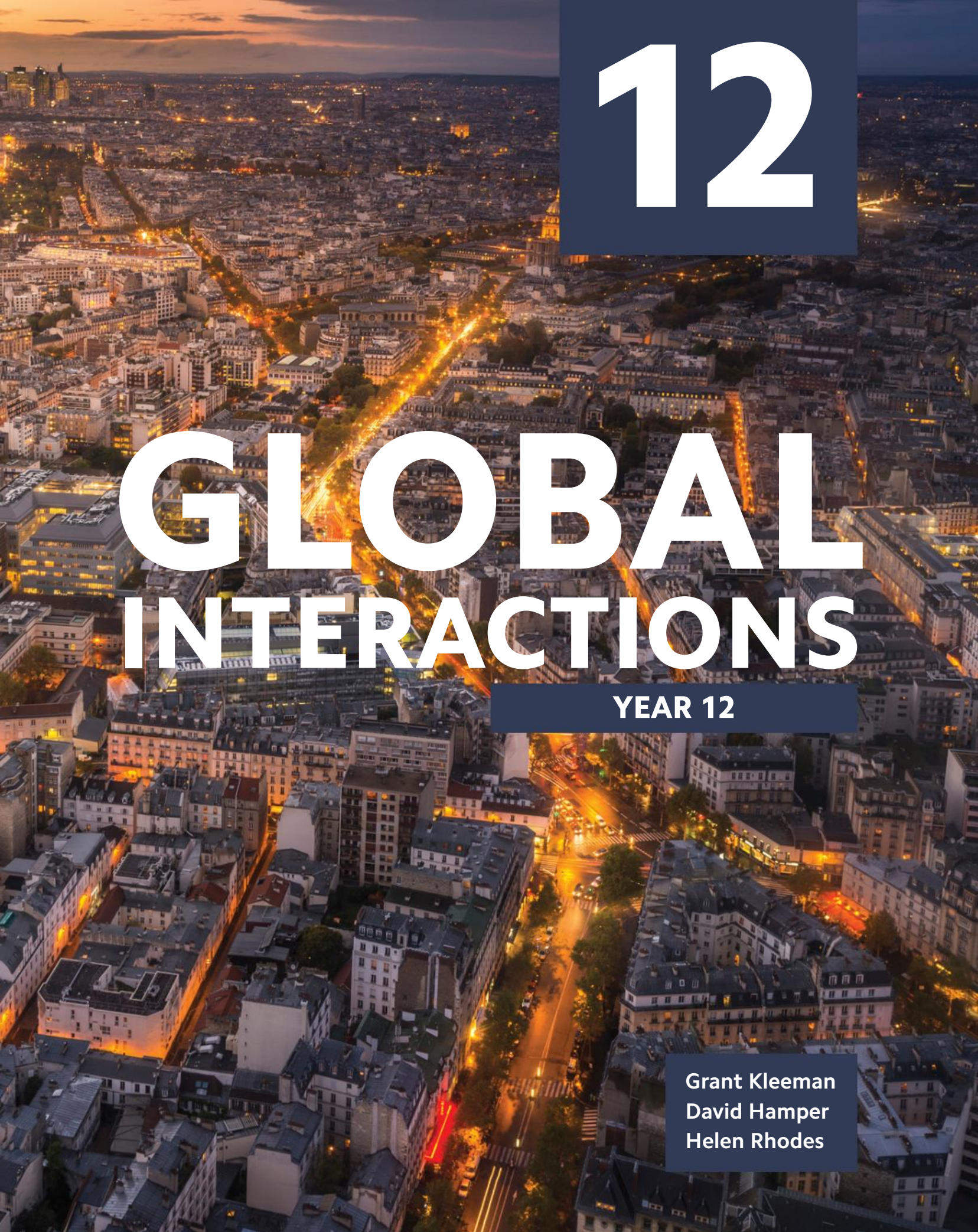


12

GLOBAL INTERACTIONS

YEAR 12

Grant Kleeman
David Hamper
Helen Rhodes

12

GLOBAL INTERACTIONS

YEAR 12

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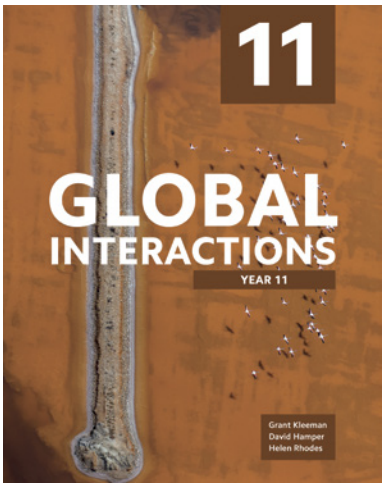
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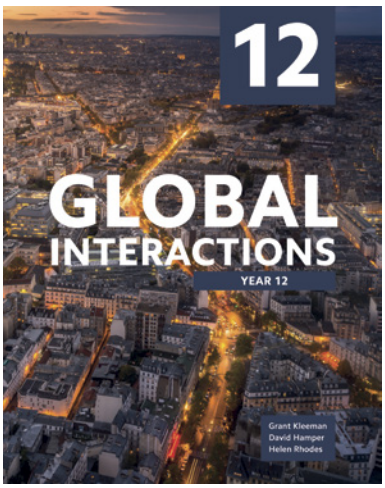
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Contents

How to use vi

SECTION 1 Ecosystems 1

CHAPTER 1
Ecosystems at risk 2

1.1 Ecosystems and their functioning 4
1.2 Factors affecting the functioning of ecosystems . . . 12
1.3 Vulnerability and resilience of ecosystems 16
CASE STUDY Natural and human-induced stress 22
1.4 Human-induced modifications to ecosystems 25
1.5 Ecosystem management and reasons for protection 31
1.6 Management strategies 37
CASE STUDY Indigenous management strategies 45
Exam-style questions and Glossary 47

CHAPTER 2
Coastal dunes 48

2.1 Nature and spatial distribution 50
2.2 Interactions within the biophysical environment 52
2.3 Nature and rate of change in coastal dune ecosystems 62
2.4 Human impacts on coastal dune ecosystems 65
2.5 Traditional and contemporary management practices 70
Exam-style questions and Glossary 75

CHAPTER 3
The Great Barrier Reef 76

3.1 Spatial patterns and biophysical interactions 78
3.2 Nature and rate of change 85
3.3 Traditional and contemporary management practices 91
Exam-style questions and Glossary 97

SECTION 2 Urban places 98

CHAPTER 4
World cities 100

4.1 Urbanisation 102
4.2 World cities 107
CASE STUDY World cities as centres of cultural authority 117
CASE STUDY Australia's world cities 118
4.3 London: a world city 119
4.4 Regional centres and small towns 122
CASE STUDY Dubbo 124
Exam-style questions and Glossary 125

CHAPTER 5
Megacities of the developing world 126

5.1 Megacities: character and distribution 128
5.2 Megacity challenges: employment 130
CASE STUDY Bangladesh 132
CASE STUDY Carpets, matchsticks and beaded garments: a story of exploited child labour 134
5.3 Megacity challenges: housing 135
CASE STUDY Favelas of Rio de Janeiro, Brazil 138
5.4 Megacity challenges: infrastructure 139
CASE STUDY India 144
5.5 Megacity challenges: health and wellbeing 146
5.6 Responses to challenges 149
5.7 Mexico City: a megacity 151
Exam-style questions and Glossary 161

CHAPTER 6
Urban dynamics 162

6.1 Suburbanisation 164
CASE STUDY Suburbinsation: the American experience . . 169

6.2 Exurbanisation 170
6.3 Counter-urbanisation and decentralisation 172
6.4 Urban decay and renewal. 177
CASE STUDY Sydney: examples of urban renewal 180
CASE STUDY Urban decline in Baltimore. 183
6.5 Urban consolidation 185
6.6 Urban villages. 193
6.7 Spatial exclusion and fortified suburbs 196
6.8 **Fieldwork:** Investigating an urban dynamic 199
Exam-style questions and Glossary 201

CHAPTER 7
Sydney: a global city **202**

7.1 Sydney: physical setting and development. 204
7.2 Changing economic character 211
7.3 Changing nature and location of industrial land uses 214
CASE STUDY Sydney's global economic corridor 217
7.4 Impacts of economic change: Sydney's retail sector 219
CASE STUDY The revival in inner-city retailing 223
7.5 Changing nature and location of residential land 225
7.6 The morphology of Sydney's residential lands . . 232
7.7 Processes shaping social geography 237
7.8 Spatial patterns: advantage and disadvantage. . 243
7.9 Spatial patterns: ethnicity, religion and identity . . 248
7.10 Culture of place 256
7.11 Sydney's future growth and development. 259
CASE STUDY Western Sydney 272
CASE STUDY Protecting the biophysical and built environments 274
Exam-style questions and Glossary 275

SECTION 3
People and economic activity 276

CHAPTER 8
Global tourism **278**

8.1 The nature of tourism 280
8.2 The global pattern of tourism. 284
8.3 Factors affecting tourism. 288
8.4 Tourism: production and consumption 296
8.5 Tourism: changing production processes 297
CASE STUDY Surge in Chinese tourism 299
8.6 Tourism: changing consumption patterns. 300
8.7 Tourism: ownership, decision-making and control . 303
8.8 Tourism: technological change. 308
8.9 Tourism: political and economic factors 313
CASE STUDY Ecotourism. 317
8.10 Tourism: the issues 319
8.11 The future of tourism. 323
Exam-style questions and Glossary 327

CHAPTER 9
Local tourism: Perisher Ski Resort **328**

9.1 The nature of the economic enterprise 330
9.2 Locational factors 335
9.3 Ecological dimensions. 339
9.4 Internal and external linkages and flows 345
CASE STUDY Snowmaking 351
9.5 Effects of global changes 353
Exam-style questions and Glossary 355

CHAPTER 10
The global viticulture and winemaking industry **356**

10.1 Nature, spatial patterns and future directions . . . 358
CASE STUDY New World and Old World wines 366
10.2 Factors affecting the nature and spacial patterns. 368
10.3 Changing economic factors. 374
CASE STUDY The Australian wine industry 383
10.4 Environmental, social and economic impacts. . . 387
Exam-style questions and Glossary 393

CHAPTER 11
The local winemaking industry: First Creek Wines **394**

11.1 The nature of the economic enterprise 396
11.2 Locational factors 399
11.3 Ecological factors 406
11.4 Internal and external linkages and flows 410
11.5 Effects of global changes on the enterprise 414
Exam-style questions and Glossary 415

Index 416
Acknowledgements 422

How to use

Case studies

Case study units relate to a specific event or location; and are written to extend students' knowledge and understanding.



CASE STUDY

Natural and human-induced stress

The following are examples of either natural or human-induced environmental stress.

Mt St Helens eruptions

In 1980, Mt St Helens (see Figure 1.3.8 A) had been dormant for over a century, in April–May scientists had become concerned about tremors beneath the mountain. Aerial observers had noted an opening on the summit of Mt St Helens where ice quickly blackened with ash. What caused most concern was the development of a bulge on the side of the mountain's northern slope.

On 18 May at 8.32 a.m., an earthquake measuring 5.1 on the Richter Scale rocked the earth directly below the mountain. The earthquake initiated an avalanche, which was followed by a massive blast of gas, rock, ash and ice shown in Figure 1.3.8 B. One part of the avalanche slammed into Spirit Lake, causing the water level to rise 60 metres. Another mass of debris crashed down into the Toutle River, filling it to a depth of 45 metres in minutes.

The effects on the surrounding ecosystem were devastating:

- 120 metres of the summit vanished, leaving in its place a crater 2 kilometres wide, 4 kilometres long and 1.5 kilometres deep, as seen in Figure 1.3.8 C.
- 380 square kilometres of land to the north of the mountain was devastated by the blast and covered by hot volcanic debris
- large areas of coniferous forest were destroyed (see Figure 1.3.9) and countless numbers of wild animals were killed
- volcanic ash, carried by the prevailing winds, was spread for 1500 kilometres to the west
- 100 people lost their lives.

Within just a few years of the eruption scientists found evidence that pioneering flora and fauna were starting to colonise the ash-grey volcanic landscape seen in Figure 1.3.10. Plants such as lupin, Indian paintbrush, pearly everlasting and fireweed took root among the coarse grey rock. Willow and elder trees had grown to a height of 1–2 metres. The roots and decaying leaves and stems of the vegetation provided the organic material needed to convert volcanic grit into sustaining soil.

The plants and trees had adapted to the extremes of season and altitude, and were equipped to stake a claim in the harsh conditions. Lupins played a key role; bacteria on their roots released nitrogen, necessary to all plants. Alders produced winged seeds that could ride the wind. Birds and animals helped the process by eating, transporting and depositing seeds in their droppings. Burrowing gophers penetrated the ash blanket and brought former topsoil to the surface.

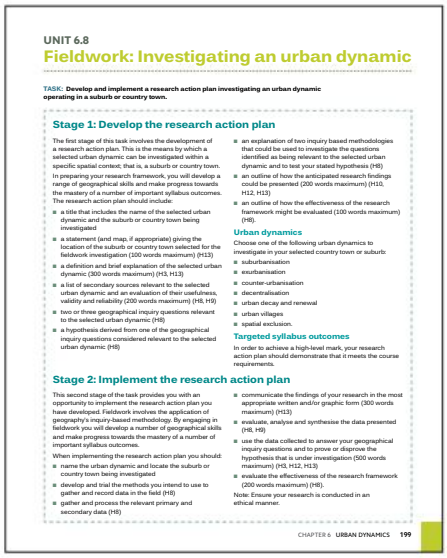
1.3.8 The Mt St Helens eruption was a source of natural stress. **A** Mt St Helens prior to the eruption, **B** Mt St Helens erupting, **C** Mt St Helens following the eruption.

The area represents a miniature fast-forward version of what happened over vast time frames in our planet's evolution. Scientists have enjoyed an unparalleled opportunity to observe the cycles of regeneration.

22 GLOBAL INTERACTIONS 2

Fieldwork

The fieldwork section provides a step-by-step guide to undertaking and evaluating fieldwork.



UNIT 6.8

Fieldwork: Investigating an urban dynamic

TASK: Develop and implement a research action plan investigating an urban dynamic operating in a suburb or country town.

Stage 1: Develop the research action plan

The first stage of this task involves the development of a research action plan. This is the means by which a selected urban dynamic can be investigated within a specific spatial context; that is, a suburb or country town.

In preparing your research framework, you will develop a range of geographical skills and make progress towards the mastery of a number of important syllabus outcomes. The research action plan should include:

- a title that includes the name of the selected urban dynamic and the suburb or country town being investigated
- a statement (and map, if appropriate) giving the location of the suburb or country town selected for the fieldwork investigation (200 words maximum) (H13)
- a definition and brief explanation of the selected urban dynamic (300 words maximum) (H3, H13)
- a list of secondary sources relevant to the selected urban dynamic and an evaluation of their usefulness, validity and reliability (200 words maximum) (H8, H9)
- two or three geographical inquiry questions relevant to the selected urban dynamic (H8)
- a hypothesis derived from one of the geographical inquiry questions considered relevant to the selected urban dynamic (H8)
- an explanation of two inquiry based methodologies that could be used to investigate the questions identified as being relevant to the selected urban dynamic and to test your stated hypothesis (H8)
- an outline of how the anticipated research findings could be presented (200 words maximum) (H10, H12, H13)
- an outline of how the effectiveness of the research framework might be evaluated (100 words maximum) (H8).

Urban dynamics

Choose one of the following urban dynamics to investigate in your selected country town or suburb:

- suburbanisation
- exurbanisation
- counter-urbanisation
- decentralisation
- urban decay and renewal
- urban villages
- spatial exclusion.

Targeted syllabus outcomes

In order to achieve a high-level mark, your research action plan should demonstrate that it meets the course requirements.

Stage 2: Implement the research action plan

This second stage of the task provides you with an opportunity to implement the research action plan you have developed. Fieldwork involves the application of geography's inquiry-based methodology. By engaging in fieldwork you will develop a number of geographical skills and make progress towards the mastery of a number of important syllabus outcomes.

When implementing the research action plan you should:

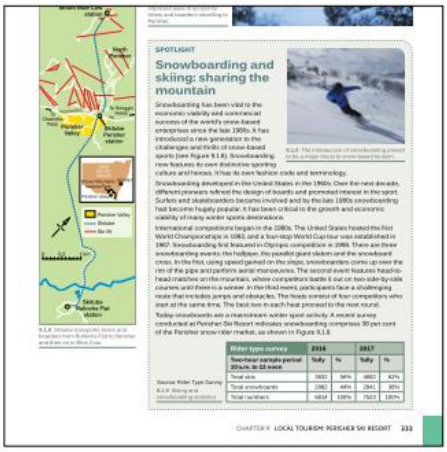
- name the urban dynamic and locate the suburb or country town being investigated
- develop and trial the methods you intend to use to gather and record data in the field (H9)
- gather and process the relevant primary and secondary data (H8)
- communicate the findings of your research in the most appropriate written and/or graphic form (300 words maximum) (H13)
- evaluate, analyse and synthesise the data presented (H8, H9)
- use the data collected to answer your geographical inquiry questions and to prove or disprove the hypothesis that is under investigation (500 words maximum) (H3, H12, H13)
- evaluate the effectiveness of the research framework (200 words maximum) (H8).

Note: Ensure your research is conducted in an ethical manner.

CHAPTER 6 URBAN DYNAMICS 199

Spotlight

Spotlight boxes focus attention on a place, an issue or a concept relating to the unit. They are designed to develop students' knowledge and understanding of the concepts and processes that are central to the study of geography at this stage of learning.



SPOTLIGHT

Snowboarding and skiing: sharing the mountain

CHAPTER 9 LOCAL TOURISM: PERISHER SKI RESORT 333

Exam-style questions

Exam-style questions are a variety of extended responses which enable students to practise and develop their exam skills.



Exam-style questions

Extended responses

- Outline the biophysical interactions that determine the spatial patterns and dimensions of two ecosystems at risk.
- Analyse the biophysical interactions that contribute to the unique characteristics of an ecosystem at risk.
- With reference to at least one ecosystem you have studied, explain the biophysical interactions that led to diverse ecosystems and their functioning.
- Analyse the impacts of human-induced modifications to energy flows, nutrient cycling and relationships between biophysical components of one ecosystem at risk.
- Explain how one ecosystem at risk adjusts in response to natural stress.
- Analyse the human impacts affecting the nature and rate of change of two ecosystems at risk.
- Compare and contrast the impact of humans on two ecosystems at risk.
- Compare and contrast the vulnerability and resilience of two ecosystems at risk.
- Describe the spatial patterns and dimensions of one case study of an ecosystem at risk, and analyse the negative impacts of humans on the ecosystem.
- Analyse the nature and rate of change affecting the functioning of one ecosystem at risk.
- Compare and contrast traditional and contemporary approaches to the management of two ecosystems at risk.
- Evaluate traditional and contemporary approaches to the management and protection of one ecosystem at risk.

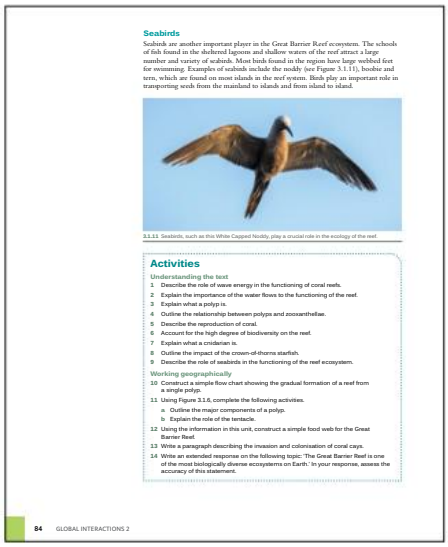
Glossary

accretion the growth of a dune due to the build-up of sand
aeolian transport the movement of material, such as sand, by wind
beach an accumulation of sediment acting as the boundary between the land and sea
beach nourishment the artificial replenishment of beach sand
berm the first component of the dune system; it lies closest to the water's edge and is created by waves piling up sand; sometimes referred to as an incipient dune
blowout the movement of sand inland, often resulting from a disturbance to the dune vegetation
coastal dunes exposed shoreline systems of one or more sand ridges derived from material transported by wind and waves
Coastcare a community based action group that aims to preserve, protect and rehabilitate coastal dune ecosystem
current the flow or movement of a large body of water in an ocean. The movement is caused by prevailing winds, the Earth's rotation and the distribution of the continental land masses
foredune the coastal dune or line of dunes that is found behind the berm; foredunes are subject to erosion and their form and composition are constantly changing; also known as a frontal dune
longshore drift the movement of sediment by currents running parallel to the shore
migrating dune a dune that is created when a blowout is extended by continued destruction of the dune system; they move inland, covering the landscape with sand
parabolic dune a dune created by blowouts; these are dunes that take on a 'U' shape as they move back through the dune system
parallel dunes the lines of dunes that lie behind the foredune; they form in lines that run parallel to the beach; also known as transverse dunes
prevailing wind the most common direction from which the wind blows in a given area
saltation the transportation of particles in a current of wind (or water) by a series of bouncing movements
sand grains of weathered rock, sometimes mixed with crushed shell
series each stage in plant succession as a plant community develops at a particular site
suspension particles of sand carried along by the wind, often well above the ground
swale a trough or depression that develops between two adjacent dunes
washout water washing over the dune system from inland lakes and water courses
wave a movement of energy through water caused by the frictional drag of wind blowing across the surface of a body of water; the development of a wave involves the transfer of energy from the wind to the water's surface

CHAPTER 2 COASTAL DUNES 75

Activities

Activities have been carefully selected to cater for the full range of student abilities. Many activities are based on the stimulus material presented and aim to facilitate the development of the skills used by geographers.



Seabirds

Seabirds are another important player in the Great Barrier Reef ecosystem. The schools of fish found in the sheltered lagoons and shallow waters of the reef attract a large number and variety of seabirds. Most birds found in the region have large webbed feet for swimming. Examples of seabirds include the noddy (see Figure 3.1.11), boobie and tern, which are found on most islands in the reef system. Birds play an important role in transporting seeds from the mainland to islands and from island to island.

3.1.11 Seabirds, such as this White Capped Noddy, play a crucial role in the ecology of the reef.

Activities

Understanding the text

1 Describe the role of wave energy in the functioning of coral reefs.
2 Explain the importance of the water flows to the functioning of the reef.
3 Explain what a polyp is.
4 Outline the relationship between polyps and zooxanthellae.
5 Describe the reproduction of coral.
6 Account for the high degree of biodiversity on the reef.
7 Explain what a cnidarian is.
8 Outline the impact of the crown-of-thorns starfish.
9 Describe the role of seabirds in the functioning of the reef ecosystem.

Working geographically

10 Construct a simple flow chart showing the gradual formation of a reef from a single polyp.
11 Using Figure 3.1.6, complete the following activities.
   a Outline the major components of a polyp.
   b Explain the role of the tentacle.
12 Using the information in this unit, construct a simple food web for the Great Barrier Reef.
13 Write a paragraph describing the invasion and colonisation of coral cays.
14 Write an extended response on the following topic: 'The Great Barrier Reef is one of the most biologically diverse ecosystems on Earth.' In your response, assess the accuracy of this statement.

84 GLOBAL INTERACTIONS 2

Understanding the text

These questions guide students towards an understanding of the content (knowledge and understanding) specified by the syllabus.

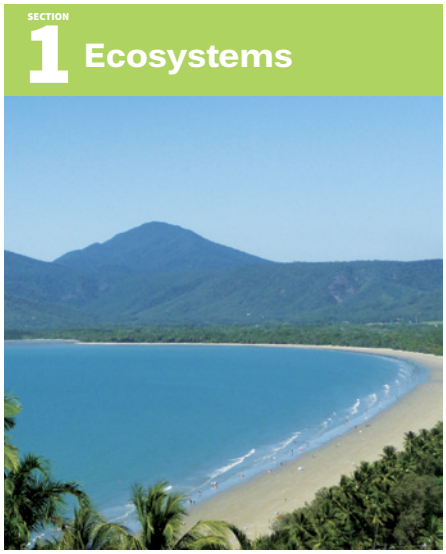
Working geographically

These tasks extend students beyond the text and involve them in a variety of learning experiences.

Using Global Interactions 2: Third Edition

Structure

This text is divided into three sections corresponding with the Stage 6 syllabus.



Section 1: Ecosystems

The focus of this section is a geographical investigation of the functioning of ecosystems at risk, and their management and protection. Students are provided with two case studies:

- coastal dunes
- the Great Barrier Reef.



Section 2: Urban places

The focus of this section is a geographical investigation of world cities, megacities and the urban dynamics of large cities and urban localities. Sydney is used as an example of a developed world city.



Section 3: People and economic activity

This section focuses on a geographical investigation of economic activity integrating local and global contexts. Students can choose from one of the following case studies:

- global tourism
- Perisher Ski Resort
- the global viticulture and winemaking industry
- First Creek Wines.

HSC Course Outcomes matrix

	Syllabus outcomes												
	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13
Section 1: Ecosystems	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Section 2: Urban places	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Section 3: People and economic activity	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

SECTION

1 Ecosystems



All life on Earth depends on the functioning of ecosystems. As a species, humans are unique because they have the ability to destroy whole ecosystems. For the first time in human history we are on the brink of catastrophic environmental change in the form of climate change. If humans fail to act, there is the danger that the Earth's systems will collapse and bring about changes that will radically alter our planet.

However, we also have the capacity to protect and restore ecosystems. Now, more than ever, we need to understand the nature of the interactions taking place within the Earth's biophysical environment so that we can sustainably manage the Earth's ecosystems. To do this, we must better understand the way that ecosystems function and the way they are responding to environmental stress such as climate change.

In this section, we investigate biophysical interactions that lead to diverse ecosystems and their functioning, the vulnerability and resilience of ecosystems, the importance of ecosystem management and protection, as well as the traditional and contemporary strategies used to manage those ecosystems.

Outcomes

Students:

H1 explain the changing nature, spatial patterns and interaction of ecosystems

H2 explain the factors that place ecosystems at risk and the reasons for their protection

H5 evaluate environmental management strategies in terms of ecological sustainability

H6 evaluate the impacts of, and responses of people to, environmental change

H7 justify geographical methods applicable and useful in the workplace, and relevant to a changing world

H8 plan geographical inquiries to analyse and synthesise information from a variety of sources

H9 evaluate geographical information and sources for usefulness, validity and reliability

H10 apply maps, graphs and statistics, photographs and fieldwork to analyse and integrate data in geographical contexts

H11 apply mathematical ideas and techniques to analyse geographical data

H12 explain geographical patterns, processes and future trends through appropriate case studies and illustrative examples

H13 communicate complex geographical information, ideas and issues effectively, using appropriate written and/or oral, cartographic and graphic forms

Overview

In Section 1, the focus is on ecosystems at risk: their functioning, management and protection.

Chapter 1 Ecosystems at risk

Chapter 2 Coastal dunes

Chapter 3 The Great Barrier Reef

Note: students are required to study two ecosystems at risk.



1.0.0 Port Douglas—coastal dunes and rainforests are both ecosystems that may be at risk.

CHAPTER

1 Ecosystems at risk

At the beginning of the twentieth century there were 1.6 billion people on Earth and while pollution and environmental degradation were common, the problems were generally local. Today, the world's population has grown to more than 7.5 billion and the environmental problems resulting from this rapid growth affect the whole planet. Whole ecosystems are at risk and as habitats are destroyed, the species of plants and animals that depend on them become extinct.

The United Nations estimates that by 2050, the world's population will be 9.7 billion and the global economy will be at least five times its present size. To sustainably manage and protect the global environment, its habitats and biological diversity, solutions must be found that address the impacts of population and overuse of natural resources.

Human impact on the biophysical environment is not a recent event. Many indigenous peoples behaved in ways that transformed ecosystems in the past and led to the extinction of species. Such impacts were usually followed by long periods of environmental stability during which the biophysical environment adjusted to human impact. Some experts argue that the Earth's ecosystems are in fact 'human artefacts': ecosystems modified by thousands of years of human use.

> **But man is a part of nature, and his war against nature is inevitably a war against himself.**
>
> **Rachel Carson, *The Silent Spring*, 1962**

1.0.1 Rainforests are one of the most at risk ecosystems on Earth.



UNIT 1.1

Ecosystems and their functioning

Ecology is a science that examines the interactions between organisms and their living (biotic) and non-living (abiotic) environment. The key word in this definition is 'interactions'. Groups of organisms interact with each other and their biophysical environment. Collectively, they form an ecological system or ecosystem. Ecosystems are dynamic; this means that they are constantly changing and adapting.

By identifying characteristic patterns of interaction, it is possible to distinguish different types of ecosystems. An ecosystem is defined as an identifiable system of interdependent relationships between living organisms and their biophysical environment.



1.1.1 Fungi are an example of recyclers that ensure nutrients are returned to an ecosystem.

Ecosystems

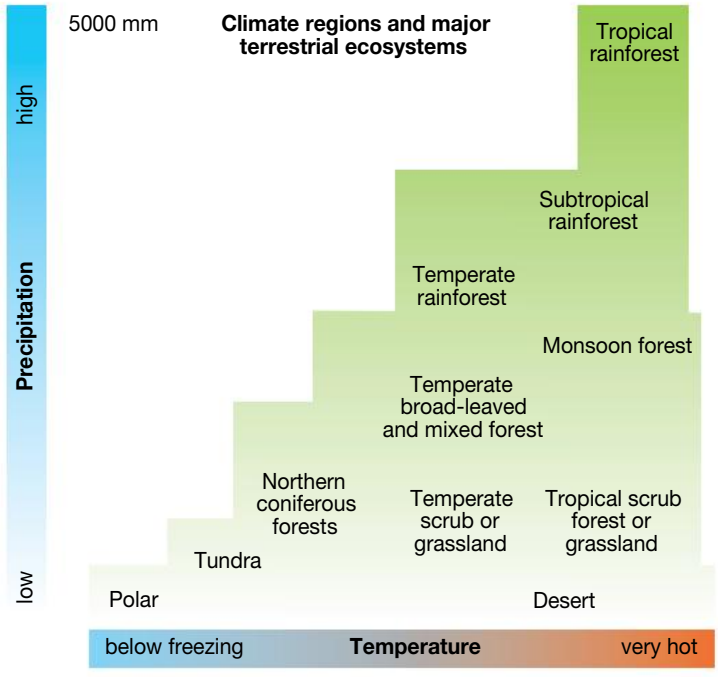
Ecosystems are systems through which incoming solar energy is captured and channelled through a hierarchy of life forms. Each ecosystem has its own characteristic plant and animal community. Plants, both on land and in the sea, convert sunlight (via photosynthesis) into storable—and edible—chemical energy. Animals feed on these plants and on other animals. The quest for food is the central organising principle within ecosystems.

An important feature of each ecosystem is the set of processes by which nutrients are retained and recycled. Living things do not create new matter. Instead, they recycle nutrients obtained from air, soil, water and other organisms, using solar energy to build and maintain themselves. The fungi shown in Figure 1.1.1 are just one example of the process of natural recycling.

Variations in ecosystems

Components of any ecosystem can vary naturally or as a result of human intervention. Each variation will in turn affect other components and processes within the ecosystem. Over time, a small variation or modification may be magnified (increased) throughout the system as a whole. This will make the ecosystem different from any other and/or will make it react in different ways to stimuli.

Environmental conditions vary and there have been substantial fluctuations in environmental conditions over the past 10 000–18 000 years. These changes include variations in the global climate and sea level; for example, until about 10 000 years ago sea levels were considerably lower. The conditions prevailing now have only existed for a relatively short period: 1500 years.



1.1.2 Precipitation and temperature interact to determine the characteristics of an ecosystem. This graph demonstrates the wide variety of ecosystems that result from the various combinations of this relationship.

Classifying ecosystems

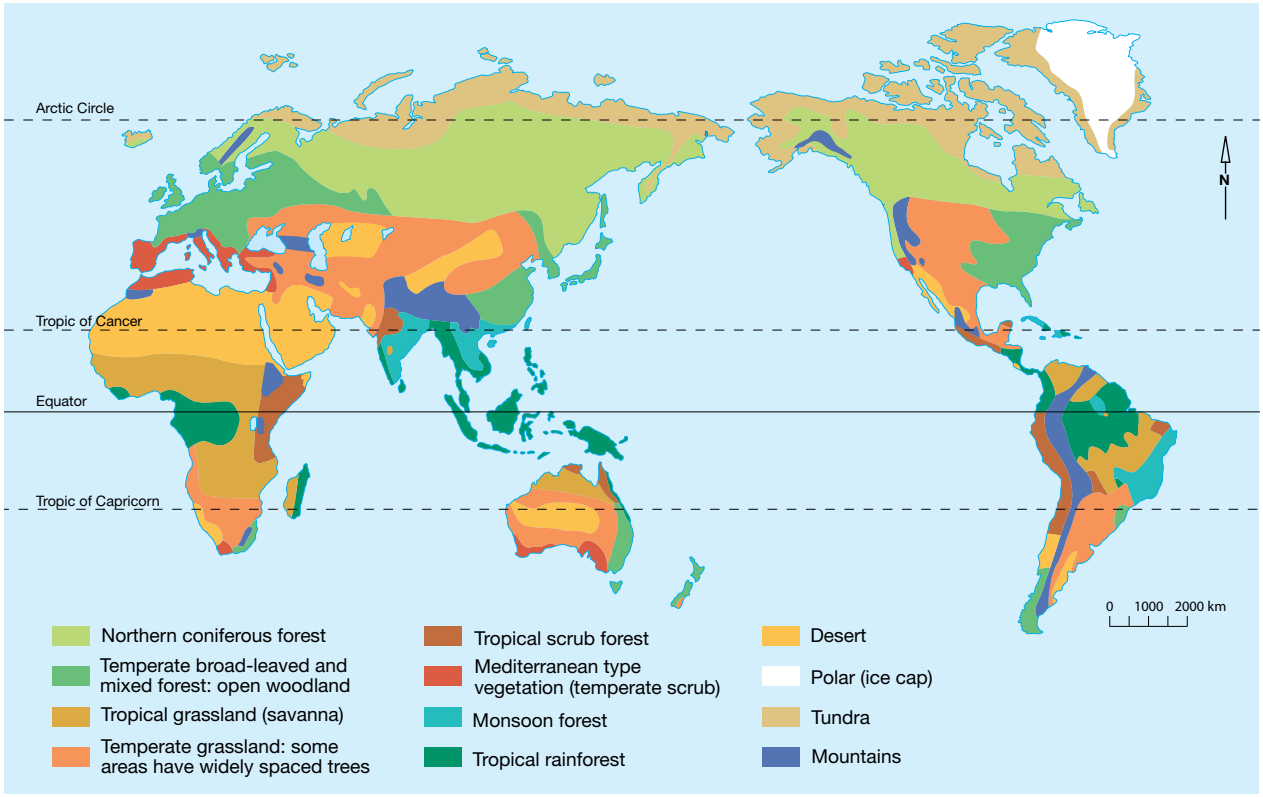
Ecosystems are usually classified according to their dominant feature and are named according to climate (for example, polar ecosystems), physical features (for example, mountain ecosystems) or vegetation (for example, rainforest ecosystems). The smaller the scale of an ecosystem, the more likely it will be named after a physical feature.

Terrestrial ecosystems

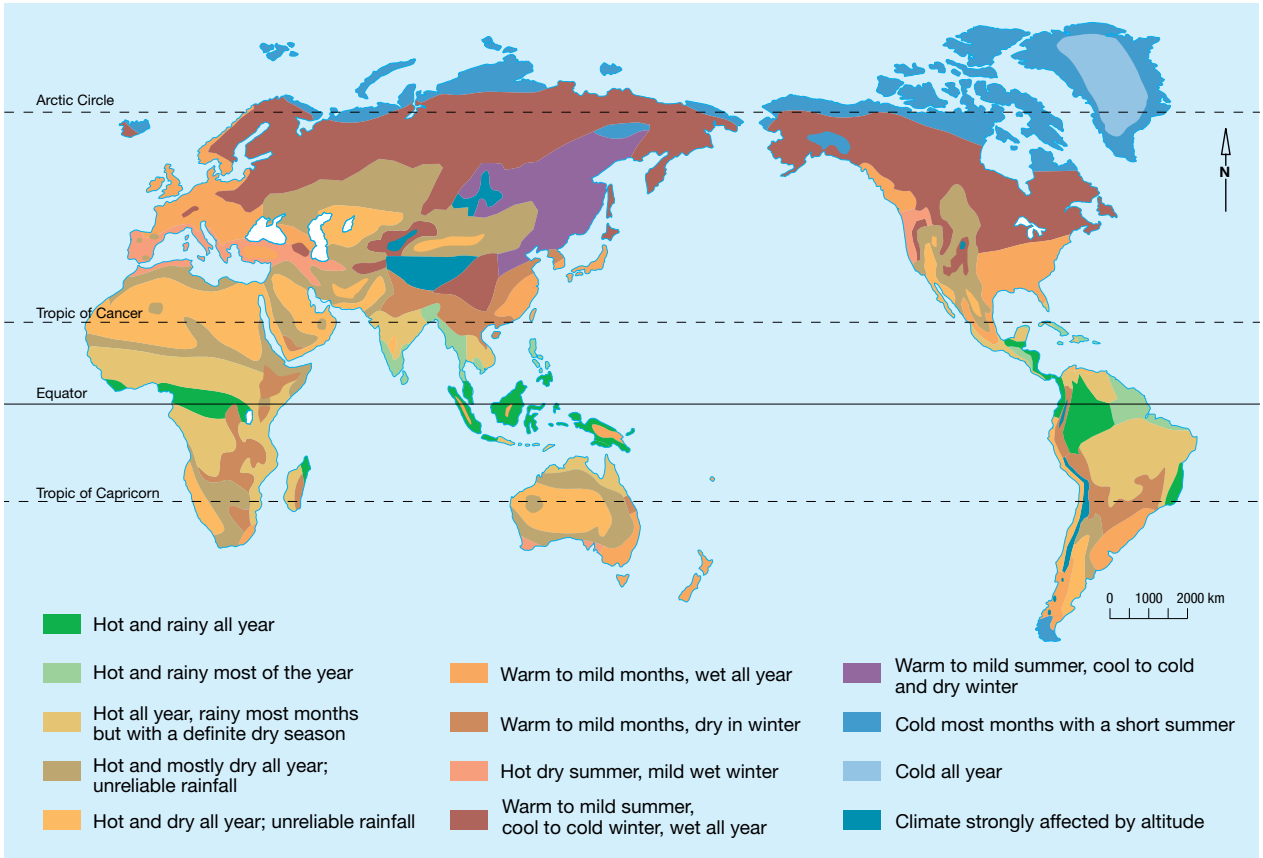
Land-based ecosystems (forests, grasslands and deserts) are called terrestrial ecosystems or biomes. The differences between terrestrial ecosystems arise from variations in average temperature and precipitation, as shown in Figure 1.1.2.

Location of terrestrial ecosystems

The location of terrestrial ecosystems is closely linked to world climate patters as shown in Figures 1.1.3 and 1.1.4.



1.1.3 The world's major terrestrial ecosystems



1.1.4 Worldwide climatic patterns

Characteristics of terrestrial ecosystems

The characteristics of the major terrestrial ecosystems are outlined in Figure 1.1.5.

Characteristics of major terrestrial ecosystems	
Ecosystem	**Characteristics**
Polar	■ Permanent ice cap, in places up to 5 km deep ■ No plant growth; no animal life away from coast
Tundra	■ Covered with ice and snow for much of the year; permanently frozen subsoil; 1–3 month growing season ■ Treeless; shrubby or mat-like vegetation ■ Most extensive in Northern Hemisphere
Northern coniferous forest (taiga)	■ Long winters with a thick cover of snow; short summers but with long, often warm days ■ 3–4 month growing season ■ Dominated by conifer trees; thick layer of needles on the ground ■ Occurs on large continental landmasses
Temperate grassland	■ Erratic rainfall; fires occur ■ Dominated by grasses and annuals (plants that complete their life cycle and set seed within a single growing season) ■ Often exploited for grazing sheep and cattle
Temperate broad-leaved and mixed forest	■ Warm, mild growing season that varies with latitude; moderate precipitation evenly distributed throughout year; large seasonal differences and changes in day length; rich topsoil ■ Some trees evergreen, some deciduous; well-developed understorey
Mediterranean-type vegetation	■ Long, hot, dry summers; mild winters with reliable rainfall; growth often stops in summer drought ■ Open forest with stunted tree growth; woodland and shrubland; many bushes and shrubs; tough evergreen leaves that are often spiny ■ Known as chaparral in North America, *matorral* in Chile and maquis in the Mediterranean area; also found in parts of southern Western Australia and parts of South Africa
Desert	■ Very little rain; true desert has less than 100 mm precipitation per year and arid areas less than 250 mm; high summer daytime temperatures (often >37°C); large temperature difference between day and night ■ Widely scattered shrubs; water-conserving plants and non-drought-adapted ephemerals (which grow and set seed quickly on rare occasions when water is available); some very dry, sandy deserts have almost no plant growth ■ Generally located between 20° and 35° north and south of the Equator
Tropical grassland (savanna)	■ Low rainfall but seasonal heavy storms can occur; frequent fires; thin soil ■ Grasses with scattered clumps of trees, grading into either open plain or woodland
Tropical scrub forest	■ Rainfall not abundant; high evaporation ■ Thorny shrubs and trees ■ Grades into tropical grassland and savanna
Monsoon forest	■ In the tropics but with distinct wet and dry seasons ■ Trees less closely spaced than in rainforest; many trees shed their leaves in the dry season
Tropical rainforest	■ Warm and humid; frequent rain; average temperature is 25°C all year; no true seasons; little change in day length; growth throughout the year; infertile clay soil ■ Closed canopy; little understorey; large number of plant species (great diversity) competing for available light; trees often have large trunks and buttressed roots; many epiphytes (plants that grow on other plants) and vines; little leaf litter
Mountain	■ Increasing altitude produces a decrease in temperature, similar to the effect of increasing latitude ■ Vegetation types vary with altitude; beyond a certain height, trees do not grow and the vegetation resembles tundra

1.1.5 Characteristics of major terrestrial ecosystems

Aquatic ecosystems

Ecosystems that are water based are called aquatic ecosystems. Examples include ponds, lakes, rivers, oceans, coral reefs, estuaries, and coastal and inland wetlands. The differences between aquatic ecosystems arise from variations in the amount of nutrients dissolved in the water, salinity, depth of sunlight penetration, and average temperature.

Size of ecosystems

An ecosystem may vary in size from a small pond to a vast area of rainforest or an entire ocean. Whether large or small, ecosystems rarely have distinct boundaries. This can complicate ecosystem management when there are definite boundaries, such as national parks or international borders. Individual ecosystems blend into adjacent ecosystems via a zone of transition or ecotone. An ecotone contains organisms common to both ecosystems, but may also have organisms unique to that area. As a result, the ecotone often has greater biodiversity than surrounding ecosystems.

The ecosphere

The ecosphere is the collection of living and dead organisms (the biosphere), interacting with one another and their non-living environment. The ecosphere represents the aggregate of the world's ecosystems.

The study of ecology

The study of ecology is concerned with interactions that occur at five levels of organisation: organisms, populations, communities, ecosystems and the ecosphere as shown in Figure 1.1.6.

Organisms

An organism is simply any form of life. While there are a number of ways to classify organisms, the simplest distinction is between producers (plants), consumers (most animals) and decomposers (such as bacteria that feed on dead animal and plant matter). Plants range in size from microscopic, single-celled phytoplankton to the giant sequoia trees of North America. Animals range in size from microscopic zooplankton to the 30-metre-long blue whale. Decomposers range in size from microscopic bacteria to large fungi, such as mushrooms.

Species and populations

A group of organisms of the same species living together is known as a population. Populations are said to be dynamic: over time their size, distribution, age structure and genetic make-up adapt in response to changes in environmental conditions.

A species is a single type of organism that has the ability to reproduce its own kind. Estimates of the number of species on Earth vary from 5 million to 30 million and as high as 50 million. The majority of animal species are insects, mites and nematodes (worms). So far, only 1.4 million species have been identified and named.

Habitats

The area in which an organism or population lives is known as its habitat. The characteristics of a terrestrial (land-based) habitat are determined by the interaction between temperature and precipitation. Together with the soil, this interaction produces an environment that allows a particular combination of life forms to develop. An aquatic habitat is characterised by features such as temperature, nutrient levels, turbidity (light intensity), salinity and water currents.

Communities

Several populations interacting with each other within a particular habitat are called a community. Ecosystems are sometimes defined in terms of communities of plants and animals that live together in a common habitat. An ecosystem can be referred to as the combination of a community and its non-living environment: an ever-changing (dynamic) network of biological, chemical and physical interactions that sustains a community and allows it to respond to changes in environmental conditions.



1.1.6 The various components of the ecosphere are all interrelated. In order to manage these ecosystems sustainably we must first understand the way these components interact.

Activities

Understanding the text

1 Define the term ecology.

2 Explain why ecosystems are described as 'systems through which incoming solar energy is captured and channelled through a hierarchy of life forms'.

3 Distinguish between terrestrial and aquatic ecosystems.

4 Describe the biosphere.

5 Describe the ecosphere. What are its components?

6 Define what is meant by these ecological terms: population, species, habitat and community.

7 Define the terms food chain, and food web.

Working geographically

8 Examine Figures 1.1.3 and 1.1.4. Write a report describing the relationship between the distribution of major terrestrial ecosystems and the world pattern of climate.

9 Study Figure 1.1.5 and select two of the ecosystems listed. Conduct research into these ecosystems and prepare a short report comparing the location, flora and fauna of each.

10 Using Figure 1.1.7 and the information contained in the text, outline the relative productivity of the ecosystems shown in the graph.

Productivity of ecosystems

The productivity of an ecosystem can be expressed in two ways:

- the amount of biomass produced in an area—the mass of new living matter produced per square metre of land (or within a volume of water) per unit of time
- energy flow—the amount of energy (in kilojoules) that is 'locked into' all the organisms in an area per unit of time.

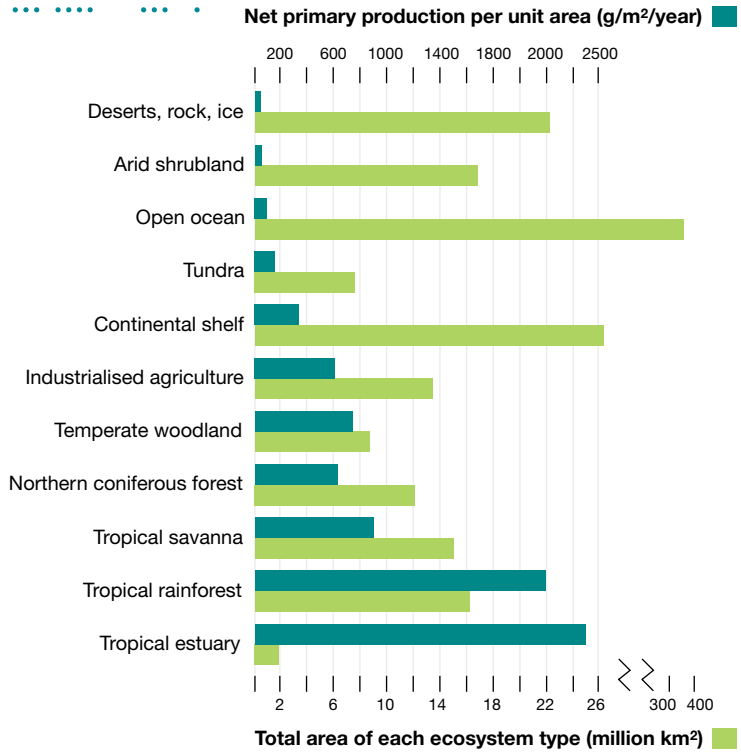
Both rates depend on the quantity of available energy and nutrients in the environment, and the efficiency with which energy and matter are incorporated into producers and passed up the food chain or food web. Figure 1.1.7 compares the productivity of some of the world's major ecosystems.

Energy flows and nutrient cycling

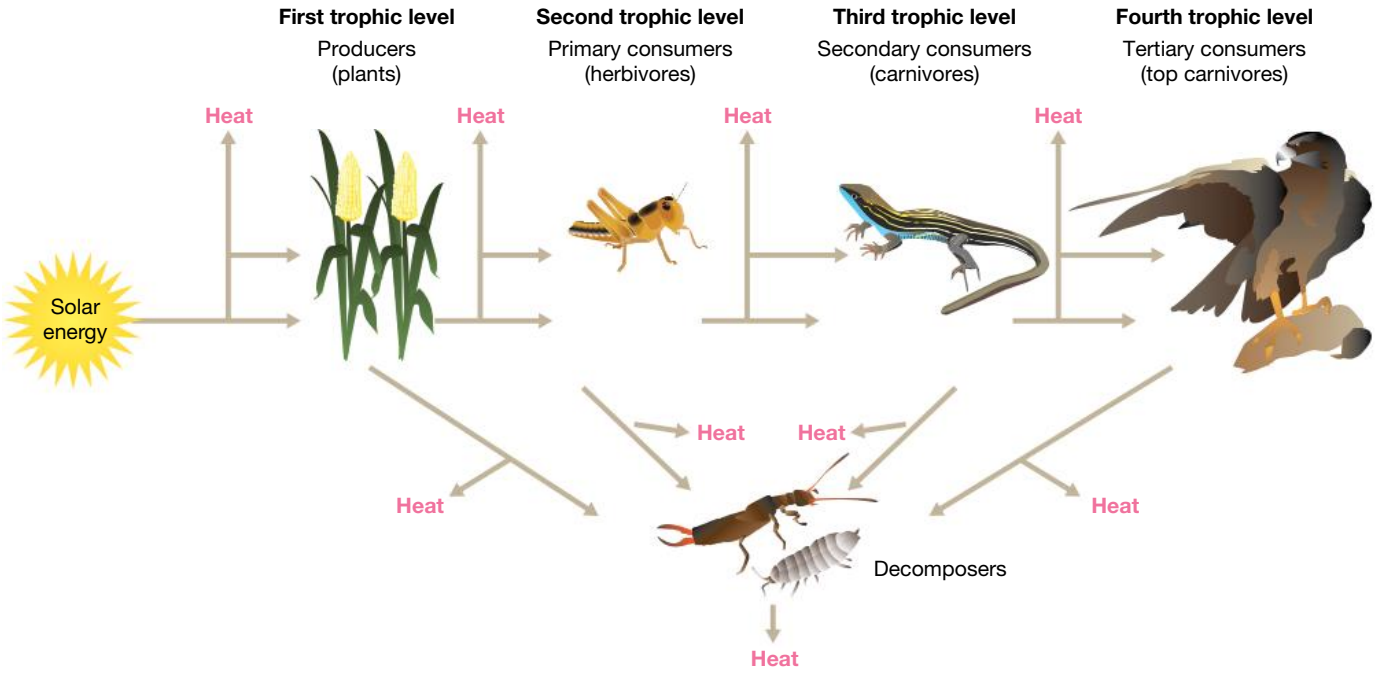
Producers, consumers and decomposers form a chain that facilitates the flow of energy from the Sun, through plants, to animals within the ecosystem. At each level of the food chain, energy (heat) is lost to the atmosphere. Food chains also facilitate the recycling of nutrients from producers, to consumers, to decomposers, then back to producers.

Organisms that share the same types of food in a food chain belong to the same trophic level. Producers belong to the first trophic level, primary consumers to the second, secondary consumers to the third, and so on. A simplified food chain, showing energy and nutrient transfers and the different trophic levels, is shown in Figure 1.1.8.

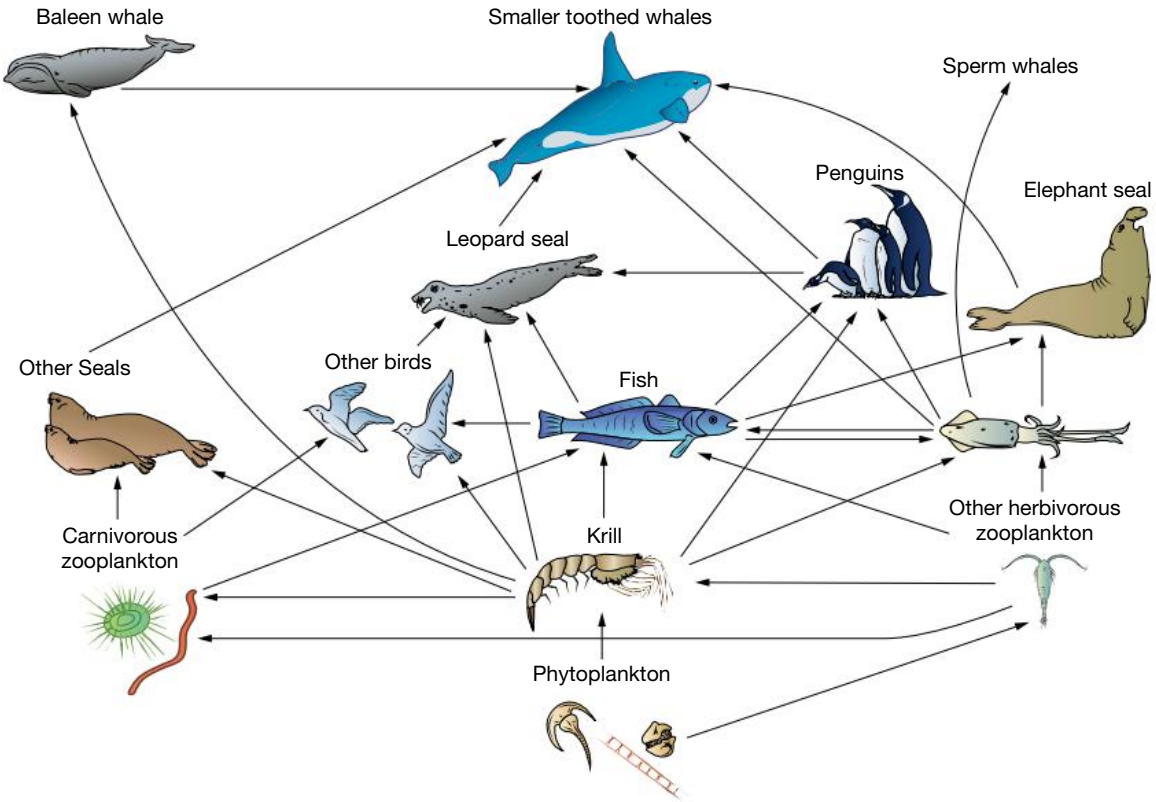
Simple food chains are rare. Organisms in a natural ecosystem are usually part of a complex network of interacting food chains, called a food web as shown in Figure 1.1.9. The various elements of the biome transfer energy by consuming each other: herbivores consume plants and are then, in turn, consumed by carnivores, with carnivores being consumed by larger carnivores.



1.1.7 This graph shows the relative productivity and size of key ecosystems. As the graph indicates, ecosystems of low productivity (such as deserts) require larger areas in order to be sustainable.



1.1.8 This ecosystem model demonstrates the role of solar energy and nutrient transfers within an ecosystem. The Sun is the source of energy in the ecosystem.



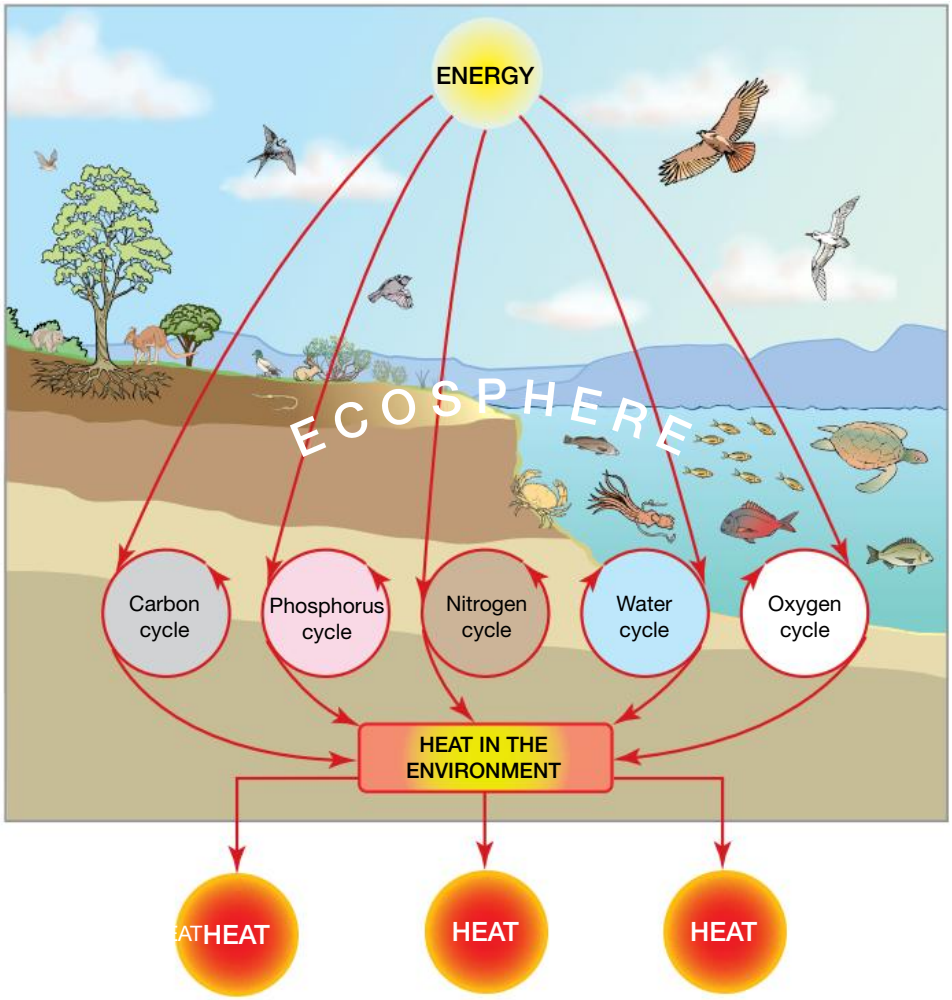
1.1.9 This is a simplified food web for Antarctica. In reality food webs are usually highly complex and involve numerous interactions of many smaller food chains.

Energy and nutrients

The Sun is the primary source of energy within ecosystems. The energy of the Sun is used by plants (producer organisms) to turn carbon dioxide and water into glucose and oxygen via a process known as photosynthesis. Plants then use the glucose as an energy source to make other substances. They also use glucose, in combination with dissolved nutrients, as a building block. Herbivores (primary consumers) consume these nutrients, using them for growth and energy for life and movement. When herbivores are consumed by carnivores, these nutrients pass up through the food web until they reach the largest carnivores, or tertiary consumers.

This process enables nutrients to be recycled from the non-living environment (reservoirs in the atmosphere, hydrosphere and lithosphere) to the living environment and then back to the non-living environment. These nutrient cycles are driven by the Sun, either directly or indirectly. They include the carbon, oxygen, nitrogen, phosphorus, sulphur and water cycles, as shown in Figure 1.1.10.

At each trophic level, significant amounts of nutrients and energy are lost, which results in the number of tertiary consumers in all ecosystems being small compared with the number of primary consumers. Ecosystem with the lowest levels of nutrients support the fewest consumers. Figure 1.1.11 shows the amount of energy lost as nutrients move up the levels of a food chain as well as the significant decrease in the number of organisms that occur at each successive trophic level.

