrics. The tags on your clothing will often include some information about where the item was made.

Step 2 Collect and record the information for your inquiry by creating a table or spreadsheet and entering your results into it.

Step 3 Choose the best way to represent your findings. Choose a format that clearly communicates the information. You may choose to represent this data as a table, a graph (e.g. pie chart, bar graph or line graph), an infographic or a map (e.g. a spatial distribution map or a choropleth map) – or even a combination of these things.

Apply the skill

Complete one or more of the following tasks to better understand the effects of your purchasing habits and Internet use and how your choices connect you to the rest of the world:

1 Exploring the origin of your clothing

Follow the steps outlined above to explore the origin of 20 items of your clothing. Collect the countries of origin for any of the 10 items you have researched, record the data and represent it in a suitable format of your choice.

2 Exploring the origin of your stuff

Select 10 items you use every day such as a pen, a computer and a DVD and examine them carefully to see if they contain some information about where they were made. You could also try an Internet search engine to research each item further but you may need the name of the manufacturer and a model name or number. Collect the countries of origin for any of the 10 items you have researched, record the data and represent it in a suitable format of your choice.

3 Exploring your communication links

Monitor your Internet and smart phone use for a week, recording the names and locations of people you communicate with via email, SMS, Facebook, Twitter, Instagram and online games. Enter the results into a table or spreadsheet.

Source 3.58 A worker shows a label on a piece of newly made clothing at the Bantai textile factory in Dhaka, Bangladesh.

Extend your understanding

1. Conduct your own research into the Rana Plaza disaster and how it brought worldwide attention to the issue of sweatshop conditions in Bangladesh. Investigate the conditions faced by workers in the sweatshops, and find out what is being done to address the problems with safety and working conditions. Write a half-page report outlining what you find.
2. Examine your wardrobe and make a list of the brands that you usually wear. Research whether or not these brands use factories in Bangladesh. Create a table to record your results.
3. Do you think your purchasing choices have a direct impact on the people who work in factory sweatshops? List your thoughts, discuss them with a partner and report back to the class.

The effects of global connections

The increased movement of goods, services, people and ideas across the world has the potential to improve the lives of millions of people and bring people and cultures closer together. It also has the potential to degrade natural environments and to deepen the divide between the wealthy and the poor.

These men are employed as ship breakers at the Chittagong ship breaking yard in Bangladesh, south of the capital Dhaka. They pull apart old container ships and oil tankers by hand so the steel in them can be recycled and reused. Many of the ships are owned by the wealthiest multinational companies in the world. It is dirty and dangerous work and there are virtually no health and safety regulations to protect workers. A labourer here can earn about $1.50 a day working as a ship breaker. Ships arrive in the South Asian breaking yards at the rate of about one a day.

4.1

What effects does global trade have on people?

1 There are about 100 000 people in Asia employed as ship breakers. In what ways do these workers benefit from their employment?

2 Brainstorm the threats to health and safety for the workers at the Chittagong ship breaking yard.

4.2

What effects does global trade have on places?

1 What do you think the impacts of ship breaking on the coastal environment are?

2 The ship breaking industry was once concentrated in Europe but moved to India and Bangladesh after the 1970s. Why do you think the industry moved?

chapter 4

Source 4.1 Bangladeshi ship breakers at the Chittagong ship breaking yard pull apart old container ships and oil tankers by hand so the steel can be recycled.

4.3

What effects does international tourism have on people and places?

1 Tourism is one of the world's largest industries. What areas of Australia and the world are most visited by tourists?

2 In what ways does tourism change the natural environment in these places?

4.1 What effects does global trade have on people?

An interconnected world

As you have learned, we live in an increasingly interconnected world. Ideas, people, goods and services move more quickly, more often and in larger quantities than ever before.

Source 4.2 Sharing culture, food and language are just some ways global trade has influenced the experiences of people around the world.

Benefits and drawbacks of globalisation

As with all changes, there are winners and losers. Consumers are obvious winners. We now have access to goods produced all around the world. Our homes are filled with goods made by people we will never meet in places we may never visit. We now have access to the skills, expertise and labour of billions of people to supply our needs and wants. Some companies, industries and countries are also winners. China, for example, has become increasingly wealthy and powerful by making and supplying goods and services for the global marketplace. Many people believe that having better trade between nations also spreads the world's wealth.

Despite the many winners, there are also clear losers. Workers in developing countries are sometimes exploited for their cheap labour and are paid much less than those in the wealthier countries who are buying the goods they produce. Their working conditions are often much worse as well.

Globalisation can also lead to the loss of traditional skills and customs. Additionally, small local businesses can find it difficult to compete with large multinational companies. The closure of these businesses can lead to job losses for local workers and negative effects for societies and communities.

The environment is also often a loser when it comes to globalisation. As more and more raw materials such as timber, land and minerals are used to feed the world's factories, natural environments are changed forever (see Source 4.4). The need to transport these goods to countries all around the world also adds to major environmental problems such as air and water pollution, deforestation and climate change.

Source 4.3 Cartoonists often portray a complex issue using a simple image, employing the device of humour to do so.

Source 4.4 Steven, a Mooi child, squats in front of what used to be the forest that supported his community. The Mooi are one of the Indigenous people who live off the forests of West Papua. Their ancestral lands are being devastated by logging and taken away for palm oil plantations. Palm oil is used in many processed foods in Australia.

From 'riding on the sheep's back' to 'riding on the dragon's tail'

Australia today is part of the global marketplace. Billions of dollars' worth of goods and services are traded between Australia and the rest of the world every year. For much of the last century, most of Australia's exports came from the farming sector and our major trading partner was the United Kingdom. Products such as wool, butter and meat were shipped around the world and sold to British consumers. Australia was known as 'Britain's farm', and because our prosperity largely came from the sale of wool, Australia was said to be 'riding on the sheep's back'.

This century has seen dramatic changes in our main exports and trading markets. Less than 10 per cent of our total exports now come from the farming sector and the United Kingdom is only our fifth biggest trading partner. Over half of our total exports now come from the mining sector (mainly iron ore, coal and gold) and our two biggest trading partners are China and Japan. China is by far our leading supplier of imported goods (A$41 billion a year) and buyer of our exports (A$64 billion a year). This change has led many observers to remark that Australia is no longer riding on the sheep's back – instead we are riding on the dragon's tail.

Check your learning 4.1

Remember and understand

1 How has Australia's place in the global marketplace changed over the last 50 to 60 years?

2 What Australian products make it important in the global marketplace?

Apply and analyse

3 Examine Source 4.2. Can you imagine how you might feel if you went to a McDonalds or other fast-food store in another country? What similarities and differences might you find?

4 Examine Source 4.4.

- a Do you think the child shown in this picture has benefited from global trade in any way?
- b What possible local benefits could there be from the logging that takes place in this area?

5 Examine Source 4.3. What point is the cartoonist making about the relationship between China and Australia?

Evaluate and create

6 Design a political cartoon based on the phrase 'riding on the sheep's back' or 'riding on the dragon's tail'. Before you begin, think about the message you want to convey about this phrase.

7 What benefits do you experience from the global increase in trade links between people and places? In what ways are you worse off because of these links? Are you a globalisation winner or loser?

Benefits of global trade for people

Benefits for individuals

Global trade means that you are now linked to manufacturers all over the world. This means that you can buy a wider range of products at cheaper prices than ever before. You are not restricted to paying for services or buying goods made in your local area, or even in your own country. Because of an intricate web of connections involving people from many countries you now have access to the global marketplace.

Online trade is spreading fast. As just one example, Australians have embraced online shopping for clothes at a remarkable rate. A single company, the British fashion site ASOS, racks up a purchase from Australia every six seconds, and is flying four jumbo jets of clothing into Australia every single week.

Not only do the buyers of goods and services benefit from global trade – there are also enormous benefits for the people that supply them. Employment and wealth has been created for hundreds of millions of people. This has improved living standards and life expectancies in many places and helped to pull people out of poverty. It is estimated, for example, that there are 600 million fewer people living in poverty in China today than was the case 30 years ago. This is largely because China has been transformed from an economy based on farming, supplying itself, to one based on manufacturing, supplying the world.

Source 4.5 Australian shoppers have access to goods from all over the world.

Benefits for businesses

Businesses are now linked to buyers from around the world. This means they may be able to sell more products to more people. They may also be able to access cheaper raw materials such as coal, iron and cotton from other places. These interconnections allow them to keep their costs down and sales up which creates higher profits.

As well as accessing cheaper materials from other countries many companies have moved much of their manufacturing base to other countries. This is often done to take advantage of lower labour costs in these countries. Many products in Australian stores carrying the labels of Australian companies, for example, are made in places such as Vietnam, China, Bangladesh and Fiji.

Source 4.6 Nike employs more than 1 million people in 777 factories in 43 countries, including China. It began as a single factory in the United States but now only one per cent of its workers are employed in that country.

Benefits of global trade for nations

Most nations around the world have welcomed the opportunities that closer links between nations have brought. Many have found that the benefits are greater if they specialise in a particular product or service. This is known as comparative advantage. If, for example, you can buy cheap cars from other places then you don't have to make your own. You can focus on producing another product such as clothing or electronics. If you are able to make these better or cheaper than any other country then you will capture the market.

Source 4.7 The Indian film industry, part of which is known as Bollywood, is the largest in the world. India has a comparative advantage in film-making based on its large population, technical knowledge and fine weather.

There is also movement of money, ideas, knowledge and technology between countries. Ideas and advances in medicine, education and business can move quickly around the world. This can help to remove cultural barriers that often exist between countries, including language and religious differences. Sharing knowledge and ideas in this way also helps us move towards what is known as the 'global village'.

Some aspects of globalisation benefit people, businesses and entire nations. Bollywood, the Hindi-language part of the Indian film industry, is an example of this. The volume of movies produced means that individual actors (both Indian and international), dancers, musicians, and other film professionals benefit from employment in the industry. Businesses reap the rewards on both small and large scales. Supporting businesses (catering, or lighting businesses for example) enjoy employment and, on a wider scale, the film industry at large benefits from the continued success of Bollywood films. The nation benefits, too, in many ways, just one of which is the increased awareness of Indian culture on a global level.

Check your learning 4.2

Remember and understand

1 What are some of the ways in which you benefit from global trade?

2 In what ways does the increasing globalisation of trade benefit other people?

Apply and analyse

3 Explain how global trade can help to reduce poverty.

4 What is comparative advantage? In which goods or services do you think Australia has a comparative advantage?

5 How does the Indian film industry help to break down cultural barriers?

6 In what ways has the Chinese economy transformed over the last 40 years?

Evaluate and create

7 Many businesses that use cheaper labour in developing countries are often reluctant to reveal this.
   a Explain why you think this is the case.
   b Nike is a notable exception to this trend. Explore the interactive map at *http://nikeinc.com/pages/manufacturing-map* to find out where Nike products are made. Which country has the largest number of Nike employees, which has the most Nike factories and how many Australians are employed in Nike factories?

8 Draw a diagram or find an image that sums up the concept of a global village to be displayed on your classroom wall. Examine the range of images submitted by your class and discuss the different ways you and your classmates have chosen to represent the idea.

Benefits of global trade for people in Australia

Australia is an active participant in the movement of goods and services around the world. We are the 55th largest country in terms of our population but the 23rd biggest exporter and the 21st biggest importer. Each year, around $500 billion worth of goods and services move between Australia and other countries. This trade brings many benefits to Australian individuals and businesses and to the country as a whole.

Benefits for individuals

Millions of Australians are employed in industries that export goods and services. These include agriculture, mining and tourism. Many others work in industries such as retail and manufacturing that rely on imported goods and services. This trade creates wealth and prosperity for these people and for the nation as a whole.

Australia's largest service export is education. There are more than 400 000 citizens of other countries enrolled in Australian universities and other education providers. This generates more than $16 billion of export earnings for Australia every year. As well as the financial benefits, Australia also receives other benefits. Many of these students apply to stay in Australia when they have finished their education and this leads to an increased number of people in many occupations, including medicine and education. Those that return to their home countries improve the level of skills in those countries and often help to improve levels of wellbeing.

Source 4.8 These overseas students are studying at the University of Sydney. Chinese students are the largest group of overseas graduates there followed by those from India, South Korea, Malaysia and Brazil.

Benefits for Australian businesses

Many Australian businesses have been able to take advantage of the increasing trade connections between people and places to become major players on the world stage. This includes Australian mining companies that have dominated world trade in minerals such as iron ore, coal and gold, as well as smaller companies that have developed uniquely designed products. Australian surf wear brands are a good example of this.

Case study: Crumpler

The Australian brand, Crumpler, most famous as the designer and supplier of distinctive messenger bags, is an example of an Australian business that has benefited from the interconnections of global trade. The Crumpler business had humble beginnings in a shed in Ballarat, outside Melbourne, where the first prototype bag was made by Stewart Crumpler himself. From there, the company grew rapidly and achieved success and has sold millions of products all over the world, reaching a wide global marketplace.

Crumpler has stores across Australia and all over the world, including in Japan, the United States, Canada, the Philippines, Singapore and China. The head office is in Berlin, Germany. A key factor of the brand's success has been the high level of international sales, with stores supported by online sales and distributors in many other countries as well.

Crumpler has 1500 Twitter followers and almost 10000 likes on Facebook, extending its global reach and consolidating its urban 'street' image.

Source 4.9 Crumpler is an example of an Australian company that has achieved global success.

Benefits of global trade for the Australian nation

It is difficult to work out exactly how much individual countries benefit from increasing trade links. Most researchers, however, agree that Australia has gained much from our greater interconnections since the 1970s. From this time we began to expand our range of trading partners from traditional markets such as the United Kingdom and New Zealand to markets throughout the world, particularly in Asia. Australian governments continue to try and reduce barriers to trade around the world and have done so for decades.

About one in every seven Australian workers is now employed in the production of exports. The figures are particularly high for those in mining (seven in every 10), farming (four in every 10) and manufacturing metal products (three in every 10). This brings extra revenue to the whole country through taxes and levies on workers and companies and has the potential to improve the wellbeing of many Australians. This has been particularly significant for many Indigenous Australians who have traditionally worked in agriculture. Many have also found employment in the booming mining sector.

Multiculturalism

The interconnections that come with global trade can bring many benefits apart from financial ones. As people move to or communicate with those from other places, there is a natural sharing that occurs. This can enrich the cultural landscape, as aspects of life such as language, religious tradition, art and food are shared and integrated with or added to the existing culture.

Sharing a different range of experiences and learning about different ways of doing things can have many positive results. Multiculturalism can broaden our outlook, lead us to interests or hobbies we wouldn't have otherwise heard about, or create opportunities to do further study or travel. This kind of sharing can do more than just provide an interesting experience – it also has the benefit of promoting mutual understanding and accepting others' differences (see Source 4.10). This in turn may lead to a more harmonious society which is accepting of diversity.

From an economic perspective, a successful multicultural society makes Australia an attractive destination for tourism, education and business.

Source 4.10 There are many benefits that come with the interconnection that accompanies global trade. Learning about other cultures and food traditions are just a couple of them.

Check your learning 4.3

Remember and understand

1 In what ways can Chinese citizens studying in Australia bring benefits to both countries?

2 How did Australia's global trade connections change during the 1970s?

Apply and analyse

3 Australia has a comparative advantage in providing a university education when compared to many other countries. Work with a partner to brainstorm the reasons for this and then discuss this with your class.

4 Read the case study about Crumpler.

- a Use the key concept of 'interconnection' to explain the business operations of Crumpler.
- b List five ways that Crumpler benefits from being interconnected with places all around the world.

5 Examine Source 4.10.

- a Can you think of other examples of the positive effects of multiculturalism apart from the ones shown?
- b Have you ever had an exchange student from another country visit your school? If so, what did you learn about their country?

Benefits of global trade for people in the Asia–Pacific region

Trade in the Asia–Pacific region is thriving, and interconnection with other countries through trade has brought many benefits to the region. The boom in the demand for information and communications technology equipment in particular (such as smartphones, tablets and computers) has accounted for much growth, while places such as Indonesia and Vietnam have driven exports of manufactured goods such as clothes and shoes. Machinery and transport are strong growth areas, and industries such as shipbuilding are expected to provide continued benefits to some Asia–Pacific economies, such as South Korea. Benefits that accompany global trade activity include a buoyant economy, higher employment levels, a higher standard of living, better access to health care and increased life expectancy.

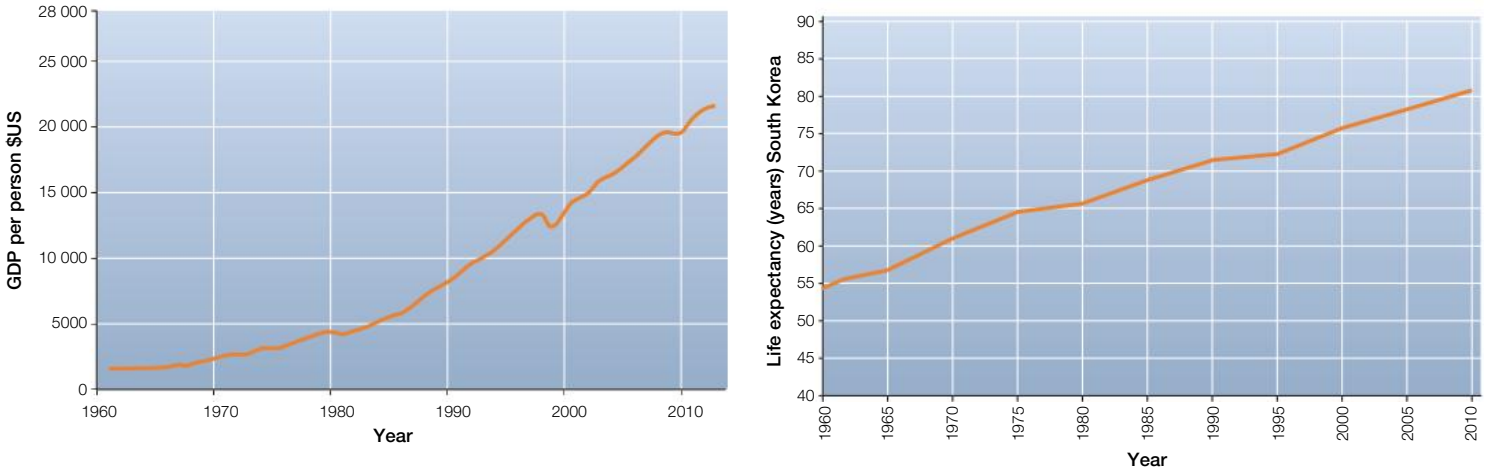
Case study: South Korea

South Korea is an example of a nation that has embraced global trade and the benefits that it can bring. It has transformed itself from a poor nation with a large rural peasant population 50 years ago to a modern, urbanised society with one of the highest levels of wellbeing in the world. Along with Hong Kong, Taiwan and Singapore it is known as an Asian Economic Tiger. These four countries are now seen as a role model for other expanding economies including Indonesia, Malaysia, the Philippines, and Thailand (known as the Tiger Cub Economies).

In 1960, South Korea was considered one of the world's poorest nations. It is now Asia's fourth largest economy and the world's 15th largest. South Koreans enjoy an average wealth greater than the average European citizen, as measured by the Gross Domestic Product (GDP) per person. Since 1960, average life expectancy in South Korea has increased from 54 years to 81 years.

This amazing transformation is due largely to the country's growing importance as a trading nation. It has chosen to concentrate on those industries such as electronics and motor vehicles that require a large, highly skilled labour force. The nation invests heavily in educating young people and providing them with the skills they need in these industries. As a result, South Korea is now the world's sixth largest exporter of cars and the fourth largest manufacturer of electronic goods.

Source 4.12 Samsung is one example of a South Korean company that has achieved massive global success. Samsung Electronics is the largest company in South Korea and the world's largest producer of smart phones, computer chips and televisions.



Source 4.11 The increase in the average life expectancy of South Koreans presents an interesting picture when compared to the Gross Domestic Product (GDP). These graphs, which show the data for the country from 1960, could be used as secondary sources for a geographical inquiry.

Source 4.13 Korean pop, known as K-Pop, is growing in popularity. The musical sensation Psy had a massive worldwide hit in 2012. His single, *Gangnam Style,* topped the music charts in more than 30 countries around the world, including Australia.

The Korean Wave

Riding the crest of increased prosperity and electronic communication via the Internet, South Korean culture is spreading around the world. The push to promote local culture actually began in the 1990s, when the South Korean government became concerned that cultural traditions were in danger of being over-run by influences from China, Taiwan and Japan. They began to encourage the growth of local cultural expression in movies, television programmes and music.

Some of the nation's largest businesses, including LG, Hyundai and Samsung, were encouraged to invest in these industries and continue to do so. Korean television dramas have become the most watched programs throughout much of Asia and Korean pop (K-Pop) bands have become hugely popular throughout much of Eastern Europe and the Middle East. In 2011, K-Pop YouTube clips were viewed 2.28 billion times, with Japan, United States and Thailand topping the list of most frequent viewers.

The South Korean government has continued to encourage the spread of Korean culture (known as the Korean Wave) as it is seen as a way of promoting South Korean views and encouraging a positive view of the country. This is regarded as important in continuing to build South Korea's reputation as an important player on the global stage.

Check your learning 4.4

Remember and understand

1 What social and economic changes have occurred in South Korea since 1960?
2 What links do you have to South Korea?
3 What are the 'Asian Economic Tigers'?

Apply and analyse

4 Examine Source 4.11.
   a Describe the change over time in life expectancy and GDP per person in South Korea.
   b Explain the links between these two measures of South Korean society.
5 What is K-Pop? Explain how it is an example of the growing interconnection of people around the world.

Evaluate and create

6 Draw a flow map that shows the movement of goods and services between South Korea and other nations. Use arrows to show the direction of these movements.
7 K-Pop is an example of the ways in which one country's culture can influence cultures in other places. Can you think of other examples of this principle?

Drawbacks of global trade for people

As you have learned, global trade has the potential to bring benefits to people and to places. It is a leading contributor to reducing poverty in many places and provides wealth and prosperity for countless people. However, these benefits often come at significant economic and social cost to other people in other countries. This takes place at individual, business and national levels.

Drawbacks for individuals

Many companies that are based in developed countries actually manufacture their goods in developing countries. This is usually to take advantage of the cheaper labour that is available in these developing countries. While this provides jobs and income for millions of people, manufacturing in developing countries does come at a cost. Workers are paid much less than those who perform similar tasks in developed countries and they often work in appalling conditions.

The demand for cheap labour and high levels of poverty means that child labour is used in some countries. There are estimated to be over 200 million children working in the world. Most of these children work on small family farms in developing countries but around 160 000 of them work in manufacturing.

Countries with high levels of child labour tend to share similar characteristics. These include:

- high fertility rates and a large percentage of the population being under the age of 15
- low rates of school attendance and low levels of literacy
- low levels of technology in comparison to other countries with whom they are competing
- a lack of government policies to deal with child labour
- large numbers of people living in poverty.

Source 4.14 Workers in a clothing factory in Dhaka, Bangladesh

Drawbacks for businesses

The interconnections that link the consumer to the person who made their product have, in some cases, become so complex that businesses lose control of the process. In Asian countries such as India and Bangladesh, for example, it is common practice for manufacturing plants to 'outsource' parts of their operations to smaller factories. They, in turn, may also outsource parts of the operations. The company executives in an office on the other side of the world then have little idea of the factories they are actually using, or whether they are involved in unsafe work practices. It also makes it difficult to maintain quality controls on the products. Additionally, there may be a backlash from consumers in the developed world once these practices become known to them.

Drawbacks for nations

Many critics of the growth in trade between countries believe that it benefits the people and businesses of the developed world at the expense of those in developing countries. These poorer countries are seen only as a source of cheap raw materials and labour. This, they argue, tends to widen the gap in wellbeing between wealthy and poor countries.

Another criticism of increased globalisation in trade is that problems in one place can affect many other places very quickly. In 2008, a dramatic fall in house prices in the United States triggered a global financial crisis and caused banks and investment companies to collapse throughout the developed world. Many companies were forced to close and spending on consumer goods fell dramatically. As developed countries reduced their consumer spending, imports went down and hundreds of thousands of people in developing countries were also plunged into poverty.

Financial problems are not the only things to spread quickly. Greater global trade may also result in the spread of infectious diseases between regions of the world as people travel more frequently for trade. In 2002–2003, a respiratory disease, SARS, was spread by tourists from its origins in China to many other countries. By the time the epidemic finished it had killed more than 8000 people in 17 countries. Outbreaks of bird flu and other health concerns like norovirus can also be spread quickly by people who are travelling around the world for business.

Source 4.15 These protesters in South Korea are campaigning against a G20 meeting of the leaders of the world's wealthiest nations. Many people are concerned that increasing global trade results in a widening gap between rich and poor countries.

Check your learning 4.5

Remember and understand

1. Why do many children in developing countries work rather than go to school?
2. What is outsourcing? How can it negatively affect people and businesses?
3. Factories such as the one in Source 4.14 are often called 'sweat shops'. Why do you think this is the case?

Apply and analyse

4. Examine Source 4.14.
   - a Estimate the number of workers in this room.
   - b Estimate the percentage of women workers.
   - c What are the roles of men in this factory? What does this tell you about gender roles in this place?
5. Imagine that you work in the clothing factory in Source 4.14. Describe a day at work.

Evaluate and create

6. Examine Source 4.15 showing a protest group in South Korea. Create a table listing both the benefits and the costs of global trade. Discuss which groups in society are likely to be opposed to globalisation and which would support it.
7. Research the global financial crisis (GFC) or the SARS epidemic and construct a flow diagram showing its spread within and between countries. How were global trade connections involved?

Drawbacks of global trade for people in Asia

Asia is the world's largest continent and home to three-fifths of the world's people. Its 48 countries contain a wide diversity of cultures, languages and ways of life. In some Asian countries, most of the population live in small villages and depend on their food-growing skills for their livelihood and to feed their families. In other parts of Asia, more and more people are working in industries such as agriculture, tourism and manufacturing. This growing involvement in industry has led to some alarming work practices. These include using child labour, unsafe working conditions and working hours that include factory shifts of up to 19 hours a day.

Case study: Clothing factories in Bangladesh

The clothing industry is the largest in Bangladesh, accounting for about 80 per cent of all exports. It employs about 3.5 million people, most of them young women. Working conditions and wages vary a great deal within the Bangladeshi clothing industry but a worker can typically earn about $50 a month. Workers officially usually work 10-hour days, but there are many reports of workers being locked into factories for much longer hours, sometimes from 7.00 a.m. to well past midnight, seven days a week.

Source 4.16 Rescue workers search for survivors in the rubble of the collapsed Rana Plaza building – Dhaka, in Bangladesh.

American clothing manufacturers began to outsource to Bangladesh in much greater numbers in 2005, following the end of an agreement that had kept a percentage of clothing production in the United States. In the rush, clothing factories were hastily installed in Bangladesh. Building regulations were overlooked and poorly controlled and factories were set up in buildings unsuitable for thousands of workers and their heavy machinery. Many lacked suitable fire exits and ventilation, making conditions in them both dangerous and uncomfortable. Hundreds of workers have died in fires in these factories as a result.

Perhaps most disturbingly, a survey by engineers found that three-fifths of the clothing factories are vulnerable to collapse. In 2013, concrete pillars supporting an eight-storey building on the outskirts of Dhaka collapsed (see Source 4.16). The building was home to five clothing factories and thousands of workers. More than 1100 people were killed, making this one of the world's worst industrial accidents. The building's owner only had permission to construct a five-storey building but illegally added three more floors to fit in more workers. He also installed heavy generators to counter the frequent disruptions to the electricity supply.

Case study: Ball stitching in India

Many Australian companies that supply the leather and synthetic balls you use for sport have their balls stitched in India. A newspaper investigation in 2012 found that many of the balls are being stitched by children who have been taken out of school by their parents to help earn money to support the family (see Source 4.17).

While Australian companies use factories that have signed agreements stating they will not use child labour, the reality is that many of them do. During busy times, when the factories are overloaded with work they use other smaller companies to help meet the labour demand. These companies employ children, most of them young girls, to stitch the balls.

Ten million balls are made in India and shipped to Australia every year in an industry worth about $1 billion. Each worker in India receives about eight cents per ball. It takes about an hour to hand stitch each ball, a task that is hard on fingers and eyes.

For people living in poor villages, however, sending their children to work doing such intense labour – at the expense of an education – is often the only option for the family's income.

Source 4.17 Twelve-year-old Reena works five hours a day, seven days a week to stitch together balls for Australian children. She thinks she has fallen three years behind her classmates in her schoolwork as a result.

Check your learning 4.6

Remember and understand

1 Why did the Rana Plaza building collapse?

2 Calculate how much workers in Bangladeshi clothing factories are paid a week. Compare this to the minimum wage in Australia which is $622.20. How does this help to explain why more clothes are made in Bangladesh than in Australia?

Apply and analyse

3 Examine Source 4.17. Explain how Reena is linked to people in Australia. How has this interconnection impacted on her?

4 Why do you think workers in developing countries such as India and Bangladesh are more vulnerable to low wages and poor working conditions than those in developed countries?

Evaluate and create

5 The people who died in the Rana Plaza collapse have been called 'victims of globalisation'. Do you think this is a fair description? Give some reasons for your answer.

6 Some clothing companies have decided to close their factories in Bangladesh due to poor publicity following the building collapse. Do you think this is a good thing or a bad thing for workers in Bangladesh? Discuss this with your class.

Drawbacks of global trade for people in Africa

Africa's resources have been used by people from other places for hundreds of years. Today, natural resources including vast quantities of wood and minerals are exported from Africa to markets all around the world. Another abundant resource currently being widely used by other countries is the African labour force. This use of African workers has had negative consequences.

Case study: The flower growers of Lake Naivasha, Kenya

On the streets of many European cities, cut flowers are widely available to buy. Demand for these flowers always peaks around Valentine's Day and Mother's Day. People who buy cut flowers in cities such as London, Paris and Berlin probably give little thought to where the flowers came from and how they got there. It might surprise them to know that their purchase is contributing to an ecological and human catastrophe 6000 kilometres away.

About one-third of the thousands of tonnes of flowers imported into Europe every year come from Kenya. Picked in the early morning, they are packed, chilled and on a plane to Europe by the afternoon. Most of Kenya's flower trade is centred on the shores of Lake Naivasha, about 75 kilometres north-west of the Nairobi international airport.

Thirty years ago, Lake Naivasha was home to large numbers of wildlife, including hippopotamuses, giraffes, zebras, antelopes and birds. Masai herders brought their cattle to drink at the water's edge and fishermen and their families lived well on the abundant fish stocks. The total population in the area was estimated to be about 30 000.

In the 1980s, the potential for horticulture was recognised and European companies began buying land on the southern shores of the lake to grow flowers and vegetables. There are now 50 large flower farms covering 50 square kilometres of land, and there are 2000 hectares of plastic-covered greenhouses.

While 40 000 people have found jobs on the flower farms, research shows that for each person working, seven others are attracted to the area hoping to find work. This places a great strain on services such as housing, water supply, electricity, garbage collection, health care, food security and roads.

Workers labour for about 15 hours a day for the equivalent of about $A2. Crime rates, particularly assaults on children and sexual assaults, are higher here than in any other part of Kenya. This is, reportedly, because children are left in the care of elderly women, for a small fee, while their mothers work on the farms. This leaves them vulnerable to attack.

Source 4.18 Kenyan roses for sale in Europe – these ones are clearly labelled, but not everyone will take note or think about the origin of the flowers they buy.

Source 4.19 A worker's town near Lake Naivasha, Kenya

Case study: Child labour in cocoa farming, West Africa

Chocolate is made from the seeds of the cacao plant which are dried and ground to produce cocoa. Seventy per cent of the world's cocoa comes from West Africa, particularly the Ivory Coast and Ghana. A typical cocoa farm covers 2–5 hectares and is owned by a single family. Cocoa farming requires a large input of labour, and as children make up 44 per cent of the population in the region they are often used as labourers on the family farm.

The demand for cocoa and for cheap labour is so great that some children are sold by their families or kidnapped to work on the cocoa plantations. A 2002 report on the cocoa industry in the Ivory Coast reported that child slavery was common on cocoa farms, with children being forced to work for little or no wages in hazardous conditions. The authors of the report estimated that 284 000 children worked under dangerous conditions on these farms. A follow-up investigation by American television in 2012 found that little had changed, despite efforts by large multinational companies such as Nestlé to reduce the use of child labour on cocoa farms.

Source 4.20 This is seven-year-old Sami Sery with his uncles. Like many children in West Africa he works in a cocoa plantation supplying the raw material for the world's chocolate industry.

WEST AFRICA: MAIN COCOA PRODUCTION ZONES

Source 4.21 Source: www.oecd.org

Check your learning 4.7

Remember and understand

1 Who are the 'winners' from the global trade in flowers from Lake Naivasha? Who are the 'losers'?

2 Why do children often work on cocoa farms in West Africa?

Apply and analyse

3 Examine Source 4.21. Where is most of the world's cocoa grown?

4 How would the supply of flowers from Kenya affect flower growers in Europe?

Evaluate and create

5 Construct a flow diagram that shows the links, movements and the interconnections demonstrated by Lake Naivasha and its flower-growing industry.

6 Do you think flower buyers should be made aware of the impacts of their purchase? Do you think this would make any difference?

7 Cocoa growing and ball stitching are not the only industries to employ children. Brick, match, cigarette and carpet-making; coffee, rice and corn growing; and diamond, gold and coal mining all employ large numbers of children.
Research the use of children in one of these industries and report your findings to your classmates. Include any details you can discover about wages, working conditions and the education levels experienced by children who work in one of these industries.
Compare what you find to working conditions in developed countries like Australia.

The effects of global trade on people and culture

Geographers use the word 'culture' to describe the characteristics of a particular group of people. Culture can be a difficult topic to study because it is an abstract concept and is not something tangible like, say, a mountain or a tree – it is not 'real' in the sense that we cannot touch it. Geographers, therefore, tend to study the products of culture. These include objects such as buildings, statues and clothing, as well as expressions of culture such as language, religion, art, food, music and dance.

Another thing that makes culture difficult to study is that it is constantly changing. Cultures grow and decline or adapt to new influences all the time. With the rapid increase in the movement of goods, services, people and ideas that has occurred in the last few decades many cultures have changed.

Here, we will examine the ways that global trade affects people and culture. Sometimes these changes have positive outcomes for the culture of a certain country. At other times, the results can be unplanned, more serious than forecast, or have serious and negative impacts.

Source 4.22 The imbalance in distribution of available food is one negative impact that globalisation has had on people in different places around the world. Here, Chinese children attend a weight-loss camp.

The negative effects of global trade on people and culture

The term cultural erosion has been developed to describe the loss of cultural diversity that is occurring in many places. This is due in part to new ideas, new products and new ways of doing things entering a culture. Examples include the spread of food, drink, clothing, music, movies and language from dominant cultures, particularly the United States.

One impact of cultural erosion is a loss of languages. More than 40 per cent of the world's 7000 languages are considered to be endangered and more than 200 have become extinct in the last few decades. Languages become endangered and then extinct when people stop using them. This can happen for a variety of reasons including the dominance of only a few languages in education, politics and trade. Those who do not speak the dominant language are at a disadvantage and so their use becomes less desirable.

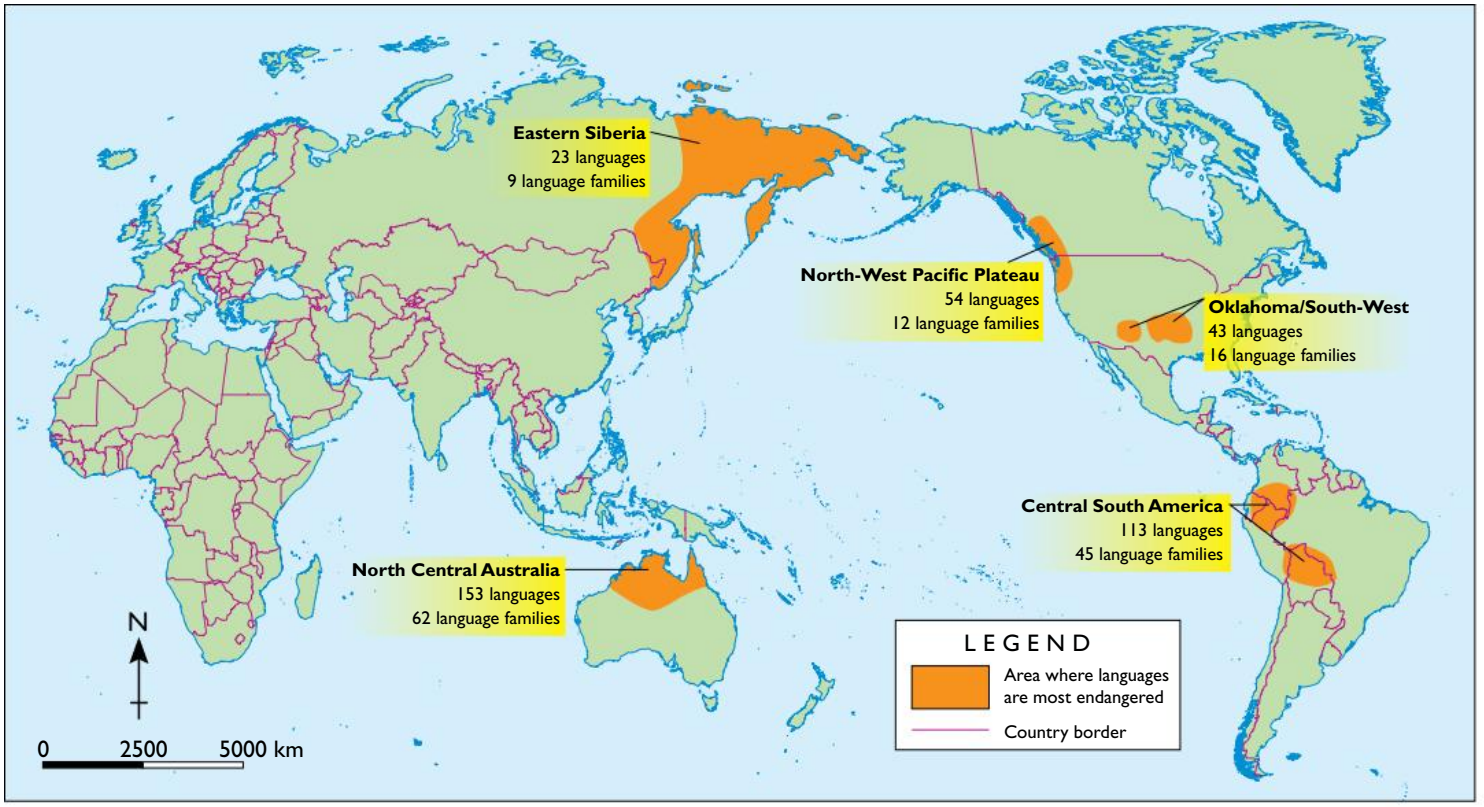
Places where language families (groups of languages that have descended from the same 'ancestor' language) are endangered are shown in Source 4.23.