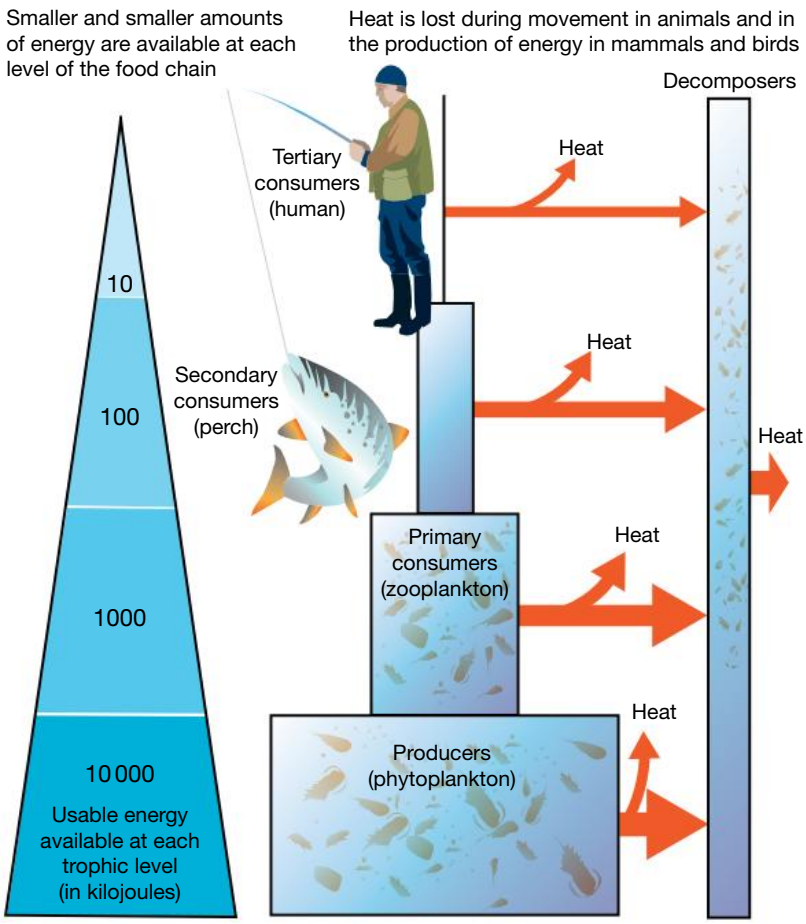


1.1.10 Recycling is an essential process in all ecosystems. Each cycle shown in this diagram is vital for the effective functioning of an ecosystem.

The carbon cycle

Carbon is the basic building block of the compounds necessary for life. Most land plants obtain their carbon by absorbing carbon dioxide directly from the atmosphere, through pores in their leaves. Phytoplankton are microscopic plants in aquatic ecosystems, which obtain their carbon from atmospheric carbon dioxide that has been dissolved in water.

Plants, via photosynthesis, convert the carbon found in carbon dioxide into glucose. The glucose is then used as an energy source and for plant growth. If the plant is consumed, the energy is then passed up the food chain. Oxygen is also given off as a by-product of photosynthesis. Figure 1.1.12 illustrates the functioning of the carbon cycle.



1.1.11 The energy constantly being lost from the system at each level of the food chain can be shown as a pyramid. This energy is lost as animals consume energy in search of food and in the production of heat during plant growth. Tertiary-level consumers are the least energy efficient and thus form the smallest number of animals in the ecosystem.

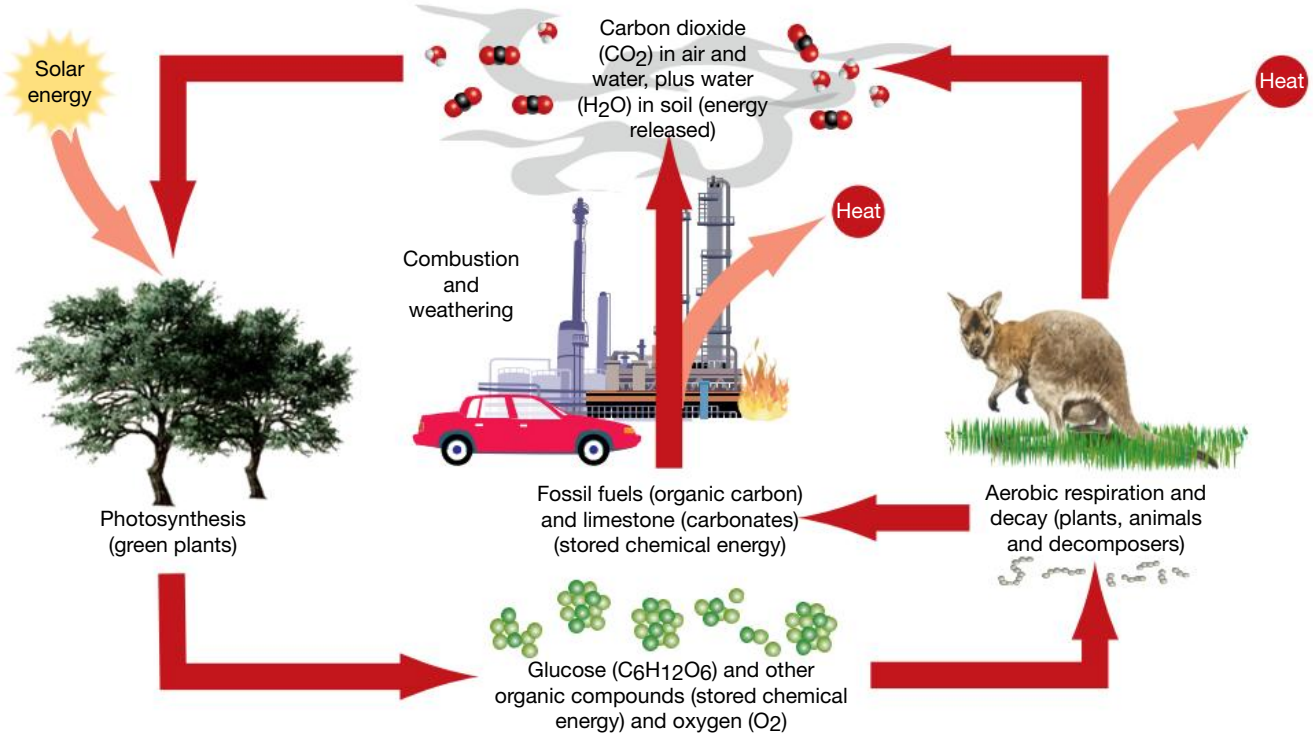
Activities

Understanding the text

1. Describe the meaning of 'trophic level'.
2. Outline the ways that nutrients are recycled in an ecosystem.
3. Explain the role of decomposer organisms in the biotic cycle of an ecosystem.
4. Outline the ways in which the productivity of ecosystems is measured.

Working geographically

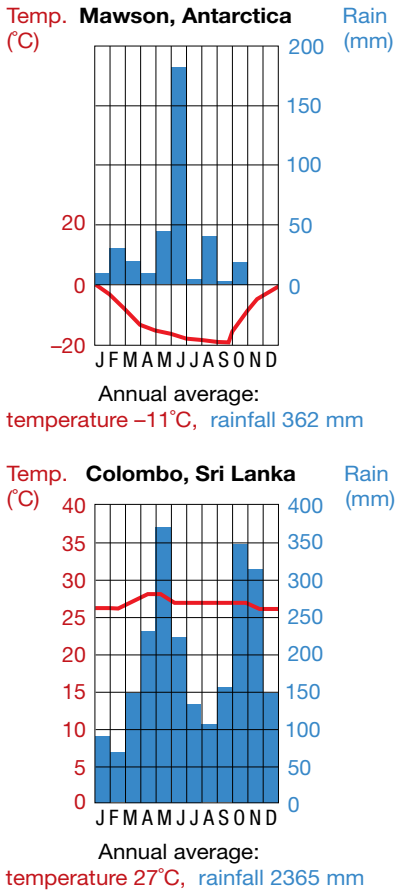
5. Write a report explaining the operation of food webs. Explain why an understanding of the operation of an ecosystem's food web would be essential for the sustainable management of that ecosystem.
6. Study Figure 1.1.11. With the aid of an annotated diagram, explain what happens to the amount of usable energy at successively higher trophic levels.
7. Study Figure 1.1.12. Explain the operation of the carbon cycle.
8. Using the internet and other resources in the library, undertake research into one of the cycles that operates in an ecosystem (carbon, oxygen, nitrogen, phosphorus, sulphur or water). With the aid of a diagram, explain the operation of the selected cycle.



1.1.12 Simplified diagram of the carbon cycle

UNIT 1.2

Factors affecting the functioning of ecosystems



1.2.1 Mawson, located in Antarctica (a polar ecosystem), receives very little precipitation. Whereas Colombo, located in Sri Lanka (an equatorial region), receives high precipitation. The variations in temperature and precipitation create two very different environments in these locations.

The four components of the biophysical environment are the atmosphere, hydrosphere, biosphere and lithosphere. In any ecosystem, the way these four spheres interact with each other affects how the ecosystem develops and functions.

Time is also an important consideration in understanding how ecosystems function. Natural changes in the biosphere can take place over tens of thousands of years, which allows time for the natural systems to adjust. Human-induced changes are typically too rapid for these natural adaption processes. For example, while the world's climate naturally changes over time, human activities (such as the burning of fossil fuels) have significantly altered the world's climate in a very short period.

The atmosphere

The atmosphere, effectively the air surrounding the Earth's surface, is the main source of the climatic factors that impact on ecosystem functioning. Temperature and the amount of rainfall determine the characteristics of all elements within the ecosystem and the speed at which they function.

Examples of the effect of the atmosphere on ecosystems are diverse. The warm, moist climate of rainforest ecosystems accelerates the rate of plant growth, the decay of dead material and the take-up of minerals, which is the main reason why they are dynamic. The atmosphere is also the source of nutrients—nitrogen, carbon (as carbon dioxide) and oxygen as well as water. Circulation patterns within the atmosphere also determine the spread of pollutants.

The hydrosphere

The hydrosphere includes the water on the Earth's surface, and is closely linked to the atmosphere since it is the atmosphere that determines the nature of the water cycle in a particular area. For example, polar ecosystems are cold deserts with annual rainfalls of less than 250 mm and very little available freshwater, as shown in Figure 1.2.1. Because of the extreme cold and the low precipitation, polar ecosystems function very slowly. In tropical rainforests, the relatively large volumes of rainfall increases the speed at which elements cycle through the ecosystem, which leads to high levels of biodiversity.

This same vigorous hydrological cycle can also increase levels of destruction, since it quickly leaches soils and erodes the land, as shown in Figure 1.2.2. If people have removed trees from the ecosystem, these processes can cause silting of neighbouring rivers and the destruction of river ecosystems.



1.2.2 While water is vital for life in an ecosystem, it can also cause destruction, such as erosion of landscapes.

Large bodies of water, such as oceans and lakes, moderate the temperatures of adjoining landmasses because water heats and cools more slowly than land.

The lithosphere

The lithosphere is the crust or solid part of the Earth. It determines the nature of soils and provides habitats for many of the decomposer organisms that recycle the minerals essential to the plants that form the basis of the food web. The lithosphere stores mineral nutrients as well as water within the spaces between the soil particles, where it is available for use by plants.

The capacity of the soil to perform these two functions helps to determine the nature of particular ecosystems. In areas of non-porous clays, wetlands may develop because water is trapped close to or above the surface, as seen in Figure 1.2.3. In areas with sandy soils, water drains away quickly, leaving an extremely dry soil profile. In these areas if rainfall is low, xerophytic (drought-resistant) plant communities, such as cacti, dominate.

Climatic factors affect the role that soils play in an ecosystem. An example is the permafrost soils of tundra ecosystems shown in Figure 1.2.4. In this very cold climate the soil remains frozen for most of the year. This means that decomposer activity is virtually non-existent and moisture is unavailable to plants. The vegetation characteristic of this ecosystem includes small tussock grasses. At the other extreme are the leached soils of the tropical rainforest ecosystems as illustrated in the soil profile shown in Figure 1.2.5.



1.2.3 Where non-porous soils are found, wetlands are a common feature of the environment.

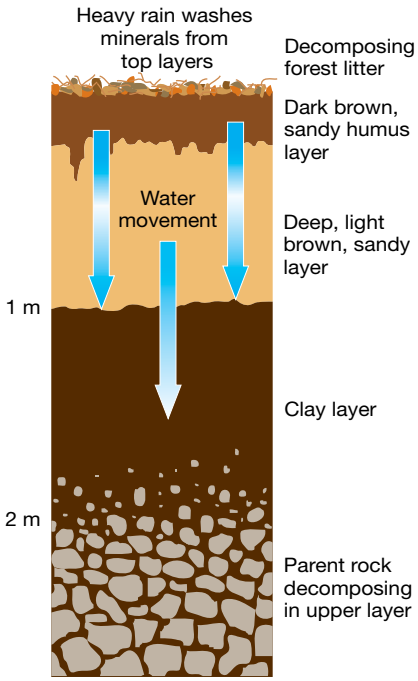


1.2.4 In the extremely cold climate of the tundra the soil remains frozen throughout the year, creating permafrost.

Landforms also affect ecosystems. Small variations in elevation can result in marked differences in plant communities. This is due to changes in moisture availability. Average temperatures decrease with increasing altitude, so the climate and ecosystems of mountains often differ markedly from those of nearby valleys and plains.

The biosphere

The biosphere is the domain on or near the Earth's surface where environmental conditions enable solar energy to produce the chemical processes necessary for life. It comprises all living and dead organisms (the biotic components of ecosystems) found near the Earth's surface. These exist in parts of the atmosphere, hydrosphere and upper lithosphere. Nearly all life on Earth exists in a narrow zone that extends from about 200 metres below the surface of the sea to about 9000 metres above sea level.



1.2.5 This is the soil profile of a rainforest. A soil profile shows the structure of the layers of soil. Despite being a highly productive system, rainforest soils are generally quite poor below the topsoil. The thin layer of topsoil is constantly being renewed with rotting vegetation (humus). This makes it very fertile. However, heavy rainfall leaches the nutrients out of the lower layers. This creates poorer soils further down the profile.



1.2.6 **A** Autotrophic organisms, such as the button grass shown here, create their own food and are often referred to as producers. **B** Heterotrophic organisms, such as wallabies, which are herbivores, consume the resources of an ecosystem.

The biosphere consists of two types of organisms: those that can manufacture their own food (autotrophs) and those that cannot (heterotrophs), as shown in Figure 1.2.6.

Autotrophic organisms

Autotrophic organisms are self-sufficient manufacturers of food. They use solar energy (light), water, carbon dioxide and nutrients from the soil to manufacture the organic (carbon-based) compounds that they use as a source of energy and nutrients. Most autotrophic organisms are green plants that make organic compounds via photosynthesis. These organisms are the lowest trophic level in the food chain and form the base of any food web. They are often referred to as 'producers'.

Heterotrophic organisms

Heterotrophic organisms are consumers, which are organisms that cannot make their own food. As well as the obvious herbivores (plant eaters), carnivores (meat eaters) and omnivores (both plant and meat eaters), this group includes the decomposers (such as worms, fungi and bacteria). Decomposers break down the remains of living matter, enabling minerals to return to the soil where they are again available to autotrophic organisms.

Bioaccumulation

Non-biodegradable toxic substances released into the environment make their way through the food chain and accumulate in organisms at the highest level of the food chain. This process, known as bioaccumulation, can affect the survival of individual organisms and populations of organisms.

Synthetic (human-made) chemicals (such as PCBs used to make plastics and electrical insulators, or the pesticide DDT), some radioactive materials and some toxic mercury and lead compounds become increasingly concentrated in biological tissues at successively higher trophic levels in food chains and webs. These chemicals have properties that favour bioaccumulation. This means that they are selectively stored in biological tissues, such as fat or bone, and degrade slowly, if at all, by natural processes.

Figure 1.2.7 illustrates how DDT becomes amplified in the food chain of an estuarine ecosystem. If each phytoplankton stores thousands of units of fat-soluble DDT in its fatty tissue, then a large fish that eats 10 of the smaller fish will receive and store tens of thousands of units of DDT.

A bird or human that eats the fish can then take in hundreds of thousands of units of DDT.

The accumulation and amplification of toxic substances in an organism can kill it directly, reduce its ability to reproduce, or weaken it to a point where it is vulnerable to diseases, parasites and predators.

Adapted from T. Miller, Living in the Environment, Wadsworth, Belmont

SPOTLIGHT

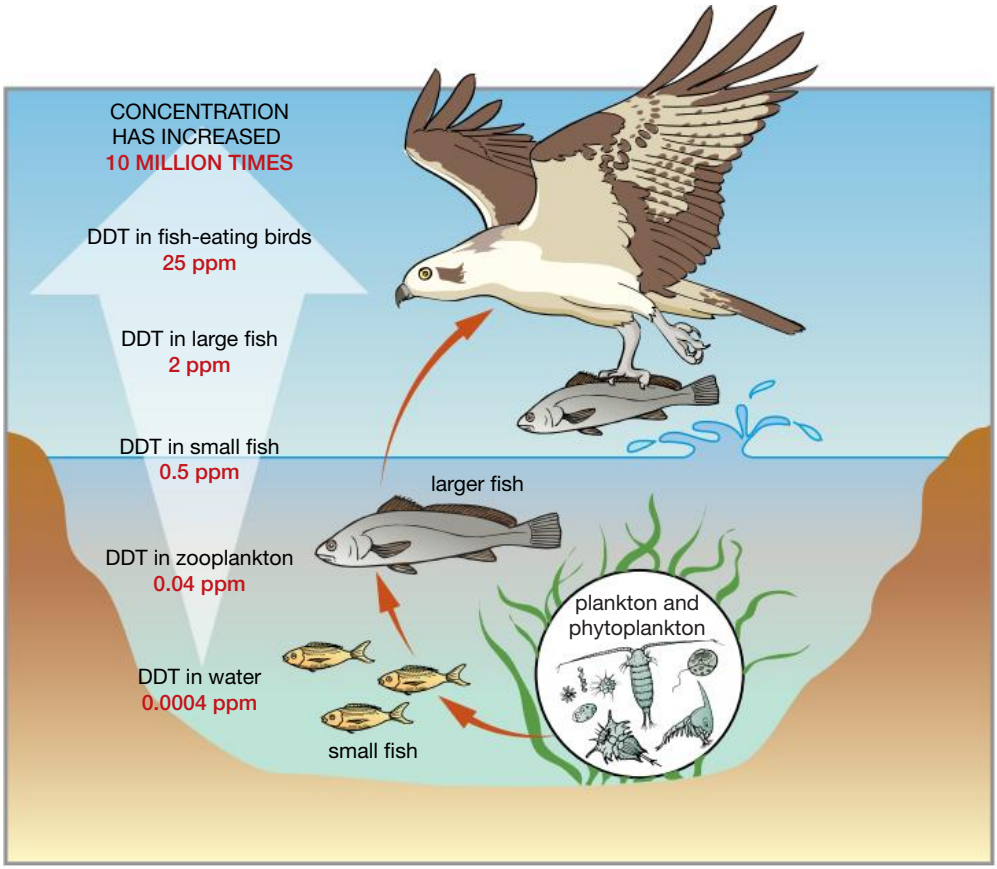
Dioxin contamination leads to fishing ban in Sydney Harbour

Dioxins are chemical compounds that are highly toxic. The World Health Organization has found that they are a cause of several types of cancer and developmental and reproductive disorders. They are known as persistent environmental pollutants, meaning that they remain in the environment for a very long time. In waterways, dioxin tend to settle into the sediments on the sea floor and gradually accumulate there.

In February 2006, the NSW Government placed an indefinite ban on commercial fishing within Sydney Harbour. The ban followed a scientific investigation that found dangerously high levels of dioxin in a fish caught in the harbour. Recreational fishing is still permitted but strict guidelines to limit the amount of seafood caught and eaten from areas west of the Sydney Harbour Bridge were implemented and remain in effect today.

Much of the dioxins in the Harbour originate from around Homebush Bay. While this area is today dominated by high density housing, for decades chemical works, paint factories and other heavy industries lined the foreshore of the bay.

These industries discharged large amounts of pollutants into the bay, including dioxins. These pollutants have settled into the thick sediments to create a toxic cocktail. It was previously believed that the toxins were locked into the mud and posed little threat to aquatic species other than the bottom dwellers of the bay, such as prawns. However, it is now clear that the toxins have gradually spread out of the bay in a toxic plume that has increased dioxin levels in a range of different species throughout the harbour.



1.2.7 This diagram demonstrates the impact of the pesticide DDT in an estuarine ecosystem. The concentration of the toxic DDT in the fatty tissue of organisms is amplified by 10 million times in this food chain (ppm = parts per million).

Activities

Understanding the text

1. Explain the difference between autotrophic and heterotrophic organisms.
2. Outline the different types of heterotrophic organisms.
3. Explain the effect of bioaccumulation on ecosystems.

Working geographically

4. Write an extended response outlining the role of the biosphere, atmosphere, hydrosphere and lithosphere in ecosystem functioning.
5. Review the Spotlight on dioxins in Sydney Harbour and complete the following activities.
   - **a** Outline the source of dioxins in Sydney Harbour.
   - **b** Explain the impact of dioxins on the functioning of Sydney Harbour.
6. Research the current situation in relation to dioxins in Sydney Harbour and write a 10-step guide on how to prevent poisoning.

UNIT 1.3

Vulnerability and resilience of ecosystems

All ecosystems function in a state of dynamic equilibrium, which is a continual state of balanced change. This dynamic, but balanced, state is the result of the interactions between elements in the ecosystem: the atmosphere, lithosphere, hydrosphere and biosphere. Change occurs because the interactions between minerals, energy and communities vary over time.

The interdependence of these four elements also means ecosystems are vulnerable. A change beyond the limit of the equilibrium, in any of these elements, means that the system as a whole cannot exist in its original state. All ecosystems are vulnerable, but the level of vulnerability depends on how small a change in any element is likely to upset the equilibrium overall. Ecosystems are not equally at risk and some are more resilient than others.

Causes of ecosystem vulnerability

All ecosystems have some ability to withstand stress. They tend to resist being disturbed or altered and will restore themselves to their original condition if not disturbed too drastically. Ecosystems are able to maintain themselves within a tolerable range of conditions.

A number of factors affect an ecosystem's vulnerability to stress. These include location, extent, biodiversity and linkages.

Location

The location of an ecosystem affects its functioning. At a global scale, latitude, distance from the sea and altitude play decisive roles in determining climate and ultimately the nature of particular ecosystems.

The microclimatic features of a location can be significant enough to create a range of distinctive ecosystem types within relatively small areas. The aspect of a slope is one such microclimatic variable, since the aspect will affect the amount of sunlight and rain it receives.

Extreme or unique ecosystems

Some ecosystems are located in environments considered extreme: deserts (extreme heat and/or aridity), the polar-regions and high mountain peaks (extreme cold), hypersaline lagoons (extreme salinity) and areas of nutrient deficiency. Organisms capable of living in such conditions have adapted to survive the extreme conditions and are therefore highly specialised. The more specialised an organism is within a particular set of environmental conditions, the more vulnerable it will be to changes in those conditions.

Corals are highly specialised organisms that flourish in the relatively shallow, nutrient-deficient waters of the tropics. Any increase in nutrient levels promotes the growth of algae. This, in turn, reduces the amount of sunlight available for coral growth. If the elevated nutrient levels are sustained the corals become stressed, reefs contract in size and the number of coral species declines. Corals are also sensitive to changes in water temperature. They normally flourish at temperatures between 25°C and 29°C, depending on their location. This narrow temperature range is very close to their upper lethal temperature. An increase of just a few degrees above the usual summer temperature can be devastating. The coral polyp dies, leaving only the white calcium carbonate skeleton. This is known as coral bleaching. One consequence of global warming will be the widespread destruction of coral reef ecosystems.

Proximity to humans

Proximity to large concentrations of people is another important contributing factor to ecosystem vulnerability. As populations grow, so does the demand for land as shown in Figure 1.3.1. Urban, industrial and agricultural land uses affect and sometimes destroy natural ecosystems, while the oceans, rivers and the atmosphere become dumping grounds for pollutants. For coral reef ecosystems, run-off that has been polluted by sewage, agricultural fertilisers and land clearance is a major source of excess nutrients and increased turbidity.



1.3.1 Proximity to human activity is a factor in the vulnerability of an ecosystem.

Extent

The extent (size) of an ecosystem is the result of a variety of factors. Recent research has shown that the boundaries of ecosystems tend to overlap each other. For example, river ecosystems extend beyond the river channel to include the whole drainage system. Human activity in the drainage basin can impact on the river itself even when it occurs some distance from the channel. It may, for example, increase soil erosion. A study of the Flathead River in Montana in the western United States showed that stoneflies and other creatures living in shallow wells on the floodplain of the river, up to 2 kilometres away from the river, mated along the river banks before returning to lay their eggs in the wells. While at the riverbank they were preyed upon by fish. This means the floodplain and the river cannot be considered as separate systems.

Ecosystems that are restricted to relatively small areas or have already been extensively disturbed are especially vulnerable. Tropical rainforests have relatively small populations of a large number of species confined to relatively small, localised communities. The loss of even a small area of rainforest can lead to the extinction of plant and animal species. Savanna grasslands have large populations of a relatively small number of species spread over much larger areas. The loss of a small area of grassland may not result in the extinction of species. However, the large herbivores typical of these regions require extensive grazing areas.

Biodiversity

When ecosystems are diverse, there is a range of pathways for the ecological processes, such as nutrient recycling. If one pathway is damaged or destroyed, an alternative may be found and the ecosystem can continue to function at its normal level. If the level of biodiversity is greatly diminished, for example through the extinction of a species, the functioning of the ecosystem is put at risk. The greater the level of diversity means the greater the opportunity to adapt to change.

Biodiversity is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity.

Genetic diversity

Genetic diversity is the variety of genetic information contained in all the individual plants, animals and microorganisms. Genetic diversity occurs within and between populations of species as well as between species.

A high level of genetic diversity favours the survival of a species, because it increases the chance that some members of the species will have characteristics that aid their survival if the population experiences stress. Genes have costs as well as benefits; a British study has shown that peach potato aphids that are resistant to common pesticides (a genetic benefit) are less able to survive British winters (a cost of genetic variation) than aphids that are not resistant to pesticides. (This situation may change with global warming.)

Species diversity

Species diversity is a measure of the number of species at each trophic level of an ecosystem. The greater the species diversity, the more robust the ecosystem: if the population of one producer or consumer organism declines dramatically there are likely to be other producers or consumers available that can fulfil a similar function in the ecosystem. Species diversity in an ecosystem can be seen in Figure 1.3.2.



1.3.2 Species diversity increases an ecosystem's resilience.

Ecosystem diversity

Ecosystem diversity refers to the diversity within an ecosystem in terms of habitat differences, biotic communities and the variety of ecological processes.

Linkages

Interdependence, or linkages, is related to species diversity. The greater the level of interdependence within an ecosystem the greater its ability to absorb change. For example, the loss of a primary consumer from a food web is unlikely to have a major impact on secondary consumers if there is a range of alternative primary consumers on which to feed.

Ecosystems that have low levels of interdependence are much more vulnerable to change. For example, there are few linkages up through the food chain of the oceans around Antarctica. Krill are the dominant primary consumer organism and the main source of energy (food) for some species of whale. There are no intermediary stages in the food chain. Any reduction in the supply of krill (from large-scale commercial harvesting, for example) will directly impact on the number of whales that the ecosystem can support.

Interdependence can take very subtle forms. Some flowering plants can be fertilised by only one species of insect. This insect may, in turn, be dependent on some other organism for part of its life cycle. Anything that jeopardises this third organism will affect the reproductive success of the flowering plant, making it far more vulnerable than if it could be fertilised by multiple species.

Some primary consumers have highly specific food sources, and many parasitic organisms depend on specific hosts. This makes these organisms vulnerable to disturbances in their ecosystems. However, the same characteristics can be exploited by humans in the biological control of pest species. For example, in Lord Howe Island, the introduced species Crofton weed has smothered vegetation and overtaken hillsides. In response, a rust fungus from Mexico has been introduced to help control the weed. Large consumer animals may range across a number of small, localised ecosystems, having genetically adapted to the variations in all of them.

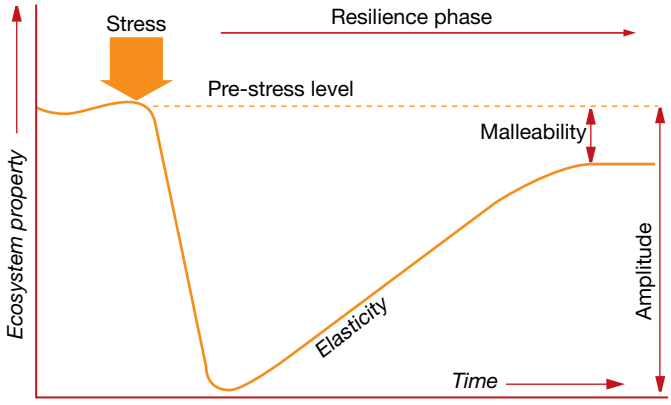
Resilience

Resilience is the ability of an ecosystem (or a component of an ecosystem) to adapt to a changing environment and to restore function and structure following an episode of natural or human-induced stress.

Ecosystems rich in biodiversity generally have greater resilience than those with little diversity. They are able to recover more readily from naturally induced stress (including drought and fire) and human-induced habitat destruction. The more successful a species is at regeneration and adaptation, the less vulnerable it is to changes in its ecosystem. Long-term ecosystem degradation occurs when the magnitude and duration of the stress exceed the ability of the component to repair itself.

In some cases, natural sources of stress play an important role in the functioning of ecosystems. Stress-dependent organisms and processes rely on changes in their environment to produce or stimulate a growth of their systems. Some eucalypt species, for example, rely on fire to initiate a stage in their reproduction cycle and many perennial desert plants rely on the occasional fall of rain to activate their growth cycle.

As with change, resilience is a natural part of ecosystem functioning. Figure 1.3.3 illustrates the impact of stress on ecosystem functioning. The intensity and duration of stress is important in terms of the effect it has on an ecosystem.



Elasticity represents the rate that an ecosystem can recover after stress or disturbance.

Amplitude refers to the maximum level of strain before it becomes impossible for the ecosystem to recover.

Malleability is the difference between the ecosystem's final recovery level and the pre-stress level—the greater the difference, the less resilient is the ecosystem.

1.3.3 The impact of stress on the functioning of ecosystems

Natural and human-induced environmental stress

Ecosystems are constantly adjusting in response to changes within the total environment. These adjustments could be in response to changes in the availability of water, average temperature or many other natural events. In nature, these changes usually take place very slowly. The biome gradually adapts as animals and plant species that have characteristics unsuited to the change die out and those more suited to the new environment remain alive to breed and pass on their characteristics to successive generations. This process is known as natural selection.

Sudden natural disasters have occurred from time to time throughout the Earth's history and have caused whole species to die out almost instantly because they had no time to adapt. Such occurrences are rare. This is not the case in respect to human-initiated stress. The damming of a river, the draining of a wetland or the clearing of vast tracts of natural vegetation for agriculture are sudden and drastic changes that can result in a loss of habitat and the destruction of a species (their extinction).

The ability to instigate large-scale environmental change means that people are able to push the state of dynamic equilibrium beyond its limits. As a result, people have created situations where they are required to maintain a state of equilibrium by utilising resources found elsewhere. The maintenance of an agricultural monoculture may rely on inputs of fossil fuel and fertiliser, pesticides and herbicides.

Activities

Understanding the text

1 Describe the concept of dynamic equilibrium.

2 Explain how location can make an ecosystem more vulnerable.

3 Describe the relationship between vulnerability of ecosystems and extent.

4 Explain why genetic diversity decreases the vulnerability of an ecosystem.

5 Explain the idea of interdependence.

6 Identify the kinds of ecosystems that have greater resilience.

7 Under what conditions does long-term degradation occur?

Working geographically

8 Explain the process shown in Figure 1.3.3.

Without them the monoculture would collapse. Today, human activities destroy or seriously threaten species and, more importantly, destroy or degrade their habitat.

Figure 1.3.4 outlines the nature of changes affecting ecosystems. Figure 1.3.5 outlines some of the effects of environmental stress.

Changes affecting ecosystems

	Catastrophic	Gradual
Natural sources of environmental stress	■ Drought ■ Flood ■ Fire ■ Volcanic eruption ■ Earthquake ■ Landslide ■ Change in stream course ■ Disease	■ Natural climatic changes ■ Immigration/invasion of new species ■ Adaptation/evolution ■ Ecological succession ■ Disease
Human-induced sources of environmental stress	■ Deforestation ■ Overgrazing ■ Ploughing ■ Erosion ■ Pesticide application ■ Fire ■ Mining ■ Toxic contamination ■ Urbanisation ■ Water and air pollution ■ Loss and degradation of wildlife activity	■ Anthropogenic (caused by humans) climate change ■ Irrigation: salinisation and waterlogging of soils ■ Soil compaction ■ Depletion of groundwater ■ Water and air pollution ■ Loss and degradation of wildlife habitat ■ Elimination of pests and predators ■ Introduction of exotic species ■ Overhunting/overfishing ■ Toxic contamination ■ Urbanisation ■ Excessive tourism

1.3.4 Changes affecting ecosystems by cause and rate

DID YOU KNOW?

The International Union for the Conservation of Nature estimates that there are 948 species in Australia vulnerable to extinction. This includes 62 species of mammals, 119 fish, 52 birds, 43 reptiles and 47 amphibians.

Effects of environmental stress

Organism level	Population level	Community–ecosystem level
■ Physiological and biological changes ■ Psychological disorders ■ Behavioural changes ■ Fewer or no offspring ■ Genetic defects in offspring ■ Cancers	■ Population increase or decrease ■ Change in age structure (old, young and weak may die) ■ Survival of strains genetically resistant to stress ■ Loss of genetic diversity and adaptability ■ Extinction	■ Disruption of energy flows: • Decrease or increase in solar energy uptake and heat output • Changes in trophic structure in food chains and webs ■ Disruption of chemical cycles: • Depletion of essential nutrients • Excessive addition of nutrients ■ Simplification: • Reduction in species diversity • Reduction or elimination of habitats • Less-complex food webs • Possibility of lowered stability • Possibility of ecosystem collapse

Adapted from G.T. Miller, *Living in the Environment.*

1.3.5 Some of the effects of environmental stress

Environmental impacts of human activity

The impacts of human activity operate within the context of an interdependent global environment. Global or international cooperation is needed to address the threats to the world's biophysical environment.

The causes of environmental degradation in today's world include massive population growth; poverty and the crippling burden of debt in the developing world; non-sustainable consumption and environmentally damaging waste generation in the developed world; non-sustainable agricultural practices in many countries; and environmentally damaging industrialisation and exploitation of natural resources. If humans are to deal effectively with environmental degradation we will need to address these issues.



1.3.6 Widespread land clearing results in habitat loss.

Species introductions

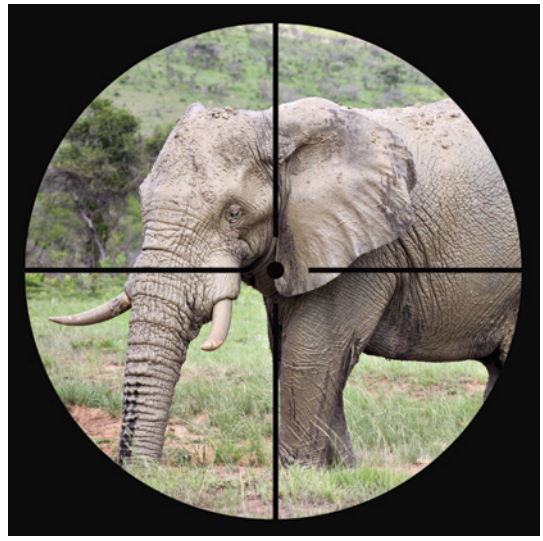
These may be either deliberate or accidental. Introduced species can wipe out local flora and fauna, either by preying on them or by out-competing them for food and space. This disrupts the flow of energy within ecosystems, the effects of which are magnified throughout the food chain.

Habitat destruction

Destruction of habitat, as seen in Figure 1.3.6, is now considered the major threat to biodiversity. Habitat loss takes several forms, including outright loss as it is converted to human use, as well as degradation and fragmentation where native species are deprived of food, shelter and breeding areas and are squeezed into smaller and smaller areas of undisturbed land.

Hunting

Hunting can lead to the uncontrolled exploitation of and trade in wildlife. It has decimated some species, such as the Amur Tiger, where around 450 are left in the wild. The Thylacine or Tasmanian Tiger was hunted to extinction. Overfishing has destroyed the herring and cod fisheries of the developed world. Large mammals, such as the African elephant shown in Figure 1.3.7, are still targeted by poachers. Despite the global ban imposed on ivory trading in 1989, enough people in the developed world are prepared to offer high prices for the ivory, which results in ongoing poaching.



1.3.7 Endangered species, such as the African elephant, continue to be hunted by poachers despite such hunting being illegal.

Pollution

Pollution is a major threat in aquatic and land-based ecosystems. Acid rain, for example, has been held responsible for a serious decline in aquatic (lake) ecosystems and forest ecosystems in northern and eastern Europe.

Activities

Understanding the text

1 Explain what natural selection is.

2 Explain why humans need to develop a global approach to environmental management.

3 Outline the main causes of environmental degradation today.

4 Describe the impact of species introductions.

Working geographically

5 Study Figure 1.3.4. Write a short report on the causes of changes to environmental functioning created by human activities.

CASE STUDY

Natural and human-induced stress

The following are examples of either natural or human-induced environmental stress.

Mt St Helens eruptions

In 1980, Mt St Helens (see Figure 1.3.8 A) had been dormant for over a century, in April–May scientists had become concerned about tremors beneath the mountain. Aerial observers had noted an opening on the summit of Mt St Helens where ice quickly blackened with ash. What caused most concern was the development of a bulge on the side of the mountain's northern slope.

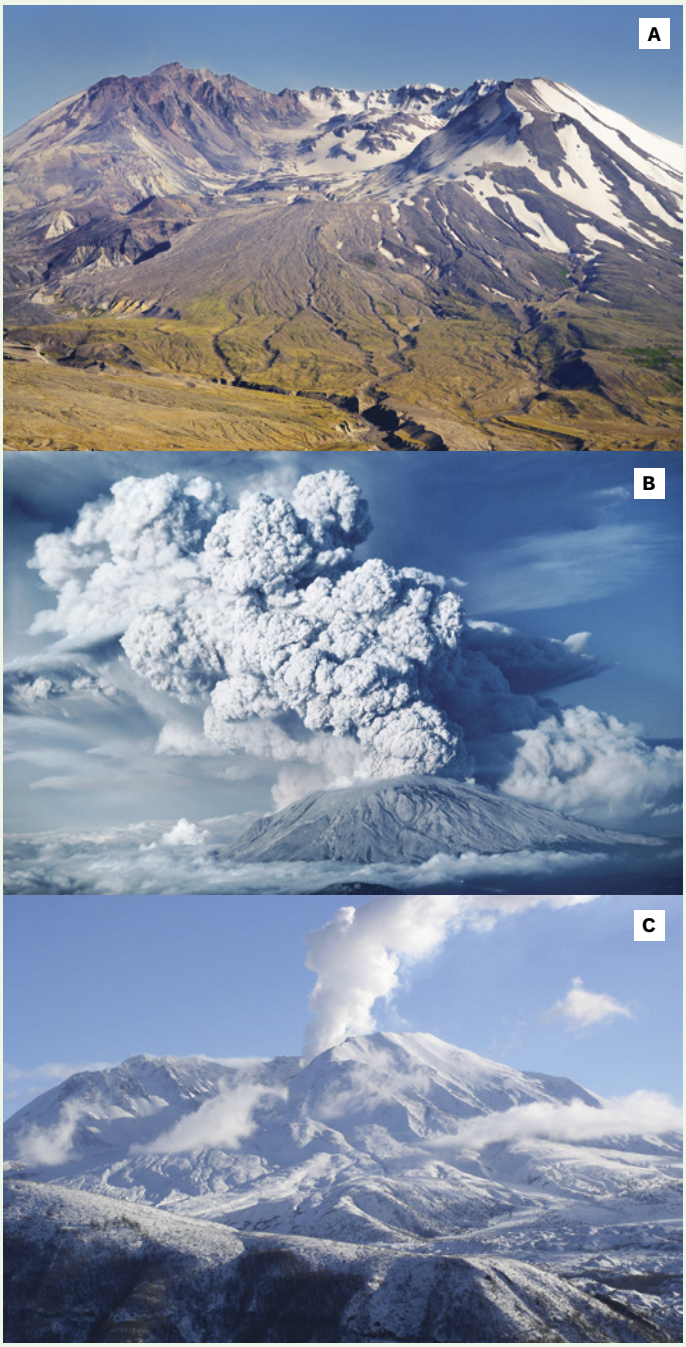
On 18 May at 8.32 a.m., an earthquake measuring 5.1 on the Richter Scale rocked the earth directly below the mountain. The earthquake initiated an avalanche, which was followed by a massive blast of gas, rock, ash and ice shown in Figure 1.3.8 B. One part of the avalanche slammed into Spirit Lake, causing the water level to rise 60 metres. Another mass of debris crashed down into the Toutle River, filling it to a depth of 45 metres in minutes.

The effects on the surrounding ecosystem were devastating:

- 120 metres of the summit vanished, leaving in its place a crater 2 kilometres wide, 4 kilometres long and 1.5 kilometres deep, as seen in Figure 1.3.8 C.
- 380 square kilometres of land to the north of the mountain was devastated by the blast and covered by hot volcanic debris
- large areas of coniferous forest were destroyed (see Figure 1.3.9) and countless numbers of wild animals were killed
- volcanic ash, carried by the prevailing winds, was spread for 1500 kilometres to the west
- 100 people lost their lives.

Within just a few years of the eruption scientists found evidence that pioneering flora and fauna were starting to colonise the ash-grey volcanic landscape seen in Figure 1.3.10. Plants such as lupin, Indian paintbrush, pearly everlasting and fireweed took root among the coarse grey rock. Willow and elder trees had grown to a height of 1–2 metres. The roots and decaying leaves and stems of the vegetation provided the organic material needed to convert volcanic grit into sustaining soil.

The plants and trees had adapted to the extremes of season and altitude, and were equipped to stake a claim in the harsh conditions. Lupins played a key role; bacteria on their roots released nitrogen, necessary to all plants. Alders produced winged seeds that could ride the wind. Birds and animals helped the process by eating, transporting and depositing seeds in their droppings. Burrowing gophers penetrated the ash blanket and brought former topsoil to the surface.



1.3.8 The Mt St Helens eruption was a source of natural stress. **A** Mt St Helens prior to the eruption. **B** Mt St Helens erupting. **C** Mt St Helens following the eruption.

The area represents a miniature fast-forward version of what happened over vast time frames in our planet's evolution. Scientists have enjoyed an unparalleled opportunity to observe the cycles of regeneration.



1.3.9 The environmental impact of the eruption



1.3.10 In the years following the eruption, the environment slowly recovered.



1.3.11 Mundulla Yellows is a disease that kills eucalypt trees.

Mundulla Yellows

First discovered around the tiny South Australian town of Mundulla, the disease Mundulla Yellows has been responsible for the death of thousands of eucalypt trees across Australia (see Figure 1.3.11).

It was originally thought that the disease was caused by a virus and was a natural phenomenon. The disease causes leaves on the trees to yellow, hence the name. Eventually the trees will die.

Researchers have found that trees growing close to roads are more at risk from the disease than those growing in natural bushland. Following this finding, scientists began to research the link between roads and the disease. They discovered that the disease may be linked to crushed limestone, which is commonly used as a road base. The lime changes soil conditions, increasing pH and salt levels while making soil less iron rich. In 2004 researchers demonstrated that by implanting trees with iron, the effects of the disease could be reduced. These findings support the link with the road base.

Victorian scientists have also been looking at links between the increase in Mundulla Yellows and human activities. One interesting finding has been the correlation between increased levels of carbon dioxide (associated with the greenhouse effect) and the rise in the incidence of the disease. Preliminary research indicates that an increase in carbon dioxide in soils and in the atmosphere makes trees more susceptible to Mundulla Yellows.

Minnamurra Rainforest

Minnamurra Rainforest is a small pocket of rainforest located on the South Coast of New South Wales, near Kiama, as shown in Figure 1.3.12. The extent, biodiversity and location of the rainforest all work together to make this a vulnerable ecosystem.

The forest is located close to urban development and is surrounded by farms. This increases the level of pollutants entering the system and has led to significant weed infestation, particularly lantana, which infests much of the forest.

Minnamurra is a remnant forest of only about 160 hectares, meaning that it is a remaining small portion of what was once a much larger forest, in fact less than 10 per cent of the original forest remains. This significantly increases the vulnerability of the ecosystem because weeds, pests and disease are more easily spread throughout the whole forest.

The biodiversity of the forest is threatened by the non-endemic (introduced) species, such as lantana, that have invaded the forest and created pockets of monocultures. Additionally, with such a small extent the number of individuals of species that can be supported by the forest is significantly reduced.



1.3.12 The location, extent and biodiversity of Minnamurra Rainforest increase its vulnerability.

Activities

Understanding the text

1. Explain the implications of resilient ecosystems and their ability to recover from catastrophic natural stress events.
2. a. Describe the impact of the disease Mundulla Yellows.
   b. Explain the possible links between human activities and the disease.
3. Explain, using illustrative examples, the impact of natural stress on ecosystem vulnerability.
4. Write a short report explaining why Minnamurra Rainforest can be considered vulnerable.

UNIT 1.4

Human-induced modifications to ecosystems

People are part of the biosphere and play a role in maintaining or disturbing the dynamic equilibrium of any ecosystem.

Human-induced change has a long history. In Europe, Africa, the Americas, Asia and Australia early hunters are believed to have destroyed remaining populations of megafauna (such as the mammoth, woolly rhinoceros and giant wombat) that were already threatened by climate change. In Australia, more than 40 000 years of fire-stick farming gradually changed the forest ecosystems so that fire-resistant species now dominate. However, it was the cultivation of crops and the domestication of animals, beginning around 10 000 years ago, that heralded the beginning of large-scale human impact on biodiversity and human-induced ecological destruction.

The planet is an ecosphere that is an amalgamation of a large number of interrelated ecosystems. These ecosystems are made up of a series of smaller interrelated communities.

Humans simplify natural ecosystems in order to grow food, build habitats and remove or extract resources. Unwanted species, both plants and animals, are removed, and other species are provided with an environment made favourable for their survival by human intervention.

Large amounts of money, time and energy are used to maintain these simplified ecosystems and protect them from pests, droughts, floods and other disturbances. The great environmental challenge now facing humans is how to maintain a sustainable balance between the simplified human ecosystems and the neighbouring, more complex, natural ecosystems on which the simplified ecosystems depend.

SPOTLIGHT

Samarco dam disaster

In November 2015, a dam failed at the Samarco mine, north of Rio de Janeiro in Brazil. The incident at the mine, which is partly owned by the Australian mining company BHP Billiton, is the single biggest environmental disaster of its kind in Brazilian history.

The dam was designed to trap tailings, which are the liquid wastes associated with the mining process. When the dam collapsed, it sent a torrent of water, mud and sediments down the valley (see Figure 1.4.1). Nineteen people were killed in the mudslide. Toxins released from the dam flowed down the Doce River and its catchment, contaminating the drinking water of more than 200 towns. The dam was modified in 2011 and it is thought that these changes destabilised the dam wall leading to the collapse.

Brazilian environmental authorities estimate that will take up to 30 years to rehabilitate the environment. BHP Billiton has already spent over $6.5 billion in rehabilitation costs and is expecting to pay much more into the future.



1.4.1 The collapse of a dam at the Samarco mine in Brazil sent a torrent of toxic mud down the Doce River.

Human modifications to natural vegetation

Removal

Removal involves clearing native vegetation and disruption of ecological processes. Replacement land uses include urban settlement, transport, industrial development and extractive industries, such as mining. Native vegetation will not return without complete reconstruction of the ecosystem, including soil replacement.



Replacement

Replacement is when native vegetation is removed and then replaced with intensively managed systems: agriculture, horticulture (gardening) and plantation forestry. This involves partial disruption of processes. Native vegetation (or components of it) can return after intensive management ceases, although this may require management to restore natural processes.



Utilisation

Utilisation refers to the exploitation of native vegetation, with some consequent degree of modification: forestry (in native forests), pastoralism and recreation in natural areas. This corresponds to a partial removal of the natural vegetation and a partial disruption of processes.



Conservation

Conservation involves the maintenance of natural vegetation for conservation and scientific purposes with minimum deliberate modification of natural processes. Lands designated as national parks and nature reserves fall into this category. In addition, there are substantial areas of vacant or uncommitted government-owned land and indigenous-owned lands. Designation for nature conservation does not preclude past or inadvertent modification. There are no direct or deliberate impacts on the native vegetation as a result of this land use, but there may be indirect impacts from land use activities on adjacent lands.



Adapted from R. Hobbs and A. Hopkins in D. Saunders, A. Hopkins and R. How, Australian Ecosystems, Surrey, Bently & Sons, Sydney

1.4.2 Human modification to natural vegetation

Globally, environmental damage is extensive. There are massive areas affected by severe marine and river pollution, and radioactive and chemical contamination, as well as a large number of cities with air-quality problems.

The use of ecosystems by humans is best described as degrees of modification to natural vegetation as outlined in Figure 1.4.2.



1.4.3 In 2016, ISIS fighters deliberately set oil wells in the Qayyarah oil fields of Iraq ablaze.

Nature of human-induced modifications

Human-induced modifications to ecosystems may be either intentional or inadvertent. In some cases they are the result of negligence.

Intentional ecosystem change

It is not always easy to distinguish between the intentional and unintentional modification of ecosystems. In many instances, human-induced ecosystem change is the unintended consequence of human activities. Such changes often occur because of an inadequate or incomplete knowledge of ecosystem functioning.

Some intentional modifications result in unintended consequences over the longer term. When Indigenous Australians burnt the bush to clear away undergrowth and aid hunting, they did so intentionally. It was part of the means by which they survived. The unintended consequence of this management practice was the long-term effect it had on Australia's pattern of vegetation. The process of natural selection and evolutionary change resulted in a mix of plant species capable of withstanding the effects of regular burning.

While we often have difficulty in determining what is intentional and what is unintentional, some instances of human-induced change are unarguably intentional. These examples are often a result of human conflict. For example, in 2016 the Qayyarah oil fields around the Iraqi city of Mosul were set ablaze by ISIS fighters (see Figure 1.4.3). The ISIS fighters, a terrorist organisation, had occupied the city for many months prior but by mid-2016 Iraqi government forces had launched an attack to retake the city. As part of their defence strategy and to cause further harm, the ISIS fighters lit the oil wells surrounding the city. The fires bellowed toxic smoke into the atmosphere. It was not until April 2017 that the fires were eventually extinguished.

Inadvertent ecosystem change

Meeting the needs and wants of a rapidly increasing human population is bringing about large-scale environmental change. In the natural world, the explosion of a population in any part of the biosphere is compensated for by an adjustment somewhere else in the biosphere. For example, an excess of grasshoppers means that the plants on which they feed are placed under stress and die. Denied a source of food, the number of grasshoppers dies back to a sustainable level. Equally, an abundance of grass will lead to more grasshoppers to keep the grass in check.

Unlike other species, humans have the ability to transfer resources from one region to another and to modify ecosystems in order to sustain continued population growth. The issue is whether such modifications will continue to lead to inadvertent changes, as outlined in Figure 1.4.4. The population sprawl around large cities such as Sydney is a result of the need to house the increasing urban population in accordance with the value systems of that society. The impact such sprawl has on ecosystems is rarely considered by those who inhabit it.

Inadvertent effects of human activities on ecosystems at risk	
Human activity	**Inadvertent effect**
Farming	■ Reduction of biodiversity and the encouragement of excessive population growth of one species ■ Destruction of habitats and ecosystem linkages ■ Soil erosion ■ Irrigation disrupting the hydrological cycle ■ Pesticides and fertilisers affecting nitrate and phosphate levels, causing poisoning and/or algal growth
Mining and quarrying	■ Removal of lithosphere, and total ecosystem destruction, especially with open-cut, or strip, mining ■ Interference with hydrological cycle
Forestry, especially clear-felling	■ Total habitat destruction ■ Loss of biodiversity ■ Soil erosion and loss of fertility ■ Reduction of planetary capacity to remove carbon from the atmosphere
Use of fossil fuels	■ Increased carbon dioxide and other gases in the atmosphere ■ Development of acid rain
Industry	■ Consumption of resources ■ Pollution of groundwater by wastes ■ Build-up of heavy metals in food chain (bioaccumulation) ■ Development of acid rain
Improved medical science	■ Excess of births over deaths, leading to destruction of an ecosystem's dynamic equilibrium ■ Excessive demands for food, especially where cropping of marginal lands is involved
Urbanisation	■ Total destruction of habitat ■ Fragmentation of habitat and destruction of ecosystem linkages ■ Pollution of atmosphere and hydrosphere ■ Increased run-off from hard surfaces ■ Pollution through disposal of waste ■ Destruction of the ozone layer through introduction of chlorofluorocarbons (CFCs), for example, into the atmosphere
War	■ Total destruction of ecosystems

1.4.4 Inadvertent effects of human activities on ecosystems at risk



1.4.5 The Deepwater Horizon oil rig explosion in the Gulf of Mexico led to the biggest oil spill in history.

Ecosystem change caused through negligence

Many environmental disasters are the result of human negligence. The damage to the environment is not deliberate, but poor planning or lack of care and maintenance can bring about devastating impacts. For example, in 1986 a reactor at the Chernobyl nuclear power plant in what is now Ukraine melted down, leading to a radioactive cloud spreading across northern Europe. The environmental consequences are still being felt today.

In 2010, the Deepwater Horizon oil rig exploded in the Gulf of Mexico, as shown in Figure 1.4.5. This killed 11 people on the rig and led to the largest oil spill in history. It is estimated that around 8 billion litres of oil flowed into the Gulf of Mexico, destroying habitats. A 2014 study estimated that around 800 000 sea birds were killed by the spill. The impact continues as toxins continue to harm on the environment.

Measuring the effects of human activity on ecosystem functioning

There is no standard to measure the effects of human activity on ecosystem functioning other than to look at the ecosystem itself and note changes. Some studies assess the effects of human activity in terms of the number of plant and animal species that have been lost. Other studies, especially those that look at specific ecosystems (for example, rainforests), consider lost area of habitat or loss of biodiversity. These measures are dependent on having a known starting point, known as a 'baseline', otherwise they simply become educated guesses.

The magnitude of change

In terms of ecosystem functioning, magnitude of change refers to the extent to which an ecosystem has been stretched beyond its state of dynamic equilibrium. The change might be slight or it could be so extreme as to totally destroy the ecosystem, leaving an area lifeless. More commonly, change could involve the development of a replacement ecosystem, as in the case of the urban environment.

Measuring the magnitude of change requires a comparison between known data and whatever benchmark data may be available. It is preferable for the benchmark data to have been collected before the change commenced.

The rate of change

The rate of ecosystem change is largely related to two factors: rapid world population growth, especially in the countries of the developing world, and the ever-increasing demand for the world's resources, disproportionately by countries of the developed world.

Much of the continuing environmental degradation is taking place in countries of the developing world, and it is in these countries that population is growing most rapidly. Therefore, it is easy to assume that population is the main cause of the degradation. However, that is not the only explanation. Maintaining the economic system of the developed world often involves a shift of resources from the countries of the developing world to the countries of the developed world. The destruction of the world's tropical rainforests is probably the best-known example of this. The rate of forest loss has reached an alarming rate, threatening whole ecosystems. As a consequence, the rate of species loss has accelerated. Developing countries in many parts of the tropical world are forced to rely on the exploitation of raw materials in order to generate enough foreign exchange to pay for imported goods and repay debts. The technology that enables them to do this is often supplied and owned by transnational corporations (TNCs) based in developed countries.

Many countries of the developing world, especially those with tropical rainforest, have rates of deforestation exceeding 0.8 per cent each year. By comparison, the forests of the countries of the developed world are largely stable or increasing in area. In other words, rich countries are preserving their own environment at the expense of poor countries.

Human populations and ecosystem change

Population pressure is closely related to the rate of ecosystem change. Governments need money to implement social and economic programs that aim to improve diet, health and education standards. They also often encourage TNCs to invest in resource-based developments, especially mining and forestry, or offer concessions to establish industry, often with few environmental controls.

The need for foreign exchange also means that governments encourage the growing of cash crops for export, such as palm oil, coffee, tea, cocoa, strawberries or cut flowers. These crops often require irrigation and potentially damaging inputs of fertilisers and pesticides. They also occupy prime agricultural land that once supported subsistence farmers. This can mean that more and more marginal land is brought into production to feed a displaced rural population. The reduced availability of agricultural land can also mean that the traditional fallow cycles are shortened and the soil no longer has time to recover between crop cycles.

Impact of aid programs

Aid programs and infrastructure development can also create problems. Consideration needs to be given to the issue of equity in aid: does it benefit the donor country more than the recipient, and the rich more than the poor? In addition, the provision of, for example, a permanent water supply can encourage nomadic herders to settle in one place, which then becomes seriously overgrazed and environmentally degraded. Inappropriate irrigation schemes can contribute to problems with salinisation, destroying the productivity of land that was in any case marginal. Although most aid projects are now assessed for environmental impact, the temptation remains for governments to seek quick results.

Activities

Understanding the text

1 Outline examples of indigenous people modifying ecosystems.

2 Compare intentional and inadvertent human change.

3 Describe why humans, in comparison with other species, have a greater ability to impact on the environment.

4 Explain what is meant by magnitude of change.

5 Define what a benchmark is.

6 Describe the two factors that are related to ecosystem change.

7 Explain how population pressures impact on environmental change.

8 Describe how the need for foreign exchange affects the environment.

9 Explain how aid programs can contribute to environmental degradation.

Working geographically

10 Study Figure 1.4.2 and outline the ways in which people modify natural vegetation. Comment on the ability of the affected ecosystems to recover in each case.

11 Using the information in Figure 1.4.4, write a discussion on the inadvertent effects of human activities on ecosystems.

12 Study the Spotlight on the Samarco dam disaster.

- **a** Describe the impact of the disaster.
- **b** Using the internet, conduct research and prepare a short report on the current situation with the Doce River.

13 Conduct research into the Deepwater Horizon explosion. Prepare a digital presentation on the impact of the disaster on the environment of the Gulf of Mexico.

14 Conduct a class debate on the topic that human populations are the major cause of environmental degradation.

15 Write an extended response outlining the impact of human populations on the environment.

Population increase and land degradation

Apart from processes such as these, which are in themselves destructive, the fact remains that a growing population needs a growing food supply and access to fuel and water. The intensification of agriculture and fuelwood collection in marginal lands is resulting in widespread land degradation and, in some instances, desertification.

Central to this process of land degradation is the loss of soil due to increased rates of erosion. Research by scientists at the University of Sheffield in the United Kingdom found that around one third of the globe's arable land has been lost due to erosion and pollution. This is the land that supports agriculture and is the most productive. It takes between 100 and 2500 years to build up around 2.5 centimetres of topsoil. Human mismanagement can result in the loss of this amount of topsoil in less than a decade.

The countries of the developing world have much faster rates of population growth than the countries of the developed world. It will take many years before zero population growth can be achieved and so the rate of ecosystem change will continue to grow unless collective global action is taken.

Human versus environmental needs

In the developed world, human use of an ecosystem is often based on the short-term exploitation of natural resources, especially soil. The production of food and fibres ultimately diminishes the productivity of the land.

Harvesting of crops removes a large amount of organic material that would otherwise decompose and return nutrients to the soil. It also removes the protective cover that organic matter provides for the soil. This cover prevents excessive erosion and nutrient leaching. Contamination of the ecosystem from chemicals used in the production process can render a soil unsuitable for further production. Productivity needs to be considered in terms of environmental needs as well as human needs.

UNIT 1.5

Ecosystem management and reasons for protection



1.5.1 Diversity is essential for the maintenance of ecosystem functioning.

The diversity of life on Earth (see Figure 1.5.1) is of inestimable value. It provides the basis for the maintenance of planetary processes and the wellbeing of people. The protection of ecosystems is central to the future wellbeing of the Earth and its inhabitants.

Attempts to protect the Earth's biodiversity range from setting aside and protecting large areas of wilderness, to the preservation of species in zoos, botanical gardens and seed banks. These measures alone will not be sufficient to save many species from extinction or prevent large areas from being degraded. What is needed is a reassessment of the relationship people have with their biophysical environment and with each other. Central to such a reassessment will be recognition of the need to adopt values, attitudes and practices that are compatible with the notion of sustainable development.

The reasons for managing and protecting ecosystems include:

- the maintenance of genetic diversity
- utility value (both current and potential)
- intrinsic value
- heritage value
- the need to allow natural change to proceed.

Maintenance of genetic diversity

Ecosystems rich in diversity generally have greater resilience and as a result are able to recover more readily from naturally induced stress, such as drought and fire, and human-induced habitat degradation. Where diversity is diminished, the functioning of ecosystems (and by association the wellbeing of people) is put at risk.

The vast number of species that inhabit the Earth represent a massive genetic 'database' of successful survival strategies developed over several billion years. Each species has its own gene pool from which an almost infinite number of combinations of individual characteristics can be selected. This diversity allows a species to adapt to changes in its environment. The more successful a species is at regeneration and adaptation, the less vulnerable it is to changes in its ecosystem.