The positive effects of global trade on people and culture

Increased links between people and places have the potential to erode cultures but can also bring cultural benefits. Modern information and communication technologies (ICT) have brought people closer together. They help people to better understand cultures different to their own and to share ideas and knowledge.

These interconnections can create a greater awareness of people and cultures in other places. This often leads to a greater respect of cultural diversity and a better understanding of the ways in which various cultural identities are formed, changed and threatened. ICT also allows individuals to tell their own stories rather than rely on governments and the traditional media to tell them.

WORLD: ENDANGERED LANGUAGE HOTSPOTS



Source 4.23

Source: Oxford University Press

For example, deep in the heart of one of the world's great wilderness areas, the Amazon rainforest, Indigenous tribes are fighting back against illegal logging that threatens their culture with modern tools: GPS, the Internet, mobile phones and Google Earth. They photograph loggers entering the forest, plot their location using GPS and inform authorities who can then send out a team to arrest the loggers. The Indigenous tribes are also linked through email, Skype and Facebook to thousands of supporters around the world.

Source 4.24 The chief of the Surui tribe in Brazil with his laptop computer. He uses his laptop for communication, in order to protest and protect his culture and his rainforest home.

Check your learning 4.8

Remember and understand

1 How has ICT lead to a greater understanding of cultural differences?

2 What is cultural erosion?

Apply and analyse

3 Examine Source 4.23.

a Of the language hotspots identified, which has the greatest number of threatened languages?

b What are the likely threats to language in this region?

4 How is the Surui tribe in Brazil using ICT to protect their culture? In a small group discuss other ways in which ICT can lead to a greater understanding of other cultures. Report back to your classmates.

Evaluate and create

5 Brainstorm the ways in which cultures can be strengthened by increased contact with other cultures around the world.

6 Do you think it matters if a language becomes extinct? Give some reasons for your answer.

The effects of globalisation on Indigenous peoples

The original inhabitants of a region or country are known as its Indigenous people. These communities often developed a way of life suited to the natural environment in which they lived without influence and interference from the outside world.

With increased links between people and places, Indigenous peoples and their cultures have been threatened by the expansion of dominant cultures, or from the arrival of new people and cultural groups.

As people from different cultures have moved around the world and settled in new places, they have often come into contact with the Indigenous peoples. In some cases this first contact has been friendly, while in other cases conflict has broken out. Whatever the nature of the first contact, the long-term effects are largely negative for Indigenous peoples. They often become a minority in their own country and suffer from widespread prejudice and discrimination. As a result, their unique culture is threatened and may become extinct.

The United Nations estimates that there are almost 5000 Indigenous groups in the world today. In total, this accounts for about 370 million Indigenous peoples living in 70 countries. Australia is home to two groups of Indigenous peoples – Aboriginal Australians and Torres Strait Islanders.

The world map (see Source 4.25) and the information provided in Sources 4.26–4.31 give examples of some of the Indigenous cultures currently threatened by new global links, and explains how they have been affected.

WORLD: INDIGENOUS PEOPLES

Source 4.25

Source: Oxford Atlas

Source 4.26
The Saami, Northern Europe

❶ The Saami

The Saami are the Indigenous people of Northern Europe, living in parts of Norway, Sweden, Finland and Russia. The Saami are traditionally semi-nomadic reindeer herders, but globalisation has brought changes to their way of life. Today, many Saami have modernised and now use snowmobiles and helicopters to herd the reindeer. However, pasture land for the reindeer is becoming limited as oil and gas mining are developed on traditional Saami lands. The oil and gas is refined and shipped around the world. The Saami are facing other environmental threats from dam building, logging and the effects of climate change.

Source 4.27
The Masai, East Africa

❷ The Masai

The Masai are the semi-nomadic people of East Africa, and live in southern Kenya and northern Tanzania. The Masai have been subjected to eviction and to opposition to their semi-nomadic lifestyle over many years. Masai lands in Kenya were reduced by 60 per cent at the beginning of the 20th century, when the British took the lands to build ranches, then later, wildlife reserves and national parks. Today, loss of land to large-scale private farms and game parks for international tourists has made nomadic grazing impossible for the Masai. Many Masai now live in towns or depend on tourism for survival.

Source 4.28
The Karen, Myanmar (Burma)

❸ The Karen

The Karen is an Indigenous group from Myanmar (Burma) who have long fought for their own homeland. Possibly the most recognisable Karen are the Red Karen, or Kayah, a subgroup whose females wear a series of brass rings to make their necks appear longer. Located in a political hotspot, the culture and lifestyle of the Karen have long been under threat from political tensions and military action in Myanmar (Burma). There are estimated to be 200 000 Karen hiding in the jungle from the Burmese army, and many Karen have fled across the border to Thailand. Here, they find themselves in refugee camps, or in villages where they are little more than a tourist attraction.

Source 4.29
The Vedda, Sri Lanka

❹ The Vedda

The Vedda people are Indigenous to Eastern Sri Lanka, and were originally forest-dwellers. The Vedda people have been exploited for centuries by outsiders wanting their land. This land has been turned from forest to housing developments and government parkland. The Vedda have been banned from the parkland areas. Those who do still try to hunt risk being arrested or even shot by park guards.

Source 4.30
The Yolngu, Australia

❺ The Yolngu

Yolngu is the name the Indigenous people of East Arnhem Land give themselves. Arnhem Land, in the Northern Territory of Australia, is owned solely by the Yolngu people, who are under threat from mining interests in the region. They are attempting to balance the needs of their traditional Aboriginal heritage with the demands of the mining industry, an industry which is a huge business for Australia. Some argue that while there are serious problems within their own communities – health, poverty and substance abuse – Yolngu manage a way of life that blends Western technology with traditions that have been passed through generations.

Source 4.31
The Mentawi, Indonesia

❻ The Mentawi

The Mentawi are the native people of the Mentawai Islands in Indonesia. The Mentawi have traditionally relied on the rainforests of the Mentawai Islands for all their needs. Today, rapid change has led to the clearance of forests, replacing the forests with profitable palm oil plantations. As a result, the Indonesian government has relocated many Mentawi to villages where they are unable to follow their traditional ways. They now suffer high rates of poverty and disease.

The Mentawai Islands are popular with international surf tourists and the Mentawi have found themselves the unlikely beneficiaries of Internet connections via groups like Surfaid, that aims to help people in isolated areas Surfaid's members are connected to through surfing.

Check your learning 4.9

Remember and understand

1 Why do Indigenous populations often decline when settlers from other places arrive?
2 In what type of environment do the Saami live?

Apply and analyse

3 List one forest-dwelling Indigenous group. What threats to their way of life do forest-dwelling Indigenous groups face?
4 What do the Masai and the Mentawi have in common?
5 Give an example of how technology has changed the way of life of one Indigenous group.

Evaluate and create

6 Make a list of the ways in which Indigenous cultures are changing. Construct a flow diagram showing how some or all of these changes are connected to each other.
7 Select one of the Indigenous groups described on these pages. Research the issue described and report back to your class on the ways in which this group is changing.

4.1 big**ideas:** broadsheet

The global coffee trade

Coffee is one of the world's most traded commodities. About $17 billion worth of coffee is traded between producing and importing countries every year. This makes it the second most valuable commodity (after oil) in the world. It is a particularly important crop to many developing countries as it accounts for as much as one-third of their entire export earnings. More than 25 million people are employed in the coffee industry, many of them small farmers.

The overall demand for coffee is growing rapidly and this is causing many changes in its production and processing. Many small farmers in developing countries are finding it difficult to compete with large plantations which are often owned by companies from developed countries. The demand for coffee is also creating environmental problems, particularly the clearing of rainforest to make way for new plantations and an increased demand for fresh water.

The coffee that ends up in your cup begins as a bean grown on plants in tropical countries, often on hillsides. The beans are picked, washed, dried, sorted and packed into 60-kilogram bags for export. Once transported the beans are roasted and ground before being packaged and sold to the consumer.

Source 4.32 Brazil is the world's largest coffee producer and exporter. Coffee farms range from large plantations owned by transnational companies, such as this one, to small plots owned by a single farmer.

skill**drill**

Describe, explain and compare patterns on maps

Geographers often use maps to interpret and analyse complex information and reach some conclusions. While a single map is a useful tool for describing a pattern, we can compare several maps to help explain these patterns. Follow these steps to describe, explain and compare the patterns on maps.

Step 1 Examine the first map carefully. Look at the title and the legend so that you know precisely what the map is showing. Take note of any patterns that you notice. These may be a cluster of similar features located close together or other patterns such as features in a rough line (lineal pattern) or spreading out like spokes on a wheel (radial pattern).

Step 2 Repeat Step 1 for the next map and for any other maps you are using.

Step 3 Look for similarities between the maps. You can do this by using your notes and by scanning the maps with your eyes. You are looking for sets of data on the maps that seem to roughly follow similar patterns. Make a note of these similarities.

Step 4 Use your observations to find a logical explanation for these similarities. For example, when comparing maps of altitude and temperature it is logical that temperatures will fall as altitude increases. Similarly, it is logical that tropical rainforests are found in warm areas with high rainfall.

Apply the skill

1 Examine Source 4.33, showing the world's top coffee producers and coffee importers. Describe the distribution of the world's top coffee producers. Pay particular attention to the Tropics of Cancer and Capricorn.

2 Examine Source 4.35, showing the world's climates. Describe the main climate types found in the tropics.

3 Compare your answers to the previous questions and explain the distribution of the world's top coffee producing countries.

4 Use Source 4.33 to describe the distribution of the world's top coffee importers.

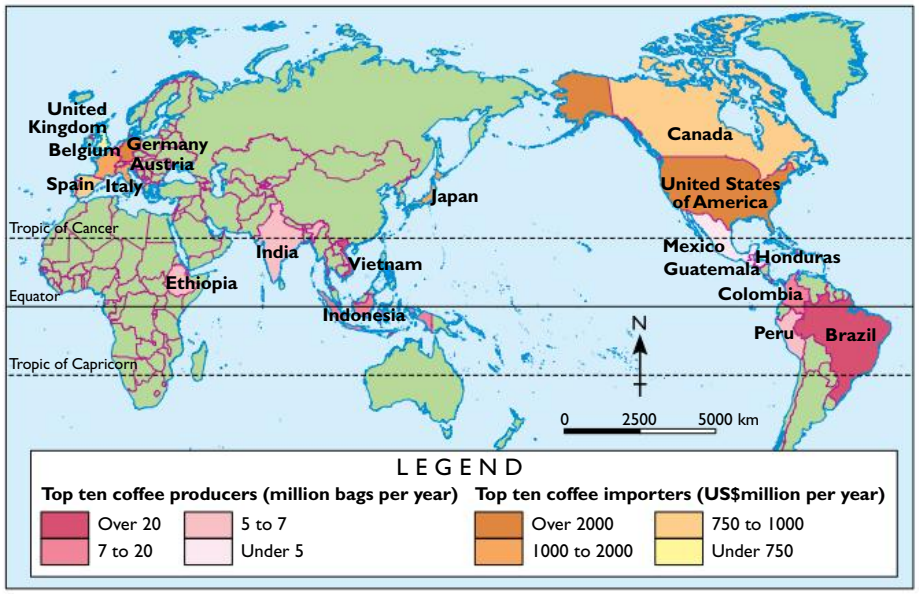
5 Having examined the maps in Sources 4.33 and 4.35, what climate factors do you think influence the growing of coffee? What climate factors are apparent in the areas that import large amounts of coffee?

Extend your understanding

1 Many coffee producing countries rely very heavily on this single crop for their export income. What are the possible dangers for countries in this situation? What kinds of risks does relying on a single crop expose them to?

2 Do some further reading or use the Internet to research the coffee industry in one of the top producing countries. How has this changed in the last 10 years and who has been impacted by these changes?

WORLD: TOP TEN COFFEE PRODUCING AND CONSUMING COUNTRIES



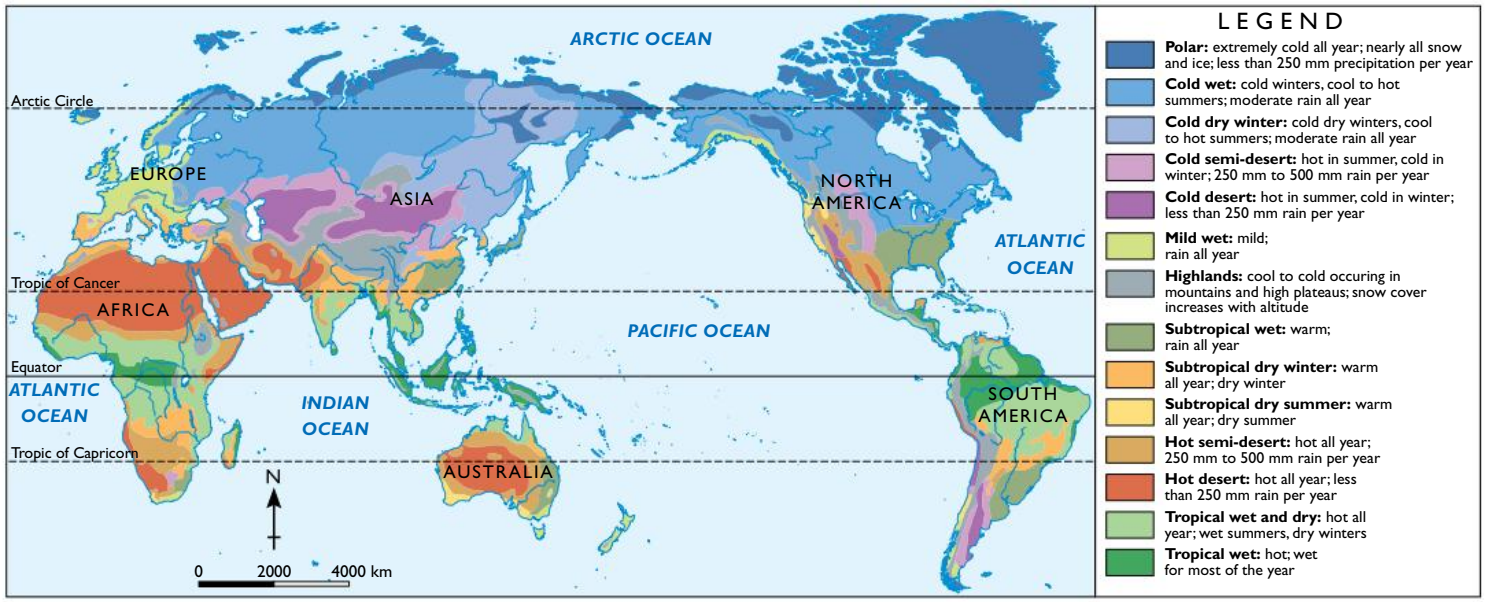
Source 4.33 Source: Oxford University Press

Source 4.34 This table shows the top ten coffee-producing and importing nations in the world

Country	Annual production (in 000s of bags*)	Country	Annual imports (in US $ 000s)
Brazil	43 484	USA	4 121 228
Vietnam	20 000	Germany	3 344 098
Indonesia	8250	Italy	1 382 895
Colombia	7800	France	1 381 309
Ethiopia	6500	Japan	1 272 614
Peru	5443	Belgium	1 204 122
India	5333	Canada	789 431
Honduras	4500	Spain	752 415
Mexico	4300	United Kingdom	631 785
Guatemala	3750	Austria	454 791

* 1 bag weighs 60 kilograms. Figures, 2008

WORLD: CLIMATES



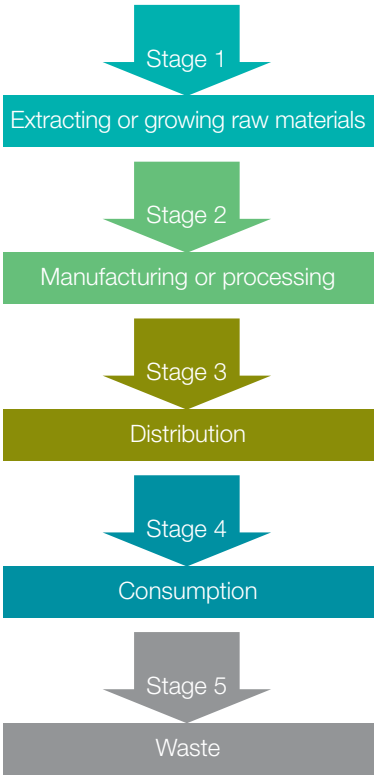
Source 4.35 Source: Oxford Atlas

4.2 What effects does global trade have on places?

Stages of production and consumption

As you have learnt, the production and consumption of goods around the world has brought change in both expected and unexpected ways to the lives of countless people. It has also changed the natural environment in many places and in many ways.

To help make sense of these changes geographers use a simple flow model known as the supply chain. Put simply, a **supply chain** is the journey of a product from its source to the consumer and then its disposal once it is used. You are surrounded by objects that have followed a series of supply chains to reach you. The main stages in supply chains are shown in Source 4.36.



Source 4.36 The main stages of the supply chain of production and consumption.

Source 4.37 Growing produce is part of the first stage of production.