DID YOU KNOW?

Since Europeans first arrived in Australia in 1788, almost 100 plant species have become extinct and more than 200 are now endangered. In addition, more than 75% of all Australian rainforests has now been cleared.

Communities of plants and animals with high levels of genetic diversity often survive periods of stress because there are usually some organisms not adversely affected by the change. The organisms that survive are more likely to be those with the characteristics that enable them to cope with the nature of the stress. If these traits are genetic, the survivors pass them on to subsequent generations. In this way a species will, over time, adapt and change. This process is called natural selection, and is often summarised as 'survival of the fittest'. Fittest, in this sense, means having the characteristics that best suit the circumstances, which is not quite the same as the healthiest.

The loss of genetic diversity brought about by human-induced stress has to be considered as an opportunity cost of an ever-expanding human population.

Investigating genetic diversity

Our limited knowledge of ecological processes has only really become evident in the last few decades as people have utilised more and more of the Earth's natural ecosystems. Continental shelves and ocean depths, once thought to be devoid of life, are now known to be teeming with diverse life forms. People are only now starting to realise that there are tens of thousands of species yet to be discovered.

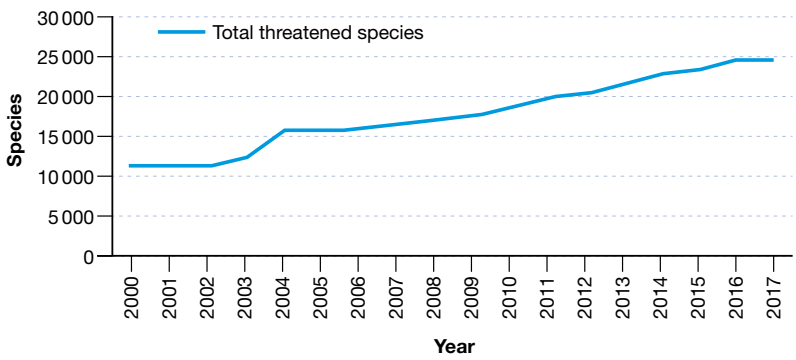
The diversity of life on Earth is the result of millions of years of evolutionary change. The pool of living diversity is dynamic: it increases when a new genetic variation is produced, a new species evolves or a new ecosystem forms; it decreases when the genetic variation within a species decreases, a species becomes extinct or an ecosystem is lost.

Ecologists say that of the estimated 5–30 million species that currently inhabit the planet only 1.4 million have been identified. These represent only about 10 per cent of the species that have ever existed on Earth. The other 90 per cent have fallen victim to an evolutionary process of natural extinction. Evolutionary extinction is thought to have accounted for a loss of approximately one species per year. The actual rate of extinction is now estimated to be approaching at least one species per day. The difference between the two rates reflects the impact of human activities (see Figures 1.5.2 and 1.5.3).

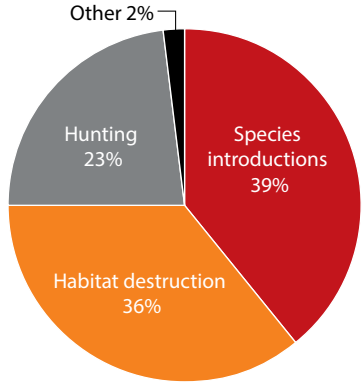
The importance of biodiversity

The Earth's plants, animals and microorganisms constitute a vast store of chemical compounds, some of which have medical applications. Many of our modern medicines are derived from plants. For example, in late 2016 trials began on a new drug, EBC-46 to treat cancer. The drug is derived from the berries of the blushwood tree, which grows in the rainforests of North Queensland. If the trials prove successful this may replace the current chemotherapy treatment that has lots of negative side effects.

In highly competitive ecosystems, such as tropical rainforests, many organisms depend on chemically based protective mechanisms for their own survival. These naturally produced chemicals constitute a major pharmacological resource. The loss of even a small area of rainforest could therefore mean the loss of disease-conquering chemical compounds. Medical scientists have estimated that they have managed to examine only about 5000 of the estimated 250 000 plants that could have pharmacological value.



1.5.2 Number of animal species known to be globally threatened



1.5.3 Known causes of animal extinctions since 1600

Threats to biodiversity

Until the mid-1960s it seemed that the best way to dispose of unwanted organisms (such as weeds) involved the production of a synthetic poison. Unfortunately, many of the poisons produced (including DDT, dioxin and organochlorides) were found to be extremely toxic and bioaccumulate in soils for many years. Worse, many of the targeted species developed resistance while their natural predators were killed off.

Science is addressing this problem by utilising chemical compounds derived from other organisms. They have now identified a range of chemicals that are species-specific and do not accumulate. For example, the pyrethrins used in household insect sprays are derived from a relative of chrysanthemums. They are broken down quickly by microorganisms, so are far less damaging to the environment than the petroleum-based chlorinated hydrocarbons that preceded them.

Other pest-controlling strategies include the introduction of organisms that will establish a balance within an ecosystem. The introduction into Australia of the moth Cactoblastis cactorum from South America to control the spread of prickly pear was an example of a biological control strategy. Many mite and insect pests can be controlled, although not eliminated, by a strategy known as integrated pest management (IPM). Species-specific predators (normally other insects and mites) are released, and pesticides are used only when the predators are not controlling the pest.

Utility value

All the living and non-living components of the Earth's ecosphere have either an existing or potential utility value or usefulness. By maintaining and protecting ecosystems we maximise humanity's ability to adapt to change. The sheer diversity of life represents a vast store of genetic material that can be tapped as human needs change. The loss of a species—whether plant, animal, fungus, bacterium or virus—denies humanity a possible future source of food, medicine, chemicals, fibres or other materials. Australia's flora and fauna make a substantial contribution to the national economy through forestry, the pastoral industry, fisheries, tourism, land reclamation, beekeeping, wildflower harvesting and the kangaroo trade.

Environmental services

At a global scale, the components of the various ecosystems play a vital role in protecting catchments, purifying water (see Figure 1.5.4), regulating temperature, regenerating soil, recycling nutrients and wastes, and maintaining the quality of the air we breathe. Their protection is critical to the physical wellbeing of humanity.



1.5.4 Wetlands play an important environmental service by purifying freshwater.

Our immediate survival depends on very few species; principally a few grasses (such as wheat, rice, sorghum, millet, maize, barley, rye and oats) and a few tubers (such as potato, sweet potato, taro, cassava and manioc). Despite genetic engineering, plant breeders rely on old-fashioned selective breeding to develop varieties of these (and other) crop plants that can withstand climate stress, salinity, disease, and insect attack; are suited to more efficient agricultural practices; or give higher yields.

Almost all the important food crops are native to environments at risk in the developing world: for example, wheat is from Afghanistan, potatoes from the highlands of Peru, and sorghum and coffee from Ethiopia and the Sudan. It is to these regions, to the wild relatives of the crop plants or the traditional varieties grown by subsistence farmers, that the plant breeders have to turn for their genetic material. This vital resource can only be maintained by preserving the environments in which the wild species grow, and supporting farmers to continue growing their traditional food crop varieties.



1.5.5 Large-scale environmental degradation such as that associated with desertification reduces the utility value of landscapes.

Both these needs highlight one of the moral dilemmas of preserving biodiversity: who owns the genetic resource? Is it the developing country and the farmer who has preserved it until now, or is it the multinational that has the technology and the money to exploit the resource?

Economic value of ecosystems

Economists have attempted to value ecosystems in terms of what people are prepared to pay either to consume them or preserve them. The 'existence value' of an ecosystem is defined as the value a community is prepared to place on the ecosystem in its natural state. Many national parks occupy areas that could otherwise be used for farming or urban development. They also contain resources, such as timber and minerals that could be exploited. The amount that people would be willing to pay for the land plus the cost of maintaining the parks is known as its existence value. The community, through government authorities, must be prepared to accept this cost.

Given that ecosystems have an economic value it follows that they also have an option value. The option value is the cost of keeping the ecosystem or species in its natural state, as opposed to exploiting its resources. For example, in 2017 Deloitte Access Economics calculated that the economic value of the Great Barrier Reef was $56 billion and that the reef contributed more than $6.4 billion annually to economic activity in Queensland. This can be a useful for countering economic arguments put forward as reasons to exploit ecosystems.

Another benefit to be derived from protecting ecosystems is that the costs of inaction can be avoided. Environmental degradation, such as desertification as seen in Figure 1.5.5, diminishes the productive capacity of the land. This not only incurs an economic cost but also diverts resources from other social priorities to the repair of environmental damage.

SPOTLIGHT

Anthropogenic versus ecocentric world view

The points raised in the discussion of the utility value of ecosystems are based on a human-centred (anthropocentric) belief that people are the most important species on Earth; that is, that human interests and aspirations are the most important consideration. According to this world view, humans have a right to utilise the world's resources. Where environmental concerns are acknowledged, they are usually expressed in terms of their effects on people. For example, we are concerned about soil degradation because it affects agricultural production and water quality.

Ecologists and environmentalists argue that the Earth's ecosystems will remain at risk until humans replace this human-centred view with an ecosystem-centred (ecocentric) view. According to an ecocentric world view, each species has an inherent right to exist or at least a right to struggle to exist equal to that of any other species. It is considered ethically wrong for humans to initiate an environmental change that leads to the extinction of any species.

Intrinsic value

Ecosystems have their own intrinsic and ethical value; they have a right to exist irrespective of their utility value. While few would disagree with such a belief, and most people would support the view that we need to protect ecosystems for the benefit of future generations, there is still no generally agreed mechanism or strategy by which this could be achieved.

Central to the notion of the intrinsic value of ecosystems is a recognition that the biophysical environment provides for many of the inspirational, aesthetic and spiritual needs of people, such as the importance of Uluṟu, seen in Figure 1.5.6. In an increasingly urban society, aesthetic values make an important contribution to emotional and spiritual wellbeing. By interacting with elements of ecosystems, humans are reminded that they are part of an interdependent natural world.



1.5.6 Unique landscapes such as Uluṟu have a very important intrinsic value.

The aesthetic qualities of ecosystems are also valued for their recreational potential. Activities such as photography, trekking, bushwalking, birdwatching and field studies draw heavily on the aesthetic qualities of the biophysical environment. The growth of ecotourism is also closely linked to the growing appreciation of the aesthetic and ecological qualities of environments.

Aboriginal and Torres Strait Islander perspectives

The links between indigenous peoples and the biophysical environment are particularly strong. Throughout the world, indigenous people derive spiritual strength from their relationship with the biophysical environment. This is the case with Australia's Indigenous peoples.

Aboriginal and Torres Strait Islander peoples regard themselves as part of the environment; they have an ecocentric world view. This world view is expressed in the cultural beliefs and traditions of the Aboriginal and Torres Strait Islander peoples and their managed use of the Earth's resources. Aboriginal and Torres Strait Islander peoples can have an acute appreciation of the natural world in which they live. They acknowledge, through their behaviour and beliefs, that they are responsible for the continuity of their world. Each individual is obliged to protect and preserve the spirit of the land and all things that live upon it. Beliefs about creation and spiritual and physical existence (the Dreaming) are the framework in which people live. These beliefs govern hunting and food-gathering activities, as well as song, dance, storytelling and art, and establish the rules governing relationships between people, the land and all things.

Heritage value

The World Heritage Conservation Council considers natural heritage to be 'natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view'.



1.5.7 Australia's Blue Mountains are listed on the World Heritage Register.

Activities

Understanding the text

1. Outline why genetic diversity is important for ecosystem functioning.
2. Explain the importance of biodiversity.
3. Explain the term environmental services.
4. Differentiate between anthropocentric and ecocentric views on ecosystem protection.
5. Define the intrinsic value of ecosystems.
6. Describe the nature of the relationship that traditional Aboriginal and Torres Strait Islander peoples maintain with the biophysical environment.
7. Explain what is meant by the term natural heritage.
8. Outline the conditions necessary for unhindered evolutionary change.

Working geographically

9. Study Figure 1.5.3. Describe the patterns shown in the chart.
10. As a class, discuss whether putting an economic value on an ecosystem assists in its protection.
11. In a small group, discuss which areas of your local area are relatively undisturbed. Write a list of ways your local community could enhance the protection of these areas.
12. Write an extended response on the following topic: 'Analyse the need to protect ecosystems at risk.'

The Australian Heritage Commission views natural heritage, worthy of National Estate listing, to include 'those places, being components of the natural environment of Australia or the cultural environment of Australia, that have aesthetic, historic, scientific or social significance or other special value for future generations, as well as for the present community'.

In Australia, the concept of 'natural heritage' is wide enough to encompass large areas of pristine wilderness as well as those sites that are more readily accessible to humans. Education has played a critical role in developing public support for heritage listing. As support has grown, more sites (particularly those near human settlements) have been added to the list. In some cases, listing was granted after a public controversy arose from a development proposal that would have degraded the heritage values of an ecosystem. Preserving important elements of our natural heritage for the enjoyment and wellbeing of future generations is a responsibility that we must all share. Australia's Blue Mountains are listed on the World Heritage Register (see Figure 1.5.7).

The need to allow natural change to proceed

The diversity of life forms on Earth is a product of ongoing evolutionary processes. Many ecologists and environmentalists argue that humans have an ethical responsibility, and a requirement based on our own welfare, to see that this evolutionary process continues relatively unimpeded. To ensure that this occurs it will be necessary to protect large areas of representative ecosystems. To achieve the desired objectives, these areas should:

- be large enough to protect and conserve intact ecosystems effectively and to allow evolutionary processes to continue
- have boundaries that reflect environmental rather than political needs (for example, they should be based on the boundaries of a catchment area)
- take into account the interests of local people—when the people who once depended on the resources of an area are excluded they may resort to destructive activities, such as poaching, because they have no other way of providing for their families
- be well-managed and effectively resourced
- be surrounded by a 'buffer zone' where human activity is carefully managed—changes in areas around protected zones may interrupt breeding and migration patterns, and affect water and air quality.

UNIT 1.6

Management strategies

Throughout the world there is a growing recognition that people must accept responsibility for protecting and managing ecosystems, especially ecosystems considered to be at risk. Environmental issues—including climate change and the threat it poses to the globe—impact on government, corporate and individual decision making more today than ever before (see Figure 1.6.1).

Management of ecosystems

There is no one measure of successful ecosystem management. Any success must be measured over a sufficient period to ensure that the changes are not just part of the normal fluctuations within an ecosystem.

Benchmarking

Objective measures of the health of an ecosystem include a focus on species numbers and the stability of populations. This is particularly effective where benchmark data for a particular ecosystem are available. Benchmark data make it easier to comment on the strength of an ecosystem. This approach works best at a local and, perhaps, national level. Data collected at a larger scale are often less precise, but techniques are constantly being improved. Increasingly sophisticated satellite-based technologies and geographical information systems (GIS) are being used to monitor environmental change at a global scale.

Lack of benchmark data can be overcome by undertaking an environmental audit. This involves measuring key aspects of environmental quality within an area and surveying flora and fauna. These data can be used to evaluate the environmental impact of any subsequent activity.

Increasingly, the environmental impact of human activity is being judged in terms of its ecological sustainability. In other words, the following questions are being asked:

- Does the activity detract from the long-term viability of an ecosystem?
- Does it adversely affect the flow of energy and nutrients within the ecosystem?
- Is the ecosystem resilient enough to absorb these impacts?
- Can the impacts be managed in a way that is not detrimental to the ecosystem's ability to sustain itself and meet the needs of future generations?

Management approaches

A management strategy is a 'plan of attack'; a response to the problem or concern. It is a way of achieving specific goals and objectives. Fundamental to any discussion about the management of ecosystems at risk is the distinction that needs to be made between the various management approaches and the philosophies that underpin them. Four broad approaches can be identified: preservation, conservation, utilisation and exploitation.



1.6.1 Awareness of environmental issues is growing, including the most significant: climate change.

- **Preservation** refers to the protection of a habitat (or species) in its existing form. It often involves the prevention of all human activities in the area being protected.
- **Conservation** involves active resource management, and the planned use of natural resources in an effort to minimise waste and environmental damage.
- **Utilisation** involves the replacement of an ecosystem with a human-made environment that is capable of providing a sustainable yield. Sustainably managed commercial agriculture is an example.
- **Exploitation** occurs when an ecosystem's resources are used irrespective of the ecological consequences. Ecosystems are often destroyed, or reduced in extent, as a result of exploitation.

The four broad approaches to ecosystem management are outlined in Figure 1.6.2.

Approaches to ecosystem/resource management

Preservation	Conservation	Utilisation	Exploitation
■ Ecosystems quarantined ■ People denied access ■ Resources remain unused	■ Resource uses limited to those that will not damage ecosystems, such as ecotourism ■ Resources used without significant impact on ecosystems ■ Resources used sustainably ■ Flora and fauna not threatened	■ Natural resources used ■ Natural ecosystems replaced by a built environment that provides a sustainable yield ■ Flora and fauna disrupted	■ Resources exploited without regard for the ecological consequences ■ Flora and fauna devastated

Philosophies of ecosystem management

Radical environmentalism — Romanticism — Stewardship — Utilitarianism — Environmental imperialism

1.6.2 Approaches to ecosystem/resource management

Environmental attitudes

Underpinning the approaches to ecosystem management outlined in Figure 1.6.2 are five key attitudes that help to define the relationship people have with the environment:

- **Environmental imperialism** is an egocentric world view that everything in nature is subordinated to the needs and wants of humans. Ecosystems exist as resources to be exploited for profit.
- **Utilitarianism** is based on the belief that things only have value if they contribute to the happiness and wellbeing of people.
- **Stewardship** contends that humans occupy a privileged position in relation to the rest of nature. People have a responsibility to protect and nurture the land for the benefit of future generations. They are the custodians of the land. This attitude aligns closely with that typically seen in traditional indigenous cultures.
- **Romanticism** values the beauty of nature. Advocates support the protection of wilderness areas; that is, those places unaffected by the activities of people.
- **Radical environmentalism** includes a wide range of views ranging from those who advocate the right of all species to survive to those who argue against all forms of development.

Evaluating environmental management

Contemporary approaches to the management of ecosystems focus on the extent to which the strategies adopted promote, or are consistent with, the principles of ecologically sustainable development.

At a global scale, the ultimate measure of successful ecosystem management will be the achievement of higher standards of living for the world's poor within the context of sustainable development; sustainable in the sense that it does not threaten the integrity of the Earth's ecosystems or natural processes. In other words, it means people living in harmony with nature.

Sustainable development

Sustainable development is achieved by maximising people's economic and social wellbeing (their quality of life) while maintaining and protecting the quality of the biophysical environment. Sustainable development and good environmental management go hand in hand. There are differing definitions of sustainable development, as outlined in Figure 1.6.3.

The principle of sustainable development incorporates four important concepts that can be used as criteria against which to evaluate the success of environmental management approaches. The criteria include the following:

- **Intra-generational equity:** People within the present generation have a right to benefit equally from the utilisation of the Earth's natural resources. At a very minimum it means that people in the developing world have a right to have their basic needs met; that is, food, clothing and shelter, a healthy environment and the fulfilment of their cultural and spiritual needs.
- **Intergenerational equity:** The present generation should not use resources or degrade environments in ways that leave future generations in a worse position than the present generation.
- **The precautionary approach:** Where there are threats of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason for postponing measures that could prevent environmental degradation. In other words, where there is doubt we should always err on the side of caution.
- **Biological diversity:** This is the diversity of life in all forms, levels and combinations. A distinction is often made between species diversity, ecosystem diversity and genetic diversity. Biodiversity is seen to be essential for the evolution and maintenance of Earth's life-support systems, as well as having both an aesthetic and cultural value.

- 'Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.'

  Our Common Future (Brundtland Report), 1990

- 'Improving the quality of human life while living within the carrying capacity of supporting ecosystems.'

  Caring for the Earth: A Strategy for Sustainable Living, 1991

- 'Ecologically sustainable development—development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.'

  National Strategy for Ecologically Sustainable Development, AGPS, Canberra, 1992

1.6.3 Sustainable development has various definitions.

Sustainable development strategies

Various strategies can help address the range of global issues for which the world community has a collective responsibility. Progress towards a sustainable future depends on the successful implementation of these strategies. They include:

- reducing political tensions within and between countries by promoting strategies and initiatives that facilitate greater dialogue, understanding and acceptance
- providing adequate food, shelter, clean water, fuel and healthcare for all people to reduce the unsustainable exploitation of ecosystems by people driven to the point of desperation by circumstances
- providing access to education and training that promotes greater self-reliance and environmental responsibility
- implementing initiatives to curb population growth
- promoting management strategies that ensure the ongoing availability of renewable resources
- implementing strategies that curb our reliance on non-renewable resources and promote the development and use of more ecologically sustainable technologies
- facilitating fair trading, thereby providing developing countries with access to markets in developed countries and access to raw materials
- using strategies that enable developing countries to reduce their debt and thereby reduce the economic pressures that contribute to the unsustainable exploitation of natural ecosystems
- accepting, without qualification, the intrinsic value of ecosystems
- promoting lifestyles that recognise that the materialistic focus typical of developed countries is unsustainable.

Activities

Understanding the text

1 Explain the concept of benchmarking.

2 Compare conservation and preservation.

3 Define the term exploitation.

4 Define utilisation of resources.

5 Describe what intergenerational and intra-generational equity involve.

6 Explain the concept of the precautionary approach.

Working geographically

7 Study Figure 1.6.2 and write a report outlining the different approaches to ecosystem/resource management.

8 Study the definitions of sustainable development in Figure 1.6.3. The definition used in the Brundtland Report has been criticised because it allows for interpretations that accommodate sustainable economic development. The definition used in *Caring for the Earth* is also criticised because it is human-centred, the environment being treated as a resource to be exploited by humans. Do you think the definition used in the National Strategy for Ecologically Sustainable Development overcomes these criticisms?

9 Write a paragraph distinguishing between restoration, rehabilitation and replacement of ecosystems.

Monitoring the progress made in addressing these global issues provides an indicator of the extent to which sustainable development is being achieved.

The important questions to ask when focusing on sustainable development are as follows:

- For whom is it sustainable?
- For what purpose is it sustainable?
- Is it sustainable at the subsistence level or the luxury level?
- Under what conditions is it sustainable?

Sustainable development is not anti-growth. Growth is permissible and indeed desirable provided that it is not at the expense of reducing the resilience of natural and managed ecosystems.

Environmental impact assessment in Australia

The principles of sustainable development can be seen in various pieces of Australian legislation. The *Environment Protection and Biodiversity Conservation Act 1999* is a Federal law that is an important part of this protection. The law requires environmental assessments to be conducted; the assessments provide information on the impact of a development. The legislation can be described as a precautionary approach. Decision makers, usually the Environment Minister, can then use the information to decide whether the development should proceed.

Similar laws exist at state levels as well. In New South Wales, the Department of Environment and Planning deals with environmental impact assessments. The assessments must be made public, allowing the community to review the assessments and to voice an opinion on a development.

Minimising human impacts on ecosystems

A range of strategies can be implemented to minimise environmental impact and to maximise areas of healthy, functioning ecosystems. The aim of such strategies should be consistent with, and measured against, the concept of sustainable development. These strategies include: exclusion, action, education, design and legislation.

Exclusion

Ecosystems considered to be at risk from the activities of people can be protected by excluding activities that are likely to have an adverse impact.

Action

The actions required to improve a degraded ecosystem are often very complex. Too little is known about how ecosystems function to successfully reinstate natural conditions, population levels and many ecological processes. However, rehabilitation can remove human induced sources of stress, assist in re-establishing populations of flora and fauna, and prevent further degradation.

Techniques used to address various types of degraded ecosystems include:

- **no action** because restoration is too expensive, previous attempts at restoration have failed, or experience has shown that the ecosystem will recover on its own
- **restoration** of an area to its original species composition and structure by a program of reintroduction, especially the planting and seeding of original plant species
- **rehabilitation** of some ecosystem functions and some of the original species; for example, replacing a degraded forest with a tree plantation
- **replacement** of a degraded ecosystem with another productive ecosystem; for example, replacing a degraded forest area with productive pasture.

Education

Education is an important aspect of any successful management strategy. It provides an opportunity to inform people about an ecosystem's unique characteristics, its needs and problems, and the ways people can minimise their impact.

Design

When it is impractical to remove the source of stress, it is necessary to plan an artificial way of minimising the impacts of the stress factor. When applying an artificial response, care must be taken not to create a source of stress greater than the original stress factor.

Legislation

The use of legislation encompasses policies that guide decision-making, laws that define permissible activities and regulations that assist in the application of laws to particular areas or sites. All these assist in the successful management of ecosystems at risk.

Changes in management strategies

The way in which ecosystems are managed is constantly changing and in part reflects the changing nature of the relationship that people have with their environment. While many groups of indigenous people saw themselves as part of the environment, many contemporary societies have tended to view the natural world as a resource to be exploited for the benefit of humanity.

The Industrial Revolution greatly enhanced our consumption of resources. This occurred without a parallel expansion in knowledge about the likely effects that this consumption would have on the ecosphere. This remained largely true until the end of World War II, when people started to question what was happening to their planet. Changes in the way ecosystems were managed were, at first, slow. It was not until the early 1970s that governments started to respond to community concerns about the state of the environment.

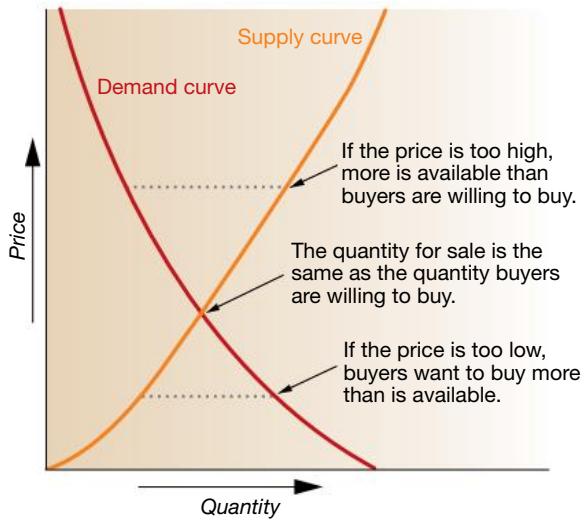
One of the most significant changes was the realisation that the ecosphere is an interdependent system; it cannot be managed by treating any one problem in isolation. A holistic view of the environment needs to be adopted which acknowledges that a decision taken in one part of the environment will ultimately impact on many others.

Changing economic attitudes

Environmental economics is a subset of mainstream economics. It is the distinctive nature of environmental resources that led to the creation of this branch of the discipline. It was an economic proposition that suggested resources were worthless until humans did something with them to give them value; for example, uranium had no value until the technology was developed to generate nuclear power. Economics regards the scarcity (supply) of a resource as one of the two factors that gives it value. The other is demand. Figure 1.6.4 demonstrates the concept of supply and demand. It maintains that the optimum price of a product and the quantity of a product produced are determined by the point at which demand and supply are equal. If there is no demand for a product then it has no value.

It was not until the latter part of the twentieth century that economists began to appreciate that the ecosphere was a scarce resource with value. The atmosphere, for example, had always been considered an inexhaustible resource, but greenhouse gases and other pollutants have made clean air an increasingly scarce resource.

The use of non-renewable resources is increasing. The system is finite, and solar energy is the only outside input of any significance. The resources that we use to satisfy our increasing wants are in themselves limited. If the goals of sustainable development are not achieved, it is inevitable that some resources will become increasingly scarce.



1.6.4 The economic concept of supply and demand



1.6.5 Ecotourism allows for the sustainable use of environmental resources.

Protecting ecosystems at risk comes down to a question of opportunity cost. Ecotourism (see Figure 1.6.5), a sustainable form of development, relies on the natural environment being preserved to create an economic benefit. The decision to protect the unique ecosystem of Fraser Island meant that the economic benefits derived from exploiting the island's mineral sands and forests had to be foregone. At one level, the economic benefits derived from ecotourism were weighed against those associated with mining and forestry. At another level (particularly among conservationists), the ecosystem was considered worthy of protection because of its intrinsic value.

Changing technologies

Technology can enhance our ability to monitor environmental degradation and implement strategies to rectify the damage. Technology offers the promise (which may or may not be realised) to genetically engineer new varieties of crops that reduce our dependence on pesticides and artificial fertilisers. It also promises to develop alternative forms of energy that reduce our dependence on fossil fuels. Technology may also be used to introduce more efficient industrial processes that reduce the rate at which we consume the Earth's natural resources. Less damaging pesticides may be identified and developed. Biotechnologies may be developed that allow us to save endangered species and perhaps even bring back extinct species.

Some technologies raise a number of important ethical and legal issues. Genetically modified foods, cloning and the manipulation of DNA are at the centre of a widespread community debate. Other less-controversial technologies provide a source of hope for the future and a means by which the rate of environmental degradation can be slowed and possibly reversed.

SPOTLIGHT

South Australia's giant lithium battery

One of the biggest challenges to widespread use of renewable energy sources is the capacity to produce what is known as baseload power. This is the capacity to produce electricity cheaply to meet the minimum normal demands. In Australia, this has always been met by coal-fired power stations as they traditionally have been the cheapest and most reliable in meeting this demand.



1.6.6 South Australia's combined wind and battery power station

Renewable energy has been seen as unreliable for baseload and has tended to play a relatively minor role in electricity production. The argument has been that solar and wind energy farms cannot be relied on day in and day out. For example, on cloudy days, solar energy production falls and so on.

However, in July 2017 a partnership between the South Australian Government, US based technology firm Tesla and French company Neoen was announced. The partnership built a 100MW/129Wh battery system that is the world's largest lithium-ion battery, storing energy produced by wind power, as seen in Figure 1.6.6. Energy within the batteries is used to provide baseload power when the environmental conditions mean that insufficient energy is being supplied directly from the wind farm.

Life cycle assessment

Life cycle assessment (LCA) seeks to quantify, or at least assess, the total environmental burden of a product or technology. The total environmental burden includes the energy expended when extracting raw materials for the product or technology and when manufacturing, distributing, using and disposing of it. While trade-offs with non-environmental considerations are inevitable, the results of an LCA approach can be significant.

Swedish carmaker, Volvo, was one of the first companies to consider LCA. As far back as 1945, Volvo introduced a system to reuse and recycle parts of their cars. Today, trucks are one of Volvo's major production lines and around one third of the materials used in their new trucks are made from recycled materials, and over 90 per cent is recyclable. The company has built recycling plants that tear down their old trucks and prepare parts for reuse or recycling.

Industrial processes are constantly being refined to reduce both their costs and impact on the environment. Savings can be achieved by reducing the inputs required in the manufacturing process, especially raw materials and energy. Savings can also be made by reducing the amount of waste to be treated and disposed of. Any improvement in efficiency reduces the demands placed on the biophysical environment.

Activities

Understanding the text

1 Describe the impact of the Industrial Revolution on the environment.

2 Explain what prompted the shift in the 1970s in the way ecosystems were managed.

3 Explain the concept of opportunity cost. How can such a concept be used to enhance environmental protection?

4 Outline the potential for technology to enhance environmental protection.

5 Define the term environmentally sustainable technology.

6 Explain the importance of life cycle assessment.

Working geographically

7 Construct a table to summarise the main ways that humans can minimise their impact on the environment.

8 Conduct research into the role of lithium batteries in renewable energy. What are the benefits and possible disadvantages of this technology?

Changing environmental attitudes

For much of history, traditional societies relied on the local environment for all their needs and therefore understood the environment thoroughly. In contemporary societies this link to the environment is far less direct. We often rely on food produced thousands of kilometres away, work and live in climate-controlled buildings and radically alter the environment to suit our own needs.

The 'environment' has become something that is distinct from the human experience. We have come to see 'the environment' as places we go to, such as visiting a national park. Even though we rely on the ecosystems and the environmental services they provide for our very survival, we have increasingly seen ourselves, our places of work and our homes as separate and unconnected to the environment.

These attitudes are gradually changing. Climate change is probably the main catalyst for this. We now know that humans are dramatically changing the Earth's climate, which will have dramatic impacts on all ecosystems. We also know that significant changes in the world's climate will greatly diminish opportunities for humans. We can no longer see human society and the environment as distinct—they are interconnected (see Figure 1.6.7).



1.6.7 Polar bears are one of the species most at risk from climate change.

Green politics

In recent decades, Green politics has become an important part of the political landscape in many developed countries. Political activists with policies that favour the protection of the Earth's ecosystems have been elected to office and are now working within governments to increase the level of environmental awareness. In some instances they use their balance of power to implement aspects of their environmental agenda. Greens have influenced the political process and election outcomes by directing preferences to the political parties that demonstrate the greater commitment to an environmental agenda. In Germany, the Greens have successfully moved to have the country's reliance on nuclear power phased out.

Consumer behaviour

Consumers are increasingly using their influence over large companies to bring about changes in corporate practices. In July 2017, the two major supermarket chains in Australia, Woolworths and Coles announced that they would begin to phase out the use of single-use plastic bags in their stores. This was not in response to government polices but to a large public campaign to change the practice.

In the food production industry, consumer preferences for organically grown food have seen this sector of the market grow dramatically. Certification protocols for organically grown food are widespread and environmental endorsements of products is seen as an important marketing edge. For example, endorsements for sustainably caught tuna appear on most cans sold in Australia.

SPOTLIGHT

Paris Agreement

In October 2016, world leaders met in Paris to discuss the impact of climate change and to develop an integrated global strategy. One hundred and ninety-seven countries participated in the conference. The delegates were considering the next phase of the United Nations Framework Convention on Climate Change; this became known as the Paris Agreement.

By mid-2017, 153 nations, including Australia had not only agreed to the conditions of the agreement but had also passed laws through their own parliaments about the Agreement. In international law this is ratifying the agreement. Originally, the United States signed to participate in the Agreement, but in July 2017 US President Donald Trump announced that the US would withdraw from the Agreement.

President Trump said that he needed to protect US jobs and that the Agreement was unfair in its impact on the US. Trump's decision led many environmentalist to fear that other countries would also withdraw. Their thinking was based on the fact the US is the biggest source of the greenhouse gas emissions that cause climate change and therefore other countries would withdraw if the US was not going to commit.

However, other countries did not withdraw, marking a significant change in attitude. In the US, individual states, cities and companies announced that they would commit to the reductions in greenhouse gas emissions that the Agreement stipulated. When Trump announced the withdrawal of the US from the Agreement he said, 'I was elected to represent the citizens of Pittsburgh not Paris'. Pittsburgh is a large US city that has traditionally been a centre for steel production and other manufacturing. Soon after Trump's comments were published, Bill Peduto the Mayor of Pittsburgh tweeted, 'As the Mayor of Pittsburgh I can assure you that we will follow the guidelines of the Paris Agreement for our people, our economy & future'.

Activities

Understanding the text

1 Describe how environmental attitudes have begun to change in recent decades.

2 Account for the changes in attitudes towards the environment.

3 Describe the place of Green politics.

Working geographically

4 Write an extended response to explain how governments at all levels, corporations and individuals can affect environmental change.

5 Investigate a political party that is environmentally based. Outline the goals and aims of the party.

6 Conduct research into the United Nations Framework Convention on Climate Change by accessing the website atnewsroom.unfccc.int. Describe the current status of the Convention and its main objectives.

7 Collect a media file on the way social and political forces are being used to combat environmental degradation.

CASE STUDY

Indigenous management strategies

Indigenous cultures generally have a much closer affinity with the biophysical environment than contemporary industrialised societies. A feature of this affinity is the careful way in which many indigenous cultures interact with their environment. This interaction is governed by attitudes that emphasise respect and coexistence.

The philosophy that often reflects the relationship between Indigenous Australian people and ecosystems is stewardship. Indigenous people believe that they have a responsibility to protect and nurture the land for the benefit of future generations. They are the custodians of their land.

The goals and objectives of ecosystem management focus on the collection of food and the provision of shelter within the context of a respect for the Earth, its fragile nature and the interdependent relationship of people and the environment. The aim of ecosystem management is self-sufficiency. By taking only what is needed, waste is eliminated.

Interdependence with the land

Indigenous people often have their own working definition of ecosystem management built into their culture through spiritual ties to the land, daily practices, seasonal calendars, choice of tools and weapons, artistic interpretation and the division of labour. The accumulated experiences of human interaction with nature is passed down from generation to generation in laws, codes of conduct, customs, rituals, ceremonies, stories and teachings. The separation of many peoples from their land has meant that some of this knowledge is at risk of being lost. The continuation and progression of these cultures and associated management philosophies is dependent on the ability of these peoples to once again use the land.

Management units and boundaries are often determined through the creation of territories, each with its own distinct political systems and laws. Aboriginal and Torres Strait Islander peoples, for example, had 600–700 distinct nations/language groups before 1788.

These nations/language groups were composed of several clans, each of which was responsible for a certain area of land. Each clan member had a link with a specific plant, animal or natural feature with which they had a spiritual connection. Each clan member was charged with the responsibility of caring for their ancestor's spirit. This is sometimes referred to as totem. This heightened the feeling of interdependence with the land.

Recognition and respect for individual ecosystems

Aboriginal hunting and gathering technologies differed from region to region. In areas where resources were scarce, difficult to find and capture, such as in the desert, the most appropriate technologies were those that provided hunters with the flexibility and mobility to deal with their harsh and unpredictable environment. In contrast, more elaborate technologies were used in areas where resources were seasonally abundant and reliable and included species that are more difficult to capture. In short, Aboriginal technologies were closely related to the conditions in which they were used and were, in many important ways, a sophisticated expression of inventiveness.

Close affiliation meant Indigenous Australian people were familiar with the cycles and processes of the ecosystem in which they were living. Hunting, gathering, farming and food production were differentiated, as were tools, technologies, customs and laws. This demonstrates that the people recognised the unique characteristics of each environment. They also accepted the ecological constraints or limits of the environment. As a result, the plants and animals eaten at particular times of the year, the degree of mobility and the nature of seasonal movements varied from region to region.

Manipulation and management of ecosystems

Manipulation of ecosystems by Aboriginal people included building artificial dikes, digging trenches, damming rivers and using fire-stick burning. Generally, these interventions did not diminish the resilience of ecosystems. However, some practices did have long-term impacts such as the burning of the bush to attract game and facilitate movement, which resulted in a modification of Australia's vegetation. These impacts were relatively minor compared to the widespread degradation caused by largescale farming, mining and industrial and urban land uses.

Management practices included planting parts of yams back into the holes from which they were dug so the plants would regenerate; artificially fertilising flowers, seeding river flats to re-establish plant populations; settling bees into tree hollows to start new hives and digging pits which filled with water and provided a breeding place for frogs.

While these examples highlight the ability of Aboriginal and Torres Strait Islander peoples to manage specific resources, the majority of Indigenous Australian management practices were directed towards the conservation of species. Strategies included:

- restrictions on species caught
- closed seasons
- taboos
- designated areas for individuals and groups
- leadership according to age, enabling ecologically sound practices to be handed down from one generation to another
- limits to population growth
- sustainable methods of hunting.

Indigenous knowledge in the present day

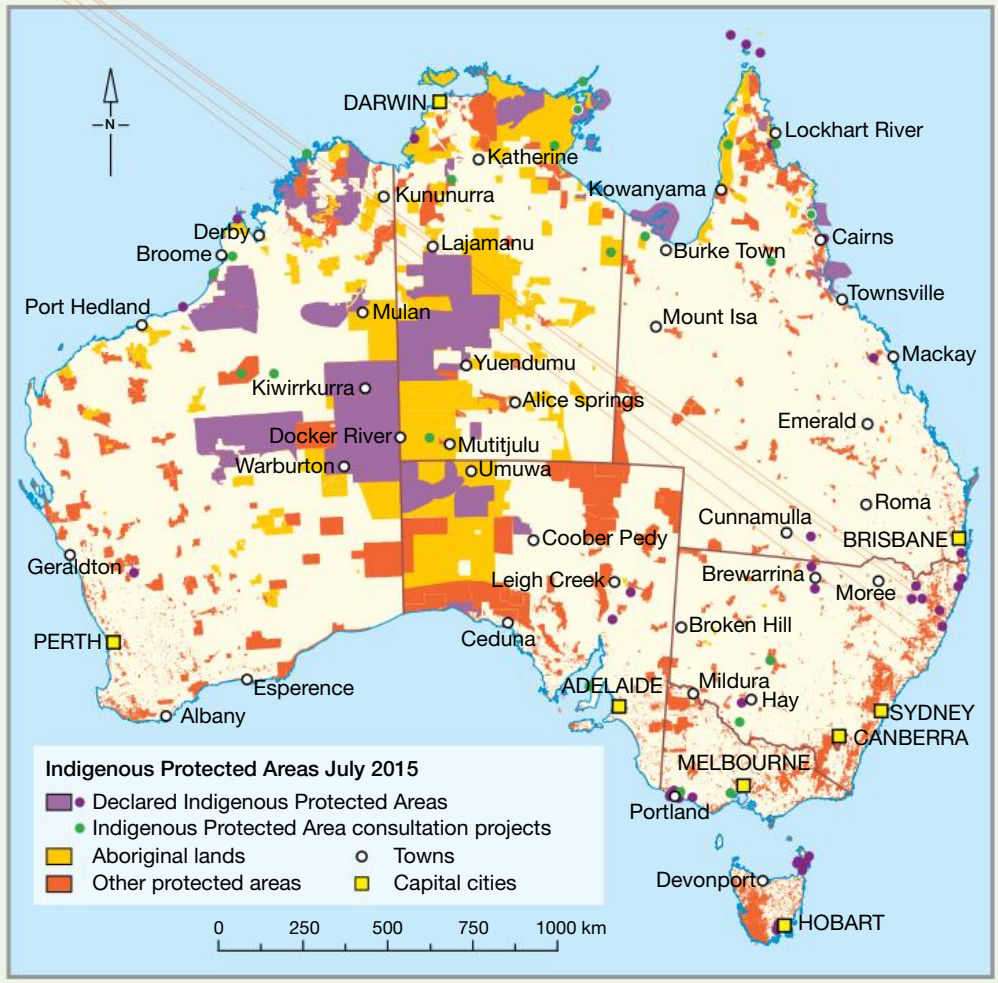
Indigenous societies have an intimate knowledge of the ecosystems in which they live. This knowledge is passed down from one generation to the next. The best means of protecting and preserving this accumulated knowledge is to allow indigenous people worldwide to continue practising their traditional way of life. This is not happening for a range of political reasons. Promoting strategies for sustainable development means more than learning from indigenous knowledge and culture; it involves the recognition of indigenous rights, especially land rights.

Indigenous Protected Areas

An Indigenous Protected Area (IPA) is defined as an area of land or sea where Indigenous owners promote biodiversity and cultural resource conservation, according to an agreement with the Australian Government. IPA make a significant contribution to Australian biodiversity conservation. The goals of the Indigenous Protected Areas element of the Caring for our Country initiative are to:

- support Indigenous land owners to develop, declare and manage IPA on their lands as part of Australia's National Reserve System
- support Indigenous interests to develop cooperative management arrangements with government agencies managing protected areas
- support the integration of Indigenous ecological and cultural knowledge with contemporary protected area management practices (source: Department of the Environment).

There are now 50 declared IPA and over 40 consultation projects across Australia, as shown in Figure 1.6.8. IPA now account for over 40 per cent of the National Reserve System.



1.6.8 Indigenous Protected Areas

Activities

Working geographically

1 a Describe the nature of the relationship that Aboriginal and Torres Strait Islander people have with the biophysical environment.

b Outline the ways in which Aboriginal and Torres Strait Islander people manipulated and managed ecosystems and list the strategies they used to conserve species.

c Describe how the accumulated experience of indigenous people around the world has been passed from one generation to the next. Why has some of this knowledge been lost?

d Explain how we can ensure that the knowledge and experience of indigenous people will be available to future generations.

2 Study Figure 1.6.8. Write a paragraph outlining the locations of Indigenous Protected Areas around Australia.

3 Using the material on Aboriginal and Torres Strait Islander people as a model, investigate the ways in which another indigenous people manage ecosystems.

Exam-style questions

Extended responses

- Analyse the biophysical interactions that lead to diverse ecosystems and their functioning.
- Explain the factors that place ecosystems at risk.
- Account for the vulnerability and resilience of ecosystems. Compare and contrast the vulnerability and resilience of two ecosystems at risk.
- Analyse the natural and human-induced modifications that cause stress in ecosystems.
- Explain why it is important to manage and protect ecosystems.
- Evaluate the traditional and contemporary management strategies used to protect ecosystems.

Glossary

abiotic the non-living components of ecosystems, such as light, soil, water and air

aquatic ecosystem a water-based ecosystem, such as a pond, lake or ocean

autotrophic organism an organism that manufactures its own food from sunlight, water and minerals; also known as a producer organism

bioaccumulation a process whereby toxic chemicals are concentrated at successively higher trophic levels within the food chain

biodiversity the variety of species and the genetic variability among individuals within each species

biome the biological components of an ecosystem

biotic the organisms that make up the living parts of ecosystems

community a group of interdependent organisms living together in a common environment and interacting with one another

decomposer an organism that feeds by breaking down the dead organic matter in an ecosystem

dynamic equilibrium a situation in which stability is achieved in an ecosystem

ecological succession one species gradually taking over an environment from another as circumstances within the environment change; for example, as a climate becomes drier drought resistant species will gradually take over

ecology the study of organisms and their relationship to one another and their surroundings

ecosphere the ecosystem of the planet; the totality of all ecosystems

ecosystem the dynamic interactions between plant, animal and microorganism communities and their non-living environment as a functional unit

ecotone the transition zone where one type of ecosystem blends into another. It usually contains many of the plant and animal species found in both ecosystems and sometimes those not found in either

existence value the amount of money that people are prepared to spend or forgo in order to keep an ecosystem (or species within an ecosystem) in existence

habitat the environment of a living organism

heterotrophic organism a consumer organism that is unable to make its own food

interdependence the dependence of organisms within a habitat on each other for the survival of their species

leaching the removal, by water, of minerals from the upper layers of a soil to the lower layers

monoculture an environment where one plant species dominates totally

natural selection a theory first put forward by Charles Darwin; the theory states that in nature only the strongest will survive and therefore nature will naturally select the strongest and allow the weaker to die out

non-endemic species species that do not occur naturally in an area

opportunity cost an economic term that means that in order to do one thing something else must be given up; that which is given up is said to be the opportunity cost

option value the money that people are prepared to pay in order to interact with an ecosystem or species

permafrost permanently frozen soils; usually found in tundra ecosystems

phytoplankton small, drifting plants, mostly algae, found in aquatic ecosystems

producer organism see autotrophic organism

productivity the rate at which biological matter (biomass) is produced by an ecosystem or part of an ecosystem

terrestrial to do with the land

xerophytic plants that exist on extremely small amounts of water

zooplankton small, floating herbivores that feed on phytoplankton

CHAPTER

2 Coastal dunes

Coastal dunes are massive accumulations of sand created and constantly changed by the power of the wind and sea. Coastal dune ecosystems are extremely fragile. They are susceptible to both natural and human-induced change. The dunes and their highly specialised plant communities can be seriously degraded or even destroyed by natural causes (such as sea level change, storms, cyclones, droughts or fire) or by human interference (such as clearing, grazing, vehicles or excessive trampling). Their location directly behind beaches has made dunes a favoured location for coastal development. This has seen them flattened, reshaped, mined, built on and in some cases removed entirely. It is only in the last 30 years that the value of coastal dune ecosystems has been recognised and the management of these unique places considered important.

Sand dune ecosystems are the product of the complex interactions of the four spheres of the biophysical environment and are considered essential to the balanced and long-term functioning of the coastal ecosystem.

This chapter will examine the biophysical interactions responsible for the development and functioning of coastal dune ecosystems. We will also explore the nature and rate of changes that affect the functioning of the ecosystem, the nature of human impacts, and the traditional and contemporary practices used to manage them.

> **Of all the coastal ecosystems, sand dunes have suffered the greatest degree of human pressure. Many sand dunes have been irreversibly altered through the activities of [people], both by accident and design.**
>
> **R.W.B. Carter, coastal geomorphologist**

2.0.1 Sand dunes are one of the most dynamic ecosystems on Earth.



UNIT 2.1

Nature and spatial distribution

Coastal dunes are large accumulations of sand located immediately behind the active beach zone. They are formed when sand is deposited onto the shore by wave action, dries out and is blown to the back of the beach. This process is referred to as accretion.

Nature of coastal dune ecosystems

On coasts where there is relatively little wave action and a large tidal range, extensive areas of tidal flats are exposed at low tide. As the tide retreats, the sand dries out and is exposed to the wind. Over time, prevailing winds shape the sand into a system of dunes. The dune systems found along the North Sea coasts of Denmark, Belgium, Germany and the Netherlands were formed under such conditions.

On coasts where the tidal range is relatively small, sand is delivered to the beach by wave action. The dunes formed under such conditions rely more heavily on a combination of wave and wind action. Dune systems formed under such conditions are found along the south-east and west coasts of Australia, the west coast of Africa and parts of the east and west coasts of North America.

In some parts of the world, sand has been accumulating since the Pleistocene period. This is the geological period dating from about 2 million years ago to the end of the last Ice Age, about 10 000 years ago. These ancient sand deposits have, over time, developed into enormous dune fields that have significantly altered the topography of the land.

Massive dune fields, with dunes stretching back many kilometres from the beach, often develop in areas where arid lands are found adjacent to the coast. Desert dunes, which are formed by the wind shifting dry sands, sometimes merge with the coastal dunes formed by the landward movement of beach sands. Such dune fields are found along the coasts bordering the Sahara Desert in North Africa, the Namib Desert in south-west Africa (see Figure 2.1.1) and along Western Australia's northern coastline. These dunes can grow to vast heights and can be several kilometres in length.

Spatial distribution of coastal dune ecosystems

Coastal dunes are found on all the world's continental land masses, with the exception of Antarctica. They form wherever there is sand available for their construction.

Sand—grains of weathered rock—can be classified as very coarse (with a diameter of 1–2 millimetres), coarse (0.6–1 millimetres), medium (0.2–0.6 millimetres) and very fine (0.06–2 millimetres). Windblown desert sand is usually finer than beach sand. Beaches generally obtain their sand from rivers flowing to the sea and from the wearing away of cliffs.

In some coastal areas other forms of coastal sediments dominate. In the south-east of England, the primary sediment type is shingle. These are rounded, waterworn stones, which have been eroded from the surrounding cliffs. In such circumstances dunes do not have the opportunity to develop. The source of coastal sediments is very important in determining whether sand is available for the construction of coastal sand dunes.

Wind is the single most important factor in determining the shape and extent of coastal dunes. Dunes are most likely to develop in coastal regions that experience strong onshore prevailing winds. For this reason the most extensive dune ecosystems are found in the world's temperate and arid tropical climatic zones. In the wet tropical zones, prevailing winds are generally weaker and less able to move the volume of sand required for dune construction. This does not mean that coastal dunes are completely absent from the tropical world. Along parts of the Sri Lankan coast and the coast of eastern Malaysia, extensive dune systems have developed. Despite being well within the wet tropical zone, the prevailing wind in these areas tends to be strong and onshore, allowing coastal dunes to develop.



2.1.1 Namibia's skeleton coast, where coast and desert merge into a huge mass of sand

Activities

Understanding the text

1 Explain why coastal dune ecosystems are susceptible to both natural and human-induced change.

2 Explain, in your own words, what coastal dunes are.

3 Compare the ways dunes are constructed in coastal areas with a large tidal range and areas with a small tidal range.

4 Describe the type of dune systems that can develop along coasts that are adjacent to arid lands. What causes this type of development?

5 Outline where coastal dunes develop.

6 Explain the role sediment plays in the development of coastal dunes.

7 State where the most developed coastal dunes are found. Why are they found there?

8 Explain the term prevailing wind.

Working geographically

9 Using a graphic organiser, such as a mind map, record the conditions necessary for dunes to form.

UNIT 2.2

Interactions within the biophysical environment

The four components of the biophysical environment are the atmosphere, hydrosphere, lithosphere and biosphere. The way these components interact is the critical factor in determining the shape, extent and nature of coastal dune ecosystems.

The role of the atmosphere

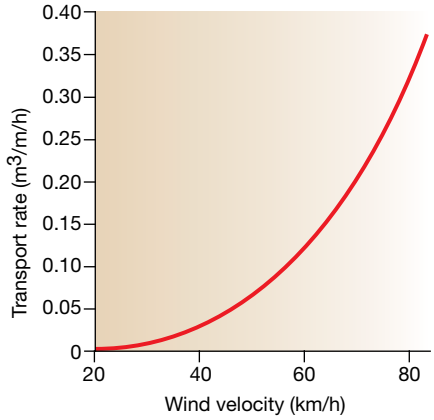
The three main components of weather are wind, temperature and precipitation. These have a significant impact on the development of coastal dune ecosystems. The climate of an area is also very important. As already noted, the wet tropics do not provide the right sort of climatic conditions for the development of coastal dune systems.

Wind

The movement of sand by the wind is referred to as aeolian transport. The volume of sand transported by wind depends on:

- the size of the sand particles
- the velocity (speed) of the wind
- the local topography (shape of the land)
- the nature of the vegetation cover.

Sand grains with a diameter of between 0.1 and 0.2 millimetres are the most easily moved by aeolian transport; any bigger and they become too heavy for the wind to carry, any smaller and the grains have too much cohesion to be dislodged. The higher the wind velocity, the higher the rate of sand movement. Figure 2.2.1 demonstrates this relationship.



2.2.1 The relationship between wind velocity and aeolian transport

The potential of the wind to transport sand is also affected by local conditions, especially the degree of protection the sand has from the prevailing wind. Where sand is covered by vegetation, aeolian transport will be minimised. The foliage of the vegetation disturbs the flow of the wind, reducing its velocity (speed). The roots of plants also help to bind the grains of sand together, making them more difficult to shift.

Types of aeolian transport

Sand can be moved with aeolian transport via suspension, saltation and surface creep, as shown in Figure 2.2.2.

SUSPENSION

Very tiny particles of sand are moved by suspension. In this process the particles are carried by the wind, often well above the ground. They are too small to be influenced by gravity and they may travel for thousands of kilometres before they finally return to Earth, often as the nuclei of a raindrop. This type of transport is most commonly seen in vast dust storms that occur in arid regions, but it does account for a small proportion of sand moved along coastlines.

SALTATION

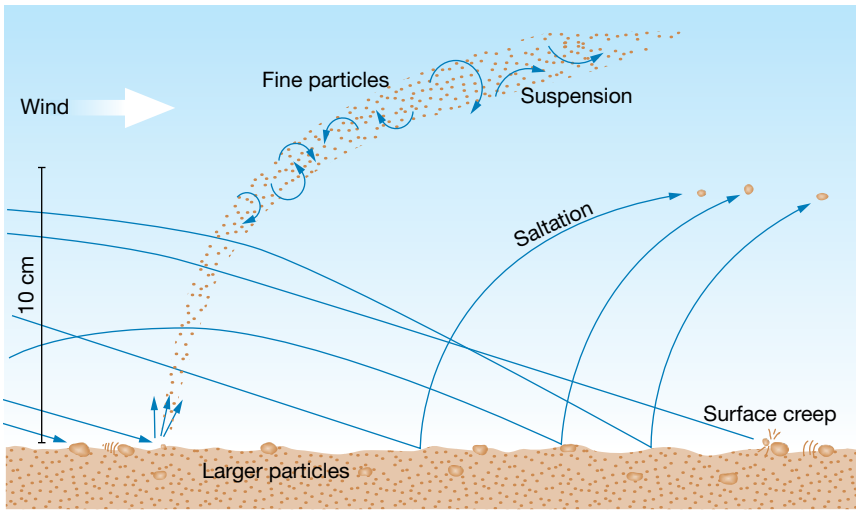
Sand is most commonly moved by the wind via a process known as saltation. As the wind strikes the ground it causes turbulence, meaning the air moves in several directions. This air movement causes the sand grains to become disturbed and more easily displaced. If the wind has enough velocity it will cause the sand grains to begin moving.

This is known as the critical velocity. The critical velocity will vary depending on the grain size, the level of vegetation and the dampness of the sand.

As the sand grains begin to move along the ground they strike other grains. This collision can cause one or more of them to bounce into the air. Once in the air, the grain is moved by the stronger winds that exist higher above the ground surface. Gravity soon causes the grain to fall back to the ground. The grains generally strike the surface at an angle ranging from 10 to 16 degrees. This angle is perfect for continued motion: if the grain falls on a rocky or other hard surface it will simply bounce into the air again. Should the grain fall back onto a sandy surface, the falling grain is likely to knock another grain, causing it to bounce and set off a chain reaction. This reaction eventually sets in motion the entire sand surface.

SURFACE CREEP

Grains of sand that are too large to be moved via saltation are transported by surface creep. Surface creep occurs when the larger grains of sand are dislodged by the impact of falling grains. The grains roll along the surface of the ground, being propelled by the smaller falling grains. About one-fifth of sand movement by aeolian transport is caused by surface creep. If the grain is any larger than around 1 centimetre in diameter it will be too big for any form of aeolian transportation.



2.2.2 The transport of sand by wind

Temperature

Temperature determines the rate at which beach sand dries and the extent and type of vegetation that grows in an area. Vegetation also impacts on the rate of aeolian transport.

The temperature also affects the functioning of ocean currents. These currents have the potential to move sediment long distances or to cause beaches to be eroded or built up.

Precipitation

Levels of precipitation (rainfall) also determine the nature and extent of the vegetation binding the sand together. Areas with regular rainfall are more likely to have a vegetation profile. Areas with low or irregular rainfall are likely to remain unstable and support little vegetation growth.

The role of the hydrosphere

Hydrological processes are those that involve water, which is one of the most important agents of change on Earth. Along coasts, water is a critical factor in determining the nature of coastlines. River systems transport sediment to the coast, where it is distributed by longshore drift and ocean currents. Waves erode cliffs and headlands, providing additional sediment. Storm waves cause damage to beaches, but constructive waves rebuild them.

Activities

Understanding the text

1 Define and explain the term aeolian transport.

2 Outline the factors that affect the rate of aeolian transport.

3 Distinguish between the processes of surface creep and suspension.

4 Explain the role of temperature and precipitation in the formation of dunes.

Working geographically

5 Examine Figure 2.2.1. Describe the relationship between wind velocity and the rate of aeolian transport. Explain what this indicates about the role of wind in dune construction.

6 Write a report outlining the role of weather in the development of coastal dune systems.

7 Study Figure 2.2.2. Write a brief report on the ways wind transports sand.

8 Write a paragraph explaining the terms saltation and critical velocity.



2.2.3 Wave action erodes headlands providing much of the sediment used in dune construction.



2.2.4 Much of the sand in Fraser Island's vast dune systems has been transported to the region on ocean currents. Dune lakes form as a result of localised rain events.

Waves

Wind-induced waves (see Figure 2.2.3) also play a role in the development of coastal dunes. Waves transport the sand that is needed for dune construction and they create change in dune systems by attacking them during storms.

During periods of relatively calm weather, waves bring sand from offshore deposits (such as offshore bars) and deposit it onto beaches. This sand is then available for the wind to transport it into the dune system. In periods of severe and unstable weather, storms create large and powerful waves that strike the coast with such force that they remove sand from beaches and the foredune area. In very severe storms the waves may attack the dune system, creating washovers.

Longshore drift

The effect of currents is very important, particularly the process of longshore drift in the development of coastal dunes.

The importance of longshore drift lies in its role as a transporter of sediment. Sediment, which is produced or deposited in one part of the coastal system, is transported to other locations within the system by the process of longshore drift. This allows dunes and other sediment-based landforms to develop in areas some distance from the source of coastal sediments.

Queensland's Fraser Island is a vast island made entirely of sand. Some of the sand that makes up the island and its huge dune system is derived from sandstone deposits found in the Sydney region. Longshore drift and ocean currents have transported the sand considerable distances northwards along Australia's eastern coastline.

Rainfall

Rainfall is another important factor in the development of coastal dunes. While rainfall infiltrates sand dunes with relative ease, heavy downpours can produce run-off, which erodes the sandy surface, exposing it to the wind. Another important change caused by rainfall is the development of dune lakes. These lakes form in low-lying areas of the dune system. Fraser Island has a large number of dune lakes, as seen in Figure 2.2.4.

In times of heavy rainfall, surface run-off accumulates in a swale, which is a trough or shallow depression between the crests of coastal dunes. Eventually the sand becomes saturated and the water table rises. With the return of warmer weather, the swale dries out and the water table retreats. By this time, however, much of the protective vegetation has drowned and the sand is now left exposed. This causes a migrating dune to form and begin moving away from the now dry lake.