Stage 1: Extracting or growing raw materials

All consumer goods begin as **raw materials**. They are dug from the ground, grown in farms and forests or taken from rivers and oceans. Raw materials include substances like oil, wood, water, metals and minerals. Most goods that we consume are made up of a combination of raw materials. A laptop computer, for example, contains at least 30 different minerals (see 'The global connections inside your laptop' in Chapter 3.3.) and even simple items such as a chair may contain three or four different materials. The processes involved in taking these raw materials impact on the natural environment at a range of scales from local to global.

Stage 2: Manufacturing or processing

Most raw materials are processed in some way to transform them into useful consumer products. This may be as simple as washing, sorting and packaging tomatoes or other foods from farms, or it may be a very complex and intricate series of processes. An increasing trend is for different parts of the manufacturing process to occur in different places, often in different countries. This requires the movement of materials and partly manufactured goods around the world.

Source 4.38 Manufacturing or processing is the second stage of the supply chain.

Stage 3: Distribution

The manufactured goods must be transported to the consumer. The largest volumes of goods are moved by ships but planes, trains and trucks are also used. Goods are often taken to warehouses for storage and then to shops where they are accessed by the consumer, who then transports them to the place they will be used.

Source 4.39 Stage 3 is distributing goods from one place to another.

Stage 4: Consumption

The use of goods and services is known as consumption. The volume of goods and services being consumed is growing rapidly. This is largely due to the growth of the world's total population and to increases in people's level of wellbeing. As more and more people are moving out of poverty they are able to access more goods and services. This growth in consumption is bringing about great change to the natural environment, including supplies of fresh water and fertile soil. Perhaps most disturbingly, our consumption patterns are damaging the atmosphere and causing global changes to the climate.

Source 4.40 Consuming goods is a stage we are all familiar with.

Stage 5: Waste

We often forget what happens to goods once we have finished with them. While some are treated and recycled, others are simply dumped. As consumption increases the amount of waste does, too. The availability of cheap replacements for many consumer goods means that broken or faulty goods are more likely to be thrown away than repaired. China generates an estimated 150 million tons of rubbish per year, and this is predicted to rise to 400 million tons by 2020, the equivalent of the world's entire rubbish production in 1997.

Source 4.41 After the consumption of goods, waste follows.

Check your learning 4.10

Remember and understand

1 Name the five stages of the supply chain.
2 Why is the consumption of goods increasing in many places around the world?

Apply and analyse

3 How does the global increase in consumption of goods impact on the amount of waste produced? Give some examples in your response.
4 Name three raw materials that go into a product that your household uses every day.
5 What are some of the ways in which people try to reduce the amount of waste they generate?

Evaluate and create

6 Rank the five stages in the supply chain from the one that causes the greatest impact on the natural environment to the one that causes the least. Explain your rankings to a partner and then discuss them with your class.
7 Select a common consumer item such as a toothbrush, chocolate bar or packet of biscuits. Look carefully at the item and write down all the materials in it. Use your research skills to trace the supply chain of these materials back to their sources.

The effects of extracting or growing raw materials on places

The first stage in the supply chain of production and consumption is extracting or growing raw materials. Extracting includes activities such as mining (of gold, minerals, uranium, etc.) or taking natural gas or petroleum to use for energy (to heat, cook and generate electricity) and fuel from the Earth.

We also grow crops to provide the raw materials to produce food (wheat which is used to make bread) or clothing (such as cotton).

Accessing the raw materials that are used to supply our needs and wants can bring about many changes in the natural environment. Extracting raw materials from the Earth, such as the minerals that go into many everyday items we use, can cause erosion, a loss of biodiversity and contamination of soil and waterways.

If the raw materials are grown, fresh water and soil systems can be impacted. Intensive farming can cause soil degradation, water scarcity and salinity in places.

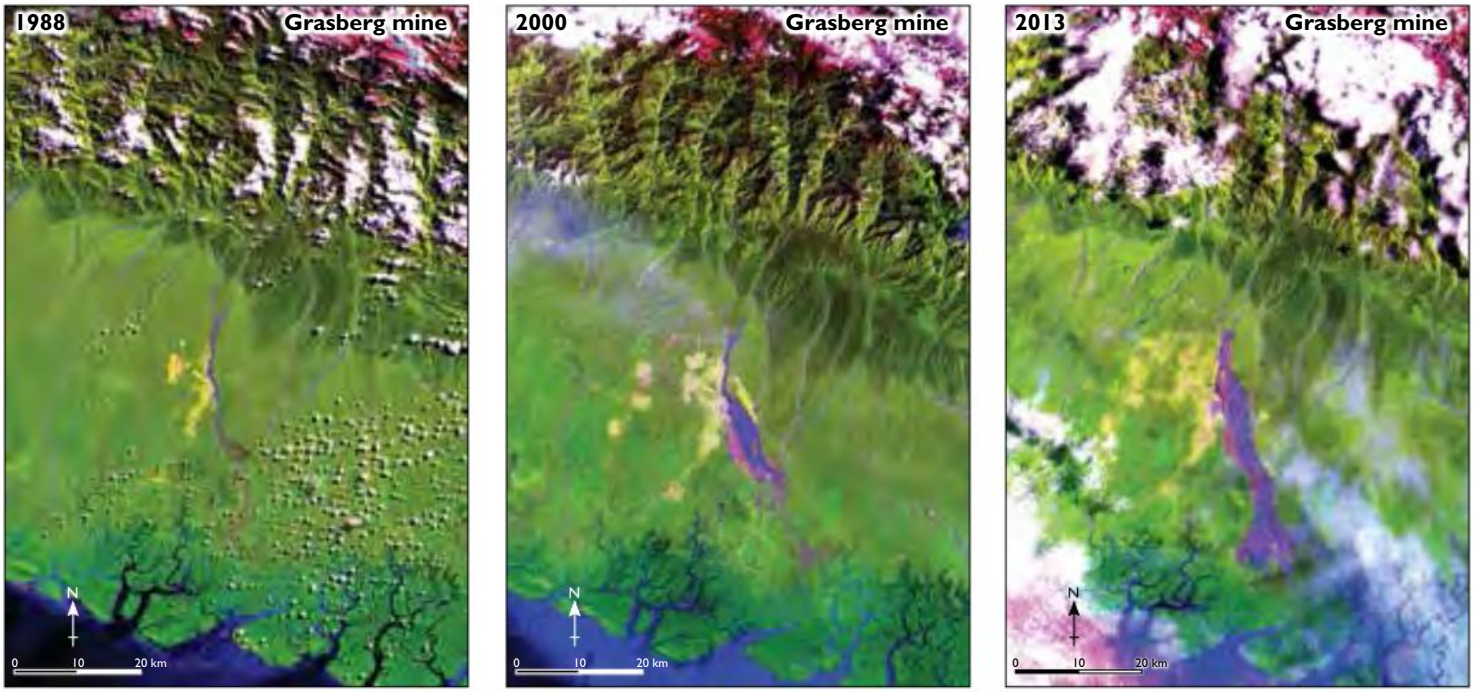
Case study: Grasberg mine, Papua, Indonesia

The Grasberg mine, located in the Indonesian province of Papua on the island of New Guinea, is the third-largest copper- and largest gold-mine in the world. Its gold reserves are estimated to be worth over $20 billion and it also contains the world's largest deposit of copper.

The mine is located high in the mountains that run the length of the island. The mining company also controls much of the land between the mine and the coast, a distance of 80 kilometres. This land is used to house the miners and to grow food for them.

In the mining operation vast amounts of water are used and the refuse from the mining process (known as **tailings**) washes into the river systems. These tailings contain silt, and this silt is changing the patterns of river flow below the mine. Most of the sediment flows into the Ajkwa river system. This river system naturally carries up to 20 000 tonnes of sediment a day but the mining operation is dumping an additional 238 000 tonnes a day into the river. This extra sediment is collecting in the lower reaches of the river, greatly altering the river system. Much of the sediment has ended up as a large plain, which has now grown to 166 square kilometres.

Source 4.42 The Grasberg mine in Papua, Indonesia, is an example of the process of extracting raw materials. The mine itself can be seen as a dark hole in this satellite image.



Source 4.43 These satellite images, taken in 1988, 2000 and 2013, show changes to Ajkwa River over time. In these false colour images pink shows areas of dry tailings and bare soil, and blue shows tailings of waste deposits. Black shows areas of water while light green areas are disturbed vegetation.

One billion tonnes of sediment have already been added to the river system. There is so much sediment that the river has ceased to flow in some places. The mining company has built a series of levees in an attempt to contain the sediment and to channel it towards the sea.

Independent reports have found that the mine is creating many other environmental problems. These include:

- dissolved copper, acids and sediments in the water supply at more than 100 times the legal limit
- unstable rock piles up to 270 metres high that sometimes collapse
- landslides due to the changing shape of hillsides
- poisoning and death of fish from polluted rivers
- risk to animals and birds that rely on the fish as a food supply
- loss of shellfish in the river estuary
- loss of mangroves along the coast and rainforest in the plain below the dam
- large areas of rainforest destroyed for settlement, agriculture and tailings.

Check your learning 4.11

Remember and understand

1 What minerals are mined at the Grasberg mine?
2 Where is this mine? Locate this region in your atlas.

Apply and analyse

3 Explain the sediment problems caused by the Grasberg mine in your own words.

Evaluate and create

4 Create a sketch map of the area shown in Source 4.43. Use a legend to show:
   - areas of disturbed vegetation in 1988
   - areas of disturbed vegetation between 1988 and 2013
   - tailings in 1988
   - tailings in 2013.
5 List the environmental effects of the Grasberg mine, ranking them from greatest impact to smallest.
6 Explain why this case study is an example of the key concept of interconnection.

The effects of manufacturing and processing on places

Once raw materials have either been extracted from the Earth or grown, they go through the next stage of production. This is the manufacturing or processing stage.

Virtually every product you use or consume has been processed in some way, or is entirely manufactured. This includes the food you eat, the clothes you wear, the transport you use and the things you consume such as paper, plastic, furniture and appliances. The processing of raw materials into these and millions of other consumer items impacts on the natural environment in many ways.

The impact this has on places depends on the type of product manufactured. Manufacturing car tyres, for example, may result in chemical emissions to air, water and soil. Manufacturing aluminium – used in products ranging from bottle tops and soft drinks to outdoor furniture and building construction – produces greenhouse gases that are released into the environment.

The manufacturing process

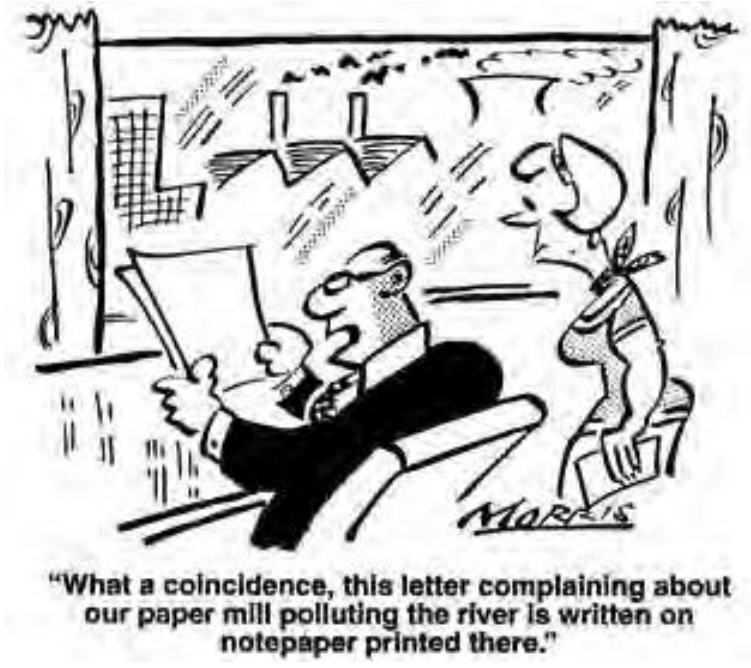
Different processing industries have varying levels and kinds of environmental impact. Here we will examine the examples of woodchip processing for paper production, and iron-ore processing for steel, and the effects they have on the environment.

Source 4.44 A paper mill in the United States. For decades, the USA was the world's largest producer of paper but they have recently been overtaken by China.

Case study: Woodchip processing for paper production

On average every Australian consumes about 200 kilograms of paper each year, two-thirds of which is imported. Paper is usually manufactured from trees. The trees are cut down and transported to a mill where they are converted into woodchips. The chips are then ground and cooked in a chemical solution to produce pulp. Chemicals such as bleaches and titanium oxide as well as fillers such as clay and chalk are added to the pulp, which is then filtered and squeezed between giant rollers to produce paper.

These processes impact the environment in several ways. Removing trees contributes to global climate change, as does transporting them to the paper mill. Mills use large amounts of electricity, which often comes from burning fossil fuels, another climate change contributor. Mills use thousands of litres of water to produce paper, and they release chemicals such as sulphur dioxide into the air. Chemicals used in the process may also be released into nearby streams and rivers.



Source 4.45 What does this cartoon say to you about the effects of manufacturing and processing?

Studies in the United States have found that the paper industry is the largest consumer of water per tonne of finished product in the country. It is also the third-largest user of energy. The industry is the fourth-largest water polluter and the third-largest air polluter. It has been estimated that each tonne of recycled paper saves 13 trees, more than 30 000 litres of water and 2.5 barrels of oil.

Case study: iron ore processing for steel production

Steel is used in thousands of products, from fine surgical blades to skyscrapers and massive ships. More than 1.5 billion tonnes of steel is consumed every year and this amount is growing. It begins as iron ore, which occurs naturally in some rocks, many of them in Australia. The ore is crushed and then melted at very high temperatures. Limestone and coke (processed coal) are added as the iron heats and becomes a liquid known as pig iron. This is melted once again in giant furnaces and impurities are removed to produce molten steel, which is poured into moulds, cooled and hardened.

It is estimated that about five per cent of the world's greenhouse gases come from the production of iron and steel. Producing a tonne of steel can produce up to two tonnes of carbon dioxide, the leading greenhouse gas. This figure varies a great deal around the world depending on processes. Many steel manufacturers in developed countries are using new technologies to reduce their emissions but manufacturers in developing countries are less likely to do this because of the added cost.

Source 4.46 A worker at a Chinese steel mill checks the blast furnace. China is the world's leading steel producer. Most Chinese steel is made from Australian iron ore.

Case study: Manufacturing in China

China is now the world's leading manufacturer, having taken the top spot from the United States since 2010. Manufacturing has grown in China due to a range of factors, including opening up the country to foreign trade, the modernisation of Chinese factories and transport networks, and the movement of Chinese people from farms to cities in search of work. This has led to improved levels of wellbeing for hundreds of millions of people living in China. These rapid changes have, however, come at a cost to the natural environment.

Air pollution

About two-thirds of China's energy for producing electricity, heating and cooking comes from burning coal, the cheapest but most polluting way to get energy. China is now home to 16 of the 20 most air-polluted cities on the planet. A third of China's urban residents are exposed to harmful levels of pollution resulting in a rise in cancers, asthma and birth defects. A UN study found that outdoor air pollution is associated with some 300 000 deaths and 20 million cases of respiratory illness in China each year.

Water scarcity

Many communities in China face water scarcity due to the over-extraction of water for industry or from water pollution. Some studies have found that more than 70 per cent of China's rivers and lakes are polluted and that more than 300 million people nationwide have no access to clean water. This drastically affects their wellbeing as they are more susceptible to water-borne diseases and food insecurity.

CHINA: POPULATION DENSITY AND ENVIRONMENTAL ISSUES

Source 4.47

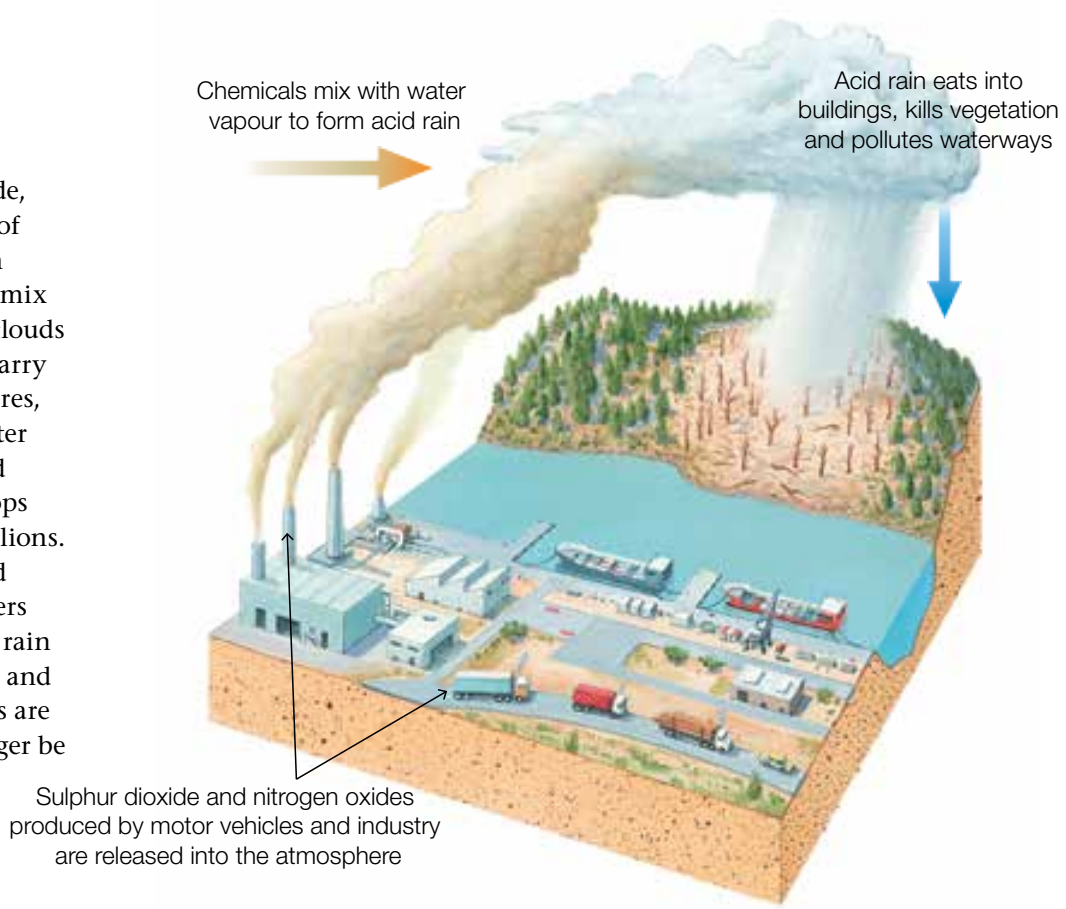
Source: Oxford University Press

Source 4.48 Chinese cities with the highest levels of air pollution, measured by the amount of small particles considered dangerous to health in the air (a reading of 20 is considered the safe limit).