In some locations, notably on Fraser Island, dunes may form across the mouth of a valley. If a stream runs through the valley, ponding may occur: the dunes, acting like a dam, hold back the stream's water and so a lake is formed. Such lakes tend to be semipermanent (or in some places permanent) and cause a major change in the local environment, encouraging different flora and fauna to colonise the affected area.

SPOTLIGHT

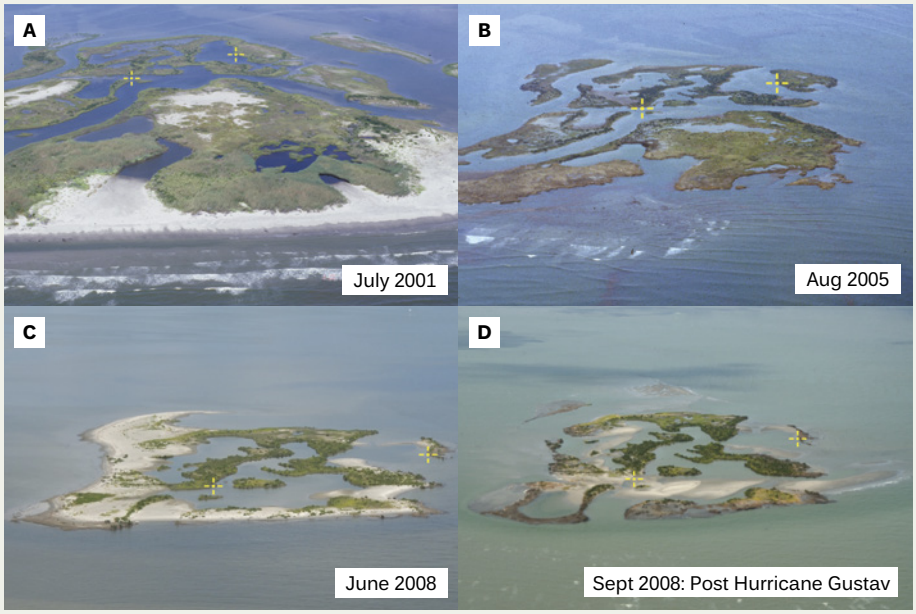
The Chandeleur Islands

The Chandeleur Islands are a collection of low-lying islands off the coast of New Orleans, Louisiana, in the southern United States. An extensive dune system is found on the islands and a unique ecosystem has developed over a long time.

This part of the US coastline is very susceptible to hurricane activity, with several large hurricanes striking the islands since 2000: Hurricane Lili (2002), Hurricane Ivan (2004) and Hurricane Dennis (2005). However, it was Hurricane Katrina in August 2005 that caused the most damage to the dune system. This was followed by another intense hurricane in Hurricane Gustav in 2008.

Figure 2.2.5 A shows the Chandeleur Islands in 2001. As can be seen, a large dune system is located around the edges of the islands. Figure 2.2.5 B was taken after Hurricane Katrina. As is clear, the whole dune system has been destroyed by a massive storm surge that has engulfed much of the islands.

Figure 2.2.5 C shows the resilience of the islands. By June 2008 when this photograph was taken, the dune system is beginning to reappear less than three years after the almost total destruction caused by Hurricane Katrina. The vulnerability of the islands was again exposed though just a few months later when Hurricane Gustav struck the islands as shown in Figure 2.2.5 D.



Source: USGS.

2.2.5 The Chandeleur Islands in the Gulf of Mexico showing the impact of hurricanes. In each photograph the yellow cross marks the same physical location.

Activities

Understanding the text

1 Outline the role of hydrological processes in the formation of coastal sand dunes.

1 Explain the contribution of longshore drift to the development of coastal dunes.

3 Explain the processes involved in the development of dune lakes and swales.

4 Define the term ponding. Why is it so significant to the dune environment?

Working geographically

5 Write a brief report on the role of climate in the development of coastal dunes.

6 As a class, discuss the view that waves are the most important factor in the development of coastal dunes.

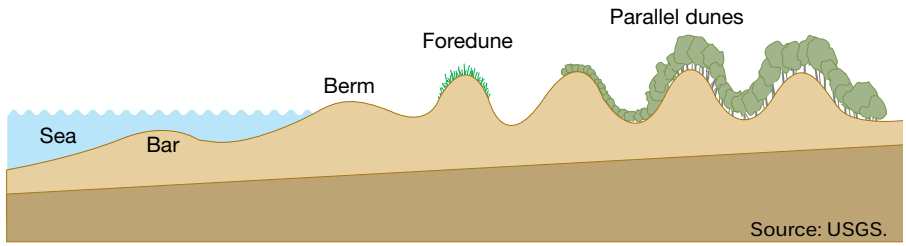
7 Analyse Figure 2.2.5. Write a short report noting the differences evident. Account for these changes.

Role of the lithosphere

Offshore sandbars and sediment deposited at the mouth of rivers are sources of material for the development of coastal dunes. This sediment is carried by longshore currents until a projecting landform traps the sediment, which is then deposited on beaches by wave action. Dune formation begins when wind blows dry sand landward from the beach. Drifts accumulate around objects, such as plants and driftwood, interrupting wind flow. The sand drift slowly increases in size until a dune-like feature develops. Until a dune is stabilised by vegetation, sand may be carried away by winds.

Dune formation

Dune systems are both complex and dynamic. They contain several components, each of which has a specific role or function in the maintenance of coastal dune ecosystems (see Figure 2.2.6).



2.2.6 Cross section of a dune showing key features

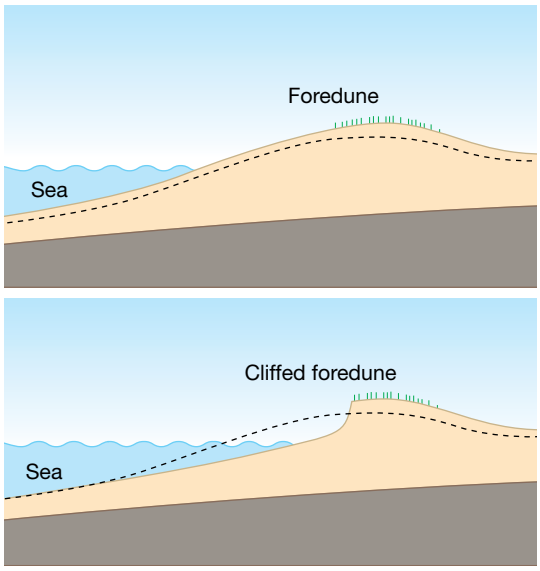
Foredunes

The foredune, or frontal dune, is the first permanent dune constructed. It is the vital component of the overall dune system because it acts as a barrier between the sea and inland areas. The foredune is located at the back of the beach and is usually colonised by grasses. As the grasses grow they trap more sand, causing the dune to grow in height and width.

On some beaches an incipient (meaning initial) dune may develop in front of the foredune. These develop when sediment accumulates during a constructive phase. The incipient dunes provide sand for the foredunes and act as a barrier, protecting the foredune during storms.

On arid coasts, where rainfall is often insufficient to support the growth of vegetation, the foredune frequently remains unstable. The sand is blown from the beach and continues to move inland. Where the wind is very strong and constant, such as along Tasmania's north-west coast, the vegetation cannot trap much sand, resulting in a similar landward movement of sand.

On some coasts only a single foredune develops. This dune is cut back from time to time due to storm action, but sand trapped by vegetation gradually restores it. Along most coasts, however, the dune system extends back beyond the foredune in a series of parallel sand ridges. These are particularly common along Australia's south-east coastline.



2.2.7 Transformation of a foredune into a cliffed foredune

Parallel (transverse) dunes

When the seaward face of the foredune is eroded by storm action, a cliffed foredune develops as shown in Figure 2.2.7. After the storm, the sediment flow to the beach is gradually restored and sand starts to accumulate again. A new ridge of sand is constructed in front of, and parallel to, the old, damaged foredune; the two dunes being separated by a low-lying trough, or swale.

The stabilisation of the original foredune by pioneer plant species causes a further build-up of sand. As this occurs, a new foredune is constructed (see Figure 2.2.8).



2.2.8 Pioneer grasses colonise foredunes, thus stabilising them.



2.2.9 Stabilised by vegetation, extensive dunes are located in Shoalwater Bay, Queensland.

As the new foredune develops, the supply of sand to its predecessor is gradually cut off, making the old foredune relatively stable, as seen in Figure 2.2.9. Once stable, the grasses on the old foredune are invaded and replaced by heath-like vegetation and larger shrub-like plants.

Along many coastlines the process outlined above has continued for thousands of years, resulting in two or three sets of parallel ridges aligned perpendicular to the prevailing wind. Gradually, the coastline extends seaward.

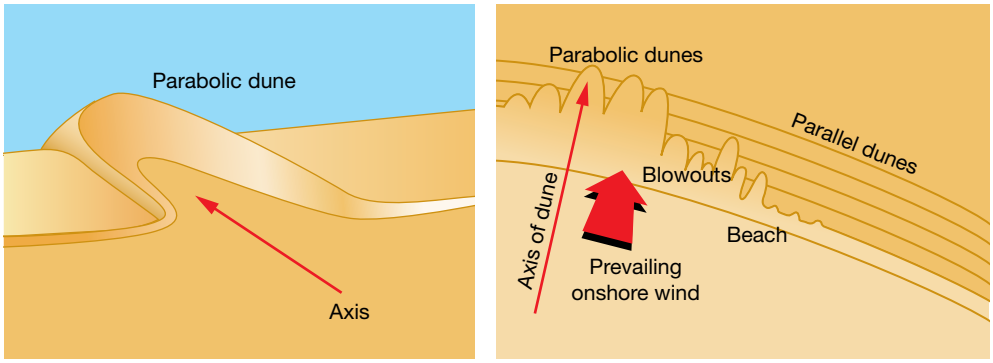
The foredune is the most vulnerable part of the ecosystem. Its protective vegetation can be destroyed by natural causes (such as storms, cyclones, droughts or fire) or by human interference (such as clearing, grazing, vehicles or excessive foot traffic). If the vegetation cover is damaged, strong winds may cause blowouts, or gaps, in the dune ridge. Unless repaired, these increase in size and the whole dune system sometimes migrates inland, covering everything in its path with sand.

Parabolic dunes

Blowouts, if extensive enough, can lead to the formation of parabolic dune systems. Parabolic dunes are long dunes that are shaped like a horseshoe or hairpin. They develop in dune systems running parallel to the coast. Their formation is related to onshore winds, and is most pronounced where sections of coast are exposed to strong winds. A blowout, a smaller version of a parabolic dune, becomes enlarged and migrates inland, cutting through the old parallel dune system (see Figure 2.2.10). It has an advancing nose of loose sand and trailing arms, which are often partly fixed by sparse vegetation. Over time, the dune can develop into a large parabolic dune seen in Figure 2.2.11. The axis of the dune is parallel to the prevailing wind direction.



2.2.10 Blowouts in the dune system at Fraser Island



2.2.11 Formation of parabolic dunes

Parabolic dunes are common along many coasts, including Australia, particularly in the south-east. The speed and direction of movement of these dunes is directly related to the prevailing winds.

Once a parabolic dune has been created, it will retain its 'U' shape for as long as the arms of the dune remain vegetated. If the vegetation is destroyed by fire or human action the dune may become unstable and the sand will spread out, creating a migrating dune system.

Composition of sand

Sand is not uniform. Its chemical and mineral composition varies greatly from place to place. This is because sands have been derived from different types of rock. The chemical and mineral composition of sands is very important in determining the nature of coastal dune ecosystems.

Along parts of the Western Australian coastline the dunes have been lithified; that is, made into a solid rock-like material. Water has reacted with the calcium found in the sand to form calcium carbonate, or limestone. In New South Wales, quartzose is one of the dominant minerals found in sand. Quartzose particles do not bond easily. Sand grains remain separated, leaving the dunes less stable.

Dune soils

The development of dune soils is vital for the long-term viability of the dune ecosystem; it enables larger plant species to colonise the dune, ensuring increased dune stability. Clear changes in the characteristics of the soil take place as the dunes progress backwards from the beach.

In the deep, sandy soils of the foredune the spaces between the soil particles are relatively large, creating good drainage. Water can easily flow through these spaces, leaching out any nutrients. As vegetation establishes itself, humus begins to accumulate in the soil's profile. This increases the sandy soil's water-holding ability. As a general rule, the greater the amount of organic matter in a soil the longer it takes to dry out. Older dune soil profiles (those farthest from the beach) have the highest organic content and tend to have the highest moisture levels. The nutrient level of the soil is also determined by the amount of organic matter present. Dunes farthest from the beach tend to be the most nutrient rich.

As a result, vegetation patterns become differentiated along a transect from the front of the dune system landward. Plants requiring moist, nutrient-rich soils can only survive in the oldest of the parallel dunes, while the foredunes are dominated by plants that are drought-resistant and low in their demand for nutrients. Therefore, the soil type affects the types of plant that grow in different parts of the dune system. This, in turn, affects the stability of the dunes and dictates the nature of change that occurs.

Activities

Understanding the text

1 Describe the main sources of the sediment used for dune construction.

2 What are foredunes? Why are they so important? What role do grasses perform in their formation?

3 Explain the formation of parallel dunes.

4 Outline the reasons why some dunes remain unstable and sands can keep moving.

5 Describe how a blowout is created.

6 Outline why older foredunes become relatively stable over time.

7 Explain why foredunes are described as the most vulnerable part of the dune ecosystem.

Working geographically

8 Construct a flow chart showing the formation of a foredune.

9 Using Figure 2.2.11, write a paragraph explaining how parabolic dunes form.

10 Use an annotated sketch to illustrate the characteristics of a dune profile.

Role of the biosphere

Dune vegetation

Dune vegetation tends to occur in zones. This zonation is closely related to the degree of exposure to harsh coastal conditions. It also has a close relationship to the stage of dune development. The oldest dunes support the most complex plant communities, while more recently formed dunes support only the most hardy, pioneering species. Figure 2.2.12 demonstrates this general pattern. Generally, dune vegetation is divided into three groups:

- primary colonising species
- secondary species
- tertiary species.

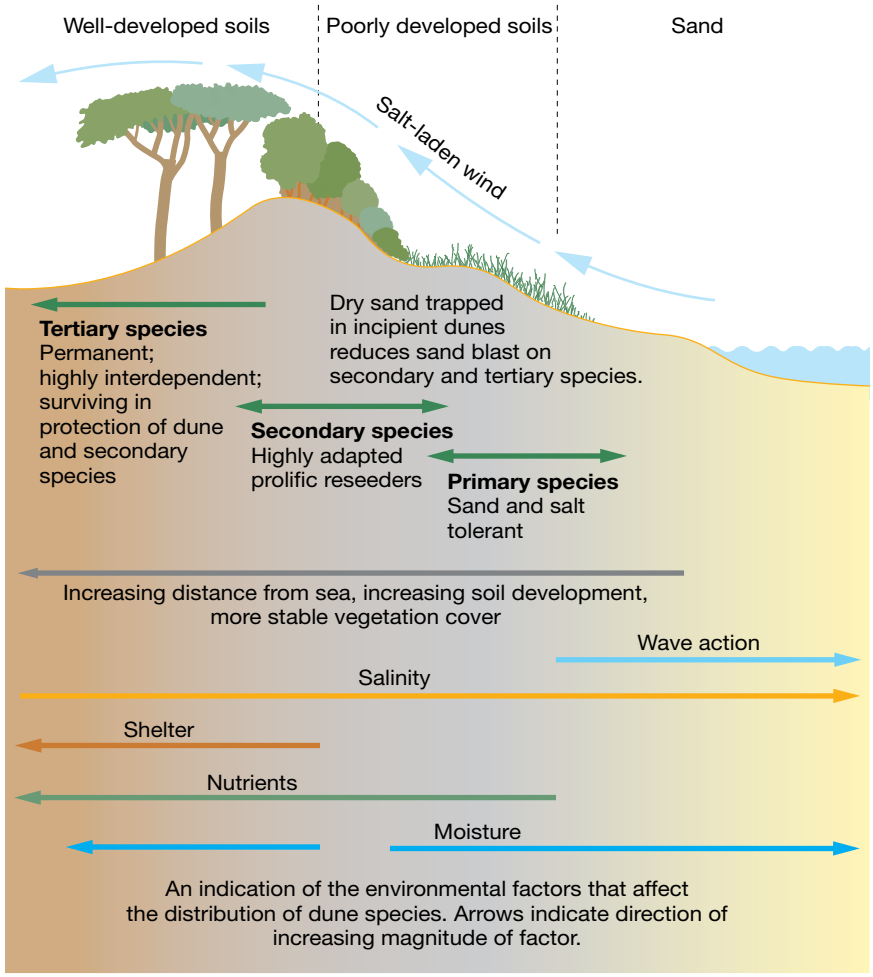
Primary species

Closest to the sea is the pioneer zone. This zone extends landward from the debris line at the top of the beach to the area occupied by the foredune. Only specialised plants can colonise areas exposed to salt spray, sand blast, strong winds and inundation by the sea. They are protected from the salt and sand blasting by a waxy or hairy covering on their stems and leaves, and they grow close to the ground, thereby offering little resistance to the wind.

Sand spinifex is the most common native species found in the pioneer zone. Marram grass, a native of Europe and North America, has been used extensively in Australia to stabilise dunes. Various species of pigface (see Figure 2.2.13), a hardy salt-tolerant plant, are also common.

While these pioneer plants provide some resistance to the removal of sand during storms, their principal role is to quickly stabilise the sand as it returns with the onset of fine weather. Pioneering plants have strong root systems and spread rapidly, creating a network of creeping stems or runners that bind the sand together. If one part of the plant is buried by shifting sand, another part can continue growing.

The pioneering plant species play a critical role in the functioning of dune ecosystem. They stabilise the sand, reduce the impact of wind erosion, set in train the process of dune-formation and initiate the development of a soil profile.



2.2.12 Generalised pattern of vegetation in the dune system



2.2.13 Salt-tolerant and drought-tolerant pigface is common in many dune systems.



2.2.14 Shrub-like plants such as coastal banksia make up the secondary species.

Secondary species

The foredune vegetation is usually composed of semipermanent heath-like shrubs and small trees that stabilise the foredune sand mass. Species in this zone include coastal wattle, coastal banksia (see Figure 2.2.14), thyme rice-flower, coastal salt-bush, beach almond and beach calophyllum. The actual mix of species found in this zone depends on climate.

She-oaks (*Casuarina equisetifolia*), coastal tea tree and larger coastal banksias are commonly found towards the back of this zone. The actual composition of this zone can reveal the condition of the beach. Extensive areas of herbland plants suggest that sand is accumulating. Where they are absent, especially if she-oaks and banksia are found close to the high-tide zone, erosion is likely to occur.

Tertiary species

In the zones beyond the coastal heath, trees tend to dominate. Here the vegetation is protected from the wind and salt spray, and soils are characterised by larger amounts of organic matter. The type of vegetation found in this zone depends on local conditions, such as topography and climate.

In this zone, banksia and she-oaks give way to more-complex plant communities. Paperbark tea trees (melaleuca, shown in Figure 2.2.15) dominate the freshwater swamps, which develop in the swales between the dunes. Areas of sedgeland vegetation (reeds) can also be found in the pools of standing water found in swales. On better-drained ridges, woodlands of eucalyptus and acacia species or lowland rainforest develop.

These zones are not fixed. As plants grow taller and humus accumulates, exposure to sunlight and soil conditions change. The soil becomes richer and holds more water. This enables scrub and woodland plants to move in, changing the type of vegetation. This process is known as succession. The woodlands and melaleuca forests represent the end product of this plant succession. For this reason they are referred to as climax communities: they are communities that are in equilibrium with their environment.



2.2.15 Melaleuca forests are common around lakes that form in the dune swales.

Coastal dune fauna

Very few animals make their home in the dunes closest to the beach. Here the environment tends to be too harsh for most animals to survive. Insects may be found, but often they are blown there by onshore winds. These insects attract birds but very few establish nesting sites in the exposed foredune zone. The only permanent residents tend to be a few species of crab. Along the beaches of New South Wales, ghost crabs often burrow into the foredunes. Reptiles are also relatively common in the dune systems. The Robust Striped Skink shown in Figure 2.2.16 is found in dune systems across eastern and northern Australia. Further back from the beach, the number of bird species increases. There are also several species of small reptile.



2.2.16 Reptiles such as striped skinks are relatively common in dunes across eastern and northern Australia.

Activities

Understanding the text

1. Outline the characteristics of the plants found in the pioneer zone. What function do these plants perform?
2. Describe the types of plants found in the zone immediately behind the pioneer zone.
3. Describe the types of species found on stabilised sand dunes where soils are characterised by larger amounts of organic matter and higher moisture content. Explain why these plant communities are described as 'climax communities'.
4. Outline where sedgeland plant communities are usually located.
5. Describe, in brief, the fauna of the coastal dunes.

Working geographically

6. Write a report outlining the plant succession that takes place in sand dune ecosystems as you move inland. Account for the differences observed.
7. Study Figure 2.2.12. Outline the relative location of the primary, secondary and tertiary dune species. Describe the conditions under which they develop.
8. Undertake library and internet research. Prepare a report on the types of vegetation most commonly found in the coastal dunes of New South Wales. Include sketches of some of the most common species.
9. Working in groups, compile a list of the consequences of removing coastal dune vegetation. Use your findings to hold a class discussion on the issue of dune clearing.
10. Write a short report outlining the relationship between the lithosphere, biosphere and atmosphere in dune formation.

UNIT 2.3

Nature and rate of change in coastal dune ecosystems

The biophysical environment is characterised by constant change caused by natural and human-related forces as well the adjustments it makes in response to various environmental stresses. Like all ecosystems, coastal dune ecosystems are confronted by a complex and dynamic set of environmental conditions. The environment sometimes changes gradually but often it can change suddenly, which places stress on the various components of the ecosystem. When environmental changes exceed tolerance levels, the ecosystem is put at risk.

Coastal dune ecosystems (like all ecosystems) contain complex networks of interrelationships between the four spheres of the biophysical environment to provide some degree of stability or sustainability. This stability is maintained by constant dynamic change. Newly deposited windblown sand is colonised by pioneering grasses, and thus stabilised. It then progresses through a sequence of seres (each stage in plant succession) until a climax community is achieved. While this occurs, the ongoing accumulation of sand in the foredune area sets in train a new round of stabilisation and progression.

In terms of ecosystem persistence (ability to resist change) and resilience (ability to cope with change), coastal dune ecosystems are particularly vulnerable. Because of the erosive power of waves and wind, sand dune ecosystems possess only a limited ability to resist being disturbed or altered. They do possess a relatively high level of resilience, but only where natural processes are able to operate. Human activities within the coastal zone significantly reduce the resilience of the dune ecosystem.

Naturally induced change to coastal dune ecosystems

The coastal environment is constantly changing; it is being shaped by the wind and the power of the sea. These changes affect all elements of the coastal environment, including coastal dune ecosystems. One of the most significant natural causes of change in the dune system is storms. When a beach is degraded by storms, there is little or no sediment for dune construction. Furthermore, the foredunes themselves are often eroded by storm waves. In some extreme storm events, the stabilised dune system may be affected.

Storm damage

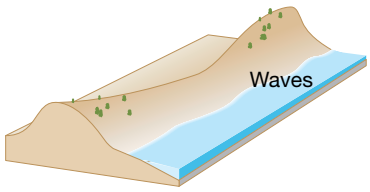
Storm-induced waves can cause major structural damage to the dune system. Washovers and washouts are among the most spectacular and destructive forms of this erosion. Blowouts are caused by the erosive power of the wind.

Washovers

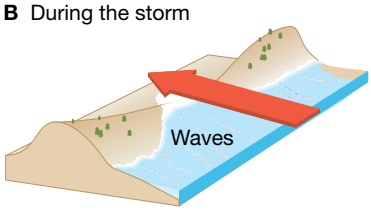
Dunes are not even across their surface. There are often small depressions and ridges along the tops of the dunes. When the height of a storm wave exceeds the height of one of these low points, the wave will flow over the top of the dune, creating a washover. With successive waves flowing over the dunes the washover depressions deepen and widen (see Figure 2.3.1). This allows more water to spill over and flow further inland. In an extreme storm event, such as those associated with tropical cyclones, waves may even continue to wash over inland dunes.

Over time dunes are able to regenerate, with sand being brought back to the beach by constructive waves. However, in areas where there are frequent major washovers the regeneration process may be slow due to the large volume of sand being removed from the dune system. Severe and frequent storms also cause extensive damage to vegetation, further hampering the regeneration process.

A Before the storm



B During the storm



2.3.1 Washovers are created by major storm events.

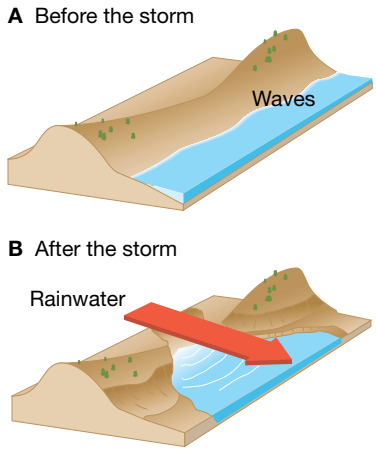
Washouts

Washouts are commonly associated with periods of heavy rain leading to the breaching of sand barriers that have isolated coastal lagoons from the open sea. Washouts can also take place within dune systems. They occur when heavy rainfall results in water being accumulated in the swales that separate dunes. If there are breaches or depressions in the dunes, this water may be channelled through these low points and overflow onto the beach, carrying the sand with it; a process similar to a washover (see Figure 2.3.2).

Blowouts

Blowouts are breaches in the dunes caused by wind erosion. They are aligned with the prevailing wind direction and may cut down to the water table. In areas with high and frequent onshore winds, blowouts continue to grow in size. As they do, they migrate through the dune system, forming parabolic dunes. If the winds are weaker and less frequent the dune may recover its original profile.

Blowouts are most likely to develop in unconsolidated coastal dunes and are often associated with increased human activity. During storms, blowouts may become channels for storm-induced waves, resulting in a washover.



2.3.2 Washouts are the result of rainwater flooding out from behind the dune system

Migrating dunes

Once set in motion, a mass migration of sand is very difficult to stop. Along some parts of the Australian coast it is possible to find dunes that have banked up against cliffs and grown so high that they rise over the top of the crest of the cliff and keep moving.

One of the world's largest migrating dune systems is found in the south-west of France (see Figure 2.3.3). The Pyla Dune (*Dune du Pilat*) is believed to have begun moving during the eighteenth century. The dune is slowly moving inland from an estuary, spilling sand over the Landes pine forests. The dune now has a crest over 100 metres high and a steep wall (around 32 degrees) of moving sand. Scientists believe that waves scouring out the sandy shores of the estuary and surrounding islands provide a constant source of sand to the dune. As the dune moves inland, it is slowly smothering the pine forests.

Stradbroke Island is a large island found off the coast of Brisbane, Queensland. A series of dunes run from the north to the south of the island. These transgressive dunes are arranged in a sequence parallel to the coast. For the dunes to have developed in this way they must have advanced away from the shore in episodes of dune migration. The dunes have stabilised because a thick layer of scrub and forest now grows over them. Some of the dunes are found at over 275 metres above sea level. The height of the dunes and the amount of sand that is contained in them demonstrate the power of the wind in moving the sand. The fact that they are now stable also demonstrates the power of vegetation in stabilising shifting dunes.



2.3.3 France's vast Pyla Dune—Europe's largest migrating dune

SPOTLIGHT

East coast low swallows beaches in Sydney's north

In June 2016 a huge storm, known as an east coast low, struck Sydney. For several days, beaches were hit by huge destructive waves that eroded vast quantities of sand. King tides exacerbated the problem.

The Northern Beaches were particularly hard hit. During the storm Narrabeen and Collaroy Beaches were eroded back by 50 metres with 150 cubic metres of sand lost off the beach. Several properties that had been constructed close to and even on the foredunes were damaged and some destroyed during the storm, as seen in Figure 2.3.4.



2.3.4 A massive storm in 2016 eroded huge quantities of sand off Collaroy and Narrabeen Beaches, leaving homes destroyed.

Activities

Understanding the text

1. Describe the circumstances that put ecosystems at risk.
2. Explain what is meant by the concepts of persistence and resilience. How do these concepts apply to coastal dune ecosystems?
3. Outline the effects of storms on beaches.
4. Explain the processes that cause washovers to occur. What is the effect of frequent washovers?
5. Compare the processes involved in washovers with those involved in washouts.
6. Explain how a blowout can result in the formation of parabolic dunes.
7. Explain the relationship between prevailing winds and blowouts.

Working geographically

8. Construct a series of illustrations to demonstrate the processes involved in the development of washouts and blowouts.
9. Study the Spotlight box on the impact of the east coast low in Sydney.
   - **a** Describe the effects of major storms in June 2016 on the Northern Beaches.
   - **b** Write a paragraph outlining the human activities that increase the threat posed by storms.
10. In small groups, compile a list of impacts on both the biophysical and built environments created by migrating coastal dunes. Brainstorm ideas for reducing opportunities for migrating dunes to develop. Share your suggestions with the class.

UNIT 2.4

Human impacts on coastal dune ecosystems

Coastal environments are one of the most stressed environments on Earth. The increase in human populations and their desire to live close to the water have combined to place considerable pressure on the fragile coastal system. The stress is most pronounced in the active zones of the coastal environment: the areas that are being changed constantly by natural processes, including wind and wave erosion. Because of their proximity to the beach, sand dune ecosystems are particularly vulnerable. Coastal dunes have been and still are used for a variety of purposes, including mining, water extraction, waste-water disposal, housing, agriculture and recreation. Problems that have arisen as a result of these uses include sand inundation, shoreline recession, species loss, destruction of archaeological sites and reduced recreational amenity.

Experience indicates that dune vegetation has only a limited capacity to recover from these impacts. Most of the coast has already lost some of its intrinsic value, which may be costly and difficult to rehabilitate. Specific impacts are caused by human-caused reductions in sediment flows, coastal development, sand mining, the introduction of weeds and climate change as outlined below.

Reduction and alteration of sediment flows

The flow of sediment along the coast is complex and depends on a range of factors, including wind direction, near-shore currents and wave action. When humans alter the flows of sediment, major changes take place in the coastal environment. A long-term net gain of sediment is necessary for dunes to develop and grow; more sediment must be flowing onto the beach than is flowing off it. If the flow of sediment is reduced or cut completely the consequences for dunes are immediate and direct.

Human activities reduce the flow of sediment in various ways. The construction of dams on inland river systems interrupts the flow of sediment into the coastal zone. The construction of sea walls and groynes (see Figure 2.4.1) interrupt the longshore movement of sediment. Sand extraction (mining) also removes sand from the coastal system.

Any structure that reduces sediment flows ultimately affects the volume of sand available for the development and growth of dunes. In some locations the volume of sand may actually increase. The construction of breakwaters and groynes can result in the trapping and accumulation of sediment and the development of a new dune system. Generally, however, any disruption to the longshore movement of sand reduces the amount of sand available in the active coastal zone. This means that after major storm events there is less sand available for the reconstruction of the foredunes or the development of a second berm. Consequently, the usual mechanism by which dunes recover from a disturbance is no longer available and the impacts can be dramatic: dunes starved of sand simply erode away and the sea can then attack inland areas. This may threaten property and give rise to demands for the construction of sea walls, which further reduce the supply of sand.



2.4.1 Sea defences, such as this groyne on a Scottish beach, restrict the flow of sediment.

SPOTLIGHT

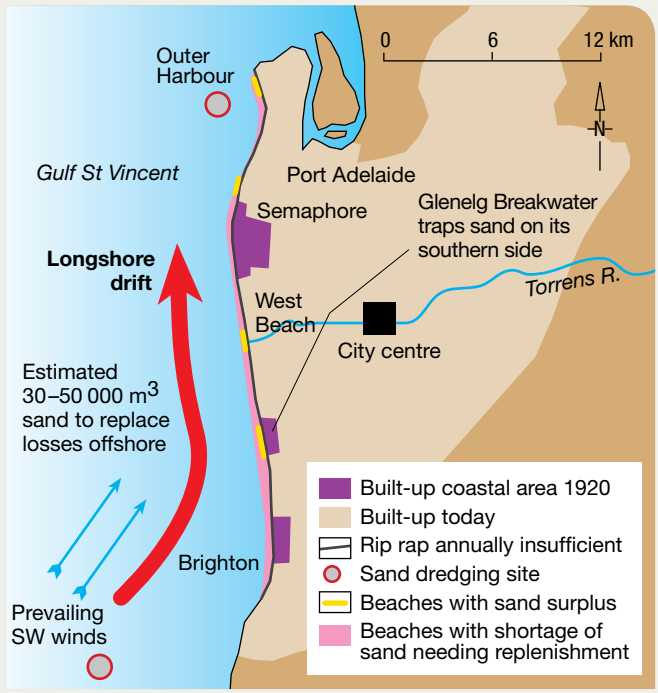
The effects of altered sediment flow along the Adelaide coast

Authorities responsible for the management of the active coastal zone must confront the effects of reduced or altered sediment flows. In Adelaide, the problem is severe and proving costly to address. Along a 25 kilometre section of coastline, stretching from Seacliff to Adelaide's beaches, sand dunes and other sediment landforms are slowly being eroded. Many fear that they will disappear forever (see Figure 2.4.2).

Storms damage the beaches each winter, removing thousands of tonnes of sand. In a natural system, sand is replaced during the spring and summer. However, coastal developments have reduced the sediment supply and damaged the protective barriers of the foredunes, exposing inland areas to erosion. Experts estimate that 30 000 to 50 000 square metres of sand is lost from Adelaide's beaches each year.

During the winter storms, the prevailing wind is from the south-west. This means that the waves hit the coast at an angle that is perfect for longshore drift. The drift moves the sand northwards. As a result, the beaches to the north now have too much sand. The increased sand in the north is causing an inland migration of the coastal dunes that is spilling out over car parks, open spaces and property.

To overcome the problem in Adelaide, local authorities have spent millions of dollars to dredge sand from the ocean floor to replenish the beaches. This is known as beach nourishment and is the most common solution where severe coastal erosion is a concern.



2.4.2 Sediment movement along the Adelaide coast

This response is very expensive and only effective in the short term. Winter storm waves will continue to erode the beaches. Longer-term strategies include restoring the longshore movement of sand, revegetating dunes and restricting access to the active coastal zone. These actions may be needed if the issue is to be addressed effectively. However, this will be a costly, and possibly unpopular, response. Authorities claim that around 70 per cent of Adelaide's population use the beaches along this stretch of coastline at least once a year. Overall, about 6 million separate visits are made each year.



2.4.3 Land reclamation projects such as this one in the Netherlands impact significantly on coastal systems.

Coastal development

Intensive development has taken place along much of the world's coastline. Some of this development has taken place in areas once occupied by dune ecosystems. Parallel dunes are often flattened and built over and in some cases even the foredune is removed. As a consequence, the flow of sand inland is interrupted and the protective barrier between the land and the sea disappears.

One of the most dramatic forms of human development is land reclamation. This involves constructing a wall some distance off the coast and then filling in behind the wall. The effect is to extend the land out into the water, but this has serious consequences for the coastal environment, including coastal dunes. Large areas of the Netherlands (shown in Figure 2.4.3), eastern Canada, Hong Kong and Singapore have been reclaimed, dramatically altering the movement of sediment along these coastlines. The reclaimed areas tend to be tidal flats, which often provide the sand for dune development and growth. As the flats are buried and built over, this supply of sand is lost.

Dune destruction in Sydney's eastern suburbs

Sydney's eastern suburbs is one of the city's most densely populated areas, as well as being a popular place for visitors. Its beaches, such as Bondi, are famous around the world; however, these beaches are just remnants of the coastal features that once dominated the area. Urban development has destroyed the dune system of almost every beach in the eastern suburbs. Figure 2.4.4 illustrates how Bondi Beach has changed over time.

The extensive nature of urban development along the beaches of the eastern suburbs can be seen in Figure 2.4.4b. Houses, apartments, hotels, shopping centres and other commercial activities have spread out across the headlands and dunes of the area. These developments have greatly altered the environment, changing its topography and ecology. Of all these changes, perhaps the most damaging has been the destruction of the dune systems that once occupied the area immediately behind the beaches.

At Coogee Beach, the dune system has been flattened to make way for urban development and parkland, as seen in Figure 2.4.5. Even the foredune has gone, replaced by a vast concrete structure that incorporates apartments, shops and pedestrian access to the beach. Without the dunes to protect the inland areas, sea walls are needed. The sea wall at Coogee runs along the entire length of the beach, causing significant scour. The wall deflects wave energy, causing the waves to wash back down the beach with more energy than normal. This increased energy allows the waves to remove sand as they flow back into the sea.

Flattened and built over, the dunes have been replaced by buildings, car parks, roads and grassed reserves. As a consequence the protective barrier once provided by the dunes is now gone, leaving the beach open to attack by the sea. The management response has been to build unsightly and expensive sea walls. This has increased beach erosion and created another set of management problems.



2.4.4 Bondi Beach in 1870 and the present day. The destruction of the dunes is clearly evident.

Recreational uses

People visiting beaches have a major impact on dune ecosystems. Research demonstrates that coastal areas that have high rates of visitor pressure will be subject to significant degradation. One of the most common reasons for this is the overall loss of plant life.

As people try to make their way to the beach they trample plants. 'Holes' appear in the dune vegetation, giving introduced weeds a chance to grow. These tend to be more resilient and cope better with trampling. The foredune vegetation, in particular the grasses, are the most easily damaged. These are also some of the most important species because they protect the least stable part of the dune system.

The tyres of off-road vehicles and the hooves of horses also destroy dune vegetation and their weight leads to greater soil compaction. Compact soil has less oxygen, which reduces plant growth and makes it even more difficult for plants to recover. On some beaches where vehicles have been banned, the effects of their use can still be seen up to 10 years later.

Dune systems have also been flattened to provide land for sporting facilities, golf courses, parking areas and parkland.



2.4.5 The dune system of Coogee Beach was destroyed many years ago to make way for development.

Trampling

Trampling, or simply walking over the dunes, is one of the most significant human impacts. Dunes are fragile ecosystems that are finely tuned to deal with the harsh environment in which they develop. Vegetation is critical to the stability of dune systems and trampling has a major impact on this vegetation.

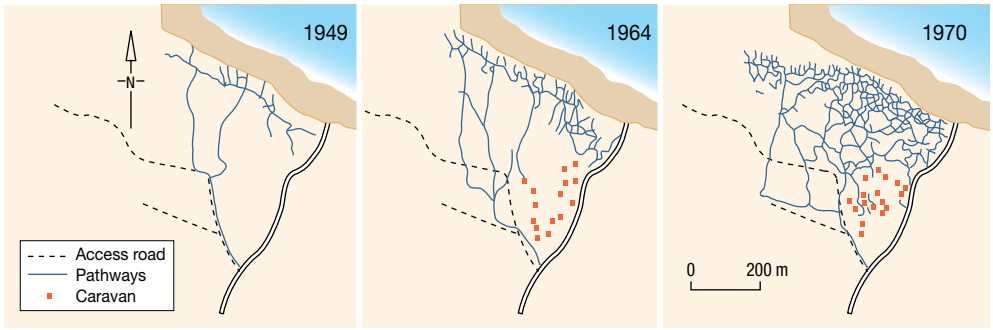
SPOTLIGHT

Dunes destroyed by Trump golf course

Prior to becoming the President of the United States, Donald Trump was a major property developer. Among his many developments around the world is a golf course and resort in Aberdeen, Scotland. Called Trump Turnberry, the golf course created great controversy during construction due to its location on sand dunes.

In order to build the golf course and resort, dunes were removed and re-sculptured to improve views and create a more interesting course. A study in 2016 by 25 UK conservation organisations listed the development as one of the three most damaging to dune systems. The course operators deny these claims and state that they carefully monitor environmental impact. However, in 2017 the environmental advisory group set up to monitor impacts was shut down.

In early 2017, parts of the golf course were damaged by shifting sands that had become mobilised due to loss of vegetation.



2.4.6 A complex network of paths associated with tourism developed in Benone, Northern Ireland impacting on the dunes there.



2.4.7 Illegal sand mining like this in Sierra Leone in West Africa is having a devastating impact on dunes.

A famous study conducted in the 1970s by coastal geographer R.W.G. Carter in the dunes around Benone in Northern Ireland demonstrates the impact of trampling. Figure 2.4.6 demonstrates how increases in development around the dunes leads to more paths forming across the dunes as people make their way to the beach.

Before 1964 there was little development in the Benone dunes and few paths. The development of caravan parks and other tourist facilities in the 1960s saw an increase in paths. By 1970, a complex network of paths criss-crossed the dunes, causing considerable damage to vegetation leading to blowouts and instability.

Sand mining and extraction

Sand contains a host of minerals that are used in a variety of industrial processes, including cement making, electronic componentry and glass manufacturing. These minerals are extracted from coastal sand dunes around the world. Sand mining is one of the most disruptive and controversial land uses carried out in the coastal environment because it involves the total removal of dune vegetation.

When mining takes place in dune systems that support climax plant communities, the process of rehabilitation can take decades and the ecological diversity of the dunes before mining may never be restored.

In recent years, there has been a sharp increase in illegal sand mining. As construction industries boom around the world the demand for sand, a key ingredient in cement, is higher than ever. In India, illegal sand mining is now the country's biggest organised crime problem. Armed gangs run the trade. In North Africa similar problems exist. In Morocco, officials estimate that half of all sand used in construction there is illegally mined. A study in Sierra Leone, shown in Figure 2.4.7, on the west coast of Africa, found that illegal sand mining there has increased the rate of coastal erosion by six times due to the loss of dune systems.

Weeds and introduced species

Coastal dunes are fragile ecosystems. To survive in such harsh conditions, plants must be able to tolerate poor soils, strong winds and salt spray. Due to these conditions, dune ecosystems are dominated by highly specialised plant species. Similar to most highly specialised species, dune vegetation is very susceptible to changes in its environment, including invasion by weeds.

A weed is defined as 'a plant that is out of place'. A weed can be either an exotic or native species. Native plants such as bracken are considered weeds in coastal dunes because they pose a serious fire risk.

Some exotic species, such as marram grass are technically weeds but are used in beach regeneration because they are effective at stabilising dunes and have a minimal impact on native dune vegetation.

Most infestations result from human activities in the coastal zone. In some cases, species that later become weeds have been introduced deliberately to stabilise dunes. For example, bitou bush is a very invasive species and was introduced by sand miners to stabilise areas after mining. As Figure 2.4.8 shows, this species has now spread over much of the east coast and takes over from native plants, creating a monoculture. In other instances, weeds are introduced via the wheels of off-road vehicles, shoes and animal faeces. Eradicating weeds can be labour intensive.

Rabbits are one of the most destructive species ever introduced to Australia. They have spread out across the continent, causing significant damage in many environments. In coastal dunes they eat grasses and other vegetation, reducing the ground cover and exposing sand to wind erosion. The burrows also destabilise the dune structure.



2.4.8 Bitou bush is a highly invasive weed that destroys native Australian dune vegetation.

Climate change

Climate change is the biggest environmental threat posed by humans to the natural world. For dune ecosystems, climate change is impacting in three main ways:

1. **An increase in sea levels:** This is associated with thermal expansion—warmer water causes water particles to expand, leading to sea level rises. The melting of polar ice caps also leads to sea level rise. As sea levels rise, coastal areas become inundated leading to dune destruction.
2. **An increase in storm activity:** Warmer waters generate more significant storm events. As discussed earlier, storms are a major cause of destruction in the dune system (see Figure 2.4.9).
3. **Changes in currents:** Sediments can be moved vast distances with ocean currents. These currents are created by complex temperature variations in the world's oceans and seas. Changes in temperatures disrupt these currents.

Climate change also effects rainfall and temperature patterns which in turn impacts on the dune biosphere as well.



2.4.9 Destructive storm events are increasing due to climate change.

Activities

Understanding the text

1. Describe the ways that humans reduce and/or alter sediment flows along coasts.
2. Explain the consequences of reducing sediment flows along a coastline.
3. Outline the impact of coastal development on coastal dune ecosystems.
4. Define and explain the process of land reclamation. In what ways does it impact on the functioning of the coastal environment?
5. Explain the effect that trampling has on coastal dunes.
6. Outline the impact that sand mining and sand extraction have on coastal dune ecosystems.
7. Describe the impact that weeds can have on coastal dunes.
8. Outline the impact of rabbits on the dune ecosystem.

Working geographically

9. Examine the information in the Spotlight on Adelaide's coast. Prepare a short report on how human activities are impacting on this coastline.
10. Examine Figures 2.4.4a and 2.4.4b. Compare the images in the photographs, and outline the changes that have occurred.
11. Conduct a class debate on the topic: Tourism is destroying coastal dunes. At the end of the debate, discuss ways to reduce the impact tourists have on the coastal dune environment.
12. Prepare a short report on the impacts of climate change on the coastal dune ecosystem.

UNIT 2.5

Traditional and contemporary management practices



2.5.1 Middens, like this one on the Younghusband Peninsula in South Australia, provide evidence that Indigenous communities spent time in the coastal dunes for thousands of years prior to European colonisation.

Traditional management of coastal dunes

Little is known about the ways Aboriginal and Torres Strait Islander people made use of and managed the coastal dune ecosystem before the arrival of Europeans. Archaeological evidence suggests that some Indigenous Australian groups frequented the dunes. Middens have been found along many sections of the Australian coast, particularly along the east coast. Middens are mounds of shells, which are the remains of seafood-based meals, as shown in Figure 2.5.1. Their existence in the coastal dunes suggests that Indigenous communities used these areas as camp sites.

Due to rising sea levels, much of the archaeological evidence has been submerged. The evidence that does exist is less than 6000 years old: the period over which the present sea level has prevailed.

There is some evidence to suggest that Aboriginal land management practices in dune ecosystems involved the use of fire. In his first voyages to Australia in the eighteenth century, Captain James Cook reported the existence of extensive migrating dune systems along many parts of the east coast. Europeans also mentioned the existence of the dunes up and down the coast. While some of these migrating dunes may have been the result of natural processes, such as severe storm events, it is unlikely that this accounts for all of them. It would seem that the spread of fire management into the coastal dunes destroyed the vegetation, exposing the sand and allowing migrating dunes to develop.

Contemporary management of coastal dunes

Successful dune management involves maintaining (and in some cases restoring) the natural functioning of the dune environment while allowing people to use the coastal environment in a sustainable way.



2.5.2 Land use controls to stop over-development along coastlines, such as here in Miami's South Beach, is a key management strategy.

Dune protection

Dune restoration can be very costly. It is much better to protect existing dunes from damage. Dune protection strategies include land use controls and management of access ways.

Land use controls

The destruction of dune systems for residential and commercial development remains one of the most disruptive activities in the coastal environment. Stricter planning can reduce the problem of over-development such as that in Figure 2.5.2. In Australia, local councils have the authority to decide what kind of developments are to be allowed in certain areas. These zoning powers mean that councils have the power to reject a development proposal that would modify or degrade dune ecosystems. Reductions in the amount of building in the active areas of the dune system, particularly the foredune, enable the dune systems to

function in a more natural state. An added economic benefit is that sea walls and other emergency measures to protect property during storms are no longer required.

Fencing

The other major cause of human-induced change in dune systems is the trampling created by beach users. Fencing, access ways and education programs help to protect dunes from this sort of impact.

Dune fencing involves the construction of fences around the foredune area (see Figure 2.5.3). These fences are designed to stop people from trampling dune vegetation. This is especially important when the vegetation is immature and fragile. The fences are normally constructed of wire and treated timber poles. Wire fences allow wind and sand to pass through and ensure that the visual impact of the fencing is reduced.

ACCESS WAYS

For fencing to be effective, people must still be able to access the beach. Specially designed access ways enable this to occur in a managed way. Access ways are paths constructed through the dunes, usually at an angle to the prevailing wind direction to minimise funnelling. They are usually fenced to protect dune vegetation. These paths normally link car parks or pedestrian zones to popular parts of the beach.

BOARD-AND-CHAIN PATHS

Trampling can also be reduced by using board-and-chain paths in access ways. These walkways are constructed using timber slats joined by lengths of chain. As they are flexible, they can conform to the shape of the dune. The timber slats help to reduce the effects of wind erosion on the exposed sand. It is even possible to construct board-and-chain paths so that four-wheel drive vehicles can cross dunes and access the beach.

Dune restoration and stabilisation

Due to their exposure to almost constant wind from the ocean, a slight disturbance of the vegetative cover may result in extensive blowouts of unconsolidated sand. Through this process, migrating dune systems are formed, which engulf everything in their paths. Migration of sand dunes also occurs when the vegetation on stabilised dunes is seriously damaged or destroyed. Dune stabilisation aims to secure exposed sand and stop it from blowing away. Stabilising migrating dunes can be very costly. The strategies used to restore and stabilise dunes include the following.

Dune reconstruction

One dune stabilisation technique involves the use of earthmoving equipment to form the dune into a more aerodynamic shape, as shown in Figure 2.5.4, thereby reducing the ability of the wind to carry away sand. Reshaping is effective because the site can be manipulated to the ideal slope, which allows vegetation to become established more easily than on very steep, natural slopes. However, unless the site is well vegetated, the dune will not be able to resist wind erosion and storm wave attack.



2.5.3 Fenced access ways help to manage trampling.

Activities

Understanding the text

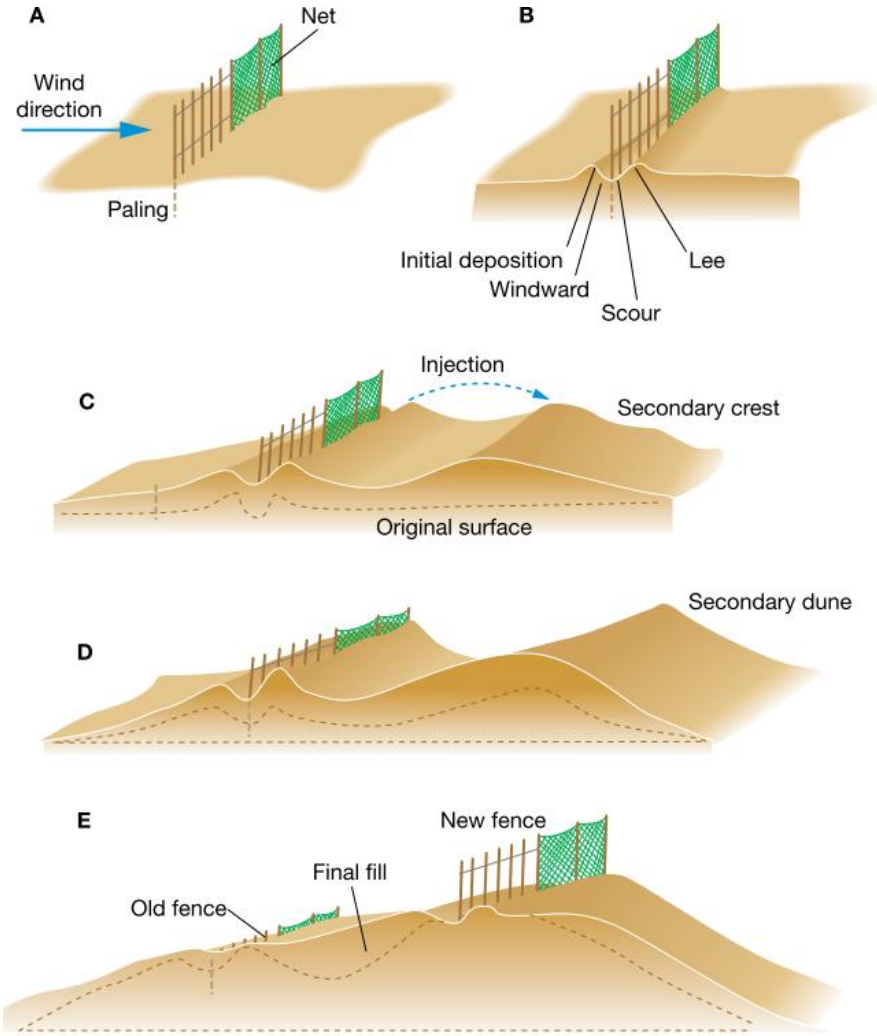
1. Explain the term midden. What does their presence suggest about use of the coastal dune ecosystem by Indigenous Australians?
2. Describe the effect that use of fire by Indigenous Australians seems to have had on the dune environment.
3. Outline what effective dune management involves.
4. Explain the role of land use controls in protecting coastal dunes.
5. Explain the role of dune fencing in the protection of dunes.
6. Assess the benefits of access ways to the dune environment.
7. Describe the benefits of using board-and-chain paths.

Working geographically

8. In small groups, prepare an oral report on the main forms of dune protection. Outline the role of each and evaluate its effectiveness.
9. Write a report comparing the use of coastal dune ecosystems by Indigenous Australians with that of Europeans. Assess the management strategies adopted by each.



2.5.4 Dune reconstruction typically involves heavy machinery and can be costly and complex.



2.5.5 Sand fences are a simple, cheap and effective tool in dune stabilisation and reconstruction.

Dune reconstruction is often used where the dune system had been severely degraded. It works best in areas where the supply of sand has not been greatly reduced by the construction of sea walls and other artificial barriers. It is possible to import sand but this is very expensive.

A variety of chemical and other inorganic stabilisers are often used to bind the sand on the reconstructed dune. Liquid sprays, such as bitumen emulsion, are an example of a chemical stabiliser. The black, oily substance seeps into the sand and binds it together. However, the side-effects of this technique are significant. The sand is stained and the black surface increases soil temperature, hindering plant growth.

Reconstruction techniques are used extensively in Europe and North America and are usually quite successful. When combined with revegetation, dune reconstruction has proved very effective. In Texas, sand dunes developed by this method have grown to a height of 2–3 metres within two years. It is also used extensively in the low-lying Netherlands, where there is a constant struggle to hold back the sea.

Sand fences

Another technique used to restore and stabilise dunes is to build sand fences that trap moving sand. These fences have panels of woven material, which allows for the passage of air but traps airborne sand. Sand fences, seen in Figure 2.5.5, slow sand movement by reducing the wind velocity in their immediate vicinity. While the fences are very effective in trapping windblown sand, once they are buried they have no further effect on sand movement.

Mats and netting

Mats and netting are effective at protecting exposed sand surfaces. When properly secured, coarse netting and mats protect the sand surface but do not collect much sand. They are best used to protect transplanted dune grasses and seedlings.

Brushwood

Brushwood is another effective, but temporary, dune stabiliser when placed over bare sand. This technique involves laying dried branches on the surface of the sand. It is not widely used because it is labour intensive and interferes with subsequent planting.

Revegetation

The most effective long-term method of dune stabilisation is through the use of vegetation. In many cases, vegetation is the least expensive, most durable, most aesthetically appealing and only self-maintaining technique available. Dune plants are especially effective at trapping and holding wind-borne sand. Their growth produces a rough surface, which reduces wind velocity near the ground. This reduces wind erosion at the sand surface. The leaves of plants interrupt the movement of sand by saltation and surface creep.

The most common method of revegetation is to develop a plant succession on the coastal dunes over a number of years (see Figure 2.5.6). This is similar to the way plants colonise an undisturbed dune under natural conditions. Degraded dunes are usually stabilised by the planting of pioneer dune grasses, such as marram grass. These are followed by secondary species (the herbaceous bushes) and then, finally, the tertiary species (the coastal trees).

PLANT SELECTION

Coastal dunes are among the harshest environments for plant growth: for plants to be successful they must have special adaptations or characteristics that allow them to survive in such harsh conditions. They must be able to tolerate rapid sand accumulation, flooding, salt spray, sandblasting, wind and water erosion, wide temperature variations, drought and low nutrient levels. Despite these limitations, plants capable of stabilising coastal dunes can be established in most coastal regions with enough rainfall to support plant growth. The selection of plant species is very important. The most effective technique is to propagate plants from seeds collected from adjacent areas. This maximises the chances of success because these plants have adapted to the conditions of the particular location. It also ensures that the local ecology is maintained, which is another important aim of dune management.



2.5.6 Restoring dune ecosystems using revegetation is one of the most effective management strategies.

Where the dune is very unstable, a cover crop (such as wheat) may be used. These are plants that are not native to the dune ecosystem and their role is simply to hold the dune together until other species become established. Cover crops are most commonly used in swales, where vegetation usually takes some time to develop.

BENEFITS AND LIMITATIONS

Revegetation is a costly and labour-intensive activity. It is most commonly carried out by community groups, such as Coastcare. (Volunteers from these groups give up their weekends and holidays to protect dunes and other coastal landforms.) The long-term benefits of their efforts are significant. Once in place and protected, the vegetation requires little maintenance. It ensures that dune ecology is retained and it represents the most cost-effective way of stabilising moving sand. However, dune revegetation will only be successful if it is combined with other management strategies. The new vegetation must, for example, be protected from trampling by people and animals.

Fire management

A fire is one of the most destructive events that can take place in a sand dune system. Once the protective vegetation is destroyed the wind can easily move the sand and alter the dune topography, causing blowouts. Fortunately, dune vegetation has a low combustibility (that is, it is difficult to set alight) and can regenerate quite quickly after being burnt. The introduction of non-endemic species, such as bracken, greatly increases the risk of fire. Furthermore, in a natural state the dunes have a series of natural fire barriers, such as dune lakes and swamps. If these have been destroyed by human activities the fires may become difficult to control.

Managing the risk of fire in dune ecosystems is very difficult. Common fire-control methods (controlled burning and the construction of firebreaks) are not suitable because they would expose sand dunes to wind erosion. The best fire management is prevention. In recreation areas the provision of barbecue facilities reduces the risk of fires getting out of control. Providing bins such as those in Figure 2.5.7 helps reduce rubbish, such as glass, that can cause fires. Fencing off dunes makes it less likely that people will use them as camping sites.



2.5.7 Simple strategies, such as providing bins in and around dunes helps to reduce the risk of fire created from glass.

Management of weeds

Weeds are a major problem in coastal dune ecosystems. Any effective management strategy must include methods for dealing with weed infestations. To be successful a strategy must have three key elements:

1. management practices that prevent weed infestations in areas that are presently unaffected
2. management practices that contain existing weed infestations
3. programs to eradicate weeds and replace them with non-weed species.

PREVENTION

Weed infestations often occur as a result of human activity. Seeds of introduced species can be brought into an area via the faeces of animals or on the wheels of vehicles. Fencing helps to minimise this risk.

Those involved in dune restoration also need to take care. For example, earthmoving equipment, used to reshape dunes, can deposit the seeds of introduced species. Also, the sand used in nourishment programs may contain seed. Therefore, it is essential that dune managers take care to ensure that the machinery, sand and planting materials used in restoration programs are free of weeds.

CONTAINMENT AND CONTROL

In areas where weeds are already established, management is more difficult. Weed species have to be identified and the appropriate means of control determined. The control may be physical, chemical or biological. Identifying the best means of control can be quite difficult. For example, bitou bush is very similar to several native species: the coastal boobialla and fan flower.

Physical techniques include hand weeding and the use of machinery. Machinery is often used when large areas are badly affected by weeds. Chemicals are the most widely used method of control as they are usually the easiest and cheapest way to treat large infestations. In extreme cases, chemicals are sprayed by aircraft or from tractors. These sprays are indiscriminate and often kill native species. They can also leach into the soil, causing biochemical accumulation: the build-up of toxins in an ecosystem.



2.5.8 The bitou seed fly is a biological control that has been released to help control bitou bush in NSW.

Biological methods involve introducing a disease or insect that attacks the weed but no other plant. These are usually the most cost-effective and least hazardous method of control because they have been extensively tested. Three such controls are being used in New South Wales dunes to deal with Bitou Bush. The bitou tip moth (*Comostolopsis germana*); bitou seed fly (*Mesoclanis polana*), seen in Figure 2.5.8; and leaf-roller moth (*Tortix sp.*) are all natural enemies of bitou and have been released to help control the weed.