Cities with between 4 to 5 times the safe limit of air pollution		Cities with more than 5 times the safe limit of air pollution			
Changchun (85)	Shanghai (81)	Beijing (121)	Hefei (111)	Shenyang (110)	Urumqi (140)
Changsha (92)	Yinchuan (90)	Chengdu (111)	Jinan (123)	Shijiazhuang (104)	Wuhan (105)
Hangzhou (97)	Zhengzhou (99)	Chongqing (105)	Lanzhou (150)	Taiyuan (106)	Xi'an (113)
		Harbin (101)	Nanjing (100)	Tianjin (101)	Xining (141)

Acid rain

The burning of coal during the manufacturing and processing stage releases large clouds of sulphur dioxide, producing acid rain over 30 per cent of the country. Acid rain is caused when certain pollutants in the atmosphere mix with the moisture (water vapour) in clouds and become acidic. The clouds may carry the dangerous cocktail many kilometres, and when rain falls it poisons the water and soils, killing fish populations and forests. It also affects the yields of crops grown by farmers to feed China's millions. Sulphur dioxide produced by cars and nitrogen oxides from farming fertilisers also contributes to the problem. Acid rain falls on one-third of China's territory and 70 per cent of China's rivers and lakes are so full of toxins that they can no longer be used for drinking water.



Source 4.49 Acid rain is a direct result of air pollution.

Check your learning 4.12

Remember and understand

1 How does paper production impact on the natural environment?
2 Examine Source 4.44. List the impacts on the natural environment that you can identify.
3 What is acid rain?
4 Why are some communities in China suffering from water scarcity? How can this lead to lower levels of wellbeing?

Apply and analyse

5 Why is the environmental impact of manufacturing often greater in developing countries?
6 Examine Source 4.45. Cartoons such as this are often used to make a serious point. What point is this cartoonist making?
7 Consider Source 4.46 which shows a Chinese Steel mill. List five ways in which you will use steel today.
8 Examine Source 4.47.
   a Describe the distribution of China's population.
   b Describe the distribution of areas affected by acid rain.
   c What association do you notice between population density and acid rain? Account for this association.

Evaluate and create

9 What steps could you take to reduce your use of paper and steel? Design a poster encouraging others to take one of these steps.
10 Use the Internet or do some further reading to research the process of making concrete. What are the main ingredients in concrete, where do they come from and how does this impact upon the environment?
11 The head of the World Coal Association has stated that 'Coal played a key role in reducing poverty in China. During the period 1980–2008 Chinese annual coal consumption increased by more than 400 per cent from 626 million tonnes to 2.7 billion tonnes.' Discuss why burning coal has advantages and disadvantages for China and its people.
12 Do you consider the economic revolution in China to be environmentally sustainable? Give some reasons for your answer.

The effects of distribution on places

After raw materials have been grown or extracted, then processed or manufactured, the resulting products are distributed. This is stage 3 in the supply chain. Distribution – transporting a product from one place to another – is a by-product of the way we frequently purchase and use things from all around the world. A product may travel many thousands of miles before it reaches us, by means including freight train, truck, aeroplane, shipping container and courier. The effects of distribution are many, and include direct impacts (emissions of carbon dioxide from fuel, for example) and indirect impacts such as traffic congestion and urban sprawl.

Case study: Shipping

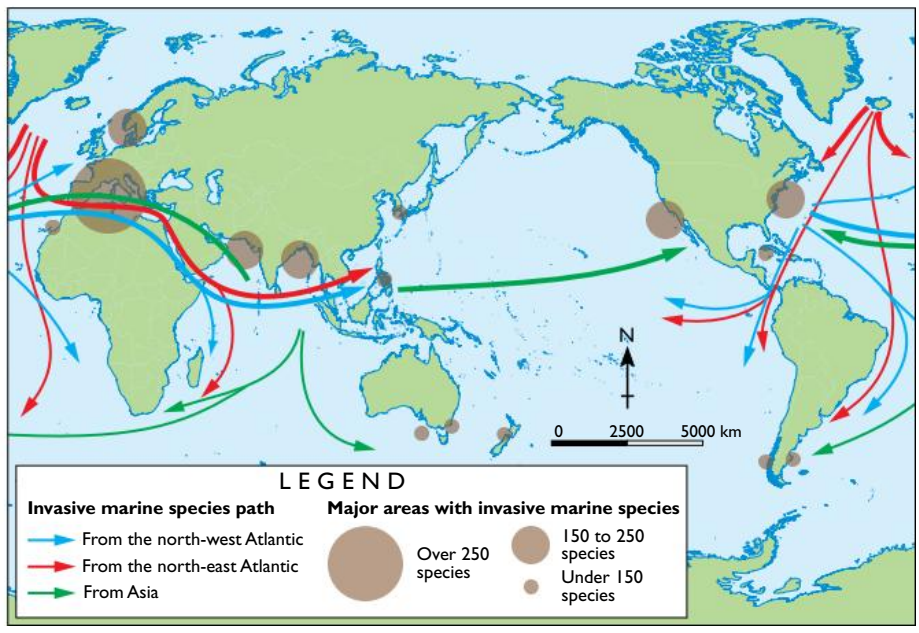
About 8 billion tonnes of goods are transported on ships every year. This represents more than 90 per cent of global trade. Ships are the most efficient form of moving large amounts of goods because of their large carrying capacity, and the lower ratio of emissions they produce. Cargo ships, for example, produce one-tenth of the greenhouse gases (GHG) of trucks for every tonne of goods carried and about one-fiftieth of the gases produced by aeroplanes.

Shipping does, however, impact on the natural environment in other ways. Although the number of shipping accidents that result in oil spills has declined in recent years they still have the potential to cause great damage to the natural environment. One of the worst shipping disasters occurred in 1989, when an oil tanker, the Exxon Valdez, ran aground in Prince William Sound, Alaska. Eight of its 11 tanks were damaged, spilling more than 40 million litres of crude oil into the sea. This resulted in the deaths of up to half a million seabirds, 1000 sea otters, 300 seals and 250 bald eagles. Billions of salmon and herring eggs were also destroyed.

To remain stable ships carry water in their holds. Known as ballast water it is pumped into the ship's hold from the sea at the start of its journey and then carried to the next port where it is discharged back into the sea. Between 3 and 5 billion tonnes of ballast water is moved around the world every year. The ballast water keeps ships and sailors safe but it also carries marine organisms, including starfish and molluscs. It has been estimated that at least 7000 different species are carried in this way and this can cause great environmental damage (see Source 4.51). The Northern Pacific seastar, for example, arrived in Tasmania in ballast water from

Source 4.50 Oil from the grounded Exxon Valdez ship affected 1770 kilometres of coastline and 28 000 square kilometres of ocean – an area approximately 10 times the size of the ACT.

WORLD: INVASIVE MARINE SPECIES AND PATHWAYS



Source 4.51 Source: http://www.grida.no

Japan in 1992 and was then carried to Victoria's Port Phillip Bay. Within two years the population had reached 12 million and had begun to ravage the native shellfish.

Case study: Aeroplanes

Aeroplanes use large amounts of fossil fuel to transport goods as well as people around the world. Burning this fuel produces gases such as carbon dioxide and nitrous oxide as well as other pollutants such as soot and sulphate particles. Because most of these are produced at altitude they tend to have greater impact on the atmosphere than those produced at ground level.

Water vapour – also a greenhouse gas – is formed by aircraft at high altitude. Water vapour condenses into droplets to form condensation trails, or contrails (visible line clouds). Contrails are thought to contribute to global warming and climate change.

Aircraft also contribute to noise pollution levels, and they have other associated impacts on places they travel to and from. These include:

- the general level of pollution and emissions caused by energy use in airport buildings
- greenhouse gas emissions from ground airport vehicles
- carbon dioxide emissions from vehicles transporting goods to the airport for distribution
- waste products that accompany the manufacture of aircraft
- waste associated with airport construction and maintenance.

Many people are concerned about the level of greenhouse gases produced by aeroplanes, and are becoming more aware of the issue when evaluating their purchasing habits. You may have opted for something you bought online to be delivered from overseas by express, which means it would have travelled by plane, an increasingly common practice with the popularity of Internet shopping.

As the world's population grows, and we continue to live in a global marketplace, the levels of pollution contributing to climate change will become more and more of a concern. The impact of aircraft is under consideration by the International Civil Aviation Organisation and the UN, amongst others. Strategies that have been discussed to reduce the effects of aircraft on the environment include:

- increasing the price of air travel to reduce the number of planes in the air and amount of flying time
- increasing air freight costs to deter people from using airmail
- ending frequent-flyer programs that encourage people to fly as often as they can
- trialling alternative fuels
- striving for better efficiency
- discouraging the building of new airports or the expansion of existing ones.

Source 4.52 The white trails behind jets are formed from water vapour, a greenhouse gas. They are sometimes called 'contrails', a shortened form of 'condensation trails'.

Check your learning 4.13

Remember and understand

1 What is ballast water? How does it impact on the natural environment?

2 What are contrails? What impact might they have on the atmosphere?

Apply and analyse

3 Describe what happened in Alaska in 1989.

4 Examine Source 4.51.

- a Which regions have large numbers of invasive marine species?
- b Describe the movements of invasive marine species from the three main source areas around the world.
- c Looking at the map, can you reach any conclusions about how the movement of invasive species might be interconnected with trade?

Evaluate and create

5 Although the number of ships has increased, the number of oil spills and shipping accidents has decreased in recent years. Brainstorm the possible reasons for this trend.

6 Research the environmental impacts of train travel. Which has the greatest environmental impact: trains or aeroplanes?

The effects of consumption on places

After raw materials have been grown or extracted, then processed or manufactured into a product and distributed, the stage of consumption follows. You have probably heard terms like 'consumer behaviour', 'consumer rights', and even 'consumer society'. All of these terms illustrate how much the consumption of goods and services has penetrated the way we live. You have probably been the consumer of many goods and services today. Some things you consume might be immediately obvious – a can of drink or a chocolate bar – but others, such as the gas that powered the hot water system for your shower – might be less evident.

As our levels of consumption increase, so the impact on the natural environment deepens. The way we consume products and resources has changed and damaged the Earth's **biodiversity** (the variety of living organisms on the planet) even contributing to plant and animal species disappearing.

Impacts of consumption on endangered species

Trading in wildlife is one of the largest industries in the world. Much of this trade is legal but still threatens many species: the legal forestry trade, for example, is endangering many plant species, while legal fishing poses threats for marine life. But the illegal wildlife trade is bringing many species to the point of extinction. The value of illegal trading in wildlife is second only to illegal drug trading.

Source 4.53 A member of the Kenyan anti-poaching team guards two of Kenya's four remaining white rhinoceroses.

Some people who are involved in the illegal trading of wildlife smuggle live birds and animals across international borders. Animal smugglers use a range of methods to hide the wildlife. Spiders are mailed in film canisters, small animals are drugged and stitched into luggage lining, and snakes are put into stockings and strapped to people's legs. Many animals don't survive the journey.

Other illegal wildlife traders smuggle animal parts across international borders. Crocodile skins, rhino horns, elephant tusks and tiger body parts all fetch huge prices on the illegal (black) market.

Case study: The online ivory trade

Many endangered species are facing a new threat brought on by increasing demand combined with Internet access. Studies by conservation groups have found that live endangered animals and body parts can be bought online. For example, a two-week study of European auction sites found hundreds of items made from ivory which comes from elephants' tusks. A similar study of Chinese sites found almost 18 000 elephant products for sale on just 13 websites.

Source 4.54 Screenshot of the Ivory Trade app.

Ivory is valued for use in carved statues and trinkets and, like the demand for rhino horn, is driven by demand in Asia. In the middle of last century there were about five million elephants in Africa, today several hundred thousand exist in the wild and they are listed as a vulnerable species. Some conservation groups estimate that up to 32 000 elephants per year have been killed in Africa for their tusks.

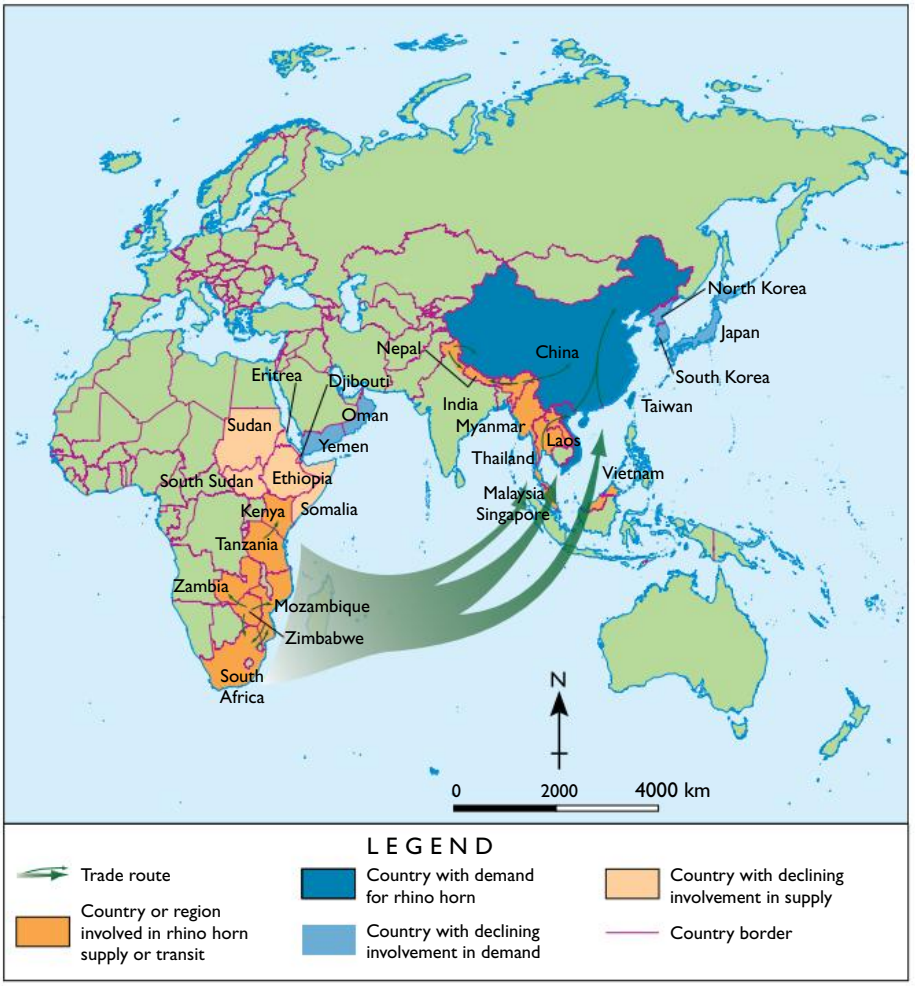
One of these groups, the International Fund for Animal Welfare has launched a digital magazine and iPad app *Unveiling the Ivory Trade* in an attempt to bring attention to the online trade in ivory.

Case study: The black market trade in rhinoceros horn

The powdered horn of the rhinoceros is believed by many people, particularly in Asia, to be a cure for many diseases. This has resulted in rhino horn being valued at $65 000/kilogram making it more valuable than gold. African rhino hunters, often poor villagers, hunt rhinos across borders and into reserves and national parks, shoot them, cut off their horns with a machete or chainsaw and sell the horn to traders who smuggle them to Asia, usually on ships. Wildlife patrol officers shoot to kill those who hunt protected species such as the rhino.

Of the world's five rhinoceros species, three are considered to be critically endangered. The population of the Black Rhino of Africa has declined from 850 000 in 1900 to less than 5000 today.

WORLD: BLACK MARKET TRADE IN RHINO HORN



Source 4.55

Source: http://ngm.nationalgeographic.com

Check your learning 4.14

Remember and understand

1 Why are rhino horns and elephant tusks valuable?

Apply and analyse

2 Examine Source 4.55.
   - a In which countries is there a demand for rhino horn? Where does this horn come from?
   - b In which of these countries is the demand declining? Give some possible reasons for this decline.
   - c How does the demand for rhino horn threaten this species?

3 Compare the threats facing elephants and rhinos in Africa. What are some of the similarities and some of the differences?

Evaluate and create

4 List the various methods described to try to protect these two endangered species. Which of these do you think would be the most effective? Give some reasons for your answer.

5 One proposed method of conserving rhinos is to make the trade in their horns legal. Rhino would then be farmed and their horns harvested for sale. Discuss the possible consequences of this proposal.

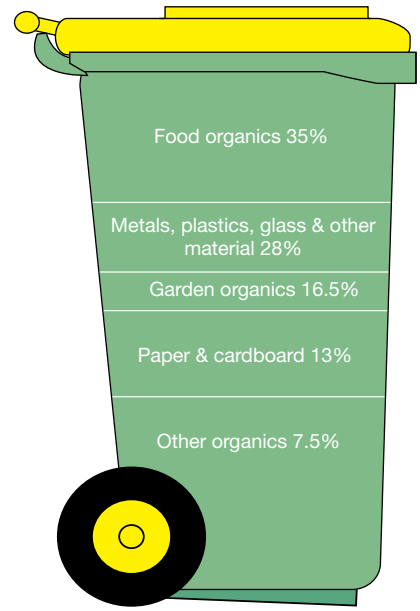
6 Tigers have been hunted throughout history, as souvenirs and to use in medicines in some parts of the world. Research the threats faced by tigers and compare these threats to those faced by elephants.

The effects of waste on places

The consumption of a product or a service is followed by waste, our fifth stage in the process of production and consumption.

Some sources suggest that only one per cent of all materials flowing through the American economy end up in products still being used six months after manufacture. What happens to the other 99 per cent? Mass production and the move of factories to developing countries have made goods cheaper and more readily available. New models are released constantly, older ones become out of date quickly and it is often cheaper to throw away a broken item and buy a new one than to have it repaired.

The move to this 'throwaway society' has resulted in vast volumes of waste being produced. City dwellers alone produce about 1.3 billion tonnes of waste a year, but the amount produced by each person varies a great deal between countries and regions. People living in developed countries such as Australia and the United States each produce about 2.2 kilograms of waste a day, five times that produced by those living in developing countries in South Asia.



Source 4.56 What is in your bin? An analysis of Australian wheelie bins found that most waste is organic (i.e from organisms that were once living).

Check your learning 4.15

Remember and understand

1 What is meant by the term a 'throwaway society'? Do you think we live in a throwaway society? Give some reasons for your answer.

2 What happens to the e-waste in those places that receive it? How does this impact on people and the environment?

Apply and analyse

3 Examine Source 4.56.
   - a What percentage of household waste in Australia is wasted food? Why do you think this figure is so high?
   - b How could the amount of waste produced by Australians be reduced?

4 Examine Source 4.57.
   - a Which places generate large quantities of e-waste?
   - b Which places receive large quantities of e-waste?

5 Why do you think people in developing countries produce less waste than those in developed countries?

Evaluate and create

6 Access the website http://www.worldometers.info/ to find out how many computers have been sold this year and mobile phones sold today. What conclusions can you reach from your results regarding global consumption of these products?