Activities

Understanding the text

1 Describe the processes used in restoration, stabilisation and reconstruction.

2 Outline the concept of dune reconstruction. When is this management strategy used?

3 State the primary objective of revegetation.

4 Describe the most common method used by dune managers for revegetation.

5 Explain what a cover crop is, and outline where and why it is used.

6 Describe the impacts of using stabilisers, such as bitumen emulsion, on coastal dunes.

7 Explain why fire management is so important in the coastal dune environment.

8 Identify the best method of fire management. Explain why this is the most effective strategy.

9 Outline the methods used for eradicating weeds from coastal dune ecosystems.

10 Assess each of the methods used in the control of weed infestations.

11 Explain the meaning of the term biological control.

Working geographically

12 Construct a flow chart that demonstrates the processes involved in the construction of artificial dunes.

13 Write a report detailing the importance of dune revegetation and outlining the processes involved in this management strategy.

14 Access the Coastcare website and then answer the following questions.

- **a** What is Coastcare?
- **b** What are the objectives of Coastcare?
- **c** What types of projects does Coastcare fund?

Exam-style questions

Extended responses

- Outline the biophysical interactions that determine the spatial patterns and dimensions of two ecosystems at risk.
- Analyse the biophysical interactions that contribute to the unique characteristics of an ecosystem at risk.
- With reference to at least one ecosystem you have studied, explain the biophysical interactions that led to diverse ecosystems and their functioning.
- Analyse the impacts of human-induced modifications to energy flows, nutrient cycling and relationships between biophysical components of one ecosystem at risk.
- Explain how one ecosystem at risk adjusts in response to natural stress.
- Analyse the human impacts affecting the nature and rate of change of two ecosystems at risk.
- Compare and contrast the impact of humans on two ecosystems at risk.
- Compare and contrast the vulnerability and resilience of two ecosystems at risk.
- Describe the spatial patterns and dimensions of one case study of an ecosystem at risk, and analyse the negative impacts of humans on the ecosystem.
- Analyse the nature and rate of change affecting the functioning of one ecosystem at risk.
- Compare and contrast traditional and contemporary approaches to the management of two ecosystems at risk.
- Evaluate traditional and contemporary approaches to the management and protection of one ecosystem at risk.

Glossary

accretion the growth of a dune due to the build-up of sand

aeolian transport the movement of material, such as sand, by wind

beach an accumulation of sediment acting as the boundary between the land and sea

beach nourishment the artificial replenishment of beach sand

berm the first component of the dune system; it lies closest to the water's edge and is created by waves piling up sand; sometimes referred to as an incipient dune

blowout the movement of sand inland, often resulting from a disturbance to the dune vegetation

coastal dunes exposed shoreline systems of one or more sand ridges derived from material transported by wind and waves

Coastcare a community based action group that aims to preserve, protect and rehabilitate coastal dune ecosystem

current the flow or movement of a large body of water in an ocean. The movement is caused by prevailing winds, the Earth's rotation and the distribution of the continental land masses

foredune the coastal dune or line of dunes that is found behind the berm; foredunes are subject to erosion and their form and composition are constantly changing; also known as a frontal dune

longshore drift the movement of sediment by currents running parallel to the shore

migrating dune a dune that is created when a blowout is extended by continued destruction of the dune system; they move inland, covering the landscape with sand

parabolic dune a dune created by blowouts; these are dunes that take on a 'U' shape as they move back through the dune system

parallel dunes the lines of dunes that lie behind the foredune; they form in lines that run parallel to the beach; also known as transverse dunes

prevailing wind the most common direction from which the wind blows in a given area

saltation the transportation of particles in a current of wind (or water) by a series of bouncing movements

sand grains of weathered rock, sometimes mixed with crushed shell

seres each stage in plant succession as a plant community develops at a particular site

suspension particles of sand carried along by the wind, often well above the ground

swale a trough or depression that develops between two adjacent dunes

washout water washing over the dune system from inland lakes and water courses

wave a movement of energy through water caused by the frictional drag of wind blowing across the surface of a body of water; the development of a wave involves the transfer of energy from the wind to the water's surface

CHAPTER

3 The Great Barrier Reef

Coral reefs are one of the most complex ecosystems on Earth. They are predominantly found in the Indian Ocean and on the western edges of the Pacific and Atlantic oceans. The global distribution of coral reefs is influenced by a number of factors, including light and sea surface temperatures.

Coral reefs require such a unique set of biophysical interactions that they are highly vulnerable to human-induced change. For example, just a small change in sea surface temperature is enough to result in the collapse of a whole reef system.

The Great Barrier Reef is a collection of more than 2000 individual reefs. It is the largest coral reef system in the world and is regarded as one of the most significant and spectacular environments on Earth.

> **The Great Barrier Reef is in grave danger. The twin perils brought by climate change—an increase in the temperature of the ocean and in its acidity—threaten its very existence.**
>
> **Sir David Attenborough**

3.0.1 The Great Barrier Reef is a highly complex and diverse ecosystem teeming with life.



UNIT 3.1

Spatial patterns and biophysical interactions

The Great Barrier Reef is a vast, complex ecosystem located off the east coast of northern Queensland, as seen in Figure 3.1.1. It stretches approximately 2300 kilometres from Papua New Guinea's Fly River in the north (8°S) to Fraser Island in the south (24°S). In order to appreciate the sheer size of the Great Barrier Reef, compare it with other large reef systems. The Belize Barrier Reef (off the Caribbean Sea coast of Belize in Central America) stretches for 290 kilometres while Ningaloo Reef off the Western Australian coast, is approximately 280 kilometres long.



3.1.1 Location and distribution of the Great Barrier Reef

The Great Barrier Reef system covers an area of 348 000 square kilometres. This makes the reef system larger than the United Kingdom, Switzerland and the Netherlands combined.

The global distribution of coral reefs indicates the importance of climate in determining their location and nature. Three conditions are essential to their formation and survival:

1. **Light:** Corals contain organisms called zooxanthellae. These organisms need photosynthesis (the conversion of solar energy into a food source) to survive. Consequently, sunlight is a prerequisite for coral formation and survival (see Figure 3.1.2).
2. **Temperature:** Corals are limited to areas of the sea where the water temperature does not fall below 17°–18°C, and rarely exceeds 33°–34°C.
3. **Salinity:** Salinity refers to the amount of salt that is dissolved in the water. Corals thrive in relatively stable, saline conditions. Elevated levels stunt coral growth and low levels will result in the zooxanthellae dying.

In 1981, the Great Barrier Reef was listed by the United Nations Education, Scientific and Cultural Organisation (UNESCO) as a World Heritage site in recognition of the immense biodiversity on the reef system. The reef is the largest World Heritage site in the world. Fifteen hundred of the world's 13 000 fish species are found within the area along with six of the world's seven turtle species. There are also 200 bird species, 500 species of seaweed, 600 species of echinoderm (such as sea cucumbers and sea urchins), 125 species of shark and ray, and around 360 species of hard coral.



3.1.2 Coral grows under very specific climatic conditions that dictate the global distribution of coral reefs.

The role of the atmosphere

The Great Barrier Reef lies within Australia's cyclone zone. For thousands of years, tropical cyclones (intense storms) have shaped the reef ecosystem. The impact of a tropical cyclone is dependent on the intensity and duration of the storm. In general, tropical cyclones cause damage to the corals themselves. The damage results from the large storm waves that are generated by the strong winds associated with intense low-pressure systems. These waves rip apart the softer corals while the hard corals are chipped and damaged. In some cases, the cyclone may result in the reef system being buried by sediment.

Large amounts of rain are also associated with tropical cyclones. As large volumes of freshwater flood onto the reef from coastal river systems the salinity level in the waters of the reef is altered. The turbidity of the water can also be increased. In 2017 (March to April), Cyclone Debbie—a large Category 4 tropical cyclone—struck the southern part of the Great Barrier Reef. The heavy rains associated with the cyclone initiated widespread erosion across inland parts of Central Queensland. River systems, such as the Burdekin, Fitzroy and Gregory rivers brought huge quantities of sediment down from the inland areas out onto the reef, dramatically increasing turbidity.

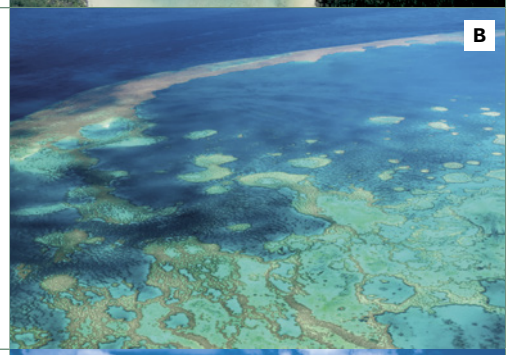
SPOTLIGHT

Cyclone Debbie

Cyclone Debbie caused a dramatic increase in physical damage to the Great Barrier Reef (see Figure 3.1.3), especially around the Whitsunday Islands. At the height of the storm, wind gusts were measured as high as 260 kilometres per hour and these winds created a huge sea swell and storm waves. In the wake of the storm, research by the Australian Institute of Marine Science found that more than 95 per cent of corals were destroyed on some reefs in the Whitsundays. Even corals found in deeper waters that are usually less impacted by storm damage had been affected by the ferocity of Cyclone Debbie.



3.1.3 These aerial photographs show the mouth of Burdekin River in North Queensland. The photograph on the left was taken days before Cyclone Debbie. The photograph on the right, taken three days after the cyclone, shows the huge sediment plume that emerged from the river.

Types of reefs		
Reef type	**Description**	
Fringing reef	Formed in shallow waters, these reefs are found close to the shoreline and around many islands. They start off relatively narrow but gradually widen as the corals grow. They are quite rare along the Queensland coast but are reasonably common around the islands of the Great Barrier Reef system.	
Offshore (barrier) reef	These reefs lie some distance from the shore. Sometimes called barrier or ribbon reefs, they run parallel to the shoreline. These are the most common types of reef found in the Great Barrier Reef system. The outer reefs are between 15 and 100 km from the shore.	
Atoll	Atolls are reefs that have built up to the sea level. They are normally circular or oval in shape. Some atolls are associated with remnant volcanoes but all have the same basic structure of a lagoon surrounded by a coral reef.	
Patch reef	These reefs develop in shallow water. They tend to be circular in shape and sometimes feature a lagoon. Often a coral cay will form within the lagoon.	
Coral cay	These are low-lying islands formed when material eroded from the reef accumulates. Initially little more than a sand bank, the cay eventually stabilises as more material builds up. Gradually birds bring seeds and a soil structure develops, leading to the formation of a stable island able to support terrestrial life forms. Coral cays are normally aligned to the prevailing wind direction.	

3.1.4 Reef types include **A** fringing reef, **B** offshore (barrier) reef, **C** atoll, **D** patch reef and **E** coral cay.

The role of the lithosphere

The lithosphere plays an important role in forming and transforming reef ecosystems. The reefs themselves produce solid limestone (the dead skeletal remains of coral polyps). At the same time, the limestone is weathered and redistributed to other parts of the ecosystem to create a range of new landforms, including coral cays (see Figure 3.1.4E).

Through the production of limestone, coral reef systems are able to withstand the erosive power of waves. Over time individual corals die. However, their death enables new corals to grow on the limestone structures that they created. In this way, current reefs are growing atop long dead reefs.

Sediment is also an important influence on the reef. Sediments, such as sand and mud, can cloud the water, creating turbidity. Turbidity refers to the cloudiness of water. It can result in less light penetrating the water to reach the reef and thus affect the processes of photosynthesis. Coral reefs may also be smothered in sediment, especially where there are high levels of continental sediment run-off; that is, sediment run-off from land. For example, there are few reefs close to the shore (known as fringing reefs) within the Great Barrier Reef system. This is due to the high rainfall along this part of the Queensland coast, which creates considerable sediment run-off. In the Ningaloo barrier reef system off the north-western coast of Australia there are numerous fringing reefs. Here the climate is dry and there are few rivers to transport sediment onto the reefs.

Activities

Understanding the text

1 Outline the location and dimensions of the Great Barrier Reef.

2 Describe the environmental conditions that are necessary for coral reefs to form.

3 Explain why the Great Barrier Reef was listed as a World Heritage site.

4 Outline the impacts of tropical cyclones on the coral reef ecosystem.

5 Explain why limestone is important to the functioning of the reef.

6 Define the term turbidity. Outline the impact of turbidity on the reef.

7 Explain why fringing reefs are more common in places like Ningaloo Reef compared to the Great Barrier Reef.

Working geographically

8 Study Figure 3.1.1. Write a paragraph or two describing the location of the Great Barrier Reef World Heritage Area. Estimate the proportion of the Great Barrier Reef contained within the area.

9 Write a brief report explaining the impact of Cyclone Debbie on the Great Barrier Reef system.

10 Study Figure 3.1.4. Compare fringing, barrier and patch reefs.

11 Write a short-answer response to the following task: Describe the role of the atmosphere and lithosphere in the functioning of coral reef ecosystems.



3.1.5 The outer reef absorbs much of the wave energy.

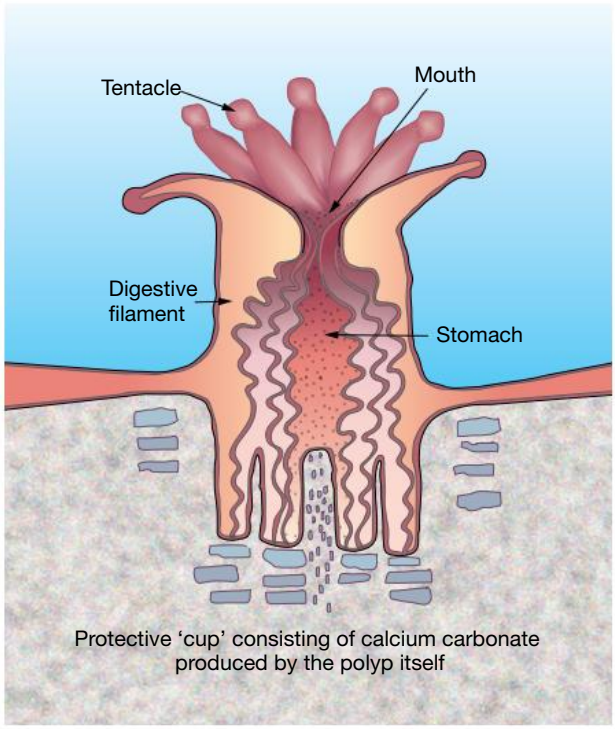
The role of the hydrosphere

Coral reefs tend to grow best where there is high wave energy. Wave energy is generated by ocean swells or by locally generated waves associated with the movement of air (wind). Reefs are very effective at interfering with wave energy. The structure of the reef is such that the seaward (or front) part of the reef absorbs much of the energy, creating an area of relatively calm water behind it, as seen in Figure 3.1.5.

The amount of water flowing across the Great Barrier Reef is so enormous it is measured in thousands of cubic kilometres. Powerful currents such as the East Australian Current, which flows southwards along the Queensland coast, move vast quantities of water and nutrients across the reef. Counter-currents flowing northwards also draw in cooler waters at different times of the year.

The role of the biosphere

There are more than 330 species of coral found within the Great Barrier Reef, the greatest diversity being in the northern section of the reef. Although predominantly a rock structure, the living reef itself has been built by animals, known as polyps (see Figure 3.1.6). These are primitive organisms that consist of little more than a digestive sac or stomach and an outer skeleton of limestone (calcium carbonate). The polyp pulls food into its mouth through a ring of tentacles.



3.1.6 Cross-section of a coral polyp



3.1.7 Coral spawning

Within the polyp live a symbiotic algae called zooxanthellae. The polyp and zooxanthellae mutually benefit from each other: the zooxanthellae produce sugars and oxygen through photosynthesis while the polyp provides nutrients. It is the zooxanthellae algae that give the corals their brilliant colours.

Each coral reef begins as a single coral polyp, which then reproduces itself to create a colony. The colony gradually expands the reef upwards and outwards. As the individual polyps die, their limestone skeletons remain to create a structure on which the new corals will form. Coral reproduction is unique. In late spring or early summer every year the corals release their eggs into the warming water. Simultaneously, the corals also release sperm in a single massive spawning (see Figure 3.1.7.) The fertilised eggs form into larvae and settle onto the skeleton remains of the dead coral to continue the reef-building process.

Species diversity

Apart from coral, the Great Barrier Reef is a highly diverse system made up thousands of individual species. The mass of nutrients created by the plants and algae of the reef system is several times that of the open ocean. The main reason for this very high rate of production is the constant recycling of nutrients that takes place within the reef system. Algae within the reef play much the same role as trees do in rainforests, another highly productive ecosystem, which is constantly recycling decaying plant material into nutrients for further plant growth.

Fish

There are thousands of fish species within the reef. Some feed on material washed in from the open ocean, while others, such as the parrot fish, graze on the coral itself, eating the algae and polyps. The abundance of fish attracts a range of predatory animals to the reef. At the top of the food chain are predators, such as sharks and dolphins.

Cnidarians

Large numbers of cnidarians—animals without backbones (invertebrates)—are also found throughout the Great Barrier Reef. Cnidarians are divided into two broad categories:

- sedentary cnidarians, which are unable to move; for example, corals and sea anemones (see Figure 3.1.8)
- mobile cnidarians; for example, jellyfish.

Regardless of their type, all cnidarians have stinging cells, which they use to catch prey and for self-defence.



3.1.8 Sea anemones are sedentary cnidarians and are unable to move.

Molluscs

Molluscs are also found in large numbers. These are soft-bodied animals, such as sea slugs, clams and octopuses. Another common animal group is the echinoderms. These strange creatures have tubed feet, an armour-like skeleton and a body divided into several parts. Starfish and sea urchins are of this genus. The crown-of-thorns starfish is one of the best-known echinoderms on the reef. It attaches itself to coral and gradually feeds off the coral, eventually killing it. At times it reaches plague proportions. This leaves large areas of the reef degraded.

Crustaceans

Crustaceans (invertebrates with jointed legs) perform an important role in recycling nutrients within the reef system. Crustaceans include prawns, crabs and lobsters. These animals live on the sea floor and eat a range of food, including the dead fish that have settled to the seabed.

Mammals and reptiles

At the upper end of the food chain is found a range of mammals and reptiles. Turtles, crocodiles and sea snakes are all found on the reef. Mammals, such as dolphins and dugongs, live on the reef all year round. Dugongs (see Figure 3.1.9), sometimes called sea cows, graze on the vast seagrass beds that are found in the sheltered waters behind the reefs. Whales, including humpbacks, inhabit the reef for breeding and calving in the winter months before returning to the Antarctic waters in summer to feed.



3.1.9 Dugongs graze on seagrass beds that form in sheltered waters on the reef.

SPOTLIGHT

The biophysical environment of coral cays

The invasion and succession of plants on coral cays is closely linked with wave and wind energy. This suggests that both the hydrosphere and atmosphere play a very important role in the shaping of the biosphere of each cay. Plants are able to invade the cays by using waves and the wind as transporters of their seed. For example, the pandanus palm seed easily floats and can be transported long distances by the action of waves. Some plants also use birds to transport partially eaten seeds, which are then deposited onto the islands in the bird's droppings.

Bird droppings, called guano, gradually build up and a soil structure will begin to form (see Figure 3.1.10). As the soil improves through the natural fertiliser of the guano and washed-up plant material, pioneer species will invade and colonise the cay. Typical pioneer species are grasses that are tolerant of the salt and wind (such as sand spinifex) and small succulents (such as pigface). Over time these pioneer species create a soil structure suitable for higher-order plants (such as pisonia trees) to develop and sometimes whole forest communities develop on the islands.



3.1.10 Birds play a crucial role in the colonisation of coral cays, like Michaelmas Cay, located northeast of Cairns.

Small mammals and reptiles transported on driftwood may eventually find their way to the cays and islands. These stowaways often begin thriving communities of species that do not have any natural predators because predators are usually too large to get out to the cays.

Seabirds

Seabirds are another important player in the Great Barrier Reef ecosystem. The schools of fish found in the sheltered lagoons and shallow waters of the reef attract a large number and variety of seabirds. Most birds found in the region have large webbed feet for swimming. Examples of seabirds include the noddy (see Figure 3.1.11), boobie and tern, which are found on most islands in the reef system. Birds play an important role in transporting seeds from the mainland to islands and from island to island.



3.1.11 Seabirds, such as this White Capped Noddy, play a crucial role in the ecology of the reef.

Activities

Understanding the text

1. Describe the role of wave energy in the functioning of coral reefs.
2. Explain the importance of the water flows to the functioning of the reef.
3. Explain what a polyp is.
4. Outline the relationship between polyps and zooxanthellae.
5. Describe the reproduction of coral.
6. Account for the high degree of biodiversity on the reef.
7. Explain what a cnidarian is.
8. Outline the impact of the crown-of-thorns starfish.
9. Describe the role of seabirds in the functioning of the reef ecosystem.

Working geographically

10. Construct a simple flow chart showing the gradual formation of a reef from a single polyp.
11. Using Figure 3.1.6, complete the following activities.
    - a Outline the major components of a polyp.
    - b Explain the role of the tentacle.
12. Using the information in this unit, construct a simple food web for the Great Barrier Reef.
13. Write a paragraph describing the invasion and colonisation of coral cays.
14. Write an extended response on the following topic: 'The Great Barrier Reef is one of the most biologically diverse ecosystems on Earth.' In your response, assess the accuracy of this statement.

UNIT 3.2

Nature and rate of change

Natural impacts

The Great Barrier Reef is a highly dynamic ecosystem. Many natural stresses impact on the reef.

Tropical cyclones are a major source of damage to the reef system. These storms create large waves that damage corals. They also bring large amounts of freshwater onto the reef through the intense rain that is often associated with such events. This alters salinity levels, placing stress on the corals and other animals. The increased turbidity caused by the erosive power of these storms is another source of natural stress on the reef.

Natural stresses also come from the biosphere. For example, the crown-of-thorns starfish, as shown in Figure 3.2.1, has the potential to cause widespread degradation of reefs as it consumes large amounts of coral. When this naturally occurring species reaches plague numbers, it causes widespread damage. Eventually the starfish consume so much coral that their food supply is exhausted and starfish numbers return to a sustainable level.



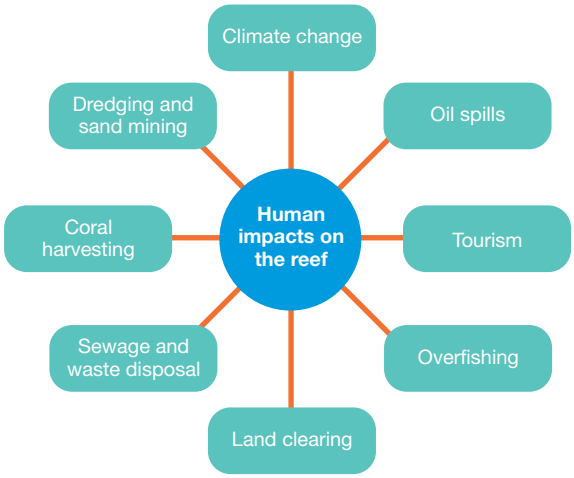
3.2.1 The crown-of-thorns starfish is a significant natural stress on the reef.

Human-induced stress

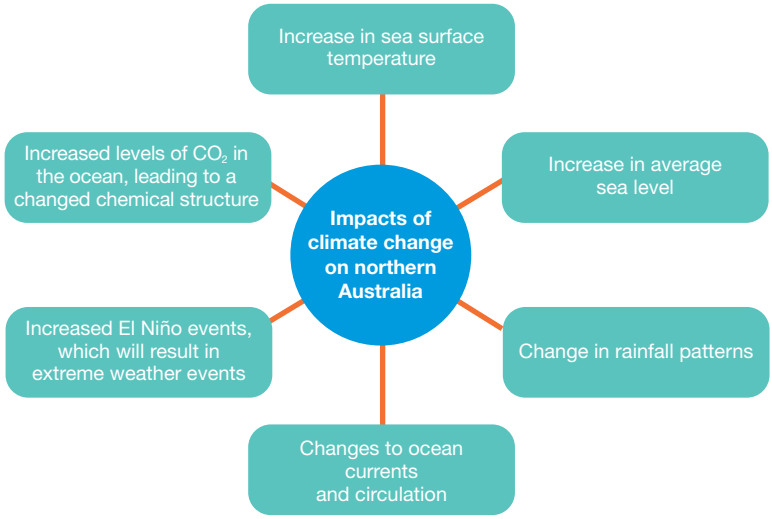
There is a long history of human activity on the Great Barrier Reef. Aboriginal and Torres Strait Islander people have fished and hunted on the reefs for thousands of years. Figure 3.2.2 summarises the major human impacts on the Great Barrier Reef system.

Climate change

Human activities are changing global climatic patterns and this is having an impact on all ecosystems. Coral reefs are particularly at risk as they are dependent on specific climatic conditions. Figure 3.2.3 summarises some of the key impacts of climate change on the Great Barrier Reef.



3.2.2 Major human impacts on the Great Barrier Reef



3.2.3 Impacts of climate change on the Great Barrier Reef

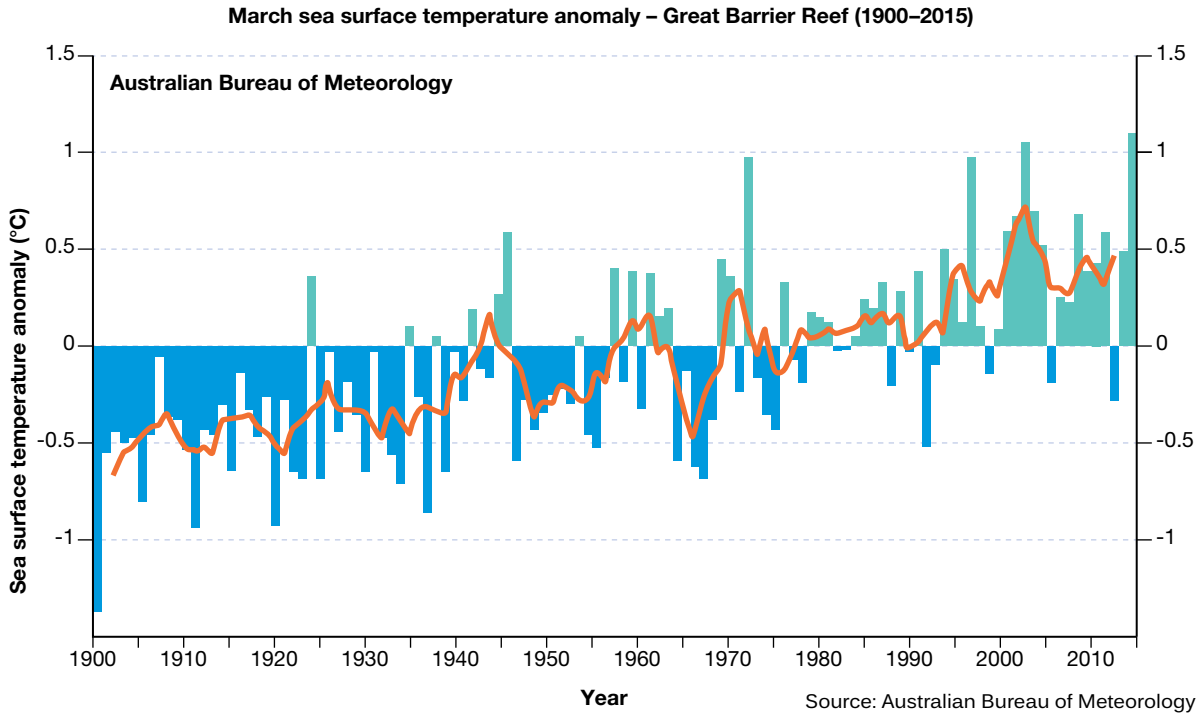
Coral bleaching

One of the major consequences of climate change has been an increase in sea surface temperatures. As Figure 3.2.5 shows, the average temperatures of the Coral Sea has become warmer across the twentieth century and continue to grow. Coral has very specific climatic requirements and this includes sea temperatures where the water does not fall below 17°–18°C, and rarely exceeds 33°–34°C. Increasingly, temperatures are exceeding this level which places stress on the corals. When the corals become stressed the symbiotic relationship between the coral polyp and the zooxanthellae breaks down, causing the coral to expel the algae. As a result, the coral loses the colour that was provided by the zooxanthellae—this processes is known as bleaching as the reef turns white, as shown in Figure 3.2.4. Not all bleached coral will die but there is significant risk of this and it is a strong indication of severe stress on the reef.



3.2.4 The reef around Heron Island on the southern Great Barrier Reef was severely degraded by bleaching in 2016.

Coral bleaching events can be associated with natural changes in climatic conditions. For example, during naturally occurring El Niño events the sea temperatures in the western Pacific Ocean and the Coral Sea rise. However, it has become clear that human induced climate change is causing more frequent and more extreme bleaching events. In 2016 a massive event saw a 29 per cent loss of the shallow reefs across the Great Barrier Reef due to bleaching, which can be seen in Figure 3.2.6. Scientists estimated that up to 93 per cent of the reef had some bleaching in 2016. Some of this was quite mild bleaching, especially in the southern parts where the coral recovered well. However, the northern parts where waters were warmer saw significant mortality of coral. March 2016 also saw the warmest sea surface temperatures in the Coral Sea recorded to date (see Figure 3.2.5).



3.2.5 This graph shows the average sea temperatures for the Coral Sea for the month of March.

Species decline

The effects of climate change are not just confined to the coral but impact the broader ecosystem of the Great Barrier Reef.

SEABIRDS

Several seabird species are already in decline across parts of the reef. Mass mortalities and a failure of eggs to hatch have occurred in a number of large rookeries of seabirds. Scientists believe that this is the result of 'provisioning failure', meaning that the adult birds are having to travel too far to find food as the availability of fish decreases due to changed ocean circulation patterns.

FOOD CHAIN FUNCTION

Climate change is altering the location, frequency and timing of nutrient upwellings. These upwellings are ocean currents that bring nutrients upwards from the sea floor. Such upwellings attract fish which, in turn, attract predator fish and mammals, such as sharks and dolphins. Changes in these nutrient upwellings have a significant impact on the functioning of the food chain. Humans are also beginning to notice impacts as a result of these changes with fewer fish being caught by commercial fishers in the region.

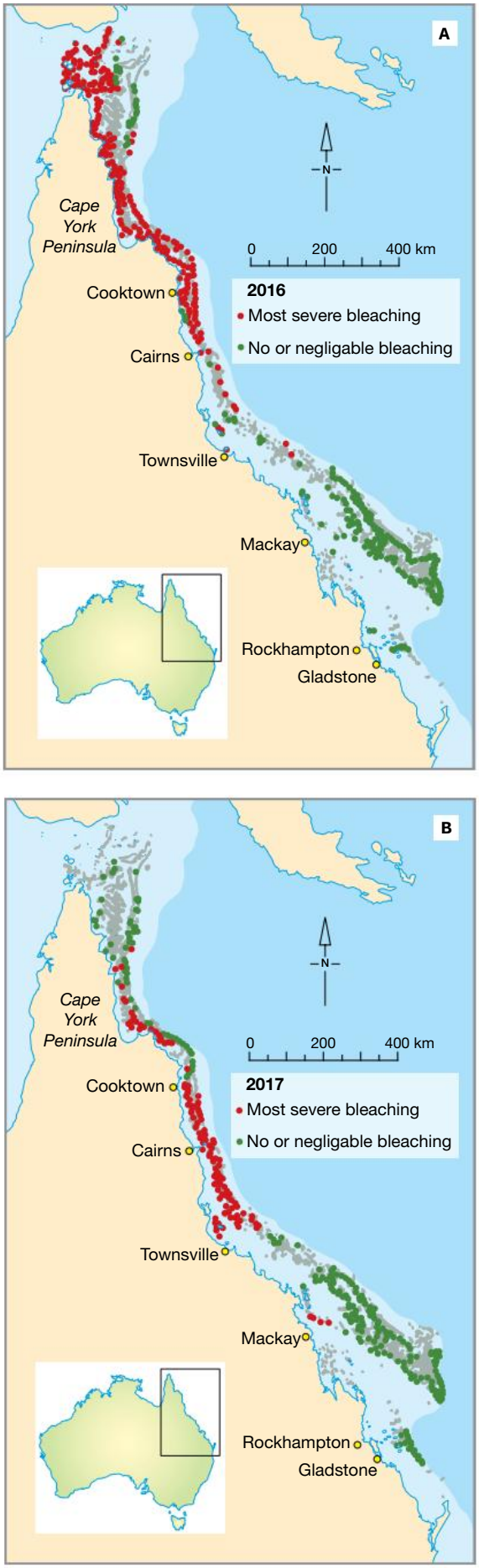
LARGER ANIMALS

Climate change is also beginning to affect the largest animals on the reef. Scientists have concerns for the habitat of the humpback whales that breed in the warm northern waters in the winter months. Turtles are another species under threat as a result of climate change. The gender of a turtle is determined by temperature: higher temperatures result in female turtles being hatched. As the region warms, more female turtles are being born and a gender imbalance is emerging. Other threats to turtles include sea level rise reducing nesting sites. Turtles nest on beaches, which are gradually being inundated by the sea level rise.

Recreational and commercial sea vessels

Recreational boating is a common pastime on the reef. On any day of the year, thousands of small craft can be observed fishing, sightseeing and sailing up and down the length of the reef. While those waters represent a relatively safe boating environment for humans, the boats have the potential to damage the reef ecosystem.

The boats' heavy metal anchors damage the reef's coral formations and dredge up the seagrass beds. Boats are also a source of pollution through oil and fuel spills, rubbish and sewage. When boat owners vent their onboard sewerage systems while at sea, raw sewage is released into the water. Sewage from a single boat is not damaging in itself. However, the impact is considerable when hundreds of boats do this.



3.2.6 Extent of coral bleaching in the summers of 2016 (**A**) and 2017 (**B**)



3.2.7 Chinese cola carrier the MV Shen Neng 1 ran aground on Douglas Shoal in 2010.

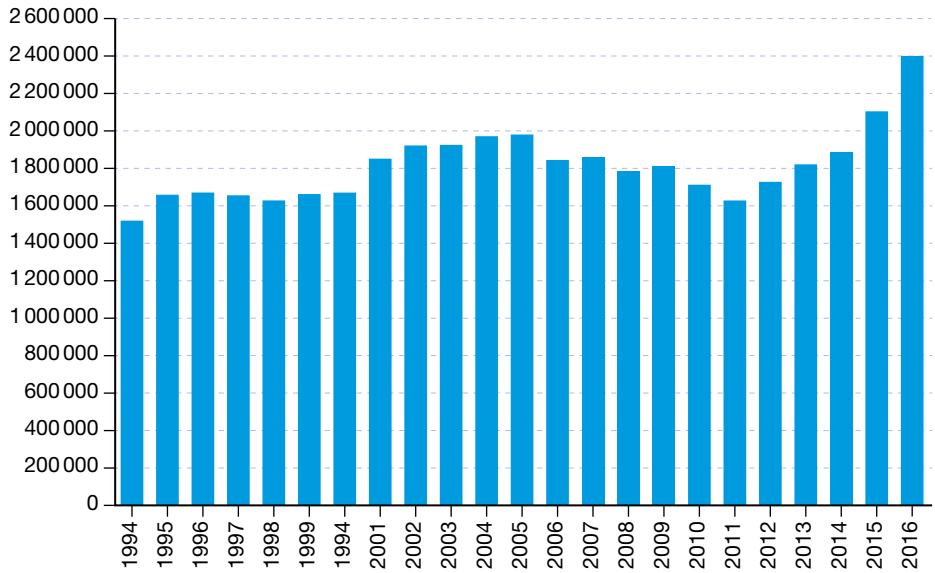
Thousands of large ships, including bulk carriers, tankers and cruise ships transit through the Great Barrier Reef each year. These ships carry many goods including grain, minerals, bulk cargo (such as cars) and oil. Fortunately, there has not yet been a major oil spill on the reef. However, with such a large number of ships the potential for a major spill exists. The Federal Government estimates that that there will be a very significant increase in the number of ships moving through the reef, reaching 10 000 per year by 2030.

There have been significant accidents in the past. In April 2010, the MV Shen Neng 1 ran aground on Douglas Shoal (see Figure 3.2.7), leaving a 400 000 square metre scar over the reef. When the matter went to court in 2016, it was revealed that the reef was still degraded. One major impact was toxic paint residues still evident on the reef where the hull of the ship had made contact with it. Today, the area is carefully managed and the International Maritime Organisation has judged that as a result of the careful management it is 'unlikely' that a major incident will occur on the reef.

Ships also bring with them rubbish and small slicks associated with leaks. The ships also have the potential to introduce feral aquatic species by releasing ballast water. This is water used to balance the ship: water is pumped into the ship, often in an overseas port, and released when it is no longer needed. Small animals and plant species can be transported across the oceans in this way.

Tourism

Tourism is one of the most important industries in far north Queensland and the Great Barrier Reef is a tourist attraction of international importance. Research by Deloitte Economics released in July 2017 placed the value of the Great Barrier Reef to the Australian economy as $56 billion. To place this into a context this is twelve times the value calculated for the Sydney Opera House. Of the total value, $29 billion was associated with tourism. Annually the reef generates around $6.4 billion of economic activity, mostly associated with tourism. Nearly 30 000 people are indirectly reliant on the reef for employment, while 39 000 people are directly employed due to the reef.



3.2.8 Visitor numbers to the Great Barrier Reef Marine Park

As shown in Figure 3.2.8, visitor numbers to the reef have grown almost consistently each year. In 2016, 2.4 million people visited the park, making it one of the most visited tourist sites in Australia. However, only around 7 per cent of the reef is allocated for tourism so despite the vast size of the reef, tourism is concentrated in areas around the Whitsunday Islands, Cairns and Townsville. The northern parts of the reef have the lowest levels of activity. The impacts of tourism include the following:

- **Coastal tourism development:** Most tourists to the region stay in hotels and resorts on the mainland. This development places a strain on coastal environments, including estuarine river systems.
- **Island-based tourism:** Tourism on islands can create problems associated with sewage and rubbish discharges.

- **Marine-based tourism:** Tourist boats make thousands of journeys out to the reef each year. These boats bring rubbish and the potential for oil spills. They also require moorings on the outer reef. Moorings destroy the coral, as do anchors and the anchor chains of boats.
- **Water-based activities:** Diving and snorkelling are popular tourist activities. Most divers are careful and cause no damage to the corals. However, studies show that a small proportion of divers swim too close to the corals, breaking them. The fragile branching corals are particularly susceptible to this.
- **Wildlife interactions:** Most tourism operators are very careful to ensure that tourists do not come too close to the wild animals that live on the reef. However, studies show that a small proportion of careless operators and tourists disrupt wildlife and this can impact on breeding cycles and natural interactions.
- **Trampling and souveniring of coral:** Trampling occurs when people walk on reefs that become exposed at low tide. This practice was a common form of reef tourism, especially on inner reefs close to the shoreline, but it has now been made illegal. Souveniring of coral, shells and other elements of the reef ecosystem was also a major problem. In the past, tourists and some commercial traders took large amounts of material, mostly from the inner reefs. Such souveniring disrupted natural processes and is now illegal unless the collector is correctly licensed.

Land clearing

There are 26 major river systems that flow from mainland Queensland out onto the Great Barrier Reef. Approximately 25 per cent of the land area of Queensland drains out onto the reef. This run-off represents a major impact on the reef. Agriculture, urban development and aquaculture (fish farming) all affect the quality of the water that runs into the Coral Sea.

As seen in Figure 3.2.9, coastal development on land adjacent to the reef is expanding rapidly. Tourist developments, such as those found between Cairns and Port Douglas and around the Whitsunday region, result in large amounts of land being cleared. This, in turn, increases surface run-off, which brings more nutrients and sediments to the reef. These developments also increase the run-off of sewage and other pollutants.



3.2.9 Urban and tourism development, like this at Port Douglas north of Cairns, impact on the reef environment.

The Great Barrier Reef Marine Park Authority (GBRMPA) notes that the clearing of wetlands is another major issue impacting on the sustainability of the reef. Estuarine and intertidal wetlands provide important habitats and nurseries for many of the species that form part of the reef ecology. These species include wading birds and small crustaceans. The wetlands also retain large volumes of freshwater during heavy rainfall. As wetlands are diminished, more freshwater flows out onto the reef, affecting salinity levels.

Agriculture and aquaculture

Aquaculture is becoming a more popular form of commercial farming. Prawns, several fish species, and pearl and edible oysters are commercially farmed in large ponds within and next to the Great Barrier Reef Marine Park. These farms can release chemicals and diseases that impact on wild species and may also be a source of pollutants.



3.2.10 Sugar cane farms dominate the coastal plains in areas such as Ayr on the Burdekin River, south of Townsville.

Conventional agriculture (see Figure 3.2.10) on the coastal plain adjacent to the reef has long been a source of concern for reef ecologists and marine biologists. The use of chemical fertilisers in the farming process can increase nutrients that promote algal growth. The algae smother the reef and reduce light penetration.

Unsustainable agriculture is also a major source of soil erosion. As seen in 2017 with Cyclone Debbie, heavy tropical rains can dramatically increase erosion with the river systems then depositing this sediment onto the reef.

Mining

The Great Barrier Reef is protected through state and federal laws and also internationally as a result of its World Heritage status. This prohibits mining within the Marine Park itself. However, the areas adjacent to the reef, for example around Mackay, are major mining areas. These mines have impacts on the reef in several indirect ways. The most significant is the need for very large ships to transit through the reef to carry away the coal mined inland. Huge ports have already been established in the region. Each year there has been nearly 5 per cent annual increase in the number of ships calling at ports within the reef area.



3.2.11 Mining projects, like the Carmichael mine, owned by Adani have attracted much protest.

The mines in Queensland are all coal mines and the burning of this coal releases large quantities of carbon dioxide, the main greenhouse gas that leads to climate change. Indian firm, Adani has been planning a huge new coal mine near Rockhampton—the Carmichael mine. The coal that will be produced by this mega mine worth $21.7 billion will release 128 million tons of carbon dioxide annually. The mine will also use huge quantities of freshwater. The mine was given approval in 2017 but remains very controversial and there are many who want the project stopped (see Figure 3.2.11). Another concern with the mine is the expansion of the coal ports on the reef coast to allow the export of the coal. The expansion of the ports has seen increased dredging, leading to increased turbidity and changes to sediment and current patterns. There are also fears that the new ports will encourage even more mine development in the future.

Activities

Understanding the text

1. Outline the impact of cyclones and storms on the reef.
2. Describe the impact of crown-of-thorns starfish.
3. Explain the relationship between climate change and coral bleaching.
4. Outline the impacts that recreational boating can have on the reef ecosystem.
5. Describe the threats to the reef posed by large commercial ships.
6. Outline the main impacts of tourism to the reef.
7. State the impact that land clearing has on the reef ecosystem.
8. Describe the main impacts that agriculture has on the reef.
9. Outline the expected effects of the Carmichael mine on the reef.

Working geographically

10. Study Figure 3.2.5. Explain the patterns shown in the graph.
11. Prepare a bullet point summary of the main impacts of climate change to the Great Barrier Reef. Using the summary, write an extended report on the impacts.
12. Study Figure 3.2.8. Using this graph, describe the trends in visitor numbers to the reef.
13. Write a short-answer response on the following topic: 'Assess the value of the Great Barrier Reef as a tourism destination'.
14. As a class, discuss whether tourism plays a positive role in protecting the Great Barrier Reef. Record your ideas in a table listing the positive and negative impacts of tourism.
15. Study Figure 3.2.9. Describe the impacts evident in this image of the urban development on the environment.
16. Investigate the Adani Carmichael mine.
    a. List the benefits and costs of the project.
    b. What is the current status of the mine?
17. Conduct a class debate on the topic: 'Protecting the environment of the Great Barrier Reef is more important that the employment of local people'.

UNIT 3.3

Traditional and contemporary management practices

Traditional management of the Great Barrier Reef

There are more than 35 distinct groups of Aboriginal and Torres Strait Islander people who have important traditional links or connections to various parts of the reef and its surrounds. Each of these groups has its own distinctive cultures and traditions.

Aboriginal people have lived along the Queensland coast and adjacent islands for thousands of years. Their traditional lifestyle is that of hunters and gatherers and they harvested both plants and animals from the region.

Torres Strait Islanders are seafaring peoples who occupy the islands of the Torres Strait. These islands separate mainland Australia from Papua New Guinea. Torres Strait Islanders have traditionally relied on fish and other marine resources for their survival.

Aboriginal and Torres Strait Islander people have, over thousands of years, developed management strategies that are sustainable; that is, they could have been practised indefinitely. They only took enough resources from the ecosystem to satisfy their needs and in doing this they did not disturb the dynamic equilibrium.

Today, the role of Indigenous Australians in the management of the Great Barrier Reef continues. In 1992, the High Court of Australia ruled that Indigenous Australians had rights over many of their traditional lands. The famous Mabo Case, in which Eddie Mabo won rights over the Murray (Mir) Islands in the Torres Strait, established the concept of native title. Today, there are more than more than 70 Indigenous owner groups that have long and enduring relationships with the Great Barrier Reef. These groups have traditional lands along the Queensland coast adjacent to the reef and on the islands of the reef and Torres Strait.



3.3.1 An Indigenous park ranger shows visitors turtle hatchlings emerging from their nest at Mon Repos Turtle Centre, Bundaberg, Queensland.

Traditional Use of Marine Resource Agreements

Indigenous communities have special rights to use the reef and its resources to practise their culture, which includes educating their children in customary laws and practices and providing traditional foods for their families. These rights are established through special agreements between the traditional owners, the Great Barrier Reef Marine Park Authority and the Australian and Queensland governments. Called Traditional Use of Marine Resource Agreements (TUMRA) and Marine Park Indigenous Land Use Agreements (ILUAs), the agreements aim to strike a balance between the customs and culture of Indigenous people and the protection of the reef environment and aim to incorporate Indigenous communities into the management of the reef (see Figure 3.3.1). For example, the Gunggandji agreement, which came into effect in 2016, covers an area around Cairns where the traditional owners agreed to not hunt for dugong (an important traditional food) for five years, as the dugong population there is under threat. The Woppaburra agreement which covers an area of 561 square kilometres around Keppel Island facilitates close relationships between scientists and the traditional owners to better manage this environment.

Indigenous Reef Advisory Committee

The Great Barrier Reef Marine Park Authority has also formed the Indigenous Reef Advisory Committee (IRAC). The committee meets regularly and has representatives from traditional owner groups and senior officials from government agencies.

The role of the committee is to provide expert advice to the authority on conservation and ecologically sustainable use of the reef and its resources. The committee draws heavily on the knowledge of the environment that traditional owners have gained over thousands of years and blends this with contemporary science.

Contemporary management of the Great Barrier Reef

The Great Barrier Reef was declared a World Heritage site in 1981. The protection and management of ecosystems that have been assigned World Heritage status fall to the Commonwealth (or Federal) Government. Therefore, even though the Great Barrier Reef is part of the state of Queensland, the Commonwealth Government is the primary manager of the reef. Many Queensland Government agencies also assist.

The Great Barrier Reef Marine Park Authority (GBRMPA) is the main agency that advises the Commonwealth Government on the management of the reef. Other agencies assist in the management of the reef through various specialised roles such as research, marine transport safety, fisheries and quarantine. Local councils manage areas along the coast adjacent to the reef. They have an indirect role in its management through their power to veto (reject) development applications and manage land use.

The Great Barrier Reef Marine Park covers an area of approximately 345 000 square kilometres. The park consists of all the waters below the average low-water mark, which is the point at which the water level exists at low tide. It also includes any islands in the park area that are owned by the Crown; that is, the Commonwealth Government. In addition, the park contains the seabed and below the seabed to a depth of 1000 metres and the airspace above the park to a height of 915 metres. These boundaries provide an important way to control mining, including oil exploration, and low-flying aircraft such as helicopter joy flights.

Islands that are within the park but not owned by the Commonwealth are protected as Island National Parks by the Queensland Parks and Wildlife Service (see Figure 3.3.2). About one-third of all the islands in the area are protected in this way. Only a handful of islands are privately owned.



3.3.2 Islands of all sizes are found across the reef. While some are privately owned, most are protected as national parks.

Zoning

In 2004, the GBRMPA announced the creation of the Great Barrier Reef Marine Park Zoning Plan. This plan was developed to allow selected human activities to take place within the park while not degrading the overall ecosystem. For example, commercial fishing is permitted in only some parts of the reef and tourist developments (such as pontoons) on the outer reef are confined to certain areas. This zoning plan ensures that the reef will survive for future generations while also allowing the present generation access to the resources of the reef.

Anchoring and mooring

Boat anchors can have a major impact on the reef. Numerous strategies have been adopted in an effort to reduce the impact from thousands of boats that sail through the reef every year.

At many of the most popular boating destinations on the reef the GBRMPA has installed public moorings, as seen in Figure 3.3.3. These moorings are permanently fixed to the seabed and allow boat skippers to tie up without the need to use their anchor. Using the mooring prevents the damage created by anchors and anchor chains dragging across the seabed.

The zoning plan also forbids anchoring in many parts of the reef, thus reducing the impact of boating. However, the sheer size of the reef means that it is difficult to police this rule and many careless skippers still damage the reef with anchors.



3.3.3 Public moorings reduce the impact of boat anchors on the reef.

Managing tourism

Tourism, such as recreational diving seen in Figure 3.3.4, is now the most intensive human activity carried out on the reef. Tourism has many negative impacts on the ecosystem. However, tourism also plays an important role in educating people about this fragile ecosystem and why it needs to be protected.

A major issue in relation to the management of tourism on the reef is that it is very concentrated geographically. For example, about 85 per cent of all visitors to the reef visit the reefs around Cairns or the Whitsunday Islands. These two regions represent just 7 per cent of the overall reef area. This means that around 1.5 to 1.7 million people visit these tiny areas of the Great Barrier Reef each year. Consequently, the potential impact is enormous and careful management is essential.



3.3.4 Tourism plays an important role in educating visitors to the reef about its fragile nature.

Tourist education

One of the aims of the World Heritage Convention is to promote education about the importance of environmental protection and the impact of human activities on ecosystems. This is seen as a vital step in dealing with global environmental issues. Every visitor to the reef pays a small fee, which is used by the GBRMPA to undertake education programs and to manage the ecosystem.

The Great Barrier Reef Marine Park Authority also has an extensive citizen scientists program called 'Eye on the Reef'. Visitors are encouraged to collect information about the health of the reef ecosystem and report this information back to the authority via an app (see Figure 3.3.5). The app also contains educational material to help people understand the intrinsic, biodiversity, utility and heritage values of the reef.



3.3.5 'Eye on the Reef' is a citizen science project that encourages visitors to collect scientific data.



3.3.6 Pontoons moored at selected sites are one of the most common tourism activities.

Management of pontoons

Research also shows that most visitors to the reef are day-trippers and most of these will spend some of their day on the reef on a floating pontoon such as the one shown in Figure 3.3.6. There have been a number of accidents involving pontoons, including the sinking of the Fantasy Island pontoon in 1988. In response, the GBRMPA will not give approval for a pontoon until the pontoon operator has completed a detailed environmental impact assessment.

Tourist boats

With thousands of recreational boats sailing through the Great Barrier Reef every week, management of tourist boats is a key issue for the GBRMPA. Speed limits have been imposed and are enforced in many parts of the reef to reduce the damage caused by the wake of boats. This is particularly important where boats travel close to shore. Other initiatives include an education program about the need to minimise pollution from boating. Television, radio and newspaper advertisements are used along with information signs at boat ramps.

Impacts on wildlife

Another concern with tourism relates to the disturbance of wildlife. Studies conducted in the 1990s found that breeding cycles in some seabird colonies were being disturbed by tourist activity. For example, seabirds on Michaelmas Cay, near Cairns, had stopped breeding due to so many tourists visiting the tiny island. The islands on which most birds breed are controlled by the Queensland Parks and Wildlife Service (QPWS). The service regularly assesses colonies and if one is found to be in danger, access to the island is reduced or stopped altogether. Many islands are now permanently closed to humans during the breeding season. The QPWS is working closely with tourist operators to limit access while ensuring tourists can visit the islands.

Whale watching has become a popular tourist-related activity on the reef. Both Commonwealth and Queensland laws have been enacted to ensure that whale-watching operators stay well clear of whales. A small but growing number of operators allow people to swim near the whales. A code of conduct has been established to ensure that this activity does not adversely affect the whales. This includes fully briefing swimmers on what they can and cannot do and ensuring that swimmers do not swim towards whales.

Turtles are another major tourist attraction. The most common interaction between humans and turtles is on the small number of beaches where the turtles lay eggs. Nesting turtles can easily be disturbed by humans and a code of conduct has also been established for operators who specialise in turtle watching. The Commonwealth Government has protected turtles on the reef through the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).

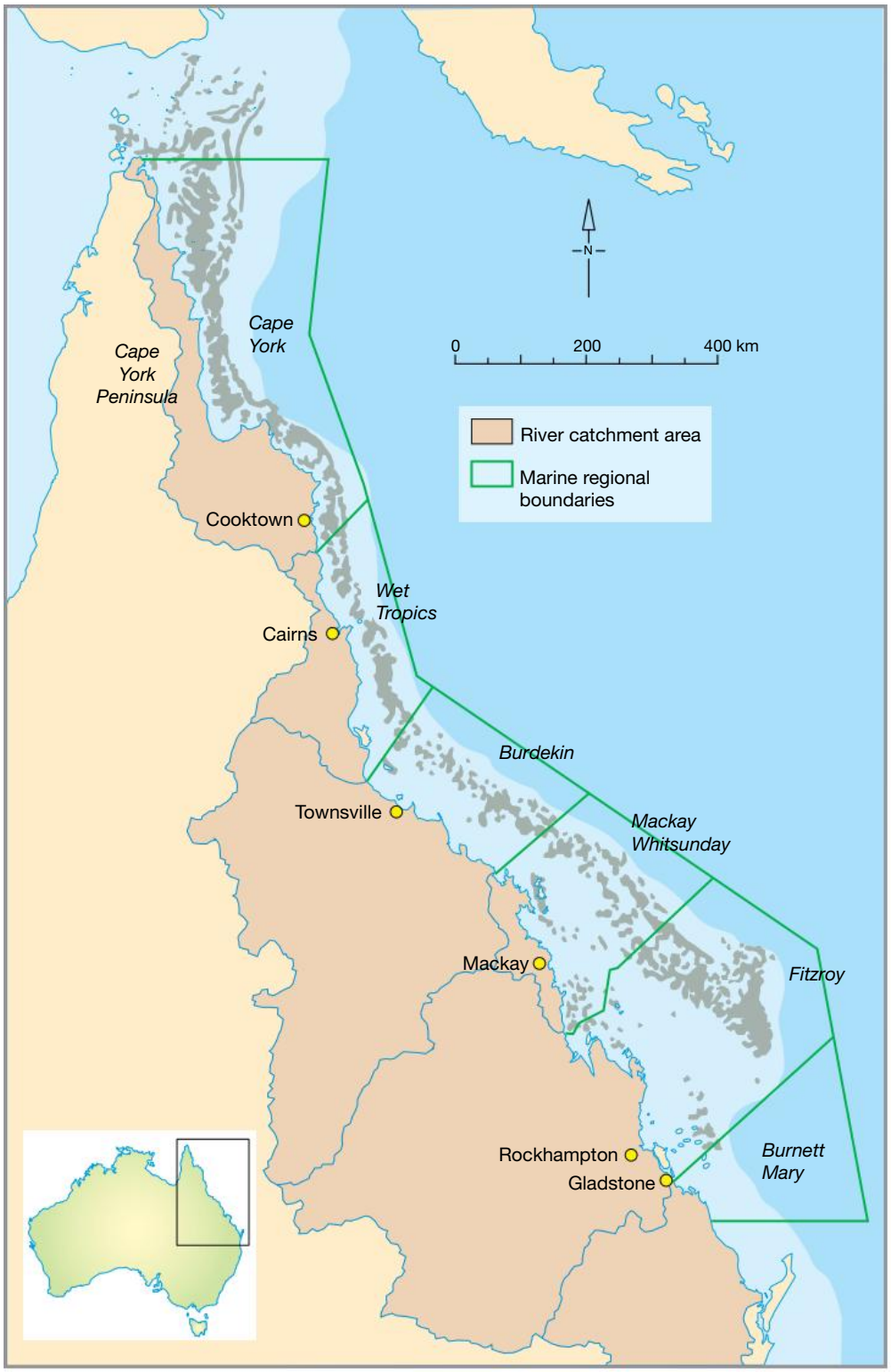
Tourism and Recreational Reef Advisory Committee

The Tourism and Recreational Reef Advisory Committee (TRRAC) was established by the GBRMPA many years ago to act as a liaison between the authority and the tourism industry. The TRRAC meets several times throughout the year and members represent a broad cross-section of the Great Barrier Reef tourism industry, scientists and government officials. Through the TRRAC the tourism industry plays an important role in the management of the reef. It is in the best interests of the industry to protect the reef, as a degraded Great Barrier Reef would not attract tourists and therefore the industry would suffer.

Improving water quality

The reef ecosystem is susceptible to degraded water quality from inland river systems. Water from inland rivers can be polluted by fertilizers, pesticides and animal waste from farms far away from the reef. Research consistently shows that the inshore fringing reefs are most at risk but increasingly reefs further away from the shore are also impacted.

The Reef 2050 Water Quality Improvement Plan was drafted in 2017 to provide long term management of water quality across the reef ecosystem. As Figure 3.3.7 shows, it covers not just the water on the reef itself but also importantly deals with the land that makes up the river catchments that eventually flow out onto the reef. Among the plan's goals are an 80 per cent reduction in dissolved inorganic nitrogen which is mostly derived from fertilizers used on agricultural land. The plan has also set a 50 per cent reduction target for sediment derived from soil erosion in the catchments.



3.3.7 The scale of the Reef 2050 Water Quality Plan is immense and covers the major river catchments of the reef ecosystem.

Activities

Understanding the text

1 Describe the relationship traditional Indigenous communities had with the Great Barrier Reef.

2 Outline the impact of the Mabo case in 1992 on traditional management of the reef.

3 Outline the purpose of the Traditional Use of Marine Resource Agreements and Indigenous Land Use Agreements.

4 Outline the role of governments in the protection and management of the reef.

5 Describe the size and location of the Great Barrier Reef Marine Park.

6 Explain what zoning is. How has it been used to manage the reef?

7 Describe the purpose of the 'Eye on the Reef' project.

8 Explain the role of Project Catalyst in protecting the reef.

Working geographically

9 Write a report explaining the role that traditional owners have in contemporary management of the Great Barrier Reef.

10 Create a bullet-point summary of the main strategies used to manage the impact of tourism on the reef.

11 Write a paragraph outlining some of the strategies being used to improve water quality across the Great Barrier Reef.

Project catalyst

There are many other community-based projects across North Queensland communities that aim to improve water quality across the reef. One such project is underway around the town of Tully where sugar cane is the major crop. The World Wide Fund For Nature (WWF) is working with 80 cane growers in a special program called Project Catalyst—see Figure 3.3.8. The project aims to reduce the amount of chemical pollutants coming off farms. One initiative is to use organic cow manure as a fertilizer to replace inorganic chemical based fertilizers that release large amounts of nitrogen. The project, which has been in operation since 2010, is estimated to have improved 150 billion litres of water annually that flow out onto the reef.



3.3.8 Project Catalyst aims to reduce the amount of inorganic fertilizers used by sugar cane growers.

Exam-style questions

Extended responses

- Outline the biophysical interactions that determine the spatial patterns and dimensions of two ecosystems at risk.
- Analyse the biophysical interactions that contribute to the unique characteristics of an ecosystem at risk.
- With reference to at least one ecosystem you have studied, explain the biophysical interactions that lead to diverse ecosystems and their functioning.
- Analyse the impacts of human-induced modifications to energy flows, nutrient cycling and relationships between biophysical components of one ecosystem at risk.
- Explain how one ecosystem at risk adjusts in response to natural stress.
- Analyse the human impacts affecting the nature and rate of change of two ecosystems at risk.
- Compare the impact of humans on two ecosystems at risk.
- Compare the vulnerability and resilience of two ecosystems at risk.
- Describe the spatial patterns and dimensions of one case study of an ecosystem at risk, and analyse the negative impacts of humans on the ecosystem.
- Analyse the nature and rate of change affecting the functioning of one ecosystem at risk.
- Compare traditional and contemporary approaches to the management of two ecosystems at risk.
- Evaluate traditional and contemporary approaches to the management and protection of one ecosystem at risk.

Glossary

aquaculture farming of marine species

atoll a circular reef structure surrounding a lagoon

climate change changes in global weather patterns associated with human activity

cnidarian an invertebrate animal without a backbone, such as a jellyfish

coral material formed from the hard outer skeletons of tiny animals known as polyps

coral bleaching a stress condition in reef corals that involves a breakdown of the symbiotic relationship between coral and zooxanthellae; as a result of this breakdown the zooxanthellae die, leaving the white limestone skeleton of the coral

coral cay a low-lying island made from eroded reef material

crustacean an invertebrate animal with jointed legs, such as a crab

echinoderm a marine animal with tubed feet and an armour-like outer skeleton; the body is divided into numerous parts

fringing reef a reef that is found close to the shore and runs parallel to the shoreline

mollusc a soft-bodied animal, such as a sea slug

mooring a fixture attached to the seabed to which boats can tie up

photosynthesis the ability in plants to convert solar energy into a food source

polyp a primitive organism consisting of a digestive sac and a skeleton of calcium carbonate (limestone)

salinity the level of salt dissolved in water

symbiotic a biological relationship between two organisms from which both benefit

turbidity the cloudiness of water

upwelling an ocean current that rises from the ocean floor towards the surface bringing large amounts of nutrients with it

zooxanthellae a symbiotic algae that lives with coral polyps and creates the colours of the coral

SECTION

2 Urban places



Urbanisation is the most important geographical process shaping the Earth's cultural geography. The shift from rural-based lifestyles to those based in towns and cities is the most significant terrestrial event in human history. More than half the world's population now lives in urban places. This shift will continue for the foreseeable future. As a result, the world's economic, social, cultural and political processes are increasingly played out within and between the world's system of towns and cities. This trend now appears irreversible due to the global shift to technological-, industrial- and service-based economies.

Urban geography is concerned with the development of towns and cities, with particular reference to the similarities and differences both among and within places. Urban geography includes a focus on:

- the characteristics that make urban places distinctive
- the relationships and interdependencies between particular sets of towns and cities (for example, world cities and megacities)
- the relationship between urban places and their surrounding territory
- the processes shaping the morphology (the functional form and character) of urban places.

Outcomes

Students:

H1 explain the changing nature, spatial patterns and interaction of ecosystems, urban places and economic activity

H3 analyse contemporary urban dynamics and apply them in specific contexts

H5 evaluate environmental management strategies in terms of ecological sustainability

H6 evaluate the impacts of, and responses of people to, environmental change

H7 justify geographical methods applicable and useful in the workplace and relevant to a changing world

H8 plan geographical inquiries to analyse and synthesise information from a variety of sources

H9 evaluate geographical information and sources for usefulness, validity and reliability

H10 apply maps, graphs and statistics, photographs and fieldwork to analyse and integrate data in geographical contexts

H11 apply mathematical ideas and techniques to analyse geographical data

H12 explain geographical patterns, processes and future trends through appropriate case studies and illustrative examples

H13 communicate complex geographical information, ideas and issues effectively, using appropriate written and/or oral, cartographic and graphic forms

Overview

In Section 2, the focus is on urban places.

Chapter 4 World cities

Chapter 5 Megacities of the developing world

Chapter 6 Urban dynamics

Chapter 7 Sydney: a global city

4.0.0 Lagos, Nigeria



CHAPTER

4 World cities

The cultural geography of the world has been transformed by the process of urbanisation. In 1800, only 3 per cent of the world's population lived in urban areas. By 1900, this had increased to 14 per cent. In 1950, the proportion of the world's population living in urban centres had increased to 30 per cent and the number of cities with over 1 million people had grown from just 12 in 1900 to 83. By 1990, 43 per cent (2.3 billion) of the world's population lived in urban areas and by 2015 this had grown to 54 per cent (4 billion). By 2025, the share of the world's population living in urban places is expected to be over 60 per cent (or more than 5 billion people).

In some parts of the world, as urban sprawl engulfs the landscape, vast urban agglomerations have developed where formerly separate cities have merged. At the top of the urban hierarchy are the world cities: centres of global economic and cultural authority. In other parts of the world, most notably in the countries of the developing world, megacities are emerging with populations that exceed those of many countries.

> **A city is a place where there is no need to wait for next week to get the answer to a question, to taste the food of any country, to find new voices to listen to and familiar ones to listen to again.**
>
> **Margaret Mead, anthropologist**

4.0.1 With over 24 million inhabitants, Shanghai is China's most populous city.



UNIT 4.1

Urbanisation

For the first time in human history more than half of the world's population now lives in cities. In 2017, the world's urban population was 3.7 billion people, and this number is projected to almost double by 2050. This 'big shift' is the result of urbanisation.

Urbanisation is defined as the increasing proportion of a population living in urban places (towns and cities). Much of the shift from rural to urban living is taking place in developing countries. This global transformation has profound implications for a wide range of issues including food, water and energy consumption. The move towards greater urban concentrations is a continuing trend, and as an ever-greater share of the world's population lives in cities, governments, non-government organisations and corporations are grappling with challenges facing the world's large cities.

DID YOU KNOW?

The ancient city of Uruk, located on the banks of the Euphrates River in Mesopotamia, is generally considered to be the world's oldest city. It was first settled c. 4500 BCE. At its height (c. 2000 BCE), Uruk had 50 000–80 000 residents living in a walled area that was 6 square kilometres; making it the largest city in the world at the time.

The rise of cities

Cities have existed for thousands of years. They first appeared when advances in agriculture enabled a surplus of food to be produced. This resulted in the emergence of a division of labour and trade. Farmers could trade surplus food for goods produced by people with specialised non-agricultural skills (such as blacksmiths, potters and weavers). Markets—the spaces in which trade took place—became a central land use feature of the earliest cities.

By the fourth and thirds millennium BCE, relatively sophisticated civilisations, and the first cities, had developed in the river valleys of Mesopotamia (which stretched across parts of modern day Iraq, Syria, Iran and Turkey) and also in India, China and Egypt.

Historically, however, city dwellers represented a small proportion of humanity overall. This is no longer the case. Today, as a result of the process of urbanisation, more than half of the world's population lives in cities.

The emergence of the big city

The big city is a relatively recent development. In 1900 there were only 12 cities with a population of more than a million people, these included London, New York, Paris, Berlin, Chicago, Vienna, Tokyo, St. Petersburg and Philadelphia. By 1950, this number had risen to 83. In 2016, there were 512 cities with a population of this size. By 2030, it is projected that 662 cities will have at least 1 million residents.

Cities with more than 10 million inhabitants are often referred to as 'megacities'. In 2017, there were 31 megacities globally and their number is projected to rise to 41 by 2030.

In 2016, 45 cities had populations between 5 and 10 million inhabitants. By 2030, 10 of these are projected to become megacities. Projections indicate that 29 additional cities will exceed the 5 million mark between 2017 and 2030, of which 15 are located in Asia and 10 in Africa. In 2030, 63 cities are projected to have between 5 and 10 million inhabitants.

An overwhelming majority of the world's cities have fewer than 5 million inhabitants. In 2016, there were 436 cities with between 1 and 5 million inhabitants and an additional 551 cities with between 500 000 and 1 million inhabitants. By 2030, the number of cities with 1 to 5 million inhabitants is projected to grow to 559, and 731 cities will have between 500 000 and 1 million inhabitants. Cities with less than 1 million inhabitants are the fastest growing, shown in Figure 4.1.1.

Population by size of urban centre, 2016 and 2030	2016			2030		
	Number of settlements	Population (millions)	Percentage of the world population	Number of settlements	Population (millions)	Percentage of the world population
Urban	...	4034	54.5	...	5058	60.0
10 million or more	31	500	6.8	41	730	8.7
5 to 10 million	45	308	4.2	63	434	5.2
1 to 5 million	436	861	11.6	558	1128	13.4
500 000 to 1 million	551	380	5.1	731	509	6.0
100 000 to 500 000*	...	1955	26.8	...	2257	26.8
Rural	...	3371	45.5	...	3367	40.0

*Note: due to national differences there is no international agreed upon definition of the population size of a city and whether a city is rural or urban.

Source: UN World Cities Data Booklet, 2016

4.1.1 The number of large cities is projected to grow rapidly between 2016 and 2030.

Ten-million-plus cities

Of the 31 cities with populations of at least 10 million inhabitants or more in 2016, 24 are located in the less developed countries. China had six megacities in 2016, while India had five.

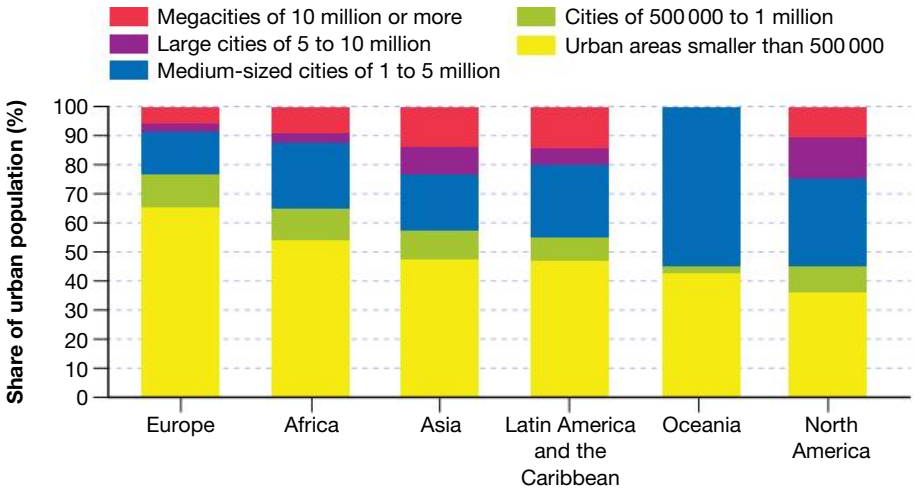
SPOTLIGHT

Determining the size of cities

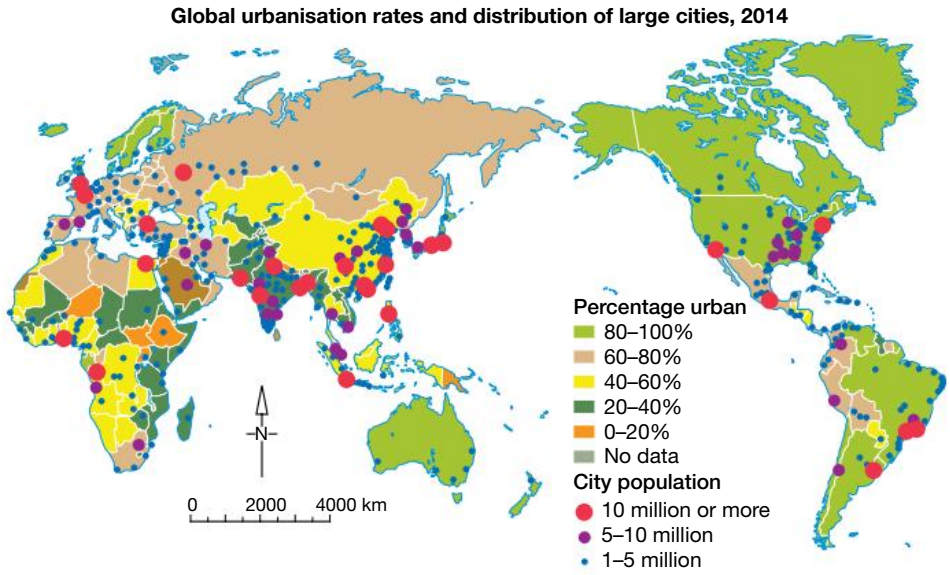
Determining the size of a city's population can be a complicated process. It all depends on how you define the city's boundaries. Toronto, Canada, for example, has approximately 2.6 million people living within the 'city proper', but the population of the surrounding 'urban agglomeration' is almost twice as large, at 5.1 million, and the population of the 'metropolitan area' is larger still, at 5.6 million. See Figure 4.1.2.



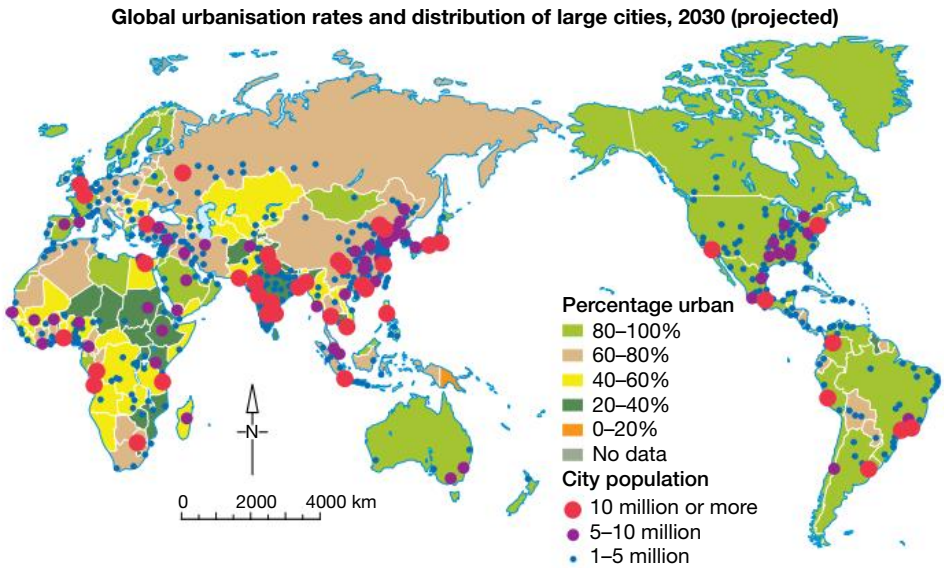
4.1.2 Toronto's population ranges from 2.6 million to 5.6 million depending on how the city's boundaries are defined.



4.1.3 Asia, and Latin America and the Caribbean, have the largest proportion of their urban populations living in megacities of 10 million or more.



4.1.4 While very large cities are found throughout the world, the largest concentrations are now found in South and East Asia. While the rate of urbanisation varies greatly across regions the lowest rates are found in sub-Saharan and central Africa and South Asia. The highest rates are found in South America, the Caribbean, North America, Australia and Europe.



4.1.5 Projections indicate that 29 additional cities will exceed the 5 million mark between 2016 and 2030, of which 15 are located in Asia and 10 in Africa. In 2030, 63 cities are projected to have between 5 and 10 million inhabitants.

The distribution of large cities

The distribution of the world's large cities has been transformed since the middle of the twentieth century. There has been a shift away from a focus on Europe and North America (whose cities dominated the global urban hierarchy in the period to 1950) to Latin America, Japan and some Asian cities in the years leading to 1990. Since the 1990s, the majority of urban growth has been experienced by the cities of sub-Saharan Africa (Lagos, Nigeria and Kinshasa, DRC), India and China and other Asian cities including Dhaka and Manila. Figure 4.1.3 shows the distribution of the world's urban population by city size and region. Figure 4.1.4 shows the global rates of urbanisation and distribution of large cities in 2014. Figure 4.1.5 shows the projected pattern in 2030.

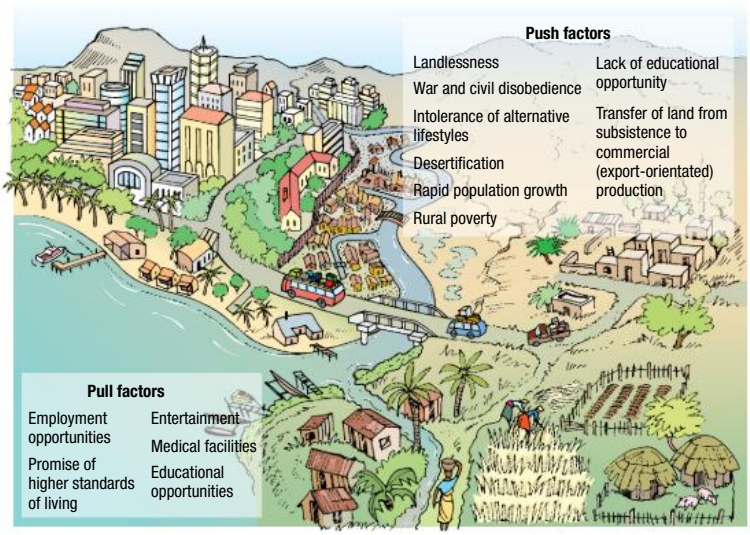
The process of urbanisation

The emergence of the large cities is largely the result of the process of urbanisation. Urbanisation refers to the increasing proportion of a country's population living in towns and cities. It is important to note that the process of urbanisation is distinct from the process of urban growth. Urban growth is defined as the rate at which an urban population increases in a given period relative to its size at the start of that period. In theory, it is possible to have urban growth while having a negative rate of urbanisation. This would occur if the growth rate of the rural population was greater than the growth rate of the urban-based population. Rates of urbanisation are the highest in the world's developing countries.

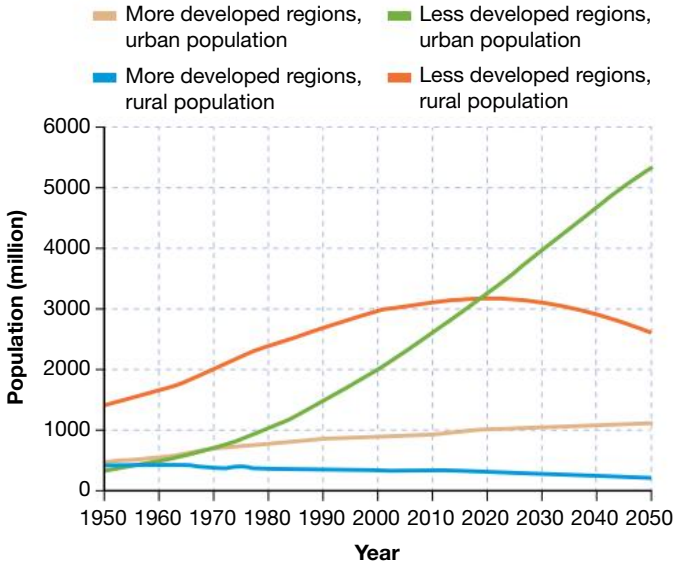
Urbanisation involves a shift of population from rural to urban areas. The 'push' and 'pull' factors responsible for this movement are shown in Figure 4.1.6. The impact of these factors is shown in Figure 4.1.7.

Urbanised regions

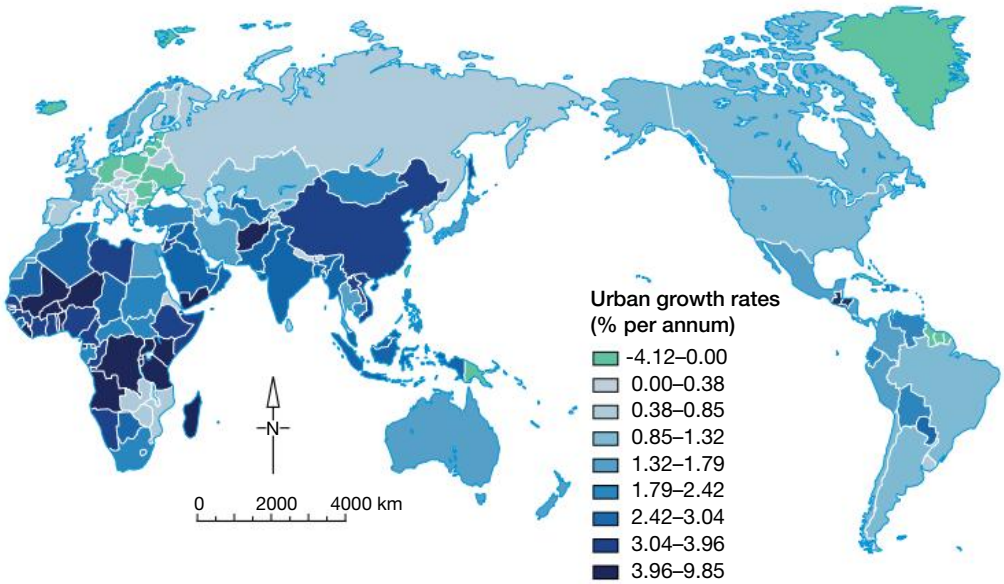
In 2017, the most urbanised regions of the world included Northern America (82 per cent), Latin America and the Caribbean (80 per cent), and Europe (73 per cent). In contrast, Africa and Asia remained mostly rural, with 40 per cent and 48 per cent of their respective populations living in urban areas. See Figure 4.1.8.



4.1.6 The 'push' and 'pull' factors responsible for urbanisation

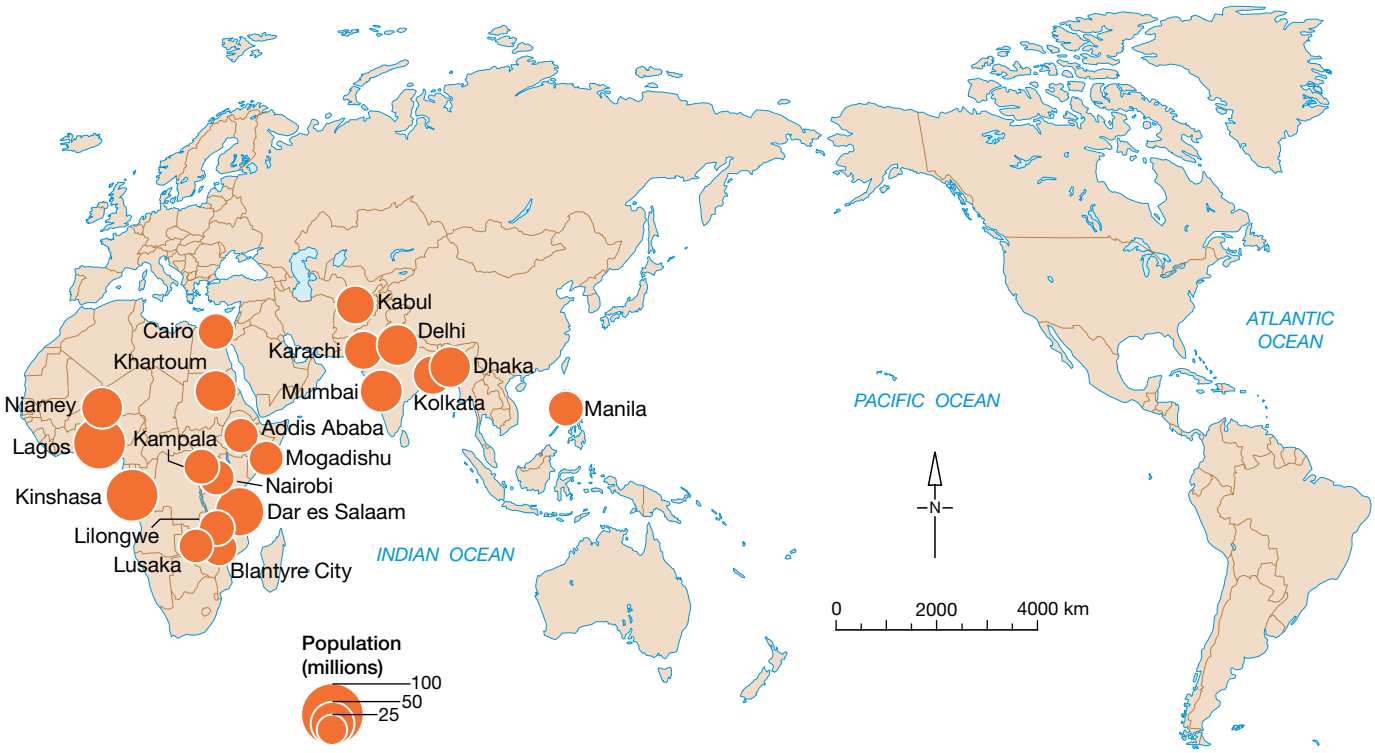


4.1.7 Urban populations in developing countries are growing rapidly, while rural populations are projected to start a steady decline from 2020.



4.1.8 Urban growth rates (2016) are highest in Africa and South and East Asia.

All regions are expected to urbanise further over the coming decades. Africa and Asia are urbanising faster than the other regions and are projected to become 56 per cent and 64 per cent urban, respectively, by 2050. By 2100 the world's top 20 cities by population are expected to be in Africa and Asia, as seen in Figure 4.1.9.



4.1.9 By 2100, 13 African cities will exceed the population of New York City. Asia will be home to several larger cities.

Activities

Understanding the text

1 Outline the extent to which the cultural geography of the world has been transformed by the process of urbanisation.

2 Summarise the data illustrating the emergence of 'big cities'.

3 Account for the rise of cities.

4 Define the term megacity.

5 Explain why it can be difficult to determine a city's population.

6 Outline the changing spatial distribution of large cities.

Working geographically

7 Study Figure 4.1.1. Using data from the table, write a paragraph outlining the projected growth of urban centres between 2016 and 2030.

8 Study Figures 4.1.3, 4.1.4 and 4.1.5. Write a paragraph or two describing the global pattern of urbanisation and the spatial distribution of large cities. Outline the expected distribution of large cities in 2030.

9 Study Figure 4.1.6. Write a report outlining the push and pull factors driving the process of urbanisation.

10 Access the Wikipedia™ 'List of metropolitan areas by population'.

- **a** How many Australian cities appear on the list?
- **b** Which country has the largest number of cities on the list?
- **c** Divide the 50 largest urban areas into those located in developing countries and those located in developed countries. Comment on the pattern evident.

11 Use the 'World population data sheet' on the Population Reference Bureau's website to find the level of urbanisation (find the 'Percent Urban' data) for the following countries:

- **a** Australia
- **b** Chile
- **c** India
- **d** Mexico
- **e** Nigeria
- **f** Russia
- **g** Rwanda
- **h** United States
- **i** Uruguay.

UNIT 4.2

World cities

World cities (or global cities) are cities that have emerged as the control centres of information and finance. These cities collectively sustain and reinforce the economic and cultural integration of the world. World cities have emerged from the process of globalisation. In this context, a 'world city' has more to do with transnational corporate authority, international banking and finance, and the work of international agencies, like the UN in Geneva, than historical imperial power and trade.

World cities defined

World cities are the command and control centres of the increasingly integrated global economy. These are not necessarily the world's largest cities but they are economically and culturally influential. They control the flow of information, cultural products, and finance that sustain the economic and cultural integration of the world.

The transnational corporations (large corporations that can operate in as many as 50–60 countries) and financial institutions based in world cities fund the global economy, and their specialised, knowledge-intensive firms deliver the services essential to its operation. These cities are also hubs for innovation and are rich in human capital (the skills, knowledge, and experience held in an individual or population). They are the cities that dominate popular culture through their powerful media outlets and creative industries. Their high art, fine restaurants and vibrant nightlife help attract and retain talented workers. They are magnets for migrants and visitors adding to their diversity, another key strength.

While world cities tend to be large, size alone is not the determining factor. Several relatively small cities have global city status because of their dominance in an important sector of economic activity. San Francisco qualifies because of its high-tech dominance and Zurich because of its role in global finance. Brussels qualifies because it hosts the institutions that govern the European Union and the headquarters of the North Atlantic Treaty Organization (NATO).



4.2.1 Dominant world cities
A New York's stock exchange
B Paris's Louvre Museum
C London's West End theatre precinct
D Tokyo's Akihabara Electric Town

SPOTLIGHT

Syllabus definition of 'world city'

A 'world city' is defined as a large city that has outstripped its national urban network and become part of an international global system; a centre of world trade and communications; a leader in banking and finance; a host of entertainment and sporting spectacles; a headquarters of nongovernmental agencies; and a major tourist destination. World cities are the command and control centres in the borderless domain of the new global economy. New York, London, Tokyo and Paris, shown in Figure 4.2.1, are examples of world cities.

The emergence of world cities

World cities have existed for thousands of years. In the past, trade was the principal determinant of their status, which in turn fostered innovation in transport, finance, law, language and communication. Cities such as Ur in Iraq (see Figure 4.2.2), Constantinople (now called Istanbul) in Turkey, Alexandria in Egypt, and Venice and Genoa in Italy are examples of cities whose role as strategic points on important trade routes enhanced their status and enabled them to expend their influence well beyond the region in which they were located.

The age of colonialism and imperialism (from the 1760s through to the middle of the twentieth century), combined with the Industrial Revolution, ushered in a new era of 'world city' authority. The capital cities and new industrial cities of the great imperial powers—Britain, France, Germany, Spain, Portugal, the Netherlands and Russia—became centres of global importance. For example, at the height of the British Empire, in the early decades of the twentieth century, decisions made in London held sway over 412 million people (23 per cent of the world's population at the time) and territory covering 24 per cent of the Earth's total land area. Raw materials and markets for manufactured goods, together with national prestige and imperial ambition, were the principal motivations for the acquisition of empires.

Today, globalisation (of which trade remains an important component) is the principal process determining world city status. A number of world cities have actively engaged with the globalisation process by specialising in finance, professional and business services, or media and communication industries. In the future, many of these cities will successfully transition to centres that dominate in terms of the emerging industries—digital technologies, life sciences, climate, energy and water, urban services, infrastructure, and robotics.

SPOTLIGHT

The rise and fall of Ur

From 2030 to 1980 BCE, Ur was the world's largest and most opulent city, a port at the place in southern Mesopotamia (now Iraq) where the Tigris and Euphrates Rivers flowed into the Persian Gulf. Ships sailed from Ur to India and other lands. But Ur's outlet to the sea silted up. A drought finished the job and the city vanished about 500 BCE. Ur today is an uninhabited ruin. All that remains is its temple, the Ziggurat.



4.2.2 The Ziggurat temple: all that remains of Ur, which was once the world's largest and most opulent city.

Globalisation and the rise of world cities

The emergence of the modern world cities is an outcome of the globalisation of economic activity. Dating from the late 1960s, the globalisation process has been driven by:

- technological developments in transport and communications
- a move away from protectionist economic policies (often referred to as trade liberalisation)
- the deregulation of financial markets
- the emergence of new, information-based forms of economic activity (the so-called 'new economy')
- the emergence of new ways of organising economic enterprises (for example, outsourcing of business-related services and key stages in the manufacturing process)
- the emergence of transnational corporations (TNCs) as key players in the global economy
- the emergence of a global market for lifestyle-related commodities, created, at least in part, by the processes of cultural integration and the development of global media networks.

These developments contributed to a rapid expansion in world trade. Labour-intensive manufacturing processes typical of the 'old economy' were relocated to developing countries where the cost of labour was lower. As a result of these developments, the functions performed by the cities we now refer to as world cities have moved beyond the national scale to become increasingly international.

The emergence of world cities is an integral part of the internationalisation of economic activity. It is also linked with the development of a spatially dispersed (spread across numerous countries) but globally integrated system of production and exchange. World cities are important centres of international finance, transnational business and international business services.

The result is a new world system of cities acting as 'organising nodes'. In other words, they link regional, national and international economies into the global economy. The production of the Apple® iPhone® (see Figure 4.2.3) demonstrates the globally integrated organisation of production and exchange.

The nature of world cities

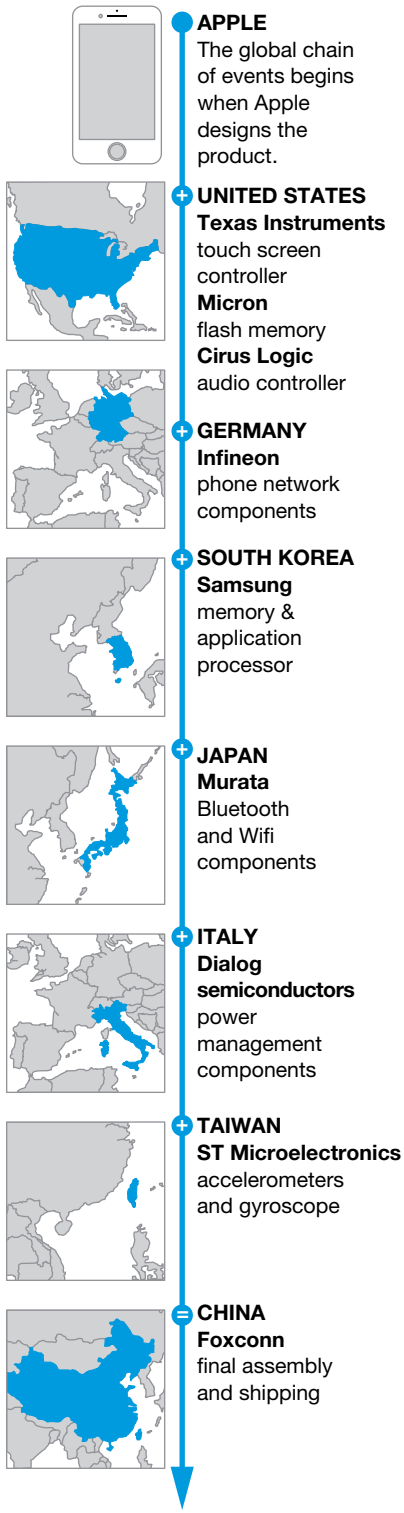
World cities act as the command and control centres of the global economy. Decision-makers based in world cities run the global economy. Transnational corporations generally have their headquarters, or at least their functional hub, in the heart of a world city, often in the city's traditional business district—lower Manhattan in New York City; 'The City' in London; Marunouchi, the commercial district of Tokyo; or La Défense in Paris, Europe's largest dedicated business district. Clustered around this corporate core are the business services—such as lawyers, accountants and consultants—that each corporation needs to function globally. In the past, corporations kept this expertise in house, but the global economy is now so complex that few corporations have the specialised knowledge to deal with it on their own. These specialised services and global experts now flourish in today's global cities.

While in the past global corporations made products such as cars and exported them, the corporations of today's world cities export ideas and services. Many of these 'exports' travel across the globe instantly, thanks to the technological advances of the last few decades.

This clustering of corporations and their specialised business services in world cities is, to some extent, unexpected. Advances in digital technologies and communications were expected to free businesses and business-related services from their traditional urban base. However, this vision that people could work in any location, secure in the knowledge that everything they needed to know would be available on their smart phone or laptop, has not materialised. While information is available almost anywhere, global corporations, especially those in highly competitive or innovative activities, find they need to be in the centre of global cities.

The global supply chain

Products and services once supplied by one city or nation are now dispersed around the world. Here are the global locations that participate in creating the iPhone.



Source: On Global Cities, R.C. Longworth, The Chicago Council on Global Affairs

4.2.3 Apple's iPhone demonstrates the globally integrated organisation of production.

In Sydney, for example, employment growth has been concentrated in the city's 'knowledge hubs'. These hubs include Sydney's CBD (financial services and professional services), Ultimo/Pyrmont (creative digital technology), Macquarie Park (medical technology) and Parramatta (specialised health and education precincts).

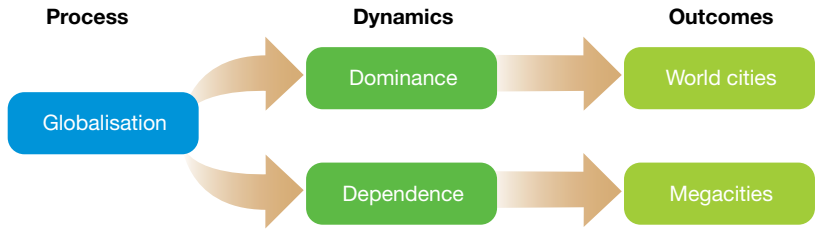
Characteristics of world cities

While no two world cities are alike, they all draw on at least a sub-set of the following characteristics. Between them, world cities typically host:

- most of the leading global markets for commodities, investment capital, foreign exchange, equities (shares) and bonds
- clusters of advanced business services, especially those dealing in finance, insurance, real estate, accountancy and marketing
- concentrations of corporate headquarters—not just transnational corporations but also major national firms and large foreign firms
- concentrations of national and international headquarters of trade and professional associations
- most of the leading NGOs and intergovernmental organisations (IGOs) that are international in scope; for example, the United Nations (UN) is based in New York, United Nations Education, Science and Cultural Organisation (UNESCO) in Paris, and the International Labour Organisation (ILO) and World Health Organization (WHO) in Geneva
- the most powerful and internationally influential media organisations (newspapers, magazines, book publishing and cable television networks), news and information services and cultural industries (including art and design, fashion, film and television)
- world leading educational institutions, research institutes and think tanks, which act as centres of new ideas and innovation in business, economics, culture and politics
- corporations that dominate the economy and trade of a large surrounding area.

Patterns of dominance and dependence

The impacts of globalisation are not evenly distributed. There are increasing differences between developed and developing economies, and between world cities and megacities, shown in Figure 4.2.4. Megacities' dominance relates to size rather than economic or cultural influence.



4.2.4 Dominance and dependence: impacts of globalisation on large urban centres

Patterns of urbanisation in the developing world are often associated not with the process of globalisation, but with internal economic processes. In the developing world people are 'pushed' out of rural areas due to lack of opportunity and 'pulled' to a city where there are few economic opportunities. What used to be called 'urbanisation without industrialisation' is now 'urbanisation without industrialisation or globalisation'. This has important implications for the dynamics of change affecting the megacities of the developing world. More people are moving to megacities but there are not the economic opportunities. As a result, the economic inequality between the megacities of the developing world and the world cities of advanced economies is widening.

Social and spatial restructuring in the major cities of the developed world is an outcome of economic globalisation, seen in Figure 4.2.5. First, urban societies are becoming more polarised in terms of poverty and wealth. The greatly enhanced standard of living of key executives in the new, globalised industries increasingly reflects global demands and salaries. Meanwhile, the industrial workforce is experiencing declining living standards and job losses. The middle class is tending to divide into a deskilled, lower middle class (working in low-paid, service sector jobs) and a much better off, multiskilled, upper middle class (for example, those working in the information-based industries).

Second, there are new financial districts, a shift in residential and commercial investment from the suburbs to higher-cost inner-city housing, and the development of 'edge cities' (distinct urban nodes with larger metropolitan areas) or 'technoburbs', which service the new global economy—all of which are important features of spatial restructuring. These, in turn, are helping to reshape the globalisation process.



4.2.5 Outcomes of social and spatial restructuring in the cities of the developed world

Spatial distribution of world cities

A number of organisations have sought to identify and classify world cities. Some classifications are more complex than others and all use a slightly different mix of criteria.

The most frequently referred to are those proposed by Forbes, a global media company, focusing on business, investing, technology, entrepreneurship, leadership, and lifestyle; the Globalization and World Cities Research Network (GaWC); and those published by A.T. Kearney, a leading global management consulting firm.

Forbes

Forbes determines world city status by eight criteria:

1. the amount of foreign direct investment the city has attracted
2. the concentration of corporate headquarters
3. how many particular business sectors they dominate
4. air connectivity (ease of travel to other global cities)
5. strength of producer services
6. financial services
7. technology and media power
8. racial diversity.

Using this criteria Forbes identifies the world's top 10 most influential cities. See Figure 4.2.6.

The world's top 10 most influential cities (Forbes 2014)

Rank	City	Country
1	London	United Kingdom
2	New York	USA
3	Paris	France
4	Singapore	Singapore
5	Tokyo	Japan
6	Hong Kong	China
7	Dubai	United Arab Emirates
= 8	Beijing	China
= 8	Sydney	Australia
= 10	San Francisco	USA
= 10	Los Angeles	USA
= 10	Toronto	Canada

Source: Forbes, 2014

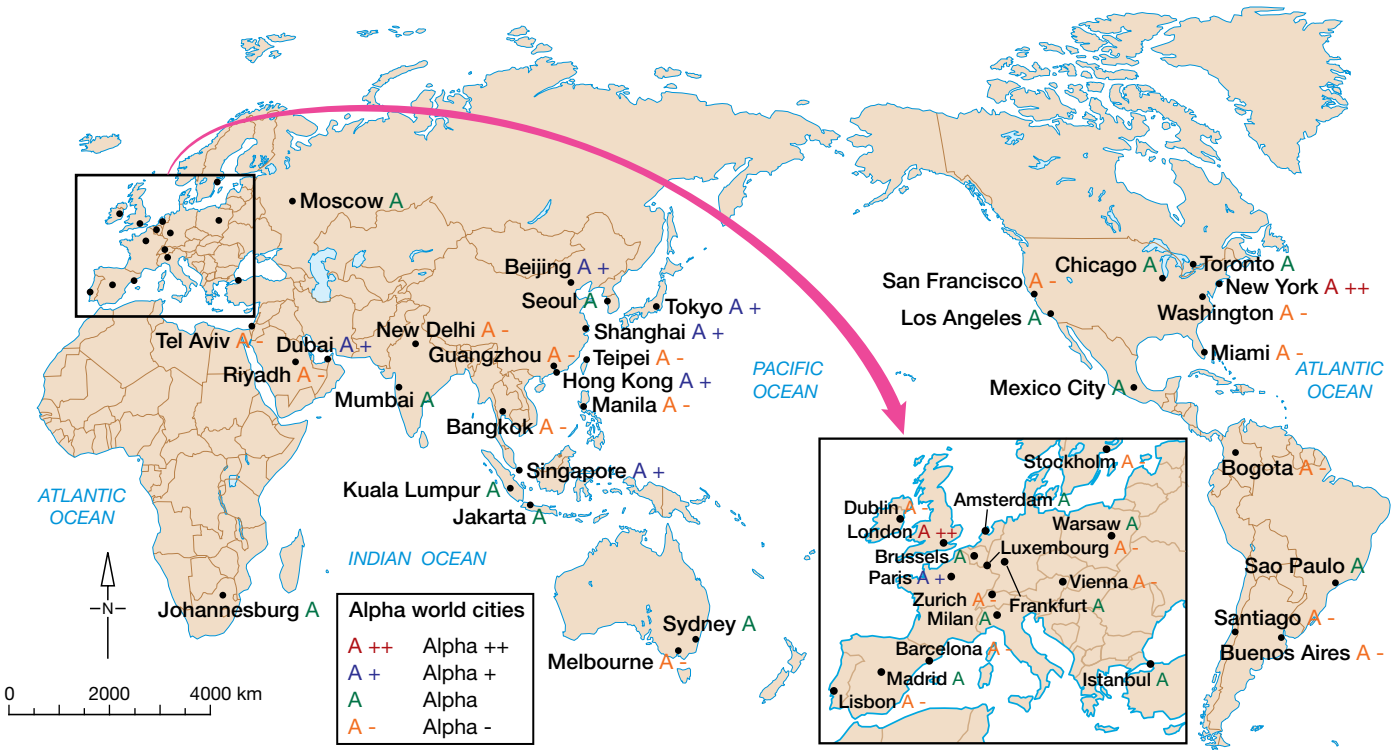
4.2.6 Forbes uses eight criteria to determine the world's top 10 most influential cities.

Globalization and World Cities Research Network

The Globalization and World Cities Research Network (GaWC), has developed a classification system that measures the interconnectedness of cities. They use the terms 'Alpha', 'Beta' and 'Gamma' to classify the extent to which cities are integrated into the global economy. Within each category there are two, three or four sub-categories with a specific meaning:

- **Alpha++ cities** are vastly more integrated into the global economy than all other cities.
- **Alpha+ cities** are those that complement London and New York City by filling advanced service niches for the global economy.
- **Alpha** and **Alpha–** cities link major economic regions into the world economy.
- **Beta cities** link moderate economic regions into the global economy.
- **Gamma cities** link smaller economic regions into the global economy.

This hierarchy of world cities is shown in Figures 4.2.7 and 4.2.8.



4.2.7 Global distribution of alpha world cities

A.T. Kearney

The 2016 'Global Elite' ranking of world cities by A.T. Kearney is shown in Figure 4.2.9. The criteria used to rank the cities included business activity, human capital, information exchange, cultural experiences and political engagement.

The 'big four'

London, New York City, Paris and Tokyo dominate the global hierarchy of world cities.

London

London is a global financial capital. The city hosts 193 corporate headquarters and is the regional base of many Transnational Corporations (TNCs).

London has a time zone advantage for doing business in Asia, and has the second best global air connections of any city, with nonstop flights to 89 per cent of global cities outside of its home region of Europe. Only Dubai has better connections.

Hierarchy of world cities, 2016		
Alpha world cities	**Beta world cities**	**Gamma world cities**
(Alpha ++) London, New York	**(Beta +)** Prague, Ho Chi Minh City, Boston, Copenhagen, Dusseldorf, Athens, Munich, Atlanta, Bucharest, Helsinki, Budapest, Kiev, Hamburg, Bangalore, Rome, Oslo, Dallas, Cairo, Houston, Lima, Lagos, Caracas, Auckland, Cape Town	**(Gamma +)** Guayaquil, Cleveland, Riga, Baku, **Adelaide**, Vilnius, Birmingham, Glasgow, Nanjing, Hangzhou, Colombo, Porto, Qingdao, Valencia, Detroit, Muscat, Osaka, Ljubljana, Kampala, Georgetown, Managua, Durban, San Jose, St Petersburg
(Alpha +) Singapore, Hong Kong, Paris, Beijing, Tokyo, Dubai, Shanghai		
(Alpha) **Sydney**, Sao Paulo, Milan, Chicago, Mexico City, Mumbai, Moscow, Frankfurt, Madrid, Warsaw, Johannesburg, Toronto, Seoul, Istanbul, Kuala Lumpur, Jakarta, Amsterdam, Brussels, Los Angeles	**(Beta)** Doha, Karachi, Nicosia, Geneva, Montevideo, Berlin, Montreal, Abu Dhabi, Casablanca, Philadelphia, Vancouver, Shenzhen, Sofia, **Perth**, Hanoi, Beirut, **Brisbane**, Bratislava, Manama	**(Gamma)** Phoenix, Tegucigalpa, Austin, Pune, Guadalajara, Dalian, Tbilisi, Dar es Salaam, Chongqing, Ankara, Lusaka, Ahmedabad, Cincinnati, Asuncion, Harare, Gothenburg, Xiamen, Al-Mawsil, Kansas City, Accra, Minsk, Tampa, Turin, Luanda, Abidjan, Tirana, Lausanne, Leeds
(Alpha –) Dublin, **Melbourne**, Washington, New Delhi, Bangkok, Zurich, Vienna, Taipei, Buenos Aires, Stockholm, San Francisco, Guangzhou, Manila, Bogota, Miami, Luxembourg, Riyadh, Santiago, Barcelona, Tel Aviv, Lisbon	**(Beta –)** Port Louis, Minneapolis, Chennai, Stuttgart, Santo Domingo, Rio De Janeiro, Kuwait City, Chengdu, Panama City, Denver, Lahore, Jeddah, Tunis, Quito, Belgrade, Seattle, Manchester, Guatemala City, Lyon, San Jose, Tianjin, Calgary, Amman, San Juan, San Salvador, Antwerp, Zagreb, Kolkata, Tallinn, St Louis, Monterrey, Hyderabad, Edinburgh, San Diego, Cologne, Rotterdam, Dhaka, Islamabad	**(Gamma –)** Taichung, Charlotte, Baltimore, Raleigh, Belfast, Leipzig, Medellin, Wuhan, Douala, Maputo, Skopje, Gaborone, Bristol, Orlando, Dakar, Suzhou, Malmo, Edmonton, Changshu, Strasbourg, Bilbao, Bologna, Columbus, Wellington, Nurnberg, Yangon, Xi'an, Wroclaw, Marseille, Dresden, Shenyang, Pittsburgh

4.2.8 The Globalisation and World Cities Research Network's (GaWC) hierarchy of world cities, 2016

New York

New York hosts the world's top investment banks and hedge funds (firms that engage in speculation using credit or borrowed capital), and the New York Stock Exchange's trading volume is nearly four times greater than Tokyo and 10 times that of London. New York–based corporate headquarters total 217.

New York is a global leader in media and advertising, the music industry (home to two of the big three labels), and also one of the most important capitals of fashion and luxury retailing.

With numerous iconic landmarks, international tourists spend more money in New York City than in any other city in the world.

New York is home to 120 higher education institutions and a large number of research institutions, especially in medicine and biological and life sciences. The city is also home to more than 2000 arts and cultural organisations and more than 500 art galleries. The performing arts are also well represented with Broadway theatre being one of the premier forms of English-language theatre in the world. The city is also one of the world's great sporting capitals.

Paris

Paris remains one of the world's great centres of culture, creativity and innovation. For centuries, the city has attracted the world's brightest and most talented. Paris's contribution to the creative and performing arts has been immense as has been its leadership in fashion and gastronomy (the practice of preparing and cooking food).

In terms of its economic importance, Paris specialises in a diverse set of tradable industries—from financial and business services to advanced manufacturing and the creative industries. Thirty-one of the world largest 500 corporations have their headquarters in Paris and the city hosts a number of world-class research universities. There is a focus on high-tech employment and investment in research and development. The city is also the world's number one tourist destination.

A.T. Kearney's 'Global Elite' ranking of world cities, 2016		
Rank	**City**	**Country**
1	New York	USA
2	London	United Kingdom
3	Paris	France
4	Tokyo	Japan
5	Hong Kong	China
6	Los Angeles	USA
7	Chicago	USA
8	Singapore	Singapore
9	Beijing	China
10	Washington DC	USA
11	Seoul	Republic of Korea
12	Brussels	Belgium
13	Madrid	Spain
14	Sydney	Australia
15	Melbourne	Australia
16	Berlin	Germany
17	Toronto	Canada
18	Moscow	Russia
19	Vienna	Austria
20	Shanghai	China
21	Buenos Aires	Argentina
22	Amsterdam	The Netherlands
23	San Francisco	USA
24	Boston	USA
25	Istanbul	Turkey

Source: AT Kearney, Global City, 2016

4.2.9 New York, London, Paris and Tokyo top A. T. Kearney's 'Global Elite' ranking of world cities, 2016.

Tokyo

Tokyo is home to the largest number of corporate headquarters (613) and one of the world's principal financial markets. Fifty-one of the world's largest 500 companies are based in Tokyo, almost twice that of the second-placed city, Paris. The city's stock exchange is the world's fourth largest in terms of turnover. The city is also a destination of choice for many of the world's most accomplished chefs and restaurateurs, and innovators in fashion and design. Many of Japan's most prestigious universities are located in Tokyo.

Top 20 stock exchanges by market capitalisation, 2017

Rank	Exchange	Market capitalisation (billion $)
1	New York Stock Exchange	19223
2	NASDAQ (New York City)	6831
3	London Stock Exchange	6187
4	Tokyo Stock Exchange	4485
5	Shanghai Stock Exchange	3986
6	Hong Kong Stock Exchange	3325
7	Euronext*	3321
8	Toronto Stock Exchange	2781
9	Shenzhen Stock Exchange	2285
10	Frankfurt Stock Exchange	1766
11	Bombay Stock Exchange	1682
12	National Stock Exchange (Mumbai, India)	1642
13	SIX Swiss Exchange	1516
14	Australia Securities Exchange	1272
15	Korea Exchange	2151
16	Nasdaq Nordic (Stockholm)	1212
17	JSE Limited (Johannesburg)	951
18	Madrid Stock Exchange	942
19	Taiwan Stock Exchange	861
20	BM&F Bovespa (Sao Paulo, Brazil)	824

* Euronext: European stock exchange seated in Amsterdam, Brussels, London, Lisbon and Paris

4.2.10 Stock exchanges by market capitalisation, Top 20, 2017. (Source: Visual Capitalist website, the 20 largest Stock Exchanges in the World, 2017)

The role of world cities

There is a close alignment between the characteristics of world cities and the roles of world cities. World cities have developed beyond their former role as centres for international trade and banking to become:

- command and control centres of the global economy, in particular the concentration and accumulation of international capital; the stock exchanges of New York, Tokyo and London influence the world economy
- the preferred location for finance and specialised service firms such as law, accounting, management consulting and advertising
- a focus for advanced telecommunications technologies
- sites of production for new, innovative industries, especially the new information-based industries, which have replaced manufacturing as the dominant economic activity of such cities
- markets that offer new economic opportunities; people living in world cities are often the first to embrace the new technologies
- a focus for media outlets with an international reach; for example, the New York–based News Corporation and Associated Press, the London-based BBC and Reuters, as well as Le Monde and Agence France-Presse based in Paris
- powerful centres of cultural authority; the home of world-renowned cultural institutions, such as museums, art galleries, universities and research centres; they also tend to exert cultural leadership via major film festivals, theatres and orchestras, opera and dance companies
- the home of major sporting events.

New hierarchy of cities

In building the new global networks of production, exchange, finance and corporate services, TNCs have created a complex new hierarchy of cities. They have increasingly concentrated economic power, business decision-making and corporate strategy development. The role of world cities as global command and control centres is often seen in terms of the distribution of global financial centres and the headquarters of major TNCs.

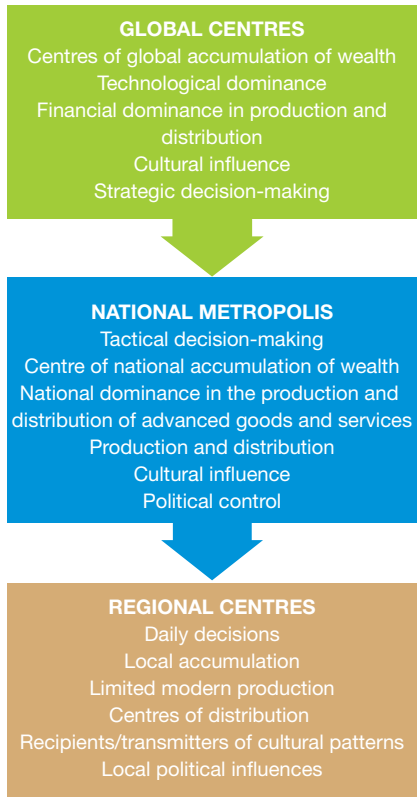
The decades of the 1980s and 1990s was a period of deregulation and liberalisation of global capital markets (which permitted free competition among international corporations), together with a major revolution in telecommunications technologies. The combined effect was to significantly increase the movement of money around the world and, with it, the intensity of competition among financial centres.

The size of the stock market is a good indicator of the financial power of a city and its relative position in the global hierarchy. Figure 4.2.10, showing major stock exchanges by market capitalisation, highlights two main trends:

- the dominance of New York, followed by the financial power of Tokyo and London
- the emergence of a broad range of major but secondary world cities below the top three: Shanghai, Toronto, Frankfurt, Hong Kong, Zurich, Sydney, and the merged exchanges of Paris, Brussels and Amsterdam (known as Euronext).

The more globalised an economy becomes, the greater the concentration of central command functions in global cities. In this respect, TNCs are seen as one of the most important elements of the new global command centres.

The new global hierarchy of cities is essentially a functional hierarchy ranging from the world cities down to national, regional and local scales (see Figure 4.2.11). Often their functions overlap. London and Tokyo, for example, are world cities as well as national administrative capitals. Cities clearly also differ in the amount of spatial dominance they exert; that is, the area over which their authority or influence extends.



4.2.11 Hierarchy of city functions

The operation of global networks

The flow of capital, information, goods and services, and people (especially highly skilled professionals) are among the more easily measured indicators of the relationship between large cities.

Flow of capital

In terms of capital flows (the money available for business investment or resources), there has been a net transfer of funds from the world's developed economies to countries in the developing world. The decision-makers directing these flows are typically located in world cities while those on whom the decisions impact are often found in the old industrial centres of the developed world (the areas from which capital is being redirected) and the megacities of the developing world (the areas to which capital is being directed). In simple terms, this results in factory closures and high unemployment in the old manufacturing centres of the developed world (see Figure 4.2.12), and factory openings and job creation in the low-cost economies of the developing world. At the same time there has been a reduction in the flow of investment between the economically developed countries.

Flow of information

Geographers have been keen to quantify the flows within the network of global cities. One such attempt focuses on 'connectivity': a measure of the flows of information and knowledge, as well as the direction in which it flows between the international office network of global service firms. These firms are the basic agents of the formation of the world city network. By quantifying such flows it is possible to rank cities on the basis of connectivity and determine the strength of links between specific cities. Figure 4.2.13 shows the rank of world cities according to this measure of connectivity. Sydney's rank of 14 puts it just ahead of Los Angeles and São Paulo and just behind Chicago and Milan. Sydney's strongest links are with major urban centres of North America and the financial centres of Asia: Hong Kong, Singapore and Tokyo. London's strongest links are with the North American cities of New York, Washington DC and Chicago, as well as Asian cities (such as Hong Kong, Singapore, Tokyo and Beijing) and certain European cities, particularly those of Germany.



4.2.12 Abandoned Packard automotive manufacturing complex in Detroit, USA. The redirection of capital from the cities of the developed world to those in developing countries has left its mark on industrial centres in what is now referred to as the US's 'rust belt'.

World city ranking according to level of connectivity

Rank	City
1	London
2	New York
3	Hong Kong
4	Paris
5	Tokyo
6	Singapore
7	Toronto
8	Madrid
9	Brussels
10	Frankfurt
11	Amsterdam
12	Chicago
13	Milan
14	Sydney
15	São Paulo
16	Los Angeles
17	Zurich
18	Mexico City
19	Buenos Aires
20	San Francisco

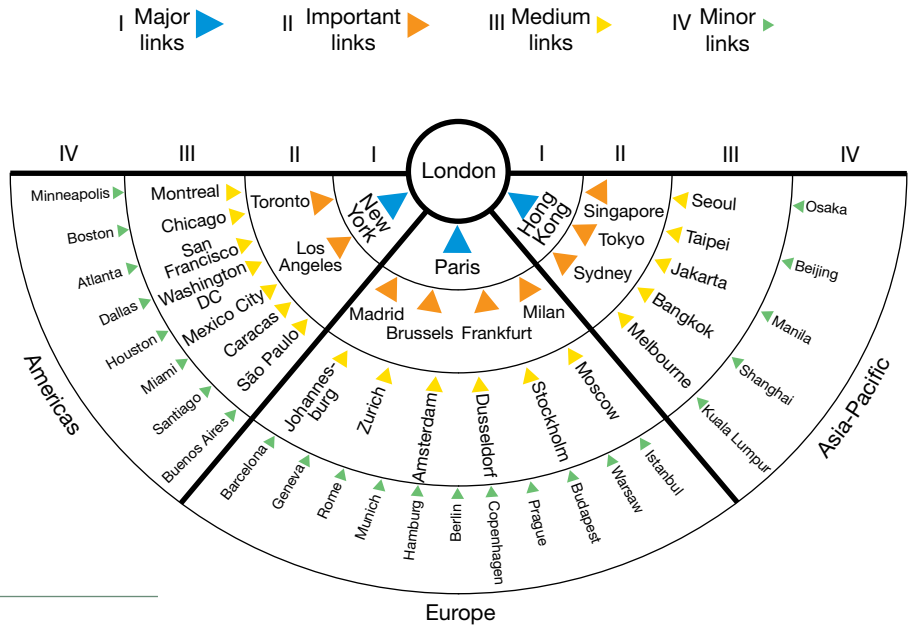
Source: GaWC

4.2.13 World city ranking according to level of connectivity

London's links with other world cities are shown in Figure 4.2.14 and examined in more detail in the Unit 4.3 London: a world city.

Flow of people

The flow of people is another important indicator of a city's status within the global hierarchy. Highly skilled professionals are the key operatives of the new economy. Their movement provides a useful insight into the relative importance of a city in the global economy. Key personnel working for global corporations will often move between the various branch offices of the company on a short-term or medium-term basis.



4.2.14 London's links with the rest of the world

Activities

Understanding the text

1. Identify the impacts of globalisation on the patterns of urbanisation in both the developed and developing worlds.
2. Define, in your own words, the term world city. Why are they important? What role do they play in the global economy?
3. Outline how the characteristics of world cities' authority has changed over time.
4. Outline the factors driving the process of globalisation since the late 1960s. What was the impact of these changes?
5. State the role of Transnational corporations in shaping the nature of world cities.
6. Outline the characteristics of world cities.
7. Explain the concepts of dominance and dependence.
8. Identify the principal world cities that constitute the 'command and control centres' of the global economy (the 'big four').
9. Identify examples of world cities that:
   - **a** link large national economies into the global economy.
   - **b** have an important multinational role.
   - **c** link important regional economies into the global system.
10. Identify the distinguishing features of London, New York, Paris and Tokyo that distinguish them as world cities.
11. Outline the role of world cities.
12. Identify the most easily measured indicators of the relationship between large cities.
13. Explain what is meant by the term connectivity.