7 Investigate what your local council does with e-waste. Is it recycled, banned or put into landfill? Write a letter to the council either supporting its approach to e-waste or recommending some changes.

E-waste

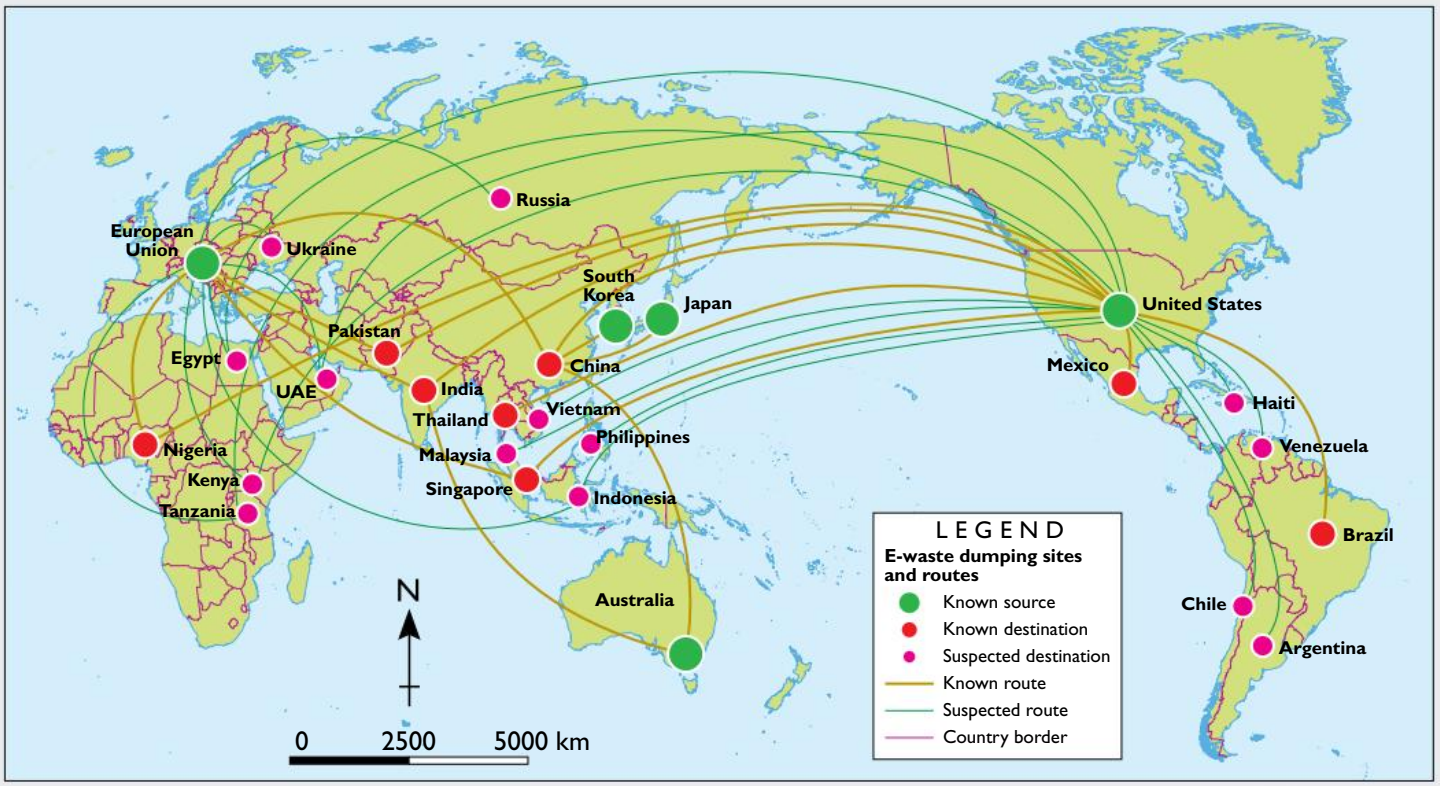
The fastest growing type of waste in the world is discarded electronic equipment such as computers, televisions and mobile phones. Known as **e-waste**, it is estimated to add up to more than 50 million tonnes a year worldwide. Monitors and computers contain significant quantities of heavy metals such as lead, mercury, cadmium and chromium. These metals are considered dangerous because they can build up in the soils, enter the food chain or contaminate water sources and, in sufficient concentrations, may cause health problems.

Computers and other forms of e-waste can be pulled apart so that the materials inside can be recycled. These include valuable copper, gold and nickel. This can reduce the environmental impact of dumping e-waste in landfill and also reduces the need to mine these raw materials for new equipment. Many Australian local councils operate e-waste recycling schemes and discourage people from dumping computers and televisions in landfill.

Recycling e-waste is labour intensive and therefore costly. For many developed countries the solution is to ship the e-waste to poorer countries with lower wages and few or no health and safety regulations. In many communities in Africa and Asia people pull apart the e-waste and melt the plastics in fires, releasing many dangerous chemicals into the air and water.

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

WORLD: ELECTRONIC WASTE ROUTES



Source 4.57

Source: Oxford University Press

Food miles

Global transport networks have made it possible for people to access food from all over the world. This means we are no longer restricted to eating foods that can only be grown in our local area at certain times of the year. It has also meant that food retailers are able to access and sell food that is produced more cheaply in other places. Food consumers, particularly those in developed countries, benefit from this globalisation of food supply. Transporting food around the world however, does have consequences for the natural environment.

One obvious impact on the environment is the emission of greenhouse gases from oil-powered transport such as trucks and ships. The further the food travels, the more greenhouse gases have been produced. The term 'food miles' has been coined to give consumers an easy way to understand some of the environmental impacts of their food choices. It is important to realise that food miles only give a rough guide to the impact of food and that there are many other aspects to consider. However, it is still a useful way of comparing the distances travelled by different foods, and encourages us to think about what we consume.

Source 4.58 Supermarkets have been part of Australian retailing since the 1960s. Prior to that, people bought their food at individual markets such as this one in in Haymarket, Sydney in 1935, or grew it themselves.

A study of the total distance travelled by the items in a typical Melbourne supermarket trolley found that they had travelled more than 70 000 kilometres! Twenty-one thousand kilometres of this was by road and the researchers estimated that the total carbon emissions of the trucks carrying this food were about the same as 4247 cars driving for a year.

skill**drill**

Collecting, recording and analysing relevant data to inform a geographical inquiry

Collecting, recording and analysing data is an important skill that geographers often use. One way they do this is by developing a table that allows them to show and compare the information they have collected. You can use this skill to develop a table to record the distance food items travel.

Step 1 Copy the table in Source 4.59 into your notebook. Fill in the blank cells in the first column with three of your own favourite food choices.

Step 2 Locate the items in your local shops or supermarket.

Step 3 Investigate the origin of each item. You can do this by:

- reading the food label
- checking the signs at the fruit and vegetable counter or deli or checking the stickers on the items
- reading the display tags at the supermarket
- speaking to the people at the local butcher or fruit and vegetable shop or the person at the counter
- investigating the company on the Internet or calling them.

Step 4 Enter the country or town of origin into your table.

Step 5 Investigate the routes likely travelled by the items produced in other countries. They most likely travelled by container ship, so follow the obvious shipping routes from the main port in those countries to the main port near you. A site like http://new.marinetraffic.com will show you the main shipping routes of the world.

Step 6 Use a world map to calculate the distances of the route for each item. Enter these figures in the 'Estimated distance by ship' column in your table.

Step 7 Estimate the road distance from your nearest port to the supermarket or place where you buy your food. You can use the 'Get Directions' feature in Google Earth to find this distance. Enter this figure in the 'Estimated distance by road' column in your table.

Source 4.59 Copy and complete this table to estimate your food miles.

	Food item	Town or country of origin	Estimated distance by ship (if relevant)	Estimated distance by road	Total estimated distance travelled to sales point
1	Fresh lemons				
2	King Island cheese				
3	Uncooked prawns (from the deli counter or fish shop)				
4	Fresh milk				
5	Valencia or navel oranges				
6	Bertolli olive oil				
7	Kikkoman soy sauce				
8	Ribena fruit juice syrup				
9	Twinings English breakfast tea				
10	San Remo couscous				
11	John West salmon				
12	Bananas				
13	Always Fresh artichokes				
14	Tinned home brand peaches				
15	Minced beef				
16	Chobani Greek yoghurt				
17	Fresh asparagus				
18					
19					
20					

Step 8 Investigate where the items produced in Australia probably originated. This may need to be a calculated guess based on a map of farming in Australia. Alternatively you could research the company who processed your food by using the Internet. Estimate the road distance travelled by these items. Enter these figures in the 'Estimated distance by road' column in your table.

Step 9 Fill in the 'Total estimated distance travelled to sales point' column. Add together the shipping and road distances if your item came from overseas, or copy the road distance figure across if the item was produced in Australia.

Step 10 Add together your data to calculate the total distance travelled by your 20 items.

Apply the skill

1 Develop a table to calculate the food miles you personally accumulate during an entire week. Collect and record your food consumption data through the week and add up your total on the last day. Which item travelled the furthest to reach you? Which travelled the least distance?

2 Compare your food miles table with those of your classmates and discuss the results. Were the total amounts roughly the same, or were there significant variations? In small groups, note down particular food items that you found travelled the longest and shortest distances.

3 Examine the picture of the market shown in Source 4.58. How does the scene shown here differ from a modern supermarket? How far do you think the items shown here would have travelled to reach the customer?

Extend your understanding

Do some further reading on the Internet to complete the following tasks.

1 Some researchers have warned that using food miles to estimate environmental impact is misleading. Research the controversy about food miles, outlining the reasons some people think they confuse the issue. Make a list of arguments for and against using food miles, and present these in table format.

2 Interview a grandparent or someone you know who is older, and ask them about the foods they used to eat when they were young. Find out how today's food choices and habits compare. Describe and explain the similarities and differences. Did they prefer the way they used to eat, or the choices available now? List their reasons.

4.3 What effects does international tourism have on people and places?

Different types of tourism

It is estimated that tourists spend around $A1 trillion annually (i.e. $A1000 billion). This revenue makes a valuable contribution to the economies of most countries around the world.

The United Nations World Tourism Organization (UNWTO) now estimates that the total number of tourists travelling each year will reach 1.8 billion by 2030. Asian countries such as India, Malaysia and Indonesia are expected to see the most rapid increase in tourist numbers over this time.

Tourists travel for many different reasons. Some simply want to relax on a beach, while others are keen to experience the culture, language and history of the places they visit. In order to understand the decisions different types of tourists make, and analyse the impacts that their decisions have on the environment, geographers tend to classify tourists into a number of groups. In this section, we will examine four of the most popular types of tourism and investigate the impacts that each is having on environments around the world.

Recreational tourism

Recreational tourism is perhaps the most well-known and popular type of tourism. Recreational tourists travel to have a good time, to relax, and to enjoy the attractions and activities on offer in the places they are visiting. Many recreational tourists spend their time relaxing on the beach, eating in restaurants, shopping or attending shows. Each year, around 39 million tourists flock to New York City to enjoy all of the recreational activities on offer there (see Source 4.60).

Historical tourism

Historical tourists are generally interested learning more about important events that may have taken place in the past, by visiting the places where they happened. They visit important buildings, view artefacts and monuments and sometimes listen to stories from local experts. The Great Pyramid in Egypt, Stonehenge in England and Machu Picchu in Peru (see Source 4.61) are all popular destinations for historical tourists.

Source 4.60 Times Square in New York City is among the most popular destinations in the world for recreational tourists because of the many attractions there.

Source 4.61 Machu Picchu in Peru attracts visitors because of its historical significance. Up to 2000 people visit every day.

Wilderness tourism

Wildeness tourists enjoy the challenge of visiting wild places such as the Amazon rainforest, Antarctica or the Himalaya. For these travellers, the lure of remote lands, rugged landscapes and even challenging weather conditions is much more attractive than a cosy hotel and a bit of sightseeing. The chance to visit places that relatively few others have and be exposed to the people and cultures of these remote places makes wilderness tourism an attractive option for many, despite the potential risks involved.

Ecotourism

Ecotourists typically travel to natural areas that are relatively undisturbed, and possibly fragile, to learn more about these special places in a socially responsible manner. Ecotourists try to minimise their impact and avoid damaging the environment in which they travel. They may even aim to improve the wellbeing of the land and those that live there. Some ecotourism raises funds for conservation (see Source 4.63), or goes to directly benefit the local communities in the places visited by tourists.

Source 4.62 Climbers on Mount Everest wait for their turn to reach the summit. Climbers like these must wait up to two hours to reach the top of the mountain.

Source 4.63 In Central Africa, ecotourism brings about $20 million a year to the region – much of this used to preserve the habitat of mountain gorillas.

Check your learning 4.16

Remember and understand

1 How many tourists travel to a different country each year?

2 Which countries are expected to see the most rapid growth in the number of tourists over the next 15 years or so?

Apply and analyse

3 As a class, brainstorm examples of experiences and destinations under each of the four tourism types. Which one did your class know the most about? Which did they know the least about? Why do you think this is the case?

4 Think about your last experience as a tourist.
   a Classify your experiences into one of the four tourism types discussed on these pages.
   b Write a list of all the ways your last holiday had an impact on the places you visited.
   c Classify these into the positives and negatives.
   d Identify the places where the impact was felt.

5 Which of the four types of tourism outlined do you think is the most popular amongst the world's tourists? Give some reasons for your answer.

Evaluate and create

6 One method to reduce the impacts of tourism is to give tourists a code of behaviour that outlines a number of rules and guidelines to follow.
   a As a class, discuss the kinds of rules and guidelines that would reduce the impact of tourism on mountain gorillas such as those shown in Source 4.63.
   b In pairs or small groups, design a brochure that you could give to tourists to educate them about the code of behaviour your class has come up with.

Impacts of recreational tourism

While some forms of tourism, such as ecotourism, may not appeal to everyone, travelling for recreation is massively popular. There are many destinations that people choose to visit for recreation, so the impacts vary widely. Some places become extremely popular as tourist destinations, and the concentrated number of visitors can have significant impact on both the natural and built environments there. For example, a beachfront that once attracted people for its sunshine and clean sandy beaches can all too quickly become overcrowded, and polluted if it is not carefully managed and cared for.

Case study: Cancun, Mexico

Many areas that were once wilderness have been changed to provide the things that tourists need and want such as hotels, airports, swimming pools and roads. On the Yucatan Peninsula in Mexico, for example, lies the tourist town of Cancun (see Source 4.64). Blessed with a spectacular coastline and warm temperatures, it attracts about 2 million visitors a year. Before it became a tourist destination, Cancun was a barrier island enclosing a massive shallow lagoon, the Nichupte Lagoon, which was an important nesting site for sea turtles and seabirds.

The lagoon was fringed by mangroves, which acted as a nursery for fish and other marine animals (see Source 4.65). As more tourists began to visit, causeways were built at both ends of the island to join it to the mainland. The causeways restricted how much fresh water was able to flow into the lagoon, changing the conditions of the ecosystem. In addition, sections of the lagoon were filled in, and 60 000 hectares of rainforest and mangroves were removed to make way for the development of hotels and resorts.

Native plants that once protected the coast and prevented erosion were replaced with non-native plants. There are far fewer fish and shellfish due both to the loss of their habitat and overfishing to feed the tourists. Large areas of coral reef are now dead or damaged as a result of the snorkelling and scuba diving. Boats and jet skis create pollution, while boat anchors can drag along the seabed, damaging coral and stirring up sediment, all of which have negative impacts on marine life.

The increased numbers of tourists and residents (who work in hotels and restaurants and run tour companies) have also resulted in waste management problems. The lagoon has become polluted with sewage, petroleum products, heavy metals and chemicals from stormwater run-off and the boating marinas in the lagoon.

Source 4.64 Tourist development in Cancun, Mexico

CANCUN, MEXICO: TOURIST AREA

Source 4.65 Source: Oxford University Press

Source 4.66 While tourists enjoy luxury accommodation in purpose built resorts, living standards are very different for many of Cancun's workers and their children.

In addition to these negative environmental consequences, there are also negative social consequences. The rapid development in Cancun has put pressure on local resources, meaning the prices of food, energy, raw materials and land have risen. There is also increasing pressure to use agricultural land for the booming tourism industry.

When tourist infrastructure for Cancun was built, little provision was made for the additional residents needed to work in the industry. As a result, there are many slums that surround the area. People living in the slums have poor living conditions, with a lack of drinking water, waste management and other services.

Although the industry provides employment, tourism workers are often poorly paid. This leads to inequalities between resident workers and tourists, with some workers feeling resentment towards tourists and being forced into other illegal means of earning an income, such as selling drugs or prostitution.

Check your learning 4.17

Remember and understand

1 Why do many tourists visit Cancun?
2 How has tourism benefited local people?

Apply and analyse

3 Investigate the natural environment of Cancun.
   a Describe the current environment. Use Source 4.64 to help you.
   b How has tourist development changed this environment? Use Source 4.64 as a source of information.
   c How have the activities and behaviours of tourists impacted on the Cancun region? Refer to particular places and activities in your answer.
4 Cancun has been described as 'a victim of its own popularity'. What does this mean? Do you agree with this statement?
5 Examine Source 4.66. What does this picture reveal about living conditions in the workers' villages?

Evaluate and create

6 Imagine that a new tourist development has been proposed for a stretch of coastline in Queensland that has a similar natural environment to Cancun. What lessons could the developers of this new resort take from the experiences at Cancun in order to reduce impacts on natural and built environments?

Impacts of historical tourism

While many modern-day tourist attractions such as theme parks and museums are built specifically to cater for tourists, most historic sites built long ago were never designed to cope with the demands of the growing numbers of visiting tourists. The interconnection between tourists and ancient buildings, for example, is having a disastrous effect on many of these historic sites in many locations.

Case study: Angkor Wat, Cambodia

Cambodia's 1000-year-old temples at Angkor Wat lay hidden from tourists for hundreds of years by the thick tropical jungle. Today, nearly 3 million tourists visit Cambodia every year, most of whom go to Angkor Wat. In 1995, there were eight hotels in the nearby town of Siem Reap. By 2013, there were more than 350, virtually all of them owned by foreigners. Many of the stone statues and steps of Angkor Wat are crumbling under the stress of millions of footsteps, and entire sections of the walls have collapsed. Pollution from hundreds of tourist buses threatens to corrode the fragile sandstone. The demand for water, including that needed to water two new golf courses built nearby, has resulted in ancient wells and moats drying up. Some researchers fear that drawing water from the ground may eventually result in the sinking and collapse of the ancient monument.

Source 4.67 Tourists scramble up the side of a temple wall at Angkor Wat, Cambodia.