Working geographically

14. Study Figure 4.2.3. Explain what this example suggests about the nature of production in an economically integrated world.
15. Study Figure 4.2.4. Write a paragraph describing the impact of globalisation on large urban centres.
16. Study Figure 4.2.5. As a class, brainstorm the outcomes of social and spatial restructuring in the cities of the developed world.
17. Study the ranking of world cities shown in Figures 4.2.6, 4.2.8 and 4.2.9. What world cities are common to each of the rankings? Which cities stand out as an irregularity in one or more of the tables?
18. Study Figure 4.2.7. With the aid of an atlas describe the global distribution of Alpha world cities.
19. Study Figure 4.2.8. Explain the differences of the various Alpha city classifications in the GaWC's hierarchy of world cities.
20. Study Figure 4.2.10. Identify the dominant world cities in terms of the distribution of the world's largest stock exchanges.
21. Study Figure 4.2.11. Outline the different functions of cities based on their position within the global hierarchy of cities.
22. Study Figure 4.2.12 and the text. Outline the factors that contributed to the decline of cities such as Detroit.
23. Study Figure 4.2.13. Outline the extent to which the ranking of cities by level of connectivity reflects the ranking of world cities shown in Figures 4.2.6, 4.2.8 and 4.2.9.
24. Study Figure 4.2.14. Write a paragraph describing London's links with the rest of the world.

CASE STUDY

World cities as centres of cultural authority

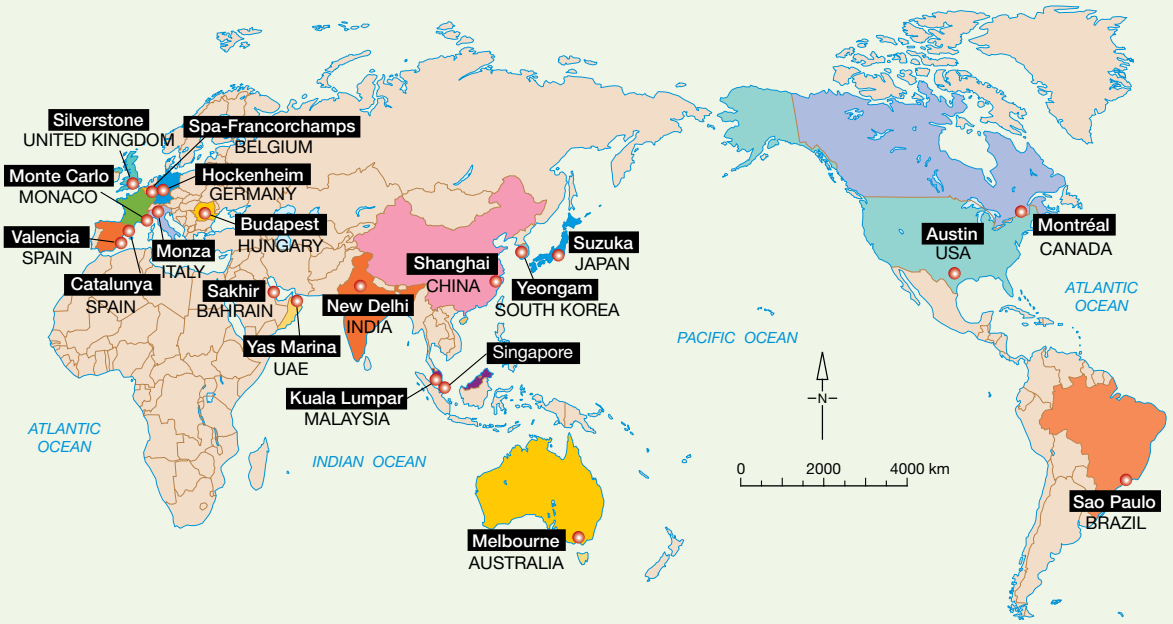
The link between the globalisation of culture and the global urban hierarchy is especially apparent with international competitions: the great 'global spectacles'. Coverage of major events and their host cities is seen around the world as a result of the globalisation of communications technology. International media coverage of football (soccer) or rugby union World Cup competitions, major tennis or golf opens, Formula 1 motor racing, marathons and the Summer and Winter Olympic Games are examples of the contemporary relationship between world cities and global sporting culture.

Apart from Tokyo (1964 and 2020) and London (2012), Figure 4.2.15 shows that in the choice of host city there is less emphasis on the dominant world cities than on those of regional importance to the global system. Host cities for the Summer Olympic Games are predominantly those lower-order global cities with aspirations of advancement in function and status. The competition to host such events has increased with globalisation. Cities at various levels in the global hierarchy compete as candidates against each other in an increasingly crowded global events market.

Host cities for the Summer Olympic Games, 1964–2020

Year	Host city	Candidate city
1964	Tokyo	Brussels, Detroit
1968	Mexico City	Buenos Aires, Detroit, Lyon
1972	Munich	Detroit, Madrid, Montreal
1976	Montreal	Los Angeles, Moscow
1980	Moscow	Los Angeles
1984	Los Angeles	Seoul
1988	Seoul	Athens, Melbourne, Nagoya
1992	Barcelona	Amsterdam, Belgrade, Birmingham, Brisbane, Paris
1996	Atlanta	Athens, Melbourne, Toronto, Belgrade, Manchester
2000	Sydney	Beijing, Berlin, Manchester, Istanbul
2004	Athens	Rome, Cape Town, Stockholm, Buenos Aires
2008	Beijing	Toronto, Paris, Istanbul, Osaka
2012	London	Paris, Madrid, Moscow, New York
2016	Rio de Janeiro	Chicago, Madrid, Tokyo
2020	Tokyo	Istanbul, Madrid
2024	Paris	Los Angeles, Paris
2028	Los Angeles	Los Angeles

4.2.15 Host cities for the Summer Olympic Games are predominantly those lower-order global cities with aspirations of advancement in function and status.



4.2.16 In 2017, 20 'Grand Prix' races were held in 19 different countries. Spain hosted two races.

Activities

Working geographically

1 Study Figure 4.2.15. Explain what the table of host and candidate cities for the Summer Olympic Games tells us about the motivations of applying to host the games.

2 Select a world sporting competition that is of interest to you. On a world map, locate the cities in which the sport's principal events are held. Which of these are classified as world cities?

CASE STUDY

Australia's world cities

The 2017 Global Cities Index, prepared by consultancy AT Kearney, ranks both Sydney (seen in Figure 4.2.17) and Melbourne among the top 20 world cities.

Sydney's economic output topped US$300 billion in 2016, comparable to the gross domestic product of Hong Kong or Malaysia. If Sydney were a city-state like Singapore it would rate among Asia's 10 largest economies and in the world's top 40. A Melbourne city-state would rank among the world's 50 biggest economies.

Together, Sydney and Melbourne accounted for 42 per cent of Australia's gross domestic product in 2015–16.

Australia's network of large cities

In Australia, there is a relationship between large corporations and the network of large cities. This relationship draws attention to the dominant role of Sydney and Melbourne compared with other state capitals. The important features of this relationship are outlined here:

- Major corporations dominate the national economy through their control of advanced technologies and the major growth sectors of the economy, their advantage in research and development, and their access to capital and governments.
- Major corporations exert control over smaller firms through price agreements, licensing, franchising and subcontracting.
- Corporate head offices in Australia are even more concentrated geographically than manufacturing centres. They focus on the two major metropolitan centres: Sydney and Melbourne, as seen in Figure 4.2.18.

Two points help to explain the data in Figure 4.2.18:

1. Sydney has traditionally been the principal centre for smaller, Australian-controlled businesses. Nearly half of these have grown through national mergers and takeovers. Recently, Sydney has emerged as the nation's principal financial centre. The city has been the preferred location for international finance and business service companies choosing to locate in Australia.
2. Melbourne stands out with a group of organisations having close production and financial linkages, and it dominates as the home for mining and manufacturing companies, including BHP Billiton, Rio Tinto, ANZ Bank, Telstra, Shell Australia and BP Australia.

Many of Melbourne's corporate headquarters represent an earlier period of Australia's industrial development and external links with the Northern Hemisphere, especially



4.2.17 Sydney: an emerging world city

the United Kingdom. Sydney represents the more recent period of capital accumulation associated with economic globalisation, mainly in the financial sector. Of the 53 banks authorised to operate in Australia, 43 are based in Sydney. This includes nine of the 11 foreign subsidiary banks in Australia and all of the 28 local branches of foreign banks. Major authorised foreign banks in Sydney include Citigroup, UBS Australia, Mizuho Corporate Bank, HSBC Bank Australia and Deutsche Bank. Other global banks have established highly successful back office operations in Sydney. Of the top 20 global banks, 17 have operations in Sydney. These foreign banks benefit from Sydney's time zone advantage, spanning the close of business in the United States and the opening of the European trading day. Sydney's skilled and multilingual workforce is another of its advantages.

Smaller state capitals play only a minor role at the global or national level of networking. Sydney and Melbourne are the national cities in the Australian corporate context; Brisbane and Perth operate at an intrastate level of networking within Australia's federal context.

Distribution of Australian corporate headquarters

City	Number of corporate headquarters
Sydney	26
Melbourne	16
Brisbane	4
Perth	4

4.2.18 Sydney and Melbourne host the vast majority of Australian corporate headquarters. Head office locations of Australia's 50 largest corporations, 2016. Based on total revenues.

Activities

Understanding the text

1. Explain why Sydney and Melbourne are classified as world cities.
2. Outline the role of large corporations in determining the dominant role of Sydney and Melbourne in the network of large cities in Australia.

UNIT 4.3

London: a world city

London is one of the world's great cities: an important centre of economic authority and control. It is home to the world's largest wholesale financial market. It competes with Paris as Europe's largest city and with New York as the world's centre of entertainment and culture.

Geography

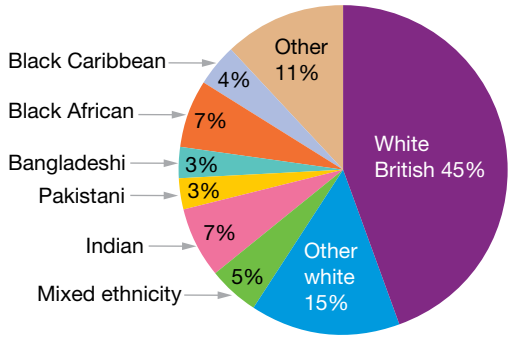
Greater London covers an area of 1569 square kilometres in the south-east of England on the River Thames, seen in Figure 4.3.1. Technically, London consists of two 'cities': Westminster and the City of London. The City of London's financial district is known as the 'Square Mile' or simply 'The City'. The population of Greater London area is 8.6 million and is expected to reach 9 million by 2020, 10 million by 2040 and as high as 11 million 2050.

Ethnic diversity

London is one of the world's most ethnically diverse cities. Fifty nationalities with communities of more than 10 000 make their home in the city. More than 300 languages are spoken. Thirty-seven percent of Londoners were born outside the United Kingdom, including 24.5 per cent born outside Europe. Only 44.9 per cent of the city's population is described as being 'white' British. Most of those with a non-British ethnic background are the children and grandchildren of those who came from the Caribbean and Indian subcontinent during the 1950s and 1960s after the disintegration of the British Empire. See Figure 4.3.2.



4.3.1 London is a major financial centre, cultural hub and place of learning.



4.3.2 London is one of the world's most ethnically diverse populations.

History

The site of London has been settled since the Romans founded Londinium more than 2000 years ago. The Romans abandoned Britain around 410 CE and the city entered a period of decline before regaining its political and economic authority under the Saxons in the late 800s CE. Saxon London grew into a prosperous and well-organised city.

By 1700, London had become the largest city in Europe with more than 500 000 residents. But London's 'golden age' was only just beginning.

By the mid–nineteenth century the city was the capital of the largest empire the world had ever known; the empire covered a quarter of the globe and encompassed 500 million people. Buildings and monuments befitting the city's imperial status were built and new docks constructed to take advantage of the booming trade with the empire. Great museums were established to house the treasures collected from throughout the empire.

Employment for selected industries in London, 2015	
Industry sector	**% of total**
Manufacturing	2.3
Construction	5.4
Retail	8.1
Transport and storage	5.0
Professional	15.8
Finance, real estate	7.1
Information and communication	7.7
Administration	9.9
Education	7.6
Healthcare	9.8

4.3.3 Employment for selected industries in London, 2015

During the second half of the twentieth century the financial burden of two world wars and the loss of an empire diminished London's status as a centre of political authority. The focus of political, economic and cultural authority shifted from Europe to North America.

During the 1970s and early 1980s, recession and the process of economic restructuring took a heavy toll on British manufacturing. While London was spared much of the economic and social distress of northern England, the great docklands of the East End never recovered from the loss of empire and the changing needs of the modern container ships. The Docklands declined to become a derelict wasteland before the developers moved in and initiated what was to become one of the world's largest urban renewal projects. During the 1990s London emerged as one of the main control centres in the 'new' global economy. Figure 4.3.3 outlines the major industries in the city. The city further consolidated its status as a world city during the first two decades of the twenty-first century.

Economy

London is a major economic entity in its own right. In 2016, 'The City' (London's principal financial district) generated £45 billion in economic output, equivalent to 14 per cent of London's total output and 3 per cent of the UK's output. The Greater London region's economy accounted for 22 per cent of the UK's GDP. Greater London is the fifth largest metropolitan economy in the world.

The morphology of London

London has four distinctive functions, each with its own geography.

The capital city

The monarchy, the legislature and the executive are located in the City of Westminster: the palaces of the royal family, the core of the state bureaucracy along Whitehall, the Houses of Parliament, the prime minister's residence in Downing Street and major departments of State along the Thames embankment.

As a seat of international governance London ranks behind Washington, Brussels, Tokyo, Paris and Berlin with approximately 30 international agencies and 400 international and nongovernmental organisations.

London's status as the capital city accounts for the concentration of research institutions, universities, teaching hospitals and law courts.

The tourist destination and centre of culture

London is one of the world's great centres of consumption, luxury, leisure, art, museums and sport. Its thousand years as a centre of power has left a rich heritage of antiquities and national monuments.



4.3.4 London is one of the world's most popular tourist destinations.

Twenty-six million tourists flood into London each year. Of these, 17.8 million are international tourists. In total, visitors spend £11.8 billion a year across the city's restaurants, hotels and attractions (see Figure 4.3.4). The tourism industry employs 380 000 people. The city's five most popular tourist attractions are the British Museum, the National Gallery, Westminster Abbey, Madame Tussauds waxworks and the Tower of London.

Tourists also account for 10 per cent of retail spending, and tourism underpins London's cultural life. Overseas visitors, for example, account for one-third of people filling theatre seats.

London's creative economy contributes £7.5 billion a year to the city's economy and employs more than 795 800 people in 15 000 enterprises. This represents 16.3 per cent of the city's workforce. London has over 300 theatres, 500 cinema screens and 12 000 restaurants. Average weekly theatre attendances total 283 500 and the revenue generated exceed £634 million a year.

'The City'

Since the sixteenth century, London's financial district— known as 'the City' or 'Square Mile'—has been one of the world's most important business centres (see Figure 4.3.5). Consider the following:

- The City employs 400 000 people directly and draws on business command and control functions (such as public relations, marketing, design and software consultancies), which employ a further 200 000 people. Despite this, only 8000 people live in 'The City'.
- London's financial district is the world's largest wholesale banking centre. In the City, 539 foreign banks have a presence; Tokyo has less than one-quarter of this total and New York less than two-thirds.
- London's foreign exchange market is the largest in the world. Over 30 per cent of the world's currency exchanges take place here, more than New York and Tokyo combined.
- London has the headquarters of 220 of the United Kingdom's top 500 companies, 118 of the European top 500 and 64 of Fortune magazine's ranking of the world's top 500. Seventy-five per cent of Fortune 500 companies have offices in London.
- London's stock exchange may be smaller than Tokyo and New York but it is more international. Over 40 per cent of the world's foreign equities (shares) are traded here, more than New York.



4.3.5 Since the sixteenth century, 'The City' has been one of the world's most important business centres.

A second, smaller financial district has developed at Canary Wharf. The world or European headquarters of HSBC, Thomson Reuters, Barclays, Credit Suisse, J.P. Morgan, Morgan Stanley, KPMG, and the world's largest law firm, Clifford Chance, are located there. In total, London's financial sector alone employs about 1.25 million people, or about one in every three jobs available.

The manufacturing centre

The manufacturing and goods-handling sectors have suffered a long decline. In 1951 more than 1.5 million people worked in London's factories. Today they employ just 250 000 people (just 2.8 per cent of the city's workforce). De-industrialisation has left its mark on the working-class areas of London in the form of high unemployment and urban decay. Former industrial sites have been redeveloped.

What remains after three decades of economic restructuring is a hard core of productive industry with a geographical reason for being in London: the most important sector is paper, printing and publishing, accounting for over one-third of the manufacturing output and one-quarter of employment. Others are electrical engineering and electronics; food, drink and tobacco; communication equipment; electronics; and the clothing industry. The distribution of manufacturing has changed very little. Most remains in a corridor running east along the River Thames and along all of London's arterial roads.

An education centre

London is home to 43 universities and centres of higher learning—the largest concentration of higher eduction in Europe—and almost 103 000 international students are enrolled at any one time.

Home to the super rich

London remains 'the city of choice' for the super-rich of Asia and the Middle East. Many maintain houses in Belgravia, Mayfair or Kensington and patronise the city's fashionable department stores and boutiques.

The number of UK-based ultra-high-net-worth individuals (UHNWIs)—those with more than $30m (£24.2m) in assets—now stands at 4363 and is expected to increase by 30 per cent by 2025. London is seen as accessible, more connected and more open than other cities. London continues to attract talent from around the world.

Activities

Understanding the text

1. Outline the key features of London's geography.
2. Specify when London experienced its 'golden age'. With what was it associated?
3. Explain why London's political authority declined during the latter half of the twentieth century.
4. State what London's economic revival in the 1990s was linked to.
5. Identify where London's capital city functions are concentrated.
6. Outline the contribution that tourism and culture make to London's economy.
7. Outline the evidence supporting the view that London is one of the world's great financial centres.
8. Outline how London's role as a manufacturing centre has changed since the 1950s.

Working geographically

9. Study Figure 4.3.2. Using data from the graph describe the ethnic diversity of London.
10. Undertake library and internet-based research. Investigate London's role as a global command centre. Use this information to illustrate the concept of 'world cities'.
11. Use Google Earth™ to explore the famous landmarks of central London.
12. Use the GaWC website to investigate London's role as a world city. Use the information collected to write an extended response detailing London's world city status.

UNIT 4.4

Regional centres and small towns



4.4.1 Abandoned homes in a Central NSW township. Images such as this illustrate the decline now evident in many of Australia's small country towns.

Advances in telecommunications technologies have led to a centralisation of business-related services into a relatively small number of world cities. This process has a cascade effect through the urban system: from the national level, to the regional level and then to the local level. The result at the local level is the decline, and even the demise, of many small towns (see Figure 4.4.1). It has certainly led to a marked reduction in services offered in such places. These services are no longer economically viable in a competitive business environment. Transactions once done face-to-face with a service provider are now, in an increasing number of instances, done online. Think about how online banking has replaced the need to visit your local branch. The decline of the small rural towns is compounded by the decline of the on-farm population—a process driven by the amalgamation of rural properties into larger production units and the takeover of family farms by corporate entities.

The impact on the larger regional centres is, however, quite different. Their story has been one of growth. This growth has occurred as they absorb the decline in the population and activities of the smaller regional centres. This dual process is best illustrated with examples.

DID YOU KNOW?

During the 1980s and 1990s, more than one-quarter of the bank branches in rural New South Wales were closed.

Restructuring

Economic restructuring in both the private and public sector has had led to either the growth or decline of regional cities. Restructuring has made Australian exports more competitive on world markets. This has helped improve the economy of many regional cities that operate as centres of primary and secondary production, such as food processing and the supply of frozen meat. It has also encouraged a shift among some industries, in both the manufacturing and agricultural sectors, to production for national and even international markets. This change has been especially advantageous to regional cities because it can involve lower operating and land costs; fewer restraints on effluent disposal; higher productivity; reduced staff turnover; and lower levels of union involvement. It can also allow environmentally sensitive industries to be located away from residential areas. The relocation of Buckman Laboratories, a chemical manufacturer, from Sydney to Wagga Wagga is an example. Regional cities, however, often find it difficult to attract and retain skilled technical and professional staff.

Retail restructuring has also contributed to the growth of regional cities, but at the expense of smaller centres. The development of large regional shopping centres has often led to the demise of the local small town retailer. Consumers bypass the local store and drive to the larger regional centres where there is more choice and lower prices.

Public sector restructuring has occurred because of a need for government spending restraint and greater efficiency. This restructuring has resulted in both gains and losses in regional cities. For example, the rationalisation of state railways and other services has often led to job losses. On the other hand, services are being increasingly withdrawn from smaller centres and centralised in the regional cities.

In summary, economic restructuring has brought about changes in the distribution of economic activity in Australia. It has prompted firms to seek out new low-cost locations, encouraged manufacturers to produce for national markets, and boosted export industries by making them more competitive. Much of this has been to the advantage of non-metropolitan, regional centres.

The demise of the small town

As regional centres have grown, many once vibrant local communities and country towns with populations fewer than 11 000 have declined. Many now face an uncertain and troubled future. Approximately 431 urban centres with populations less than 4000 will struggle to survive. Many of these towns are losing the infrastructure necessary to maintain a viable community.

Activities

Understanding the text

1 Outline the impact of economic restructuring on regional centres.

2 Explain how small country towns have been affected by economic restructuring.

Working geographically

3 Use the media to gather information relating to the demise of small towns and the changing role of regional centres. Use this information to illustrate the concepts addressed in this unit.

4 Study the Bernard Salt extract: *Growth and loss: how Australia is being reshaped*, and then write a paragraph or two summarising the key points he is making. Describe the pattern of growth and decline shown in Figure 4.4.2.

Growth and loss: how Australia is being reshaped

By Bernard Salt

At the time of federation the Australian continent contained about four million residents. Roughly half lived in rural and regional Australia in places such as Ballarat [and Bathurst] which [were] then bigger than Perth. About a third lived in capital cities such as Sydney and Melbourne that jointly contained one million residents. Very few lived on the coast outside capital cities. ...

... Fast forward more than a century and this nation and its people have been transformed. The number living in rural and regional Australia has doubled from two million to four million but as a proportion of the total this figure has dropped from one-half to one-sixth. ...

... The demographic and geographic transformation of Australia occurred in the second half of the twentieth century. Post-war immigration turbo-boosted the nation's growth such that today seven million residents or 30 per cent of the Australian people were born overseas. Australia is more ethnically diverse than America or Canada or Britain or Germany. And our economy has shifted from the delivery of wool, wheat, cotton, meat and dairy to Britain to the extraction and export of coal, iron ore, bauxite and nickel to Japan, China and South Korea. Agribusiness was labour intensive; mining is increasingly automated.

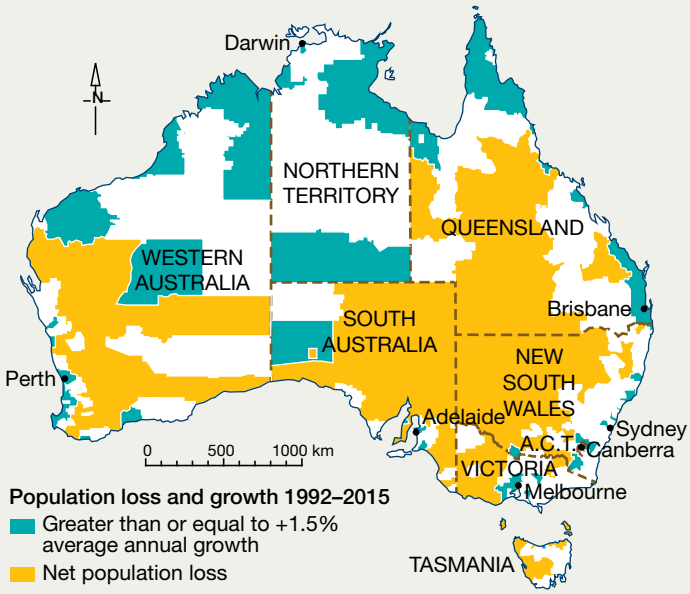
An outcome of these megatrends has been a re-imagining of the settlement of the Australian continent ...

... And so began, probably from the 1970s onwards, the great emptying of the Australian interior. Not all places but very much the villages, the towns and the farmlands scattered throughout the wheatbelt, the grazing lands and some dairying country. The map (Figure 4.4.2) shows where Australians have shifted from and to over the generation since 1992.

Areas of loss generally extend west of the Great Divide and embrace the Murray Darling Basin, Western Victoria, Tasmania's west coast, the Eyre Peninsula and the Upper and Lower Great Southern in Western Australia. Australia's dairy farmer population for example dropped from 21 000 to 13 000 between the 2001 and 2011 censuses effecting a deleterious ripple impact on local communities. ...

... On the one hand farm aggregation and the advent of smaller family sizes has diminished demand for services sending towns into demographic decline. But clearly some places endure; there is still demand for agricultural services like livestock trading yards, machinery repairs and fuel supply outlets let alone for groceries, banking services, health and even church and sporting activities. ...

... Gone [however] is the atomised dispersal of population, jobs and services delivered through a network of villages; in comes a centralised system of urban places



4.4.2 Areas of population loss and strong population growth, 1992–2015

located further apart requiring only occasional but planned interaction. The sense of community in towns is thus diminished or at the very least is changed across the farmlands or has been relocated to modest growth centres ...

... And while all of this is of interest to business there is another more powerful perspective that goes to the core of our ability to control the destiny of our places. Over the past century there has been a power shift from the regional to metropolitan Australia. A sizeable proportion of non-metropolitan gross domestic product is now managed out of the city via mining's various "operations centres", head offices and fly-in fly-out workforces.

... The Australian nation and its regions are to a large extent buffeted by bigger forces like the globalisation of commodity prices which drives aggregation, like the automation of farm equipment that facilitates bigger farms, and like the shift in values by young people toward city-based education and lifestyle. The reverse logic applies to the coastal lifestyle cities and the commuter corridors of our capital cities. Australians have always and most likely will always pursue residential locations that maximise lifestyle. ...

Contrary to popular thought the resettlement of the Australian interior demonstrates the inability of small communities to shape their destiny. Sandstone was always going to revert to grazing once the gold ran out; it just took a century for this reality to play out.

This raises important questions for Australians. How might global megaforces reshape the way in which we generate wealth and prosperity in the future and what might be the impact on our cities and regions? ...

Bernard Salt, *The Australian*, April 14, 2016

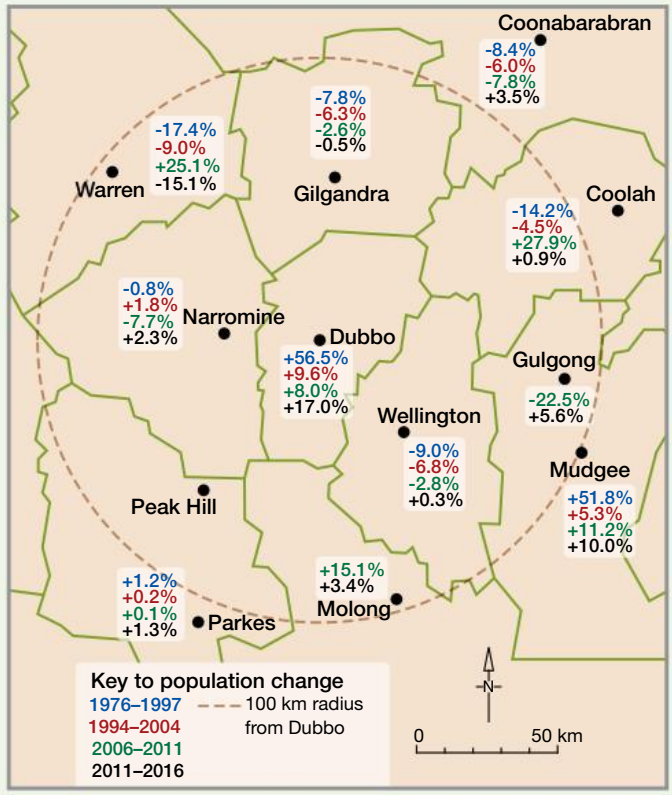
CASE STUDY

Dubbo

Dubbo is a city of some 38 943 people located on the western plains of central New South Wales, shown in Figures 4.4.3, 4.4.4 and 4.4.5. The city has grown while other smaller urban centres in the region have stagnated or experienced population decline because of Dubbo's ability to provide services to a wide area. It has an advantageous position on a number of transport routes. The Great Western Highway passes through Dubbo and brings traffic travelling across the state. The city is also located on the Newell Highway and is part of the route connecting Melbourne and Brisbane. It is on the railway line and has relatively good connections to Newcastle via the upper Hunter Valley.

These transport connections have resulted in economic growth generated by the development of warehousing and distribution facilities. Manufacturing plants in Victoria, for example, use distributors in Dubbo to service all country New South Wales, and possibly Sydney, as trucks travelling to Brisbane lose little time on their journey north. Dubbo is the only major regional centre in its region. To the south-east, Orange is the nearest city of any size and is at least 90 minutes by car. To the north, Tamworth is the only large centre and does not fall within Dubbo's expected catchment area. There are no major settlements west of Dubbo before Broken Hill.

Nearly half of Dubbo's workforce is employed in wholesale and retail activities or in community services. Roughly 10 per cent of workers are engaged in financial services. The abattoir (Fletcher International Exports) employs around 700 workers and is the largest single enterprise in town; the base hospital is the next largest. Entertainment and recreation are important employers. There are more than 30 motels in the city, with demand coming from people travelling along the Newell Highway, from visitors to the famous Western Plains Zoo, and from people coming into Dubbo on business.



4.4.3 Population change in the area surrounding Dubbo, 1976–1997, 1994–2004, 2006–2011, and 2011–2016

Activities

Understanding the text

1. Describe the impact of Dubbo's growth on surrounding communities.
2. Explain how Dubbo's location has contributed to its economic success.
3. Outline how Dubbo's employment structure reflects its status as a regional service centre.

Working geographically

4. Study Figure 4.4.3. What trend is evident in the data presented on the map showing the population change in the area surrounding Dubbo?



4.4.4 Oblique aerial photograph of Dubbo's CBD, the centre of the city's commercial life



4.4.5 Satellite photograph of Dubbo, NSW

Exam-style questions

Extended responses

- Account for the increasing proportion of the world's population living in urban places.
- Explain the changing global distribution of large cities.
- Explain the nature, character and spatial distribution of world cities.
- Analyse the role of world cities as powerful centres of economic and cultural authority.
- Examine the role of world cities and the operation of these cities within global networks.
- Explain the operation of the global network of large cities.
- Analyse the relationships of dominance and dependence between world cities and other urban centres.
- Explain the changing role of regional centres and the demise of the small town.

Glossary

colonialism the policy or practice of another country or power acquiring full or partial political control over a country, occupying it with settlers, and exploiting it economically

division of labour a way of organising work, especially manufacturing, so that particular types of work are done by particular people

globalisation the process by which businesses or other organisations develop international influence or start operating on an international scale

imperialism a policy of extending a country's power and influence through colonisation, use of military force, or other means

Industrial Revolution a period of major industrialisation that took place during the late 1700s and early 1800s; during this time there was increased use of mechanisation in agriculture and textile manufacturing, as well as a change in energy use to steam (for ships and railroads)

life sciences the branches of science that involve the scientific study of living organisms—such as microorganisms, plants, animals, and human beings—as well as related considerations like bioethics

megacity a very large urban agglomeration of at least 10 million inhabitants

new economy an economy that has transitioned from a manufacturing-based economy to a service-based (education, health, finance, technology) economy

old economy includes traditional industries such as manufacturing

protectionism economic policies that protect industries via the imposing of tariffs and taxes (the opposite of trade liberalisation)

trade liberalisation economic policies that open up a country's economy to foreign competition (the opposite of protectionism)

transnational corporations large enterprises (businesses) that control assets in other countries as well as their home country

urban agglomeration a central city (or more than one centre) with neighbouring communities linked to it by continuous built-up areas

urban growth the net increase in the population of an urban centre

urbanisation an increase in the proportion of a country's population living in urban areas; this generally involves a movement from rural to urban areas

world cities the centres of global economic and cultural authority

CHAPTER

5 Megacities of the developing world

The majority of the world's urban population—in common with most of the world's total population—live in developing countries. In mid-2016, developing countries had 3.3 billion urban dwellers compared with only 978 million in the developed countries.

For the foreseeable future, virtually all population growth will be in urban areas of developing countries. According to the latest UN projections, the urban population of developing countries will have doubled, from fewer than 2 billion in 2000 to nearly 4 billion in 2030. By way of contrast, the urban population of the developed countries is projected to increase only modestly: up from 900 million in 2000 to 1 billion in 2030.

In 2017, there were 29 megacities, most of them in the developing world. This trend will continue as several large cities in Asia, Latin America and Africa are projected to become megacities by 2030. Rapid growth has imposed great pressure on the infrastructure and resources of cities, leading to social disintegration and widespread urban poverty. Many people move to these cities with hopes of a job, better health care and educational opportunities. They are often disappointed. Forced to shelter in squalid slums or squatter settlements, they find it difficult to find work. Many are only able to work within the low-paid, informal sector where exploitation is widespread. Without access to a clean source of water they suffer debilitating diseases. Hospitals and schools are unable to cope with the surge in demand.

> **These megacities are a big part of humanity's future and the prospect should be both exhilarating and terrifying.**
>
> **Edward Glaeser, author of *Triumph of the City***

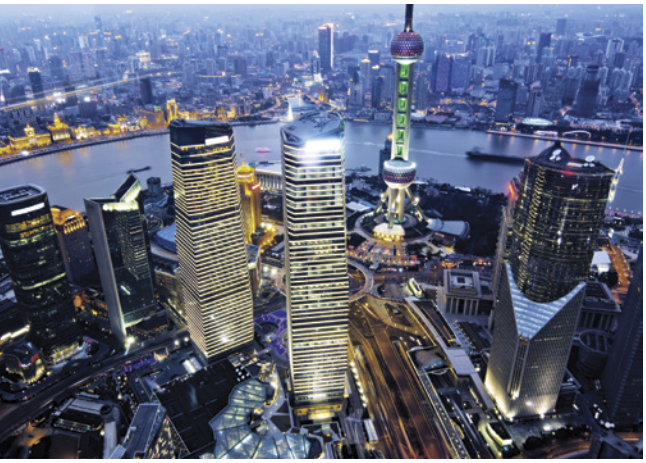
5.0.1 Lagos, Nigeria


LAGBUS

UNIT 5.1

Megacities: character and distribution

The rise of megacities poses formidable challenges in areas such as housing, health care, education, utilities (electricity, sanitation and water supply), environmental quality and the provision of transport infrastructure. In these cities, the urban poor often live in squalid squatter settlements and slums, and city authorities struggle to dispose of waste and supply clean water. Megacities are likely to be a drain on the Earth's dwindling resources, while making a major contribution to environmental degradation.



5.1.1 Shanghai is the largest of China's six megacities.

The world is increasingly becoming one of giant cities, and these cities are increasingly located in developing countries (see Figure 5.1.1). While the major urban centres of Europe, the United States and Japan are growing only slowly, the reverse is true for the megacities of the developing world. Megacities are defined by the United Nations as those cities with a population exceeding 10 million people.

In 1950, only two cities—New York and London—met the UN's megacity criteria. By 2016 there were 31 megacities with 24 of these in developing countries. Eight cities had populations greater than 20 million.

While size is the easiest criteria by which to define a megacity, it is not a good measure of a city's economic, cultural and political influence. London, for example, is ranked twenty-ninth in terms of population but is among the top two in terms of political, economic and cultural influence. It is, in fact, a command centre of the global economy. Many of the developing world's megacities rank higher than London in terms of size but are much less powerful in terms of their financial and commercial influence. A new pattern is emerging: the largest cities are no longer the most important cities in the global economy.

Over-urbanisation and over-ruralisation

The main reason for investigating the megacities of the developing world in a different context from those in the developed world relates to differences in economic and social circumstances. The situation in megacities is often referred to as over-urbanisation; that is, there are more urban residents than the economies of the cities can support. Often this growth is the result of rural–urban migration. In many regions of the developing world, there are more people than the economies of rural areas can support. This is referred to as over-ruralisation.

Over-urbanisation occurs when large cities cannot provide enough jobs or raise enough revenue (via taxation) to provide the services that people need. The larger the city grows, the greater the problem becomes. It becomes more and more difficult to balance the increased urban population, the growth of the city's economy and the infrastructure required to support both. Over-ruralisation results from rapid population growth, the purchase of land by agribusiness corporations and the expansion of export-orientated cash cropping. These processes undermine people's ability to meet their own needs and the needs of their family.

Urbanisation and manufacturing

In the developed world, urbanisation was accompanied by a growth in manufacturing. Manufacturing was labour-intensive and grew at a rate that enabled it to absorb the expanding urban workforce, which meant that most of the increasing urban population were able to find employment. This has not occurred in the developing world.

Many of the large cities in the developing world lack a well-established manufacturing sector. Many developed during the colonial era as a focus of colonial administration and as commercial centres serving the interests of the colonial power.

In the post-colonial era, manufacturing was seen as a way of promoting modernisation and economic growth. Governments promoted manufacturing, especially when it replaced imported products (import substitution) or produced goods for export. While some of this manufacturing was labour-intensive, there were not enough jobs to meet the needs of the rapidly growing urban workforce. Technological developments have compounded the problem. Many manufacturing processes now utilise capital-intensive technologies. These significantly reduce the demand for labour.

Characteristics of megacities' economies

The basis of the urban economies of the megacities in developing countries is different from world cities. The following economic characteristics of Asia's megacities illustrate this point:

- Most megacities perform national or international functions. High-order services (such as government, banking, insurance and finance) are important components of their economic structures. At the other end of the scale, all the megacities have large informal sectors such as vending and hawking of services seen in Figure 5.1.2, but this varies from one city to another. In Lagos, the informal sector accounts for 69 per cent of total employment. In Dhaka, 65 per cent of employment is based in the informal sector, with the tricycle rickshaws that dominate urban transport being the largest single source of employment. The figures for Mumbai and Kolkata are 68 per cent and 67 per cent, respectively.
- Megacities are also major manufacturing centres, but this varies widely. Mumbai, Kolkata and Seoul, for example, have manufacturing employment in the 35–40 per cent range. In Manila and Dhaka it is about 23 per cent.

Employment

In common with the world cities, the new international division of labour (particularly the shift of labour-intensive manufacturing employment to low-cost developing countries) is redefining the structure of employment in some megacities. The number of people employed in manufacturing has increased, especially in cities that host the labour-intensive manufacturing processes of transnational corporations (TNCs). Most of this employment growth has occurred in the new industrial estates built on the outskirts of cities such as Jakarta, Bangkok and Dhaka.

The population composition of Asia's megacities is changing as a result of international migration. These movements include guest-worker streams. Source countries of these workers include Indonesia, Bangladesh, Pakistan and the Philippines. Destinations include Japan, South Korea, Singapore, Taiwan and the countries of the Middle East. Filipinos (especially women working as domestic maids), Pakistanis and Bangladeshis (typically construction workers) often send the money they earn to their families back in their country of origin.

Inequality

One of the more significant outcomes of globalisation has been to sharpen social divisions between the haves and the have-nots. Increasingly, the rich and the poor are building their own separate environments (shown in Figure 5.1.3). The rich are retreating to well-resourced, walled communities and are using privatisation schemes to develop their own basic service structures. The poor are increasingly confined to unplanned settlements, shanty towns or squatter settlements on the outskirts of the megacities, where local governments are unable to provide for even their most basic needs.



5.1.2 Street vendors are indicative of the informal sector in many of the developing world's megacities.

Activities

Understanding the text

1. Outline the demographic trends being seen in the world's megacities, and explain why this is such an important area of geographical study.
2. Explain why the plight of those living in megacities represents such a challenge for governments.
3. Outline the criteria used by the United Nations to identify megacities.
4. Explain why size is an inappropriate criteria by which to judge the economic, cultural and political importance of a megacity.
5. Explain why we study the megacities of the developing world in a different context from those located in the developed world.
6. Distinguish between over-urbanisation and over-ruralisation.
7. Explain how the experience of the megacities is often linked to over-urbanisation and over-ruralisation.
8. Outline the relationship between manufacturing and the growth of large cities in the developed world.

Working geographically

9. Study Figure 5.1.3. As a class, brainstorm the factors that might have contributed to the inequalities illustrated by the photograph.



5.1.3 Inequalities between the rich and the poor in megacities are becoming increasingly apparent. The Paraisopolis favel (Paradise City) borders the affluent district of Morumbi, São Paulo, Brazil.

UNIT 5.2

Megacity challenges: employment

High levels of unemployment and underemployment are a feature of the developing world's megacities. In the absence of properly planned and managed urbanisation, urban labour markets find it impossible to absorb the growing number of job seekers. Estimates of the International Labour Organisation (ILO) suggest that 20–25 per cent of urban adults in developing world cities are without regular work. The result is urban poverty and social exclusion. Jobs are not just an economic necessity; they are a way of participating in community life and a means of establishing an identity. According to the World Bank, about one-quarter of the urban population in developing countries live in absolute poverty (see Figure 5.2.1). In Africa, 40 per cent of urban households are living below the locally defined poverty lines. In Latin America, the figure is 25 per cent.



5.2.1 Urban poverty in Dhaka, Bangladesh. Without access to employment, people living in the cities of the developing world have no way to provide for their basic needs. The result is widespread poverty.

Alleviating poverty

When properly managed, urbanisation can play a role in addressing poverty and has helped millions escape poverty through:

- higher levels of productivity
- employment opportunities
- improved quality of life via better education and health
- large-scale public investment
- access to improved infrastructure and services.

This is evident in East Asia, where increases in urbanisation over the last three and half decades has been accompanied by reductions in poverty. In the early 1980s, East Asia was the region with the highest incidence of poverty in the world, with 77 per cent of its population living below the poverty line; by 2015, this has fallen to 11 per cent. In China, urbanisation accompanied by massive state-promoted economic growth helped pull 680 million people out of extreme poverty between 1981 and 2010, and reduced the rate of extreme poverty from 84 per cent in 1980 to 10 per cent in 2013. China alone accounts for three-quarters of the global reduction in poverty.



5.2.2 Street food vendor, Bangkok, Thailand. Many of the urban poor are forced, or choose, to create their own employment within the informal sector.

The informal economy

Because there are so few jobs in the formal economy, many of the urban poor are forced, or choose, to create their own employment within the informal sector. (See Figure 5.2.2.) The informal economy plays an important role in the economy of the megacity. It provides cheap goods and services for the urban poor. However, the potential for exploitation is great. With such a large surplus of labour, wages can be kept low and working conditions poor. The exploitation of child labour often takes place within the informal sector. The United Nations estimates that 37 per cent of the people living in the megacities of the developing world are employed in the informal sector.

Attempts to overcome the employment problem focus on income-generating projects that bring informal businesses into the mainstream economy and assist exporters to tailor production for lucrative foreign markets.

DID YOU KNOW?

China's middle and upper-middle class is projected to grow from 15 per cent of the country's population in 2016 to 73 per cent in 2030—that's 850 million people! They will earn between US$16 000 and US$160 000 a year, a widely used definition of these classes.

Promoting employment

City authorities can do a lot to promote employment.

Formal sector

Goods infrastructure encourages domestic and foreign investment, which is necessary for large-scale job creation. Planners can attract investors by developing industrial parks, export processing zones or other designated areas for private sector development. Linking industrial zones with seaports and airports reduces the time, cost and inconvenience of shipping goods. The development of Special Economic Zones in China has proved effective in attracting foreign investment. TNCs take advantage of the concessions on offer and invest in new production facilities. Over time, this has contributed to the emergence of a new international division of labour, which shifts labour-intensive manufacturing activities (and employment) from developed countries to the emerging economies of South and East Asia.

Informal sector

Most of the urban poor work in the informal sector in jobs that are low in pay, productivity and security. To facilitate the shift into the formal sector, local authorities can enact new laws and regulations that encourage people to formalise their enterprises. They can also provide assistance to small enterprises to upgrade skills and increase access to productive resources and market opportunities. Mini enterprises and family based businesses have the ability to absorb large numbers of the urban poor. Microfinance (small loans) and microcredit can assist the urban poor to start or expand their small businesses. They help the poor make the transition from the informal to formal economy.

Benefits of microfinance

NGOs (non-government organisations) have led the campaign to expand banking services to the urban poor. Many such initiatives have led to the establishment of microfinance institutions. These are bank-like institutions that cater for the needs of the urban (and rural) poor. Small loans, or the provision of credit, have allowed impoverished people (often women) to engage in self-employment projects that enable them to generate an income and, in many cases, begin to build wealth and exit poverty. The World Bank estimates that there are now more than 7000 microfinance institutions.

Freedom from Hunger and its local community based partners are among the most enthusiastic supporters of microcredit. Loans are used to help women become entrepreneurs who run home-based businesses, such as making food products or crafts to sell. These loans can be as small as $5 or as much as $300. No longer forced to scrape together whatever money they can earn, these women generate a regular income, along with a new sense of accomplishment and self-esteem. See Figure 5.2.3.

The traditional banking industry, keen to build relationships with potential customers, now sees the benefits in providing small loans to the urban poor.



5.2.3 Shalun Para, 30 years old, and her husband opened this little restaurant thanks to a small loan. Microcredit is used to bring small-scale enterprises into the formal economy. They have also helped alleviate urban poverty.

Activities

Understanding the text

1. Outline the extent of unemployment and poverty in the world's megacities.
2. Describe, with reference to the experience of countries in eastern Asia, that there is an alternative to high unemployment and widespread poverty.
3. Describe how economies of megacities in developing countries differ from those of world cities.
4. Define the term informal economy. What role does the informal economy play in the economy of the megacity.
5. Explain what is meant by microcredit. Why is it considered so important in creating employment and human wellbeing?

Working geographically

6. Write a paragraph or two outlining the strategies authorities can adopt to create employment in both the formal and informal sectors of the economy.
7. Use the internet to investigate the issue of child labour. Write an extended response outlining the nature and extent of child labour in the developing world and the responses to it. Include reference to the types of child labour, the nature of the work performed, the scope for exploitation and the strategies that NGOs and governments are using to address the issue.

CASE STUDY

Bangladesh

The informal sector in Dhaka, Bangladesh

The informal sector of Dhaka—which employs 75 per cent of the urban population—lies outside any formal regulatory environment and is a response to over-urbanisation. Because there are so few jobs in the formal sector, people living in the city have to create their own employment, such as the street vendor in Figure 5.2.4. The informal sector is labour-intensive and includes a large number of small, locally owned workshops and street vendors of many different types, such as water sellers, bottle collectors, food stall holders, shoe polishers, barbers, waste recyclers, cart pullers, prostitutes and professional beggars. Dhaka's informal sector largely exists to serve the needs of the city's urban poor and tends to operate outside the control of the authorities. It is often untaxed and rarely taken into account when estimates of gross domestic product (GDP) are made. The sector provides employment for up to 87.4 per cent of employed persons aged 15 and above, with only 12.6 per cent working in the formal sector.



5.2.4 Street vendor in Dhaka, Bangladesh. Dhaka's informal sector provides employment for up to 87.4 per cent of employed persons.

Rural–urban migration is the principal reason for the growth of Dhaka's informal sector. The city attracts some 300 000 to 400 000 new migrants each year, a rate that is projected to result in a population of almost 23 million by 2025; currently it is the home for 18.2 million inhabitants. Every year, thousands of climate refugees migrate to Dhaka due to the impacts of climate change—increasing floods, cyclones and drought.

Fifty-one per cent of people living in the city's squatter settlements and slums relocated to the city in search of work, 29 per cent due to poverty and 7 per cent after losing their lands and houses to river erosion. Most of these migrants move to Dhaka in search of the many opportunities the city offers, especially the opportunity to work. Most end up working in the informal sector. In turn, the new migrants contribute significantly to Dhaka's economic growth as they provide much needed labour.

The least visible informal workers find irregular work in the city's small workshops, restaurants and hotels, as sub-contracted janitors and security guards, casual or day labourers in construction, piece rate workers in sweatshops, and temporary office helpers or off-site data processors. Also invisible are the mostly women workers who sell or produce goods from their homes: garment makers, embroiderers, incense-stick rollers, paper bag makers, hair band makers, food processors, shoe makers etc. Some of these home-based workers work on their own account, while others work on a piece-rate basis for a contractor or a firm.

Child labour is widespread in the informal sector. There are 1.7 million child labourers in Bangladesh, with the highest concentration in Dhaka (0.69 million). Almost 87 per cent of children who live in the country work in the informal sector.

Almost all workers in the informal economy share one thing in common: the lack of formal labour and social protection. Most workers are without secure contracts, worker benefits or social protection. Work in the informal economy is often characterised by small or undefined workplaces, unsafe and unhealthy working conditions, low levels of skills and productivity, low or irregular incomes, long working hours and lack of access to information, markets, finance, training and technology.

Grameen Bank

Grameen Bank (GB) is a community development bank based in Bangladesh. It provides credit to the poorest in the country, without the need for collateral. It is a banking system based on mutual trust, participation and creativity. Small loans are used as an effective weapon to fight poverty. Under the initiative, financial resources are made available to the poor people on terms and conditions that are appropriate and reasonable. They can use the loans to start a small enterprise, such as the poultry farm shown in Figure 5.2.5, that can support their family.

Today the bank has more than 8.8 million borrowers, 97 per cent of whom are women. With 2568 branches, GB provides services in 81 392 villages, covering more than 97 per cent of the total villages in Bangladesh. One of the benefits of the project has been to slow the rate of rural–urban migration. By providing economic opportunities for the rural poor there is less incentive to make the move to Dhaka.



5.2.5 A poultry farm financed by Grameen Bank in Bangladesh. Small loans can be used to lift women out of poverty.

NGOs campaign for workers' rights

An alliance of NGOs, known collectively as the Clean Clothes Campaign (CCC) are campaigning to improve the working conditions in the global garment and sportswear industries. Since 1989, CCC has worked to ensure that the fundamental rights of workers are respected. They educate and mobilise consumers, lobby companies and governments, and offer support to workers as they fight for their rights and demand better working conditions.

A focus of the CCC has been the garment manufacturing factories of Dhaka in Bangladesh. These enterprises produce garments for internationally recognised retailers including Walmart and Sears (two US retailing giants); and H&M, GAP, Zara, Next and C&A. A series of deadly fires and factory collapses in 2012 and 2013 brought the plight of these workers to international attention. In the worst of the incidents, at the Tazreen Fashions factory, at least 111 workers perished in a blaze.

In early 2017, thousands of garment workers held a series of non-violent protests (see Figure 5.2.6). They were demanding an increase in the minimum wage to US$191–203 per month. The existing US$67 monthly wage is considered insufficient to meet the basic needs of a family, nor cover other household expenses.

The response of employers and the government was swift and repressive. An estimated 2000 to 3000 workers were fired and 1500 were charged with vandalism, looting, threatening other workers and assaulting factory officials. At least 13 union leaders and activists, many of whom had no association with the protests, were detained or arrested. In response, 26 labour rights organisations, including CCC have lobbied two-dozen of the largest apparel brands and retailers in an effort to have them reconsider the agreements under which they source the garments they sell in their stores.



5.2.6 Bangladeshi garment workers campaign for a living wage.

Activities

Working geographically

1. Write a report outlining the role played by the informal economy in Dhaka.
2. Outline how Bangladesh's community based banking program has improved the livelihood of the country's poor. Explain how it has helped slow the rate of urbanisation in the country.
3. Using the internet, investigate other NGO initiatives designed to enhance the wellbeing of those employed in Dhaka's informal sector.

CASE STUDY

Carpets, matchsticks and beaded garments: a story of exploited child labour

The International Labour Organization (ILO) estimates that in developing countries alone, at least 167 million children between 5 and 14 years are working full time. The number rises to about 264 million if children are included for whom work is a secondary activity. Of these, 61 per cent are in Asia, 32 per cent in Africa and 7 per cent in Latin America. While Asia has the largest absolute number of child workers, Africa has the highest incidence, at around 40 per cent of children between 5 and 14 years of age. According to the ILO, 59 per cent of child labourers work in agriculture; 25 per cent in services; 7.2 per cent in industry; and 7 per cent in domestic work. See Figure 5.2.7.

Initiatives to combat child labour

In response to the large-scale use of child labour in India's hand-knotted carpet industry, new and promising initiatives have been established to combat it. One such initiative is the introduction of Rugmark: a product-labelling scheme based on the preference of many Western consumers for goods produced under morally acceptable working conditions. Millions of hand-knotted carpets have now been exported from India carrying the Rugmark label, which indicates that they have not been made by children below the age of 15.

The Rugmark initiative was introduced in 1994 by a German NGO with the support of carpet importers and the German government. It attempts to eliminate child labour in the Indian carpet industry by harnessing the desire of consumers—for carpets that are not made using child labour. Carpet manufacturers who register with Rugmark commit to not using child labour in production processes and allow the Rugmark Foundation to conduct unannounced inspections of their looms. The Rugmark Foundation then attaches labels to its carpets, thereby selectively promoting the export of carpets made without the use of child labour.

Reasons for exploitation

Elsewhere in India, hidden from public view, rows of young girls (some aged as young as 5 years) can be found working alongside their mothers. For 16 hours a day their tiny, blistered fingers skilfully turn out matches for export. The toxic smell of hot liquid sulfur (in which the sticks are dipped) is overwhelming. Many of the children are forced to work because their parents are in debt to the factory owner.

Over 11 million children are forced to work in India, and campaigners fear that as India's economy continues to boom, children are increasingly being exploited to meet the country's hunger for global success.



5.2.7 A young boy works laying bricks.

Rescue and regulation

In a recent raid in the capital, Delhi, police rescued a large number of boys from local sweatshops. Agents had lured them from India's poorest regions, promising the children that they would be taken care of and paid well. They were found hidden on the top floors of garment factories—held captive in filthy, cramped rooms under lock and key. They spent their working hours painstakingly applying crystal beads to garments. These small, backstreet factories are difficult to shut down. Hundreds of children are kept hidden from public view, deep in the city's slums.

An Act of the Indian Parliament—the Child Labour Act 1986—bans the employment of children below 14 years of age in specified occupations and processes that are considered unsafe and harmful to child workers. It also regulates the conditions of children in workplaces where they are not prohibited from working. The laws remain quite ineffective.

Campaigners have tried to address the problem of bonded labour by paying off the debts of parents but many children soon find themselves back on the factory floor. When children are forced to start working at a young age, the chances are they will remain illiterate, unskilled and unable to demand their rights for equal wages and better working conditions.

UNIT 5.3

Megacity challenges: housing

Meeting the demand for housing is a challenge confronting all the developing world's megacities. This is because population growth—both from natural increase and from rural–urban migration—is greater than the growth in housing supply. Adequate housing is expensive due to lack of supply, and as a result, the poor are forced to crowd into already squalid slums or squatter settlements (informal settlements), as seen in Figure 5.3.1.

Added to the housing problem is the insecurity associated with the threat of eviction. Evictions often come with 'justifications': urban beautification; claims of illegal occupation of public and private land; construction of infrastructure; major international events; and political, military and ethnic reasons.



5.3.1 Riverbank slums, Jakarta, Indonesia. Megacities find it difficult to address the housing needs of rapidly growing populations.

Inadequate housing

The scale of the housing problem is staggering. In developing countries, almost 30 per cent of the urban population lives in slums (about 881 million people). By 2025, it is likely that up to 1.6 billion will require adequate, affordable housing.

In specific locations the challenges are immense. Forty per cent of the population of Karachi, Pakistan, live in slums and squatter settlements. In Mumbai, India, 66 per cent of residents live in shanties. In Manila, the capital city of the Philippines, the figure is 32 per cent. In Mexico City, it is nearly 50 per cent. In Cairo, Egypt, more than 1 million people live in the city's cemeteries, while many others sleep in mosques. In Lima, Peru, around 55 per cent of the city's population live in inner-city slums, and another quarter in squatter settlements. Around half a million people live and sleep on the streets in Kolkata, India; some 3.5 million people (nearly 20 per cent of the population) live in 'legal' slums, or *bustees*, and refugee settlements. In Delhi, also in India, 50 per cent of the city's 18 million people live in slums or 'unauthorised colonies' (squatter settlements) without civic amenities. In Zambia, the informal housing sector provides 60–70 per cent of urban housing. In Caracas, Venezuela's capital, it is 80 per cent and up to 90 per cent in Ghana.

Lack of services

Informal settlements are largely unplanned and this means they lack basic services such as water and electricity supply, roads, drainage systems and other vital infrastructure. Residents have to improvise on most of these services. They dig shallow wells for water; they defecate in the street or in improvised toilets. They illegally connect themselves to power supply lines and their settlements are often flooded during the rainy season because there is no proper drainage.

Government strategies

For more than 50 years, governments have tried to deal with the proliferation of informal settlements in a number of ways. Strategies have included denial, tolerance, formalisation, demolition and displacement.

Over time, however, it has been recognised that poverty and inequality cannot be simply eradicated through demolition or eviction. While efforts to accommodate and improve settlements are becoming more common, the desire for eradication persists in many cities. Forced evictions in various parts of the world are putting the rights of settlers at risk.

Many cities are looking for alternatives that formalise these areas through incremental, on-site upgrading. In addition to offering effective protection against forced evictions, it is critical to provide residents with access to basic services, public facilities and inclusive public spaces.

SPOTLIGHT

Defining informal housing

In informal settlements, residents mostly live in temporary dwellings made from tarpaulin, bamboo, cardboard, corrugated iron and other materials that are set up on vacant plots of land. These communities range in size between four and 1000 households, and are often located near construction sites, along railway tracks, behind large buildings and around the city's fringe.

UN-Habitat, the United Nations Human Settlements Programme, defines informal housing (squatter settlements and slums) as having at least some of the following five characteristics:

1. inadequate access to safe water
2. inadequate access to sanitation and infrastructure
3. poor structural quality of housing
4. overcrowding
5. insecure residential status.

Site-and-service and core housing projects	
Objectives	■ Affordable housing is provided to lower-income households or to those who have been relocated. ■ There is an increase in housing choices for the urban poor. ■ New construction techniques and materials, including traditional skills and techniques, are introduced.
Elements	■ Services such as water, sanitation and electricity are provided for each plot. ■ Core household facilities are provided (such as kitchen and sanitary facilities or, additionally, a small living space) that the owner can expand on an incremental basis (vertically or horizontally). ■ Loan schemes are offered for beneficiaries.
Beneficiaries	■ The target group is the urban poor, who are defined in terms of income and/or housing and environmental conditions and security of tenure.
Finance	■ Grants are provided to a housing agency or local government by the central government and/or international donor agencies. ■ A housing agency or local governments contribute to the investment costs, in cash or kind; for example, through provision of public land, infrastructure and social facilities. ■ Households contribute both in-kind (self-help housing constructions) and in cash. ■ Loans are made available either directly by formal credit organisations (such as housing banks) or through NGO microcredit schemes for the purchase of a plot and core unit.
Role of NGOs, community based organisations and the private sector	■ Communities are involved during the project design and implementation stages. ■ NGOs assist community organisations and mobilise the resources needed for construction and/or the repayment of loans. ■ Small and micro-scale enterprises provide services, such as iron works and plumbing.
Advantages	■ High-visibility improvements are made to people's standard of living. ■ Security of tenure gives people an incentive to invest in improving their homes. ■ An opportunity is provided to introduce new construction techniques and materials, while providing low-income housing.
Disadvantages	■ Sometimes it is difficult to know whether the initiatives have benefited those in greatest need. ■ The tendency to construct housing with higher-than-minimum affordable design standards puts many developments beyond the reach of the very poor.
Impacts	■ In common with slum-upgrading programs, these initiatives have introduced affordable housing and service standards. ■ The cost-recovery basis of the programs makes funds available for an expansion of the programs. ■ They demonstrate that low-income people can contribute both in kind and cash if correct incentives are created.
Conditions for success and the possibility for replication	■ Projects need to be modest and affordable and target the needs of the poor. ■ Where standards are set too high, low-income groups are excluded in favour of better-off households, and such projects lead to inefficient use of subsidies while the needs of the poor remain unmet. ■ Local and/or central public authorities are sometimes reluctant to establish very modest standards for fear of repeating the worst features of squatter settlements. ■ Eligibility criteria and selection procedures have to be transparent to prevent better-off groups from becoming the main beneficiaries.

5.3.2 Site-and-service and core housing projects

Meeting the housing needs of the urban poor

Some argue that squatter settlements should be demolished so squatters can be relocated to alternative places. But resettlement is socially disruptive and squatters are generally moved to less accessible locations which reduces access to informal employment. Others argue that since the numbers of people living in squatter settlements is high, it is not possible to demolish informal settlements and that upgrading them would be better strategy.