Case study: Pyramids of Giza, Egypt

The Pyramids of Giza, on the outskirts of Cairo in Egypt, are some of the most instantly recognisable buildings in the world. More than 4500 years old, they stand as a monument to human ingenuity. They have withstood centuries of desert erosion but are now threatened by mass tourism. Inside the tombs and pyramids, ancient paintings are being eroded by salt deposits that are caused by the sweating and breathing of tourists. Despite strict rules, some tourists touch the ancient paintings, which hastens their decay. The air pollution caused by the growth of Cairo's suburbs and the many tourist buses has corroded the pyramids' surfaces.

Source 4.68 Tourists and buses at Giza's ancient pyramids

Case study: The Great Wall, China

The Great Wall of China was declared one of the Seven Wonders of the World in a public vote in 2007, and China is one of the fastest-growing tourist destinations in the world. Rapid economic growth and rises in living standards in China are allowing millions of Chinese people to own cars and visit places they could not previously access. These two factors are bringing even more people to the Great Wall every year. Unfortunately this is creating many problems for this ancient structure.

In some heavily visited sections virtually every stone has been defaced with graffiti and some tourists even take pieces of the wall as souvenirs. Cars are sometimes driven along the wall, rave parties are held on it, and parts have been torn down to use for building materials or to create space for other developments. It has been estimated that only one-third of the wall still stands, the rest having been torn down or eroded away.

Source 4.69 Crowds such as those shown here flock to the Great Wall of China during national holidays in China in 2012.

Check your learning 4.18

Remember and understand

1 List the ways in which tourists change the ancient structures described on these pages.

2 Why is water supply an issue for Angkor Wat?

Apply and analyse

3 Why is the impact of tourism on ancient places such as these likely to worsen in the future? Can you think of any likely impacts for each of the places shown here in addition to the ones already described?

4 Examine Source 4.67. How are these tourists impacting on Angkor Wat? Are these impacts also likely to occur at the Egyptian pyramids or the Great Wall?

5 What are some of the positive impacts of tourism that may occur at each of these three historic sites?

Evaluate and create

6 The case studies presented focus on the impact of mass tourism on the built environment. Brainstorm ways in which tourism can impact on other aspects of the human environment such as language, culture and religion.

7 Do some further research about the impact of tourism on one of the three historic sites mentioned here. Prepare a Powerpoint presentation about what you discover and present it to the class.

Impacts of wilderness tourism

Many tourists are drawn to wilderness areas to experience natural sights and events. Well known examples of wilderness tourist destinations include Uluru in Central Australia, the Grand Canyon in America, and the Serengeti in Africa, where many people travel to go on wildlife safaris. Wilderness tourists, and the facilities built for them, can bring great change to natural environments.

Case study: Tourism in Antarctica

Antarctica is the world's last great wilderness and a land of extremes. Located at the most southerly point of the Earth's surface, it is the highest, coldest, driest, windiest and most isolated continent. This makes it one of the least visited places on Earth. Despite being about twice the size of Australia, Antarctica receives only 26 000 tourists a year compared to Australia's 5.8 million visitors.

Most visitors to Antarctica travel on cruise ships from South America and visit a few sites on the Antarctic Peninsula. They come to marvel at the unique wildlife, the pristine condition of the natural environment and the stunning scenery. Nearly 40 per cent of these tourists are from the United States. Australians make up only eight per cent of tourists to Antarctica.

People usually visit Antarctica for only short periods but their visits usually take place at that same small number of sites. This leads to a long-term cumulative impact. Tourists also tend to visit the places with the most wildlife, which has the potential to disrupt the animals' normal way of life. The fragile environment means tourism in Antarctica has to be carefully controlled and managed. It is particularly difficult to manage environmental problems, however, as there is no government, police force or park rangers to manage impacts and control behaviours.

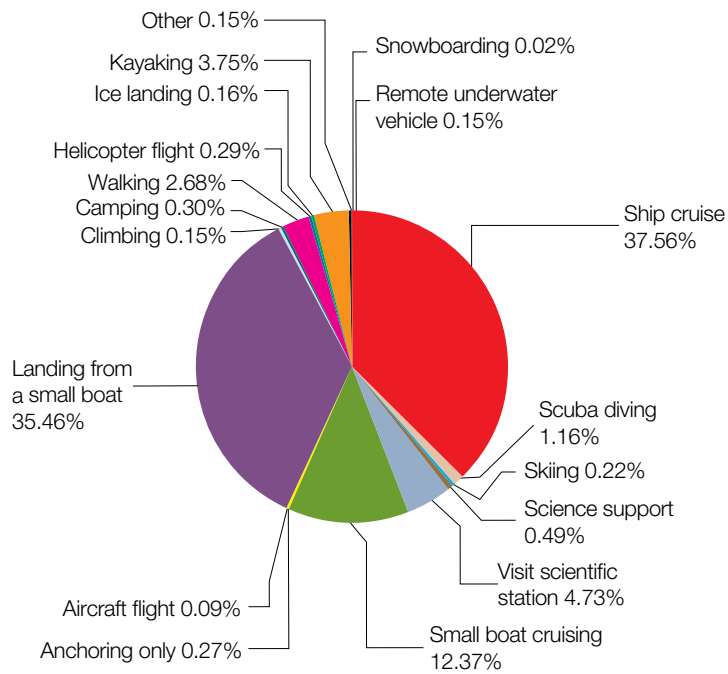
Potential impacts from wilderness tourism

- Disturbance of wildlife, especially as most tourists are taken to penguin and seal colonies by small boats from large cruise ships.
- Oil spills from cruise ships. Rubbish and waste from ships also pose a problem.
- Difficulty in rescuing people involved in medical or other emergencies.
- Introduction of foreign species to Antarctic waters from water carried as ballast on cruise ships.
- Tourists can also damage plant life, such as trampling slow-growing beds of moss.

Source 4.70 Passengers from a cruise ship photograph a pair of Emperor Penguins in Antarctica.

Protection

Tourism in Antarctica is self-regulated by the International Association of Antarctic Tour Operators (IAATO). The association has strict guidelines for its members and their ships, such as limiting the size of ships allowed into Antarctic waters. The numbers of people that can land at sites are also limited. The association is seen as being successful in managing tourism in the area; after all, if damage to Antarctica occurs, the attractiveness to tourists will be lost.



Source 4.71 Tourist activities in Antarctica.

Source 4.72 The passengers and crew of the first flight from Hobart to Antarctica in 2008 gather beside the runway. In the centre of the front row is Peter Garrett, Australia's environment minister at the time.

Membership of IAATO, however, is not compulsory, and there is still the possibility of businesses that don't belong to the association bringing in larger ships carrying more people and causing more damage. This has not happened so far but, if it did, nothing could be done to prevent it as there are no international laws governing the area.

The future of Antarctic tourism

While virtually all tourists currently access Antarctica by boat, this may be about to change. The Australian government has spent $46 million to put a regular air service in place between Hobart and Casey Station in Antarctica. This has meant the construction of a reliable runway on a 700-metre-thick glacier. Airbus A319 planes have been modified with long-range fuel tanks added so that a return flight to Hobart can be made without refuelling. This minimises the chances of a fuel spill in the pristine environment.

The service will be for scientists and researchers working from the Australian bases in the summer months and will reduce the current three-week sea journey to a four-and-a-half-hour flight. This will allow more scientists to visit Antarctica.

While tourist flights from Australia currently do not land in Antarctica, the technology used to construct this runway may be employed by tour operators in the future. It is important to remember, however, that Antarctica remains a challenging environment to visit and this will always keep the number of tourists relatively low.

Check your learning 4.19

Remember and understand

1 Why do so few tourists visit Antarctica?
2 Would you like to visit Antarctica? Give some reasons for your answer.

Apply and analyse

3 Examine Source 4.71.
   a What are the two most popular activities in Antarctica?
   b What are some of the potential environmental impacts of these activities?
   c What percentage of tourists take a flight in an aircraft?
   d Why might this percentage increase in the future?
4 Discuss some of the potential and real environmental impacts of aeroplane flights to Antarctica.

Evaluate and create

5 Design a poster that will be displayed in the rooms of a cruise ship which will sail to Antarctica. Your poster should outline a code of behaviour for tourists who will travel on the ship, to educate and guide them on how to reduce their environmental impact. Because not all passengers will speak the same language you will need to use pictures and symbols rather than words on your poster.

Impacts of ecotourism

Many tourists are becoming aware of the impacts of their travel on people and places they visit. As a result, many of them have started looking for opportunities to reduce these impacts. In response to this growing awareness, many destinations are developing ecotourism options. These tend to be nature-based, educational and designed to have a minimal impact on the environment. Ecotourism is now one of the fastest growing tourism sectors.

Case study: Kapawi Ecolodge, Ecuador

The Kapawi Ecolodge and Reserve is located in the Amazon Basin, 250 kilometres south-east of Quito (see Source 4.74). It is close to the border of Ecuador and Peru on the Pastaza River, a major tributary of the Amazon. People can really only reach Kapawi by air or by a three-day canoe trip – it is a 10-day walk to the nearest town. Because of this Kapawi is one of the most pristine and remote areas of the Amazon Basin. It is also one of the most biologically diverse areas on Earth with 10 000 species of plants and more than 570 species of birds. The lodge is located in the territory of the Indigenous Achuar people, which covers 5000 square kilometres and is home to 6000 Achuar.

The Kapawi project began in 1996 as a partnership between Conodros (an Ecuadorian tour company) and the Achuar people. They wanted to start a sustainable business that would preserve the unique cultural and environmental assets of Ecuador's Amazon Basin. Conodros provided the initial funding, management and technological expertise to get the project started. Full management of the project was handed over to the Achuar on 1 January 2008. They now have total ownership and responsibility for the Kapawi Ecolodge and Reserve. As management of the environment is an ongoing process, Kapawi continues to strive to improve management processes, and involves guests in this too.

ECUADOR: TOURIST MAP OF KAPAWI ECOLODGE

Source 4.74 Source: Oxford University Press

Source 4.73 Kapawi Ecolodge, deep in the Amazon rainforest.

Source 4.75 Achuar people teach tourists staying at the Kapawi Ecolodge about the biodiversity of the Amazon rainforest.

Before Kapawi, most of the Achuar had earned money from raising beef cattle. This agricultural activity causes significant damage to the environment. Today, members of the 56 Achuar communities earn a significant percentage of their income from ecotourism. For the communities near the lodge, up to 60 per cent of their total income comes from direct employment at the lodge, supplying products and selling handicrafts.

Leave nothing but footprints, take nothing but photographs

The lodges at Kapawi are built using traditional Achuar architecture techniques combined with modern technologies. This includes building on stilts to minimise the impact on surrounding vegetation. All soaps, detergents and shampoos used are biodegradable. Sewage goes through a three-step drainage process. Plastic, glass and metal waste is packed and taken away to be recycled. Paper waste is burned. Biodegradable garbage is composted. Batteries are collected and taken to countries with recycling facilities. The entire lodge is powered by a hybrid system of solar energy and a diesel generator. Showers have solar-heated water.

Tourists who visit Kapawi can take part in many activities, including hiking, bird-watching, visits to local Achuar communities, learning about traditional foods and medicine, camping and canoeing.

Kapawi Ecolodge is a successful sustainable tourism business. Tourism has been managed so that the environment and the culture of the Achuar people can be maintained. In addition, the Achuar people have found sustainable ways to become part of the world economy while still maintaining their traditions.

Check your learning 4.20

Remember and understand

1 Describe the location of the Kapawi Ecolodge.

2 What are some of the interconnections between the Achuar people and people from other places?

Apply and analyse

3 Copy and complete this table to list some of the ways in which environmental impacts are minimised at Kapawi:

Features of buildings	Tourist behaviours	Reducing waste

4 How does the isolation of the ecolodge help in minimising its environmental impacts?

5 Ecotourism can be defined as 'responsible travel to natural areas that conserves the environment and improves the wellbeing of local people'. Do you think that the Kapawi Ecolodge is an example of ecotourism? Give three reasons for your answer.

Evaluate and create

6 Compare the tourist developments at Kapawi (see Source 4.73) and Cancun (see Source 4.64). What are the key differences? Discuss which of these types of development is most likely to represent the future of tourism. What will this mean for environmental impacts in the future?

The effects of tourism in the future

Tourism is an industry that is constantly changing. Geographers who research tourism and leisure have identified the following trends that will shape the ways in which people and places are impacted by tourism in the future.

Trend 1: More people travelling more often

Tourist numbers are expected to continue to increase. By 2030, the number of international travellers will reach 1.8 billion per year if current trends continue. As some places become too crowded tourists are expected to look for new destinations to offer them the experiences they want. This gives new places the opportunity to benefit from the resulting tourism, which provides a significant boost to an economy. However, it also makes them vulnerable to negative impacts on the environment and their culture.

In many places where profits are put ahead of minimising impacts, tourism has brought environmental degradation and a loss of traditional ways of life. As many communities in developing countries rush to attract tourists, many geographers are concerned that the lessons from places such as Cancun, Angkor Wat and Giza will be forgotten.

Trend 2: Increased awareness of environmental issues

More travellers are becoming concerned about their impact on the places they are visiting. Many are choosing their destinations partly because of environmental qualities such as conservation. Mass tourism to large resorts such as those at Cancun, however, still dominate in some countries. Ecotourism, though, and nature-based tourism are growing two to three times more quickly than tourism as a whole.

Source 4.76 Namibia is predicted to be the 'next big thing' in African safari tourism as traditional areas in South Africa, Kenya and Tanzania become too 'busy' for many travellers.

There are many popular destinations for conservation-aware tourists including parts of Australia, and Africa, which has stunning landscape and the chance to see wildlife in its natural environment.

The Internet has allowed people to learn more about destinations before they travel and this trend is expected to continue. Places that are becoming degraded are becoming less popular as tourists pass on their negative experiences through travel websites. This may result in greater efforts in these places to repair environmental damage and for future developments to be more environmentally friendly.

Trend 3: Travellers want 'real' experiences

There has been a significant growth in the number of people who are looking for authentic places and experiences rather than artificial ones that have been created specifically for tourists. One of the fastest growing types of travel experiences is known as adventure tourism. This includes the 'adrenaline junkies' who want extreme experiences such as mountaineering, white-water rafting and rock-climbing as well as those who want gentler physical experiences such as hiking and biking.

For many tourists, the experiences they have are becoming more important than the places they visit. Many are looking to interact with local people and to experience their culture away from the packages offered by large hotels and tour companies. Adventure tourism allows them to move out of mass tourism and have an individual experience. Where this has occurred it seems to impact people and places much less than mass tourism and can lead to a better understanding of cultures and environments.

Other trends

In addition to these trends described above, many others have been observed.

- Trips are becoming shorter but tourists are spending more.
- Twice as many people now book their travel on the Internet than use a travel agent.
- Growth in the number of tourists from Asia is larger than from any other region.
- There is a surge in 'niche' tourism: small numbers of people travelling for unusual reasons. This includes medical tourism, when people travel to another country for surgery and other medical procedures. Already worth up to $60 billion a year, medical tourism is growing at 20 per cent a year.
- There is also an increased demand for 'accessible tourism' for the 10 per cent of the population with a disability (see Source 4.77).

Source 4.77 Tourism catering for disabled people is a growing industry.

Check your learning 4.21

Remember and understand

1 How has the Internet changed travel and tourism?
2 What is adventure tourism?

Apply and analyse

3 Make a list of those factors and trends that may result in tourism having a greater impact on the environment in the future. Make another list of those factors and trends that suggest that tourism will impact less on the environment. Which of these two outcomes do you consider most likely? Give some reasons for your answer.
4 Examine Source 4.76.
   a Why do you think these tourists have visited this place?
   b How has this visit impacted on the natural environment?
   c How will these impacts increase if the number of tourists to Namibia greatly increases?

Evaluate and create

5 Imagine that it is 2050 and that you are a reporter for an online newspaper. Write an article describing the ways in which tourism has changed in the last 35 years or so (since 2015). You could describe a typical 2050 holiday and include an advertisement for a typical 2050 destination.

4.3 big**ideas:** broadsheet

Tourism at Gallipoli

On 25 April 1915, Australian and New Zealand troops fighting in World War I landed on the Gallipoli Peninsula. The battle lasted about eight months and claimed the lives of around 8000 Australians. It is seen by many as a milestone event in our nation's history. Thousands of Australians visit Gallipoli every year to pay their respects to the soldiers who fought there and to see this famous place for themselves.

While a few busloads of visitors arrive at Anzac Cove on an average day, on Anzac Day, the anniversary of the landing, tourist numbers increase dramatically. This gained popularity in 1990 when then Prime Minister Bob Hawke attended the dawn service and declared that 'Gallipoli is, in one sense, a part of Australia'. Anzac Day dawn services at Anzac Cove and Lone Pine now attract up to 10 000 people, most of whom sleep on the ground the night before the service.

To cope with visitor demands during this busy time, bus movements on the narrow winding roads are restricted, temporary grandstands are erected and a special group of Australian volunteers clean up rubbish once the visitors depart.

While many Australians see a visit to Gallipoli on Anzac Day as their right, others believe that the sheer number of visitors degrades the environment and demeans the memory of those who fought there. Some guidebooks are now recommending that tourists not visit on Anzac Day but go on other, less busy days instead. There are some who hold the view that perhaps Australians shouldn't be going there at all, or at least should be better informed about the Gallipoli Campaign.

Visiting Gallipoli on Anzac Day has become, amongst other things, a geographical issue. This is because the landscape itself is fragile, and the size of Anzac Cove, some feel, cannot support the number of visitors that descend on the Cove at once on Anzac Day. It is also an issue because people have different points of view. This is often the case in geography and comes about, in part, because people have different reasons for connecting to places.

Source 4.78 Tourists attending the Anzac Day service at Lone Pine cemetery, Gallipoli.

skill**drill**

Interpreting qualitative data about geographical issues and events

Geographers need to consider different points of view, and the reasons behind these different viewpoints, when evaluating a geographical issue or event. They may use qualitative or quantitative data when doing this.

When presented with qualitative data like news pieces, blogs, or research articles, geographers will examine the opinions in these sources, evaluate the sources and the motivation behind them, and analyse the issue or event using this information.

Follow these steps when interpreting qualitative data related to a geographical issue or event.

Step 1 Identify the issue you wish to investigate.

Step 2 Gather the relevant sources of qualitative data.

Step 3 Carefully read each source. Highlight or take note of the following:

- What do you know about the person who expressed this opinion?
- What possible bias may this person have about this issue?
- What is their opinion on this issue?
- What evidence or information do they use to support their opinion?
- Why did they write or publish the piece? For example, were they paid to write it?
- Who is the target audience?
- What result do you think the writer wants? For example, do they want to sway public opinion or change a current practice?
- Is the source reliable?

Step 4 Using your answers to the questions above, examine the motivation behind the piece. Is the person approaching the issue from a historical, economic, cultural or social perspective?

Step 5 Analyse the issue by comparing the different points of view provided in each source. You can ask questions like these to help you do this:

- What are the main points raised about the issue?
- Is there anything that the writers agree on?
- What are the main points on which they disagree?
- How does their perspective (historical, economic, cultural or social) influence their opinion?

Apply the skill

Following the steps provided, examine each of the four following Sources which express different points of view about visiting Gallipoli on Anzac Day.

1. Do you think Virginia Maxwell (see Source 4.79) is writing from a historical, economic, cultural or spiritual perspective? Why do you think this? List your reasons.
2. Describe the issues surrounding visiting Gallipoli in your own words. Use the key concepts of environment and place in your description.
3. Compare the pieces written by Shelley (Source 4.82) and Erin (see Source 4.83) in their blogs.
   a. How do you think a discussion between Erin and Shelley might go if they were to meet? Write a short dialogue based on the conversation they might have about their views on Gallipoli.
   b. With a partner, present your dialogue in a role-play for the class. Be prepared to stay in character and answer questions from your classmates about your feelings on Anzac Day.
4. Why do you think people can have such different points of view about geographical issues? Identify another place you think people might have different viewpoints about and list the possible reasons for this. You could research somewhere like Cronulla Beach in Sydney, for example, or the Franklin River in Tasmania if you are stuck for a place to write about.

Source 4.79

> It's important to remember that this site is just as significant and important for the Turkish people as for the Australians, the New Zealanders and the British. Visitors who come at other times than on Anzac Day get a much better chance to do some quiet reflection, get the full historical context from the tour guides and get the Turkish perspective on the battle as well. This is something that you won't get on a crowded overnight package trip from Istanbul, which is how most people end up seeing the site. It's also easier to find accommodation at other times, and avoids damage to the park, which is fragile.
>
> Virginia Maxwell, co-author of the *Lonely Planet: Turkey* guide

Source 4.80

Instead of commemorating the heroism of Australian soldiers who landed on that fatal shore in 1915, the conference in October concluded that Australians should reframe the landing as an unmitigated disaster and apologise to the Turkish Government for invading their country.

'The landing was nothing but an unjustified invasion of foreign soil like the British invasion of Aboriginal land in 1788,' says John Lack of the University of Melbourne. 'And we should put the two coves together – Sydney Cove and Anzac Cove – because both invasions were just as bad as each other and cost a lot of lives.'…

John McQuilton of Wollongong University says Australians should look at the story of Gallipoli from the Turkish angle to see how they feel about it, a view that has been neglected for too long. The Turks lost 86 000 soldiers compared with Australia's 8709. 'It is now time to embrace our old enemy Turkey,' he says. ….

McQuilton says Australians should stop going to Gallipoli and claiming rights over Turkish soil for their commemorative activities. 'This land belongs to Turkey and the reason they are building so many memorials of their own is they want it back,' he says.

'Charge of the rewrite brigade,' by Jonathan King
http://www.battleforaustralia.org/battaust/AustInvasion/References/Stanley_on_Gallipoli.html

Source 4.82

We will never forget. The journey that we were privileged to experience on the Gallipoli peninsula was incredible! A journey of both heart-gripping and breathtaking emotions as well as a surreal pilgrimage; a tiny glimpse of what the Anzacs went through on the 25th April, 1915. …

We embarked on a 5-day tour with Top Deck, discovering a quick peek of Istanbul and Gallipoli. … it's fair to say that we left our hearts on the shores of the Gallipoli National Park, with the many remaining there. Men of bravery, men of obedience, and men, who courageously and heroically left family, loved ones and their country behind.

… if you ever do get a chance to go to Gallipoli, especially over Anzac day, I would highly recommend it, as it really is (as cliché as it sounds) a life-changing experience.

It was an honour and an eye-opening adventure to be able to stand in the place where thousands had been laid to rest. What a memory to carry. We all walked out of the experience, knowing that we will never think of Anzac day the same. Lest we forget.

Shelley, attended the Anzac Day service, Gallipoli, 2013
http://thesharechair.blogspot.com.au/2013/05/Anzac-day-gallipoli-lest-we-forget.html

Source 4.81 For many tourists, a visit to Gallipoli at a quiet time allows them to connect more closely with this place.

Source 4.83

I have had this rant to all of my mates who go to Gallipoli for Anzac Day.

It is a problem when Anzac Day starts to resemble the Big Day Out. There are the bogans draped in the Aussie flags who have been up all night. There are the stages, the microphones, the cameras, the celebrities, the spotlights, the lead up that could confuse the upcoming rendition of the 'Last Post' with an upcoming rock band. There are the people who have fought online and forked out hundreds for tickets. And now, there will even be ballots.

Erin, in her blog 'Lessons for the 20s something wanderer'
http://lessonsforthe20somethingwanderer.blogspot.com.au/2013/04/lesson-28-why-im-not-at-gallipoli.html#!/2013/04/lesson-28-why-im-not-at-gallipoli.html

Extend your understanding

1. Research the environmental impact that visitors are having at Gallipoli, and the ways in which local authorities are responding. Present your findings in a short written report.
2. Design a code of behaviour for visitors attending Anzac Day services at Gallipoli, to help them minimise their impact on the environment.
3. Write a few paragraphs or a short speech about attending Anzac Day services at Gallipoli, framing your viewpoint from a single perspective (historical, economic, cultural or spiritual). For example, you might write your piece from the economic perspective of a tour bus operator to Gallipoli.

Source 4.84 View of soldiers attacking during the final days of the Gallipoli Campaign in 1915.

glossary

A

acid rain rainfall that has been affected by pollution so much that it becomes acidic, and in turn harms the environment

Agricultural Revolution, the a period of gradual change to the agricultural system that began in Britain in the 18th century, and included the introduction of new techniques and machinery in farming

annotate to add notes which explain, comment or clarify

aquifer an underground water supply consisting of a layer of rock or other permeable materials that contains water

arable a word used to describe land that is suitable for growing crops

armed conflict war between different countries, or civil war between groups within a single country

B

bar graph a graph that shows information as a series of horizontal bars

biodiversity the variety of living organisms on the planet

biome a large area of the Earth that is home to similar plant and animal communities that are adapted to that particular environment; e.g. desert or forest

biofuel a fuel that is produced directly from a living or recently living organism such as plant or animal waste

biodiversity the variety of life in a particular area or biome

BOLTSS a mnemonic (memory device) for remembering the essentials of a map: border, orientation, legend, title, scale and source

boreal refers to the north, or the northern regions

boreal forest the coniferous forest biome, dominated by fir, spruce and pine trees

C

calorie a unit used to measure the energy in food

cartogram a map that is distorted to show a representation of a value rather than land area

change a key concept in geography: the dynamic nature of all processes on Earth, whether slow or fast, small or large

choropleth map a map that shows particular data or characteristics, such as population density, by shading regions in variations of one colour (e.g. light green through to dark green)

climate change long-term significant change in the Earth's weather, including variations in rainfall and wind patterns, regional changes, and particularly the increased average atmospheric temperature

climate graph a combination bar and line graph that shows the rainfall and temperature of a given place; also known as a climograph

compass bearings a precise way of giving compass directions, such as 1350 south-east

complex map a type of map that contains more than one set of information

compound column graph a column graph that has sub-divided columns for further comparison

coniferous relates to trees or shrubs that bear cones and have needle-like leaves, like pine trees

coniferous forest a type of forest comprised of conifer trees, sometimes called a boreal forest

conservation agriculture a type of agriculture that uses farming methods that seek to cause minimum disturbance to the natural environment, conserve resources and complement natural processes

contour lines lines drawn on a map that connect points at the same height to show the height and steepness of land

CSIRO Commonwealth Scientific and Industrial Research Organisation, Australia's national science agency

cultural (adjective) relating to the shared characteristics of a group of people

cultural erosion the process of gradual loss of traditions, language and way of life of a country, community or society

D

deforestation the cutting down of trees and other plant life in a forest

desert a dry region of the Earth with little vegetation or rainfall, but experiencing extreme temperatures

desertification the transformation of fertile land into relatively dry desert areas

developed country an industrialised country with a well-developed economy capable of supporting its own people

developing country a non-industrialised country with a lower living standard, and lower Human Development Index ranking than other countries

direction a way of orienting a map, usually shown by the use of compass points, such as north

digital divide the unequal levels of access that people in different countries have to communication technologies like the Internet and mobile network coverage

digital terrain model topographic illustration that uses digital data to create a side view of the elevation of an area

dot distribution map a map using dots or other shapes to show the location of a particular feature

E

easting the lines that run vertically on a topographical map

economic (adjective) relating to employment, income and trade

ecosystem abbreviation for 'ecological system', a complex community made up of living organisms that interact with each other and with their environment

ecosystem services the important benefits that healthy ecosystems provide to humans; includes the service of providing (e.g. food and water) and regulating (e.g. purifying air and water)

ecotourism a form of tourism that involves visiting a natural environment with the aim of observing, experiencing and learning about it while conserving and supporting the environment and its inhabitants

endangered species a species at risk of becoming extinct

e-waste discarded electronic equipment, such as computers, tablets and mobile phones that are no longer wanted

extraction the process of taking raw materials from the Earth; includes activities such as mining

environment a key concept in geography: a specific place on Earth and all the things, both animate and inanimate, that are there

erosion the wearing away of the Earth's surface by wind, water or ice

ethnicity the background, nationality or culture of a person or group of people

extensive farming a type of farming that requires large areas of land, for example dairy farming, which needs to provide grazing land for cattle

F

false colour image an image that uses colours that are different or more exaggerated than those which occur naturally, in order to make it easier to interpret

famine widespread shortage of food

fertility rate the average number of children women in a particular area or country will have throughout the course of their lives

fieldwork geographical study on location of the site of inquiry

flow diagram a diagram that shows the movement sequence or stages in a process

flow map a map that shows movement (such as people or goods) from one place to another

food accessibility having physical and economic access to enough food that can be reached by those who need it

food availability the state of people having enough food of appropriate quality consistently available

food insecurity a state where not everyone has consistent access to enough safe nutritious food to sustain a healthy life; the opposite of the state of food security

food loss the reduction in the amount of food from where it is produced to where it reaches the consumer

food miles a term used to describe the estimated distance food travels from its site of growth or production to the consumer

food security a state where all people at all times have access to enough safe nutritious food to sustain a healthy life

food waste food that is thrown out by a retailer or consumer

fossil fuel fuel that is made from the organic remains of organisms that have been dead for a long time

G

genetic modification a process by which scientists can change the genes of plants and animals to give them certain desirable traits

geographic diagram a simplified drawing of the real world

Geographic Information System (GIS) a map plus database system for navigation and information collection

geographic photograph a photograph that is taken to depict a place or particular feature of the landscape for the purpose of demonstrating an aspect that is being studied

geographic sketch a sketch focusing on those parts of the environment relevant to the geographic study; often completed in the field but sometimes from a photograph

Global Positioning System (GPS) a device that uses satellites to accurately pinpoint the location of a car or phone, and then utilises data in the form of a digital map to help us find our way around

global trade the buying and selling of goods, services, produce and capital between countries or territories across international borders

global warming the gradual rise in the overall atmospheric temperature of the Earth, believed to be caused by increased levels of certain greenhouse gases in the atmosphere

globalisation the increasing interconnection between countries, including economic, political and cultural exchange between countries all over the world

grasslands a biome of wide open spaces, where the vegetation is dominated by grasses; sometimes called a prairie, steppe or savannah

Green Revolution, the a period of research, development and alteration of agricultural techniques that took place between the 1940s and 1960s, most markedly in the developing world, which saw global increased agricultural production

greenhouse gas a gas in the atmosphere, such as carbon dioxide, that traps heat in the Earth's atmosphere

Gross Domestic Product (GDP) the total monetary value of all the goods and services produced by a country over a specific time period (usually a year)

ground level photograph a photograph that is taken when the camera lens is level with the ground

H

historical (adjective) relating to past experiences and events

horizons layers that are formed in soil over time due to the gradual breaking down of rock into finer particles

hot spot a point not on a plate boundary where there is tectonic activity

hub and spoke a diagram or model in which information is arranged in a format shaped like a wheel, with the hub as the centre

Human Development Index (HDI) a tool developed by the United Nations to grade and rank the social and economic development of the world's countries

I

Industrial Revolution, the a period of major socioeconomic change during the late 1700s and early 1800s, where agricultural and other manufacturing processes were revolutionised by the use of machinery

infrastructure the components necessary for any business or city, such as buildings, electricity, roads, airports and water supply

intensive farming a kind of farming that can supply large volumes of produce in a relatively small area, for example poultry or vegetable farms

interconnection a key concept in geography: the relationship between all things, both animate and inanimate, and all processes, both natural and human

Internally Displaced Person (IDP) someone who has been forced to relocate within his or her own country

invasive species a plant, animal or other organism that is not native to an area, and whose introduction has negative effects on its new environment

irrigation the artificial supply of water to dry land to help in the growing of crops

landfill the method of disposing of rubbish by burying it; a place where rubbish is buried

leaching the draining away or removal of soluble substances

levee a floodbank or embankment that has been built to divert the flow of water or stop it overflowing

life expectancy the average number of years someone can expect to live based on statistics

line graph a graph that displays data as a line

lineal pattern a pattern with its features appearing in a rough line

location where things are located on the Earth's surface

M

map a simplified plan of an area shown from directly above the area

mental map a map that we keep in our heads, usually of our local area or places we are very familiar with, that allows us to navigate without a phone, GPS or hard-copy map

mountain vegetation vegetation that grows on the colder slopes of mountainsides

mulch decaying organic material such as leaves or compost that is spread over soil to insulate it and keep it warm and moist

multinational company a company that operates in more than one country

N

natural regeneration a form of permaculture that allows continuous growth of trees on farmland, whereby the natural process of replacement or re-establishment of plants is encouraged

O

oblique aerial photograph a photograph taken from an airplane (or similar aircraft) where the camera is at an angle to the Earth's surface

organisation how and why things are arranged and managed on the Earth's surface by people

over-farming the process of growing the same crop or harvesting the same product (such as fish) in the same location year after year until the soil or water is depleted to such an extent that it can no longer provide the resource

overlay map a map on some type of transparent paper or layer that is placed over a base map, used to show the relationship between features or evens on the Earth's surface

P

permaculture the growing of a garden or maintenance of an ecosystem that uses the natural systems and resources of plants and animals to sustain itself, without harming the environment

physical map a map that shows the locations and names of physical features of the Earth, such as mountains and rivers

place a key concept in geography: a part of the Earth's surface that is identified and given meaning by people

polar land very cold region that surrounds either the North or South Pole

political map a map that shows the locations and names of built features of the Earth, such as cities, roads, dams and railways

population density the population of a human habitat in terms of individuals per unit area (e.g. 1500 people per square kilometer)

population pyramid a graph that displays the population of males and females in a region by age-group

prairie a biome of wide open spaces, where the vegetation is dominated by grasses; sometimes referred to as grasslands, steppe or savanna

precision farming system of farming that adapts modern technology to analyse aspects of the environment to bring out better economic and environmental outcomes

primary data data collected for a geographical inquiry by a person conducting an inquiry, such as survey data, hand-drawn maps or photographs

Q

qualitative data any information that can be recorded in words, for example, Uluru is very large

quantitative data any information that can be recorded as numbers, for example, Uluru is 3.6 kilometres long

R

radial pattern a pattern with its features spreading out like spokes on a wheel

rainfed agriculture that relies on rainfall for water

rainforest dense forest areas found in tropical areas with warm temperatures and heavy rainfall

raw material the basic organic resources from which things are made; often refers to the Earth's natural materials such as oil, wood, and water

refugee a person who moves to another country because of a natural disaster or to avoid persecution

reliability the confirmation that information is from a reputable, trustworthy source that can be verified as legitimate and accurate

S

salinity the amount of salt content in the soil

satellite image image of a place taken from satellites orbiting above the Earth's surface

savanna a biome of wide open spaces, where the vegetation is dominated by grasses; sometimes called a prairie, steppe or grasslands

scale a key concept in geography: the level at which a geographical inquiry takes place – personal, local, regional, national or global

scale (mapping) a line that indicates the distances on a map as represented in the real world

scatter plot a graph that shows two sets of data by plotted points along two axes, the pattern of which shows their correlation; sometimes called a scatter graph or scattergram

secondary data data collected for a geographical inquiry from another source, such as textbooks, atlases and government websites

sediment solid particles that sink and settle at the bottom of water

silt fine sand rock, sand or clay particles that are carried by water and then deposited in another location

soil degradation the deterioration of soil condition caused by human activity, which results in a lowering of its levels of nutrients, quality and productivity

space a key concept in geography: the way things are arranged on the Earth's surface

spatial distribution the shapes and patterns in which things are arranged on the Earth's surface

spiritual (adjective) relating to a person's beliefs

spit a curved build-up of eroded material that forms at the mouth of a river

steppe a biome of wide open spaces, where the vegetation is dominated by grasses; sometimes called a prairie, savanna or grasslands

subsistence farming type of farming whereby the yield of crops grown or raised by a farmer are just enough to cover their household needs

suburb an area beyond a city centre, with medium-density housing

supply chain the stages through which a product journeys, from its source to the consumer and finally its place of disposal

sustainability a key concept in geography: the ongoing capacity of Earth to maintain all life

T

tailing the build-up of residue or waste products in water from the mining process; fine particles of sedimentary waste suspended in water

tariff a tax or payment that a government places on imports or exports of a particular type of product or produce; used to restrict or control trade between countries

tectonic plate one of the immense, slowly moving pieces that make up the Earth's surface and carry the continents and oceans

temperate forest a large forest biome that experiences a range of seasonal climate conditions; lies between the tropics and the polar regions

terracing the process of cutting 'steps' into sloping land to make flat sections

thematic map a map that shows details about a particular topic, such as land use or the distribution of resources

topographic map a map that shows the shape of the land, its relief and landforms

tropical forest a biome that lies between the Tropic of Capricorn and the Tropic of Cancer, which has high regular rainfall, high average temperatures and a high level of biodiversity

tundra a biome that is characterised by having a vast, treeless environment across the Arctic region of Asia, Europe and North America

U

undernourished the state of not having enough food to develop or function adequately

upland rice growing the practice of growing rice on hillsides or mountainsides

urban descriptive of a city or town

urban sprawl the growth of a city onto productive farming land on the city fringes

V

vertical aerial photograph photo taken from an aircraft in which the camera is pointed directly at (perpendicular to) the ground

W

water scarcity the lack of sufficient water to supply the needs of an area

water table the surface underground below which the ground is completely saturated with water

weather map a map that shows conditions in the Earth's atmosphere, such as air pressure, wind speed, wind direction, and warm and cold fronts

weathering wearing away by exposure to the Earth's elements

index

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acknowledgements

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notes

A teenage boy in Uganda helps out on a banana plantation south-west of the capital Kampala. A number of diseases and pests have devastated banana production in Uganda over recent years prompting the government to make a controversial decision to relax bans on growing genetically modified bananas. On average, a typical adult in Uganda eats at least three times their body weight in bananas each year – more than any other nation on Earth. As a result, bananas are vital to food security there.

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