Dealing with the problem of informal settlements requires more than short or medium term measures such as simply upgrading settlements. Upgrades can attract even more people to move to the informal settlements. Long-term measures include improving the living standards of people in rural areas, since it is the people in rural areas who are migrating to urban centres in search of a better quality of life. They are deserting rural areas because of deteriorating living conditions.



5.3.3 Security of tenure encourages these settlers in Mumbai to invest time and money to upgrade their housing.

Strategies for meeting the housing needs of the urban poor include site-and-service projects, upgrading projects and core housing projects. Among the advantages of such projects are that they preserve the:

- existing economic systems and opportunities
- low-cost housing stock in accessible locations
- community and family support structures.

Site-and-service projects

Site-and-service projects involve the provision of tracts of urban land, which are divided into plots and provided with basic support services; that is, electricity, water and sanitation. The plots are then either sold or leased to those who wish to build their own home on them. The sale or lease of the plots provides capital that can be used to establish additional site-and-service projects. They also shift the housing burden from the government to the households in need of shelter. Site-and-service programs have been widely used in India, Brazil and Zambia. Having secured ownership or control of their land, residents are more inclined to invest time and money in improving the physical amenity of their dwelling.

Figure 5.3.2 outlines site-and-service projects.

Upgrading projects

Upgrading projects are usually designed for areas of the city that are already built up (see Figure 5.3.3). The objective is to transform areas that, although frequently developed illegally, provide shelter close to employment opportunities. Rather than total clearance, priority is given to the installation of infrastructure, such as water and sewers, electricity, street paving and schools. It may also involve the extension of whichever social services may be available, and the granting of tenure. Sometimes financial and building assistance will be granted, providing for the improvement of houses and business premises.

Core housing projects

Core housing projects involve the construction of a simple concrete structure with water and toilet facilities. The occupants then complete the house themselves.

Activities

Understanding the text

1 Explain why the megacities of the developing world experience a shortage of housing. Outline the extent of the problem.

2 Outline the characteristics of informal settlements.

3 Outline the various strategies used to meet the housing needs of the urban poor. What are the advantages of such projects? Why are they preferable to resettlement?

Working geographically

4 Study Figure 5.3.1 and then answer the following questions.

- a Why are people forced to live in such conditions?
- b What can be done to address the issue?

5 Study Figures 5.3.2 and 5.3.3. Outline the strategies central to the provision of site-and-service housing. How does site-and-service housing differ from upgrading and core housing projects?

CASE STUDY

Favelas of Rio de Janeiro, Brazil

Favelas (Portuguese for slums, and shown in Figure 5.3.4) are the low-income historically informal urban areas in the cities of Brazil. In Rio de Janeiro, there are an estimated 1000 favelas and they are home to about 1.5 million people, or close to 24 per cent of the city's population. The conditions in the favelas are typical of those found in informal urban housing districts throughout the developing world. They include:

- widespread poverty: average incomes are very low, as low as US$100 a month
- contaminated drinking water: usually accessed by tapping into a city water main at the bottom of the steep slopes on which the favelas are located; waterborne diseases are common
- inadequate sanitation: only about 50 per cent of favela residents have access to indoor toilets and the sewers are often open drains running at street level, creating major outbreaks of waterborne diseases; this has led to infant mortality rates 50 per cent higher than elsewhere in the Brazil
- uncollected rubbish: waste is either disposed of by incineration (which causes respiratory disease) or dumped at the foot of the favela; uncollected rubbish becomes a breeding ground for disease, especially during the city's hot and humid summers
- mudslides: initiated by heavy tropical rainstorms
- inadequate infrastructure: there are few services such as mains electricity, schools and health centres; the levels of drug-related crime are also high.



5.3.4 'Favela' is the name given to the informal urban housing areas in the cities of Brazil.



5.3.5 Complexo de Alemao, Rio de Janeiro, one of the largest favelas in the city. The cable car connects the area with the commercial district of Ipanema.

Improving the wellbeing of people living in Rio's Complexo de Alemao

The Complexo de Alemao is a collection of squatter settlements located on steep slopes in the north of Rio de Janeiro. Various initiatives have been mounted to improve the wellbeing of the people who live there. In 1995, with the aid of Inter-Americans Development Bank, Rio de Janeiro initiated the Programa Favela-Bairroo. The program's aim was to transform the favelas into regular urban districts. The program is now seen as a model for improving the living conditions in informal settlements rather than resettling inhabitants. It sought to improve the quality of life of residents by:

- providing more than 26 000 residents with access to a clean water supply and a drainage system that collected their waste; this reduced the prevalence of waterborne diseases
- installing public lighting and widening streets to improve safety in the area and to allow access for rubbish trucks to collect waste
- building new primary schools, a technical college, a library and two crèches, along with other healthcare and public services
- stabilising the hillsides around the favela to prevent future landslides
- establishing a Pacifying Police Unit to help restore law and order; the number of murders has dropped by 500 per cent, which allowed the city authorities to improve the infrastructure and public services, and to formalise and legalise the favela
- creating a safe environment for NGOs such as 'Solar' which tries to provide residents with an alternative to criminality; Solar provides day care, primary and secondary schooling and counselling
- constructing a cable car (see Figure 5.3.5) to connect the favela with the commercial district of Ipanema; this provided residents with better access to the commercial centre and improved their employment prospects.

Activities

Working geographically

1 Write a report outlining the conditions found in Rio de Janiero's favelas and the strategies being used to improve living conditions for residents.

UNIT 5.4

Megacity challenges: infrastructure

Providing access to safe water, sanitation, energy and transport are central to the infrastructure challenges faced by megacities.

Water and sewage

The provision of water and sanitation is a major challenge in megacities, such as Karachi, Jakarta, Dhaka, Mumbai and Chennai (Madras) in India (see Figure 5.4.1). Karachi supplies piped water to only 40 per cent of its population, and that is rationed to a few hours per day. Forty per cent of Jakarta's population buy water from street vendors and more than 80 per cent have no direct connection to a piped water system (they rely on groundwater extraction). In Bangkok, less than one-third of the people have access to piped water.

Keeping pace with the rapid rate of growth in these cities is impossible for the authorities responsible for providing water and sewage infrastructure. Lack of adequate funding is only part of the problem. Informal settlements can become established in a matter of days on any piece of vacant land. In such circumstances, authorities cannot plan. Communities can be established before authorities have time to provide even the most elementary infrastructure.

SPOTLIGHT

Facts: clean drinking water

- Seventy-one per cent of the global population (5.2 billion people) have access to a safely managed drinking-water service—that is, one located on premises, available when needed, and free from contamination.
- Eighty-nine per cent of the global population (6.5 billion people) use at least a basic service. A basic service is an improved drinking-water source within a round trip of 30 minutes to collect.
- An estimated 884 million people lack even a basic drinking-water service, including 159 million who are dependent on surface water. Many of these people live in the megacities of the developing world.
- Globally, at least 2 billion people use a drinking water source contaminated with faeces.
- Contaminated water can transmit diseases such diarrhoea, cholera, dysentery, typhoid, and polio. Contaminated drinking water is estimated to cause 502 000 diarrhoeal deaths each year.

Facts: sanitation

- Only 39 per cent of the global population (2.9 billion people) use a safely managed sanitation service—defined as use of a toilet not shared with other households, with a system in place to ensure that excreta are treated or disposed of safely.
- Only 27 per cent of the global population (1.9 billion people) used private sanitation facilities connected to sewers from which wastewater was treated.



5.4.1 Millions of people living in the megacities of the developing world still lack access to sanitation.

- Sixty-eight per cent of the world's population (5 billion people) used at least a basic sanitation service.
- Over 2.3 billion people still do not have basic sanitation facilities such as toilets or latrines. Of these, 892 million still defecate in the open, for example in street gutters, behind bushes or into open bodies of water.
- Poor sanitation is linked to transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid and polio.
- Inadequate sanitation is estimated to cause 280 000 diarrhoeal deaths annually and is a major factor in several neglected tropical diseases, including intestinal worms, schistosomiasis, and trachoma. Poor sanitation also contributes to malnutrition.

Activities

Understanding the text

1 Outline the extent to which the megacities in the developing world fail to provide their inhabitants with access to water and sewage infrastructure. Why is this the case?

2 Outline how authorities have responded to the challenge of meeting peoples' need for sanitation.

Working geographically

3 Study the Spotlight box: 'Facts: clean drinking water' and 'Facts: sanitation'. Use the data provided to write an extended response outlining the deficit in the provision of clean water and sanitation in the developing world and the impacts of such a deficit.

Sewage facilities in megacities are often ancient and inadequate. In cities such as Manila, Dhaka and Karachi few people living in informal housing have access to a sewage system. In general, little of the sewage collected is treated; rather it is left to flow, untreated, into local waterways. In Cairo's metropolitan region about half the sewage produced is dumped, untreated, into open drains that empty into the Nile River; the same river that is a primary source of water for irrigation and domestic use. In Indonesia, the 12 500 kg of raw sewage generated daily by the millions of slum dwellers in and around Jakarta is dumped into one of the nine rivers that flow into Jakarta Bay.

The high cost of providing infrastructure designed to conventional standards has prompted authorities to examine more cost-effective approaches. These include specially designed infrastructure better suited to the immediate needs of the urban poor. Insead of building water and sewage-disposal systems using conventional Western technology, 'low-cost' systems are used that are based on appropriate and affordable technologies, such as hand pumps and pour-flush toilets.

Energy

Because informal settlements develop in an unplanned fashion, they are rarely connected to the electricity grid. Residents must instead rely on other forms of energy (such as kerosene) or illegally connect themselves to nearby power supply lines. The latter is a dangerous practice, threatens the stability of the electricity grid and denies utilities revenue that could be used to maintain and upgrade the grid.

In India, there are an estimated 300 million urban dwellers living in energy poverty, and the vast majority of these people rely on kerosene for lighting. Use of kerosene has direct adverse effects that relate to a person's health, safety and general wellbeing. When kerosene is burnt, it releases airborne particles: carbon monoxide, sulphur dioxide and various nitrogen oxides. Exposure to these pollutants impacts on peoples' health because it increases the risk of respiratory infections. In addition, families using kerosene lamps risk burns or accidental fires started by the open flame. Kerosene-based blazes are common in India's informal settlements.



5.4.2 These homes in one of Johannesburg's 189 informal settlements are now connected to the electricity grid.

Pre-paid electricity initiative in the City of Johannesburg

City Power, an electricity supplier in the City of Johannesburg, South Africa, is investing millions to reduce illegal electricity connections and ensure the safe use of electricity in informal settlements in and around the city. This initiative includes the installation of pre-paid meters in all of the city's 189 informal settlements; see Figure 5.4.2.

In addition to meeting the energy needs of those living in informal settlements, the program is designed to reduce pressure on the grid due to illegal connections. All the illegal connections are being removed as residents are connected with legal electricity. They will be metered, so residents will need to pay for the electricity they use.

Social enterprise lights up India's slums

Pollinate Energy (a social enterprise) was founded by six young Australians in 2012, following a blackout in India that left more than 600 million people without power. With backgrounds in sustainability, renewable energy technology and economics, they understood that they could use simple solar lights to address energy poverty. A social enterprise is defined as an organisation that applies commercial strategies to maximise improvements in human and environmental wellbeing. It may also make a profit for its owners and shareholders.

Globally, more than 1.3 billion people don't have access to electricity, and over 300 million are in India alone. Despite economic development this represents 25 per cent of the country's population.

India's urban poor earn around $1.50 a day and, because they're living without access to electricity, they spend about $3 a week buying kerosene, to power a very dim light.

The solar light shown in Figure 5.4.3 is sold on a deferred payment plan to make it affordable. Customers pay for it over five weeks, and in around 10 to 12 weeks they break even on that payment. They then save the $3 a week they would otherwise spend on kerosene.

Pollinate Energy works though local entrepreneurs. These entrepreneurs effectively run their own businesses. They are trained by Pollinate Energy and, because they speak the language and understand the local culture, are able to sell the lights to the families living in the slums.

In the first four years Pollinate Energy has installed nearly 16 000 sustainable systems, mostly solar. They have reached more than 72 000 people, serviced nearly 2000 communities, and saved just over 86 million Indian rupees which would otherwise be spent on kerosene.

On the environmental side they've helped avoid 1.64 million litres of kerosene and nearly four million kilograms of carbon dioxide emissions.

Pollinate Energy is an Australian funded charity. It now operates in Bangalore, Hyderabad, Kolkata and Lucknow but aims to increase this to 20 cities by 2020.

Waste disposal

Solid waste disposal services are often inadequate in megacities. The proportion of solid waste collected in Jakarta is just 25 per cent, while in Karachi it is 33 per cent, in São Paulo 36 per cent, in Kolkata 55 per cent, and 70–80 per cent in other megacities, such as Chennai, Manila, Mexico City and Bangkok.

In many cities, the recycling of solid waste has become an important source of income for the very poor. Manila's 'Smokey Mountain' landfill was notorious, as is the city's Payatas landfill. In Beijing, an estimated 100 000 poor rural migrants scavenge through the 20 000 tons of waste generated each day by the city's 20 million people in search of any recyclable material. For this they earn about US$50 a month; a small fortune compared to what they could earn on a farm.

Providing the infrastructure for the collection and treatment of solid and liquid waste is often beyond the resources of megacities. Initiatives promoting the recycling of waste materials not only contribute to a reduction in solid waste but also provide a source of much needed income for the urban poor.

Smokey Mountain landfill, Manila, Philippines

While the Philippines Government has now closed the Smokey Mountain landfill, many of the scavengers simply migrated to the city's Payatas dump site, the largest open landfill in the Philippines (see Figure 5.4.4). Approximately 80 000 people now live in the area adjacent to the dump.

The Fairplay For All Foundation is one of the non-profit NGOs working with residents of Payatas. Its programs include a grassroots football team, Payatas Football Club, a registered Alternative Learning Center (the Fairplay School), and the Fairplay Cafe which serves healthy food in the community. Fairplay's vision is to achieve a 'level playing field on and off the pitch'—that is, the foundation aims to create an environment where residents can develop, learn, and grow to break their own cycle of poverty.



5.4.3 An Indian craftswoman uses a Pollinate Energy light to earn an income.

Activities

Understanding the text

1. Explain why illegal connections to the electricity grid are seen as problematic.
2. Outline the extent of energy poverty in India. Why is the use of kerosene so dangerous?
3. Outline how the issue of illegal connections to the electricity grid is being addressed in Johannesburg.

Working geographically

4. Outline the ways that Pollinate Energy is making a difference to the wellbeing of slum dwellers in India.
5. Investigate inititives being used in different megacities to address the issue of energy poverty. Write a report outlining your findings.



5.4.4 Manila's rubbish pickers. The sorting and recycling of waste generates an income for some of Manila's poorest residents. Here children and adults work as a scavengers. Nearby, slum-dwellers working for a British charity are turning rubbish into fashion items that are proving popular in high-end London shops. At its height, 30 000 people made their living from picking through the landfill's rubbish.



5.4.5 Heavily polluted waterway in Jakarta, Indonesia. The failure to collect waste and dredge such waterways has resulted in an increase in flooding and the incidence of waterborne disease.

Jakarta's clogged waterways increase the severity of flooding

Jakarta's clogged waterways, seen in Figure 5.4.5, are not just an eyesore. They amount to a serious urban environmental problem that has killed dozens of people during increasingly frequent flooding events. These floods displaced more than one million people and led to billions of dollars in losses.

Jakarta's flooding problem has become progressively worse for two reasons. First, the national government and city officials have not provided the funds necessary to dredge the city's 17 rivers and canals or collect the mass of waste generated by its rapidly growing population. Officials estimate that 20 per cent of the city's waste ends up in local rivers and canals.

Second, unchecked development in the greater Jakarta region, which is now home to more than 30 million people, has meant that retention ponds, swamplands and other open spaces, which would previously absorb rainwater, were paved over for shopping malls and apartment blocks.

It was not until 2012 that the first dredging program in four decades took place, carried out by both the city government and the national Ministry of Public Works, and supported by a US$189 million grant from the World Bank.

DID YOU KNOW?

One tonne of trash produces up to 200 litres of biogas, which is enough to power an average home for one hour.

Community recycling of domestic waste by women in Dakar, Senegal

The Set-Setal settlement in Dakar, Senegal, has a population of over 45 000. In the past, municipal authorities struggled to collect 35 per cent of the 263 cubic metres of waste produced each day. Fifty-one per cent of households had no toilet facilities and 76 per cent had no way to process wastewater, which was typically poured onto the streets. Infectious diseases, such as typhoid and malaria, were common.



5.4.6 Congested street in Jakarta, Indonesia

In an example of a community-based initiative, women in the settlement have embarked on a waste management program. The results of the program have been impressive. They include the following:

- Waste is collected regularly, and informal dumps have been eradicated. This has improved the sanitary and health status of residents.
- Income is generated from supplementary activities, such as the sale of compost and recycled plastics.
- The managerial abilities of the women involved have been enhanced.
- Poverty has been alleviated through the employment of jobless youth, mostly from female-headed households.
- The approach has been adopted in other parts of the country.



5.4.7 Mumbai's railways are critical to the functioning of the city.

Activities

Understanding the text

1. Describe the scale of the problem of uncollected soilid waste in megacities of the developing world. Why is it a problem? What can be done to address the issue?
2. Outline the importance of recycling for the urban poor.

Working geographically

3. Write a paragraph outlining the relationship between uncontrolled urban waste and the incidence and severity of flooding in Jakarta, Indonesia.
4. Outline how the community recycling of domestic waste by women in Dakar, Senegal is addressing the issue of urban waste. What other benefits are derived from the initiative?

Transport infrastructure and congestion

Congestion in a megacity worsens as its population increases. Growing populations overwhelm the existing urban infrastructure, much of which in the developing world is old and poorly maintained. Managing congestion is a complex and challenging task. To avoid constraints on their growth, cities need to plan for effective transportation and fund the infrastructure associated with the provision of housing, electricity, telecommunications and other services.

Jakarta: the megacity with the worst traffic congestion

Jakarta has been named the megacity with the worst traffic congestion. Three and a half million people a day commute into the city from the wider metropolitan area of Greater Jakarta and many come by car. The cars, though, are mostly motionless, it is gridlock during the 5 a.m. to 8 a.m. and 5 p.m. to 8 p.m. rush hours, and for much of the day. Research using satellite navigation data has found that the average driver starts and stops more than 33 000 times a year. An estimated 70 per cent of the city's air pollution comes from vehicles. See Figure 5.4.6.

Keeping Mumbai moving

In Mumbai, traffic congestion is described as appalling. In a city of 18 million inhabitants there are 1.8 million motor vehicles. The number of vehicles is growing every day as more drivers take to the roads. The city's middle classes have been expanding and as people have been getting richer, the number of cars has been multiplying. Fortunately, Mumbai has an extensive, albeit overcrowded, public transport network. Ninety per cent of the city's commuters still use the railways. In recent years, both the city's rail network and roadways have been upgraded.

Mumbai is typical of many of the developing world's megacities. Rapid population growth has placed a tremendous strain on the city's transport infrastructure. Roads are clogged with traffic and the rail network struggles to cope with commuter loads well in excess of what it was designed to carry (see Figure 5.4.7). Every day more than 200 trains make over 2000 trips along 300 kilometres of track, carrying more passengers per kilometre than any railway on Earth. In many parts of Mumbai, walking is faster than driving through congested traffic.

To address the problems of congestion, Mumbai has embarked on one of the world's largest transport infrastructure construction projects. The three-phase Mumbai Urban Infrastructure Project (MUIP), funded by the World Bank, seeks to strengthen the city's mass transport infrastructure and improve the efficiency and capacity of the suburban railway services. To supplement the MUIP initiative, the Mumbai Metropolitan Region Development Authority has initiated a program of road network improvements and the construction of an efficient traffic-dispersal system in Greater Mumbai. To avoid consuming more land, a new eight-lane bridge will carry traffic 4 kilometres over the sea.

MUIP phased development

Phase I: This commenced in 2002 and was completed in 2011. At a cost of US$700 million, Phase I included the construction of link roads, 644 eco-friendly buses, traffic management systems and air quality monitoring. Rail projects included an increase in capacity on existing rail corridors, rail line extensions, new rolling stock, and new maintenance facilities.

Phase II: Phase II included further rail corridor capacity building (additional tracks), new rolling stock, maintenance facilities, as well as station improvement and trespassing controls.

Phase III: Approved in late 2011, the US$8.1 billion Phase III includes a fast transport corridor from the city's principal rail terminal to the city of Panvel to the east of Mumbai with a connection to the proposed new Navi Mumbai International Airport. It also includes an extension of the Harbour Line to Borivali, and multiple additional tracks being laid on existing routes. The project is scheduled for completion in 2031.

SPOTLIGHT

Mumbai's Coastal Road Project

The Coastal Road Project is a 29.2 kilometre freeway that will run along Mumbai's western coastline connecting Marine Lines in the south to Kandivli in the north. The estimated cost of the project is US$2.3 billion.

The Coastal Road will be built into two phases. It will have eight lanes, including two lanes dedicated for a bus rapid transit system. The project will require the reclamation of around 164 hectares of land including a large area of mangrove wetlands. The project can be viewed on a YouTube™ animation.

Activities

Understanding the text

1 Explain why congestion is such a huge problem in the megacities of the developing world.

2 Outline how the issue of congestion has been addressed in the city of Mumbai.

Working geographically

3 Investigate the progress being made on Mumbai's Coastal Road Project.

4 Investigate the strategies being adopted in other megacities. Present your findings as a written report.

5 Working in a group, discuss how authorities could respond to the traffic congestion experienced in megacities. Which of these responses would be the most responsible given the scarcity of resources and the other pressing urban problems they must address?

CASE STUDY

India

Housing the urban poor of Kolkata

The involvement of NGOs in the development of low-income housing in urban areas is a relatively recent phenomenon. In India, the government has expressed a strong interest in promoting the work of such bodies, especially where they work with community-based organisations to improve the quality of housing and related services. The willingness of Indians to volunteer is being harnessed by various NGOs. This is an empowering exercise aimed at training poorer communities to become involved in programs that improve their own living conditions. It is also seen as part of the process of social change.

The provision of housing and land for the urban poor can serve a political purpose. For example, it reduces the likelihood of community-based activism by the urban poor. This was certainly the case in Kolkata, India, which was one of the first developing world cities to adopt a policy of upgrading slums.

Kolkata's 'legal' slums, or *bustees*, are inhabited by the organised urban poor and a section of the lower middle class. Because of their terrible living conditions (see Figure 5.4.8), the *bustees* have always been seen as a breeding ground for political activism, and even revolution.

In the late 1950s, a bustee movement, led by the Indian Communist Party, vigorously campaigned against slum clearance. They were successful in preventing mass evictions at a time when slum clearance and relocation of the poor was government policy. In time, this local political involvement led to one of the most successful slum-improvement programs in the developing world.

Plans that were developed in conjunction with the Bustee Improvement Program emphasised the need for slum renovation and upgrading, rather than demolition.

When India's state-based government authorities intervene in the housing or rehousing of 'legal' slum dwellers they tend to marginalise local voluntary organisations and NGOs. Often the entire voluntary sector is bypassed. When this occurs, the role of local welfare organisations and community-based organisations is limited to finding accommodation in low-income settlements for the new arrivals.

Rather than withdrawing completely, NGOs often focus on the next lowest social strata: the squatters, or 'illegal' slum dwellers, who have pressing housing needs and are still unorganised. Most local authorities and political parties tend to have little interest in this section of the urban poor and as such NGOs do not receive political support.

From the point of view of those most affected—the inadequately housed urban poor—the chance to improve their living conditions often depends on whether they are politically organised or not. For the latter, self-help initiatives and NGOs are often the only hope.

Young people empowering the urban poor of Mumbai

In developing countries, NGOs play an important role in helping to reduce and eliminate poverty. Their activities vary widely, but their aims are the same. Youth for Unity and Voluntary Action (YUVA) is one of many NGOs working in Mumbai, for the rights of the urban poor. It organises youth and women for social action around the issues of poverty, the environment and governance.



5.4.8 Kolkata Municipal Corporation's Bustee Improvement Program aims to overcome urban poverty and degradation such as this.

YUVA dates from the late 1970s, when a group of students of Nirmala Niketan College of Social Work, Mumbai, ventured into the squatter settlements of Jogeshwari as a part of a college placement. Their work in the slum inspired them to draw up a fully-fledged program for underprivileged youth—the chief objective being to develop a rights-based approach to address structural inequalities and respond to the issues of the poorest and most marginalised. They believed that when the oppressed were made aware of these inequalities, they would come together to address them. Thus, the program aimed to develop a young leadership capacity among vulnerable populations. A few years later, on 30 August 1984, Youth for Unity and Voluntary Action was formally registered as a voluntary development organisation supporting and empowering the oppressed and marginalised by primarily concentrating on their human rights.

One of YUVA's main activities is supporting pavement dwellers, who are under constant threat of being evicted and of having their makeshift homes bulldozed by the municipal authorities. Often when people are evicted, the authorities offer to relocate them to the outskirts of the city, far from their work and from their children's schools. Most soon trickle back to their old locations and the cycle starts again.

These people find themselves powerless in the vice between politicians and large urban developers. This situation also offers considerable scope for petty corruption by local officials.

YUVA educates people about their rights with respect to housing, employment and schooling for their children. Recognising that, as elsewhere, most responsibility for household survival falls on women, YUVA also supports activities such as women's savings funds.

Swachh Bharat Abhiyan (Clean India Mission)

Swachh Bharat Abhiyan is an Indian Government-sponsored campaign to clean the streets, roads and infrastructure of the country's cities and towns (see Figure 5.4.9). It is India's largest ever cleanliness campaign.

One of the aims of the initiative is to reduce or eliminate open defecation through the construction of individual, cluster and community toilets. By constructing 12 million toilets in rural India, the government aims to achieve an Open-Defecation Free India by 2019, with US$30 billion allocated to the campaign.

Worldwide, an estimated one billion people, or 15 percent of the global population, still practise open defecation. India has the highest number of people engaged in the practice, around 490 million people, or nearly a third of the population. Most open-defecation takes place in rural areas, where an estimated 52 per cent of the population engage in the practice, as opposed to urban areas, where the figure is thought to be around 7.5 percent.



5.4.9 India's Home Minister, Rajnath Singh, inaugurates Smart Public Toilet Facility in Delhi. The communal toilet facility was funded by the Swachh Bharat Abhiyan initiative.

It is hoped that the initiative will liberate up to a million low-caste Dalits from the task of manually cleaning non-flush toilets. Manual 'scavenging'—the removal of human excreta from dry or non-flush toilets—is a centuries-old practice in India. It is mainly carried out by the Dalits, formerly known as the untouchables, who are at the lowest rung of the Hindu caste system. They go from house to house every morning to collect night soil (human faeces). Most are paid as little as US$5 a month.

Activities

Working geographically

1. What is central to the approach adopted by NGOs when working to improve the housing conditions of the urban poor in Kolkata?
2. Why is the provision of housing described as having a 'political purpose'?
3. Explain why Kolkata has been able to develop one of the most successful slum-improvement programs in the world.
4. On whom do NGOs focus their efforts? Why?
5. Write a paragraph outlining the aims of the government-sponsored initiative, 'Swachh Bharat Abhiyan (Clean India Mission)'. What problems does it aim to address?

UNIT 5.5

Megacity challenges: health and wellbeing



5.5.1 Mumbai waterway. As in many cities of the developing world, untreated sewage and other wastes are dumped directly into local waterways.



5.5.2 Versova Beach—before (**A**), during (**B**) and after (**C**) the clean-up

In the megacities of the developed world, urbanisation is associated with improved health and living standards. However, growing poverty—both relative and absolute—in the megacities of developing countries has had serious impacts on the health of the urban population. This is especially true of infectious and parasitic diseases associated with deficiencies in the physical environment, such as overcrowded housing, inadequate water and sewage infrastructure (see Figure 5.5.1), air pollution, uncollected garbage, vermin (such as rats), diseased domestic pets, and dangerous workplaces.

Health issues

Overcrowding is associated with the transmission of infectious diseases, especially airborne respiratory diseases such as colds, pneumonia and tuberculosis. These spread quickly in crowds and where personal hygiene is poor. Lack of privacy can lead to mental health problems, contributing to stress, depression and other psychosocial disorders.

Food contamination due to a lack of facilities and hygienic conditions for food preparation and storage also results in the occurrence and transmission of infectious diseases. Food contamination leading to diarrhoea and dysentery contribute significantly to illness and premature death of children. Many of the urban poor purchase food from street vendors, a sector that is poorly regulated and where food is often prepared in unsanitary conditions.

Rats, fleas and the bubonic plague (associated with rat infestations) are another factor in urban environmental health. Long consigned to history books in developed countries, the Black Death is still an occasional feature of urban life in some of the developing world's megacities. An outbreak was reported in Madagascar as recently as November 2014.

Meeting the health needs of rapidly expanding urban populations often exceeds the resources available to governments and city authorities. Doctors are in short supply and existing hospitals are overcrowded.

Key facts: diarrhoeal disease

Diarrhoea is a symptom of infections caused by a host of bacterial, viral and parasitic organisms, most of which are spread by faeces-contaminated water. Infection is more common when there is a shortage of adequate safe water for drinking, cooking and cleaning, and sanitation and hygiene are lacking.

- Diarrhoeal disease is the second leading cause of death in children under five years old.
- It is both preventable and treatable.
- Each year, diarrhoea kills around 525 000 children under five.
- A significant proportion of diarrhoeal disease can be prevented through safe drinking water and adequate sanitation and hygiene.
- Globally, there are nearly 1.7 billion cases of childhood diarrhoeal disease every year.
- Diarrhoea is a leading cause of malnutrition in children under five years old.

Improving health

Improving the health of those living in informal settlements not only depends on increasing access to medical services, but also involves cleaning up settlements and providing access to a clean source of water and sanitation. Swachh Bharat Abhiyan, the Indian Government's campaign, has a focus on cleaning the streets, roads and infrastructure of the country's cities and towns. It is India's largest ever cleanliness campaign.

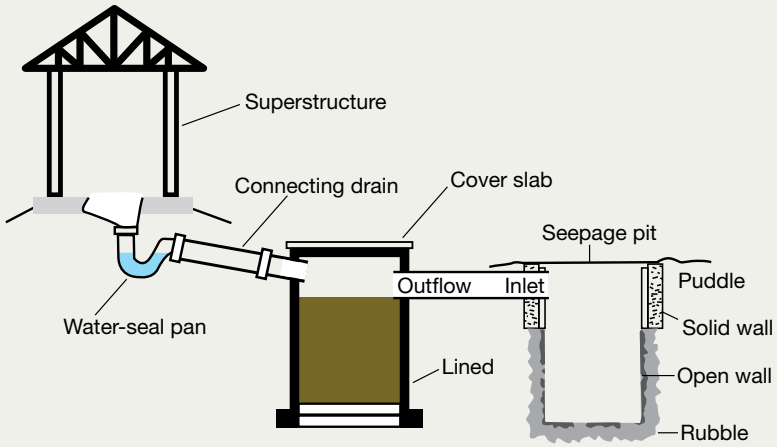
One initiative involved cleaning up Mumbai's Versova beach, as seen in Figure 5.5.2.

SPOTLIGHT

The pour-flush toilet

A pour-flush toilet (see Figure 5.5.3) has a water seal that avoids the problems associated with odour and insects. Excreta is flushed by pouring 2–3 litres of water into the pan. The mixture is directed into a pit, where the biodegradation of organic wastes occurs. The water used in the flushing process percolates through the soil surrounding the pit, so the potential for groundwater pollution is very high. Therefore, pour-flush toilets are not a suitable solution to the sanitation needs of the urban poor when the groundwater table is close to the surface.

Sludge must be emptied regularly from the pit. The use of two adjoining pits alternately enables the sludge in a full pit to undergo further decomposition while the other pit is being used. It also facilitates the manual emptying of sludge after further decomposition.



5.5.3 Pour-flush toilets are a relatively cheap response to the needs of unplanned urban settlements in megacities.

As with pit latrines and composting toilets, grey water (waste water from the kitchen, laundry and bathroom but not the toilet) has to be treated separately. This is often done by the construction of a seepage pit or trench.

Over a period of 85 weeks, 5.3 million kilograms of trash was removed from the beach and adjacent waterways. The Versova Residents Volunteers (VRV) group led the clean-up. Another initiative involves promoting cleanliness among children through a comic series featuring Chacha Choudhary, one of India's most popular cartoon characters.

SlumAid: working to improve the health of slum dwellers

SlumAid (see Figure 5.5.4) is a UK-based NGO that raises funds and recruits volunteers to work with some of the world's poorest communities to improve peoples' health and access to education. With projects in Mumbai, Jaipur and Nairobi, SlumAid supports local NGOs in efforts to improve the health of slum dwellers through disease control and better nutrition. In Mumbai, its partner's mobile health clinics treat eczema and common colds, as well as leprosy and tuberculosis. Many of these conditions are preventable with vaccinations, improved infrastructure and more knowledge about hygiene and maternal and neonatal care. Children, especially, were dying unnecessarily and in high numbers. Babies came with tetanus after home deliveries, gastroenteritis from waterborne disease, and even measles.

SLUMaid.org
A project of New Millennium Networks Ltd

5.5.4 The SlumAid logo

Air pollution

One of the major challenges for developing world megacities is to clean up the pollution resulting from years of uncontrolled, unregulated industrial production. Despite recent efforts to address the problem, sulphur dioxide emissions from industry remain a major problem. Meanwhile, new emission problems emerge; notably higher levels of lead (from leaded petrol) and nitrogen oxides (a pollutant associated with increasing access to and use of motor vehicles). Such air pollution is commonly associated with acute and chronic illnesses, such as asthma and bronchitis. Infrastructure failure and the resulting traffic congestion contribute to inefficient fuel use and worsening pollution.

One approach to megacity development is 'knowledge-based development'. This is city development that is intentional, planned, better coordinated and more purposeful. These initiatives can be used to alleviate congestion, pollution and related health problems. Central to this approach is the role of the people themselves, in the form of self-help projects, community self-government and better government.

Tackling New Delhi's air pollution

Authorities in India's capital have announced a range of measures to combat the crippling air pollution that regularly engulfs the city, especially in winter, as seen in Figure 5.5.5.

New Delhi is one of the world's dirtiest cities. It's not unusual for air-borne particulate matter to sore above 900 micrograms per cubic metre—more than 90 times the level considered safe by the World Health Organization (WHO).

Short-term measures include banning all construction and demolition activity and shutting down the city's coal-fired power plants. On occasions the city reduced the number of cars on the roads by operating an 'odds and evens' system, depending on the vehicle's registration number. Also included are bans on diesel-powered electricity generators. Long-term strategies include stricter emission controls for cars and a tax on diesel-fuelled vehicles entering the city.

Activities

Understanding the text

1 Outline the health and nutritional problems affecting residents of megacities in the developing world. Under what conditions do infectious and parasitic diseases flourish?

2 Outline how these issues might be addressed. Give examples.

3 List the main sources of pollution affecting environmental quality in megacities. What is their impact on public health?

Working geographically

4 Write a report outlining the impacts of diarrheal diseases. What does the Versova Beach clean-up tell us about the effectiveness of community-based initiatives?

5 Write a paragraph outlining the activities of SlumAid. Why are initiatives such as this proving beneficial? Why is education important in improving the health and nutrition of the poor?

6 How is the issue of air pollution being addressed in New Delhi?

7 Investigate how issues of air, water and noise pollution are being addressed in different megacities of the developing world. Present your findings as an oral report.

8 Discuss the proposition that low-tech community-based facilities (such as the pour-flush toilet) are an adequate response to the challenges faced by the urban poor in megacities.



5.5.5 The iconic 'India Gate' in New Delhi engulfed in smog in winter.

UNIT 5.6

Responses to challenges

According to various United Nations reports on the urban environment, the major needs for the future are to:

- strengthen local government and make it more effective
- implement new approaches for alleviating poverty through local job promotion
- develop supportive communities
- make cities more environmentally friendly.

This will require not only a strengthened role for governments, but also the involvement of many other participants, including the poor themselves and the private sector. Community-based approaches and utilising the expertise and experience of NGOs will be central to any sustained improvement in the urban environment of megacities.

NGOs and community-based groups are particularly important in social processes, such as the mobilisation and articulation of interests, the mobilisation of local resources and the implementation of improvement programs (see Figure 5.6.1). The efforts of NGOs are especially important in mobilising communities to safeguard and improve the quality of the urban environment. In Bangkok, NGOs have launched a Magic Eyes ('magic eyes are watching you') anti-litter campaign to persuade older school-age children and their parents to help keep the city clean. In parts of Karachi, the city's poor have benefited from NGO efforts to provide water pipes, septic tanks and sewerage systems in unauthorised (shanty town) settlements. As a result of such efforts, communities now have their own water and sanitation system, all installed at only one-tenth of the normal cost. Private businesses, working through NGOs, have assisted in making basic housing projects more successful in Manila.

In some of the major Asian cities, planners are setting up Environment Management Action Plans. In Beijing, Mumbai, Colombo, Jakarta and Manila, such plans are being assisted by Metropolitan Environment Improvement Programs. These programs aim to reverse the process of environmental degradation caused by rapid urbanisation, industrial pollution and neglect. They also try to involve civic and professional groups, commercial associations, religious and community organisations and the media.

A lack of financial resources is a major obstacle in fostering community-based development. Experience now shows that, once they are organised, communities can and do begin to contribute their own financial resources and repay loans. The developed world's urban experience provides an example of how such a commitment can be achieved. There is a close parallel between the role played by community based credit unions and building societies and the self-help initiatives operating in megacities. A contemporary parallel in rural Australia is the formation of community-based banks and credit unions.



5.6.1 Residents of Hyderabad, India, use motors to pump drinking water from a government water supply pipe.

Jakarta: community based action

Jakarta is a city of nine million people. Surrounding the built-up area are a large number of informal settlements, called kampongs, which lack most municipal services and basic infrastructure, such as paved roads, adequate drainage and clean water. Due to the lack of proper sanitation, frequent flooding and overcrowding, the environment of many of these kampongs has suffered serious degradation.

Kampong residents lack the resources, organisational ability and political clout to improve conditions. The Indonesian Government attempted to deal with these problems by initiating a series of centrally planned infrastructure projects. Local governments and communities had little input into the planning process, and lacked the resources to maintain them.

Activities

Understanding the text

1 According to the United Nations, what are the major needs for the future of megacities?

2 Who will need to be involved in this process?

3 How can the shortage of financial resources in megacities be addressed?

4 What role will NGOs and community-based groups play in the future of megacities? Give examples of the initiatives undertaken by such groups.

Working geographically

5 Study 'Jakarta: community based action'.

- a Describe the living conditions in the kampongs.
- b Why were the residents unable to improve the conditions in the kampongs?
- c What was the response of the government? Why was this response unsuccessful?
- d How has the government's approach changed? What are the advantages of this new approach?
- e Outline the approach adopted by Mercy Corps Indonesia. Why is this approach considered a success?

6 Write a paragraph outlining the benefits of the initiatives undertaken by the UNICEF-supported Slum Improvement Project in Dhaka, Bangladesh.

7 Access the website of the Mumbai Metropolitan Region Development Authority and prepare a report outlining the initiatives being undertaken to improve the city's transport infrastructure.

8 Investigate the activities of NGOs working in the squatter settlements of megacities. Outline the nature of the approach being used. In particular, focus on how they mobilise the community and initiate self-help projects.

9 Using the internet, find examples of responses to the challenges of megacities by community-based groups, NGOs, TNCs and individual governments. Summarise your findings in a table, for example:

Challenges	Responses by community-based groups, NGOs, transnational organisations and individual governments
Access to employment	
The provision of shelter	
Water and sewage	
Health and nutrition	
Air, water and noise pollution	
Waste disposal	
Congestion and the provision of transport infrastructure	

In recent years, the Indonesian Government has changed its approach. It now encourages the private sector and local communities to become more involved, especially by building up the capacity of local leaders. For example, in one kampong area, local council members organised and motivated residents to participate in a gardening and clean-up program. The result was to transform kampong residents from passive recipients of government assistance to active participants in their own development, and in the process it gave them valuable experience in organisation and community action.

'Healthy Places, Prosperous People' program

Another example of a successful initiative is the 'Healthy Places, Prosperous People' program run by Mercy Corps Indonesia, a US-based NGO. With funding from International Development Research Centre (IDRC), the Urban and Regional Development Institute (URDI), the USAID-funded Environmental Services Program (ESP) and SwissContact, the program seeks to improve the neighbourhood quality of slums in North Jakarta. The program encourages the residents of slums to work closely with the local government in addressing water supply, sanitation and solid waste issues. This initiative is a good example of how a community-based program works to address environmental problems in the slum neighbourhoods. Mercy Corps Indonesia initiates the program but then supports residents to work closely with each other to address their problems. The slum residents' willingness to improve their neighbourhood is the most important factor of the success of a community-based program in addressing environmental problems in slum neighbourhoods.

'Slum Improvement Project' in Dhaka, Bangladesh

Dhaka is one of the fastest growing megacities in the world. The city's vast slums pose one of its biggest challenges. Up to 40 per cent of the total population of the city live in informal settlements or slum-like areas. These areas have few if any basic utility services, including potable water, sanitation and drainage.

The Slum Improvement Project (SIP), a local government initiative supported by UNICEF, was established to address the social and environmental problems affecting Dhaka's slum dwellers. Based on a participatory approach, the initiative has provided an integrated package of basic physical, social and economic infrastructure services to the urban poor. The project's microcredit program has been found to be particularly successful. Many poor households have increased their income using this facility. The SIP has significantly raised levels of awareness, particularly in health and sanitation among slum dwellers, resulting in significant reductions in the incidence of disease. The SIP has empowered poor women through community involvement, particularly through the savings and credit program, thereby enhancing the overall status and economic independence of women in families and communities.

UNIT 5.7

Mexico City: a megacity

Mexico City is one of world's largest megacities. In 2017, the population of the city proper was 8.9 million. The population of the city's larger metropolitan area is 21.2 million.

Mexico City was once one of the most attractive cities in the Americas, with magnificent public buildings and tree-lined streets. Today, Mexico City is a noisy, crowded, traffic-congested city dominated by high-rises and encircled by hundreds of slum districts (see Figure 5.7.1). This includes the world's largest mega-slum, Neza-Chalco-Itza, which has an estimated population of four million. While most inhabitants have access to basic amenities, the vast majority of people live below the poverty line. Drug abuse is widespread and the crime rate is high. Mexico City's challenges include overcrowding, poverty, pollution, corruption and a chronic shortage of clean water.

Six times larger than any other Mexican city, the city dominates the economic, cultural and political life of the country. It has 16.6 per cent of Mexico's total population, produces 44 per cent of the country's GDP (which makes it the world's thirty-ninth largest economic entity) and is responsible for 52 per cent of all industrial production and 54 per cent of the country's services.

It provides more than 40 per cent of the jobs in manufacturing and 80 per cent of government employment. It has 50 per cent of the country's theatres, 75 per cent of its radio stations and all its TV stations. Mexico City is, therefore, a primate city; that is, a city that completely dominates other urban centres within the country.

Physical setting

Mexico City lies in a 7500 square kilometre bowl-shaped basin at an elevation of more than 2100 metres. The basin is surrounded by snow-capped mountains that rise a further 1000 metres above sea level. The mountains trap the city's smog, producing atmospheric pollution that was once considered to be the world's worst.

Without a river to provide water, the city has had to depend on wells and springs. The extraction of groundwater is unsustainable and has led to widespread land subsidence throughout the city. As water is pumped out of the subsoil, parts of the city sink. In some places, the rate of subsidence exceeds 30 centimetres a year. This adds to the cost of building and maintaining the city's infrastructure, such as its public buildings, transport system and water and sewage systems. As the city's water resources have been depleted, the authorities have had to bear the heavy cost of pumping water in (and sewage out) over surrounding mountains.

Much of the city occupies the site of a now-dry lake. This makes the city especially vulnerable to the effects of earthquakes, which tend to be much more destructive in areas dominated by unconsolidated sedimentary deposits. Earth movements cause water pipes to fracture and leak. As much as 20 per cent of the city's water supply is lost in this way. The last major earthquake occurred in 1985 and caused extensive damage to large parts of the city.



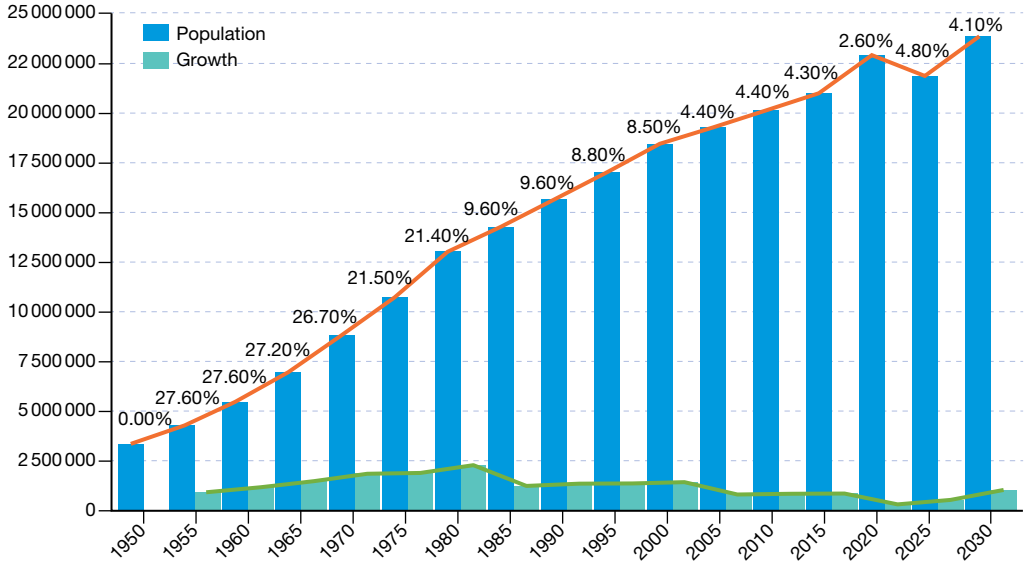
5.7.1 Mexico City is the world's largest megacity.

Rapid growth

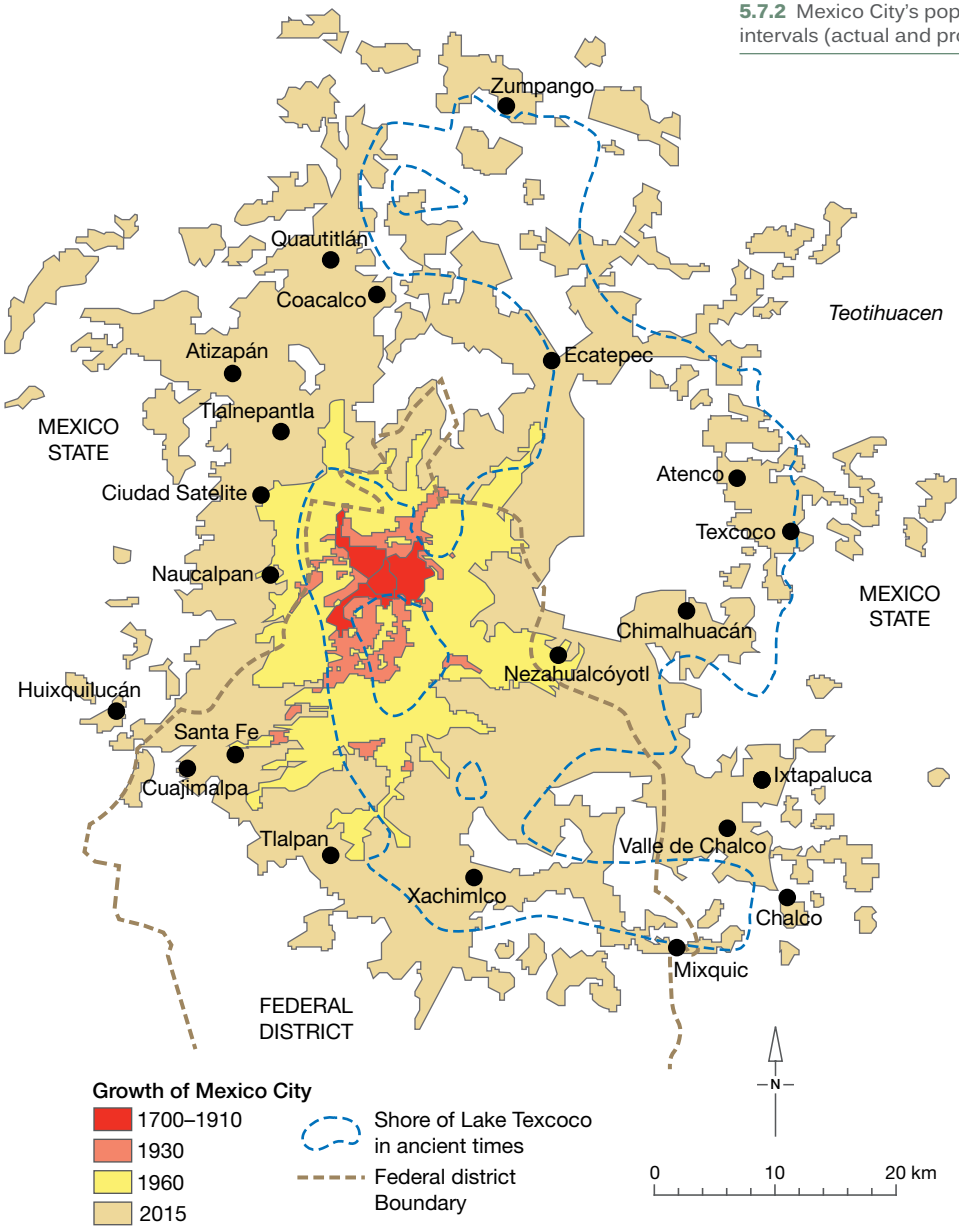
Mexico's rate of urbanisation has been rapid. Just over 79 per cent of the country's 127.5 million people now live in urban centres. In 1980, the figure was 66 per cent. Between 1950 and 2017, Mexico City's population increased from 2.9 million to 21.3 million. While the rate of growth has slowed, the city is expected to have a population of 23.8 million by 2030. The city's average annual rate of growth averaged 5.2 per cent for the 25 years from 1950 to 1975 and 2.1 per cent between 1975 and 2000.

Between 2000 and 2015, annual growth averaged a much more modest 1.2 per cent. (See Figures 5.7.2, 5.7.3 and 5.7.4.)

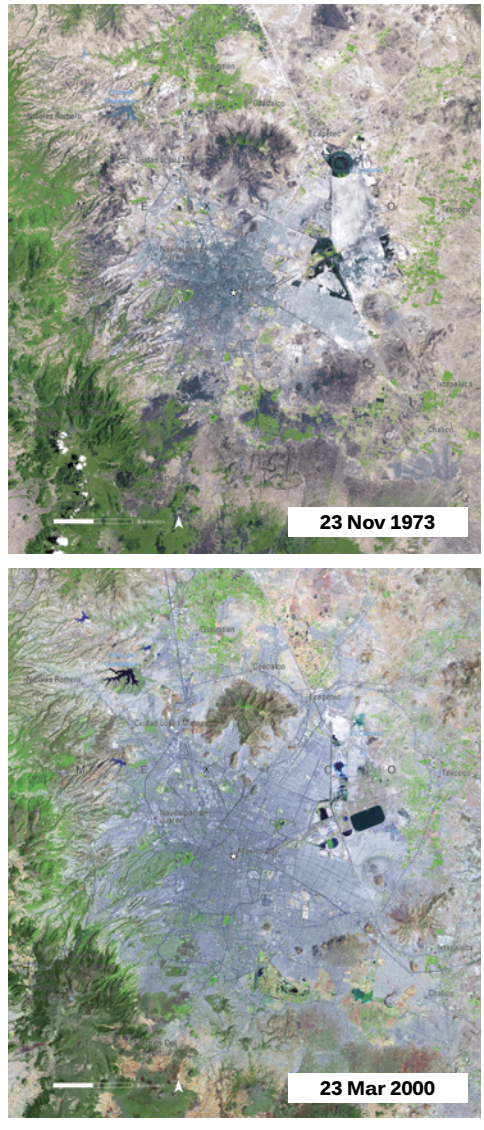
In the period between 1965 and 1990, 11.4 million people poured into the city from rural areas. This influx accounted for nearly 40 per cent of the city's population growth; the balance was a result of natural increase. The rate of net migration is now close to zero. This accounts for the lower annual population growth rate projected for the period 2020–2030 in Figure 5.7.2.



5.7.2 Mexico City's population growth and annual growth rates, five-yearly intervals (actual and projected), 1950–2030



5.7.3 The growth of Mexico City, 1700–2015



5.7.4 Growth of Mexico City's urban sprawl—satellite images 1973 and 2000



5.7.5 The Los Cuartos slum district, Mexico City

Many of the new arrivals during the peak period of rural–urban migration were men who came to find jobs and then sent for their families. Most were landless peasants displaced by the expansion of the cash cropping initiated by foreign-based agribusiness corporations and encouraged by a government eager to boost the income derived from exports.

Even though the rate of growth has slowed, the city will continue to grow. The source of this growth is already in place. Half of the city's population is under the age of 18, and because of the continued expansion of large-scale cash cropping, the drift to the city is likely to continue. Mexico's rate of natural increase (1.3 per cent in 2016) is expected to remain relatively high by world standards. The teachings of the Catholic Church and the Latin tradition of machismo (male sexual assertiveness) hinder campaigns promoting birth control.

Social and spatial inequalities

There are great contrasts in the level of economic and social wellbeing experienced by the people of Mexico City. The affluence of the city's west side and some of the southern suburbs contrasts with the poverty of the north-east and the illegal squatter settlements known as *ciudades perdidas* (lost cities)—see Figures 5.7.5 and 5.7.6.

In the city's poorest areas, millions of people live in unacceptable conditions. Overall, 28 per cent of families, each averaging 5.5 people, live in single-roomed homes made of concrete blocks and corrugated iron. The streets are mostly unpaved, and many areas don't have access to safe drinking water or sewerage systems. Open drains become a breeding ground for disease.

Mexico city's *pepenadores*

Pepenadores is a Mexican word for 'waste pickers'. They operate in the landfills, where they often live with their families, and collect solid waste suitable for recycling. The *pepenadores* endure hard and risky working conditions and live in a less-than-healthy environment. Moreover, they are forced to sell the waste they collect at very low prices, earning on average US$219 a month. Over 10 per cent of *pepenadores* are children, bringing in up to 40 per cent of their families' incomes.

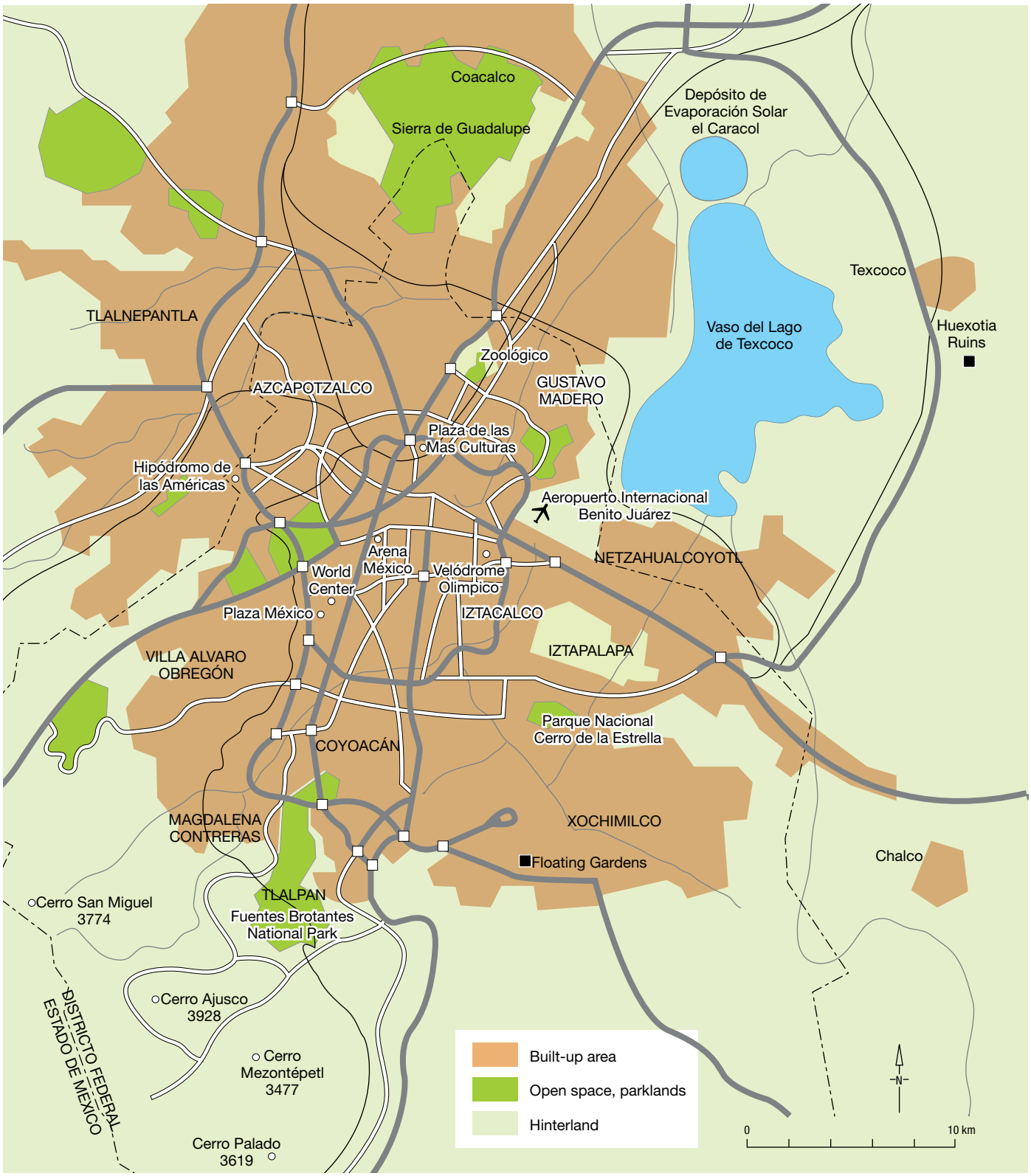
To address the plight of the *pepenadores* the NGO Mundo Sustentable has built a sorting centre outside the landfill. Children are prohibited from working there, and the *pepenadores* can sort waste faster and more efficiently. Ten recycling shops have also been built to create new jobs and provide education about recycling. In addition, the NGO supports children's education, sending as many as possible back to school.

The social impacts of the initiative are already apparent with over 400 families involved. The income of the families has risen 40 per cent, their health has improved and their children are now in school. The amout of waste being recycled has also increased, giving an environmental bonus.

SPOTLIGHT

Transport in Mexico City

- The Mexico City Metro is the second largest in North America after the New York City Subway. With 195 stations, 226.49 kilometres of track and more than 5.6 million passengers a day, the metro is the ninth busiest in the world. In 2015, there were 1.623 billion pasenger journeys.
- Many above-ground structures in Mexico City, such as the Segundo Piso freeway, are now specially designed to withstand seismic activity by moving with, rather than against, the tremors of an earthquake.
- According to Mexico's Ministry of Road Transport and the Federal District, Mexico City has among the highest concentration of cars in the world, with over 5.5 million vehicles.



5.7.6 Mexico City

Cultural life

For Mexico City's affluent elite, the city remains one of the most exciting and sophisticated cities in Latin America. It is a city of broad boulevards and gleaming office towers, of sparkling fountains and large, attractive gardens and parklands. Entertainment ranges from plays to bullfights. There are several symphony orchestras and dozens of art galleries and museums (see Figure 5.7.7). The National Museum of Anthropology, with displays of Aztec and Mayan art, is one of the world's finest. In some of the wealthier neighbourhoods, people live in palatial homes protected by their own security guards.



5.7.7 Mexico City's Palace of Fine Arts, a famous theatre, museum and music venue in Mexico City. The broad boulevards and gleaming office towers, sparkling fountains and large, attractive gardens and parklands stand in stark contrast to the conditions in which the city's poor live.

Economics and finance

Trade liberalisation and deregulation have produced some winners. In 1992, in the midst of one of the country's worst economic crises, the number of billionaires in Mexico increased from 10 to 15. Their combined wealth was equal to 10 per cent of Mexico's GDP. Large-scale farms and private industries geared towards the North American market have also benefited.

Since the signing of the North Atlantic Free Trade Agreement (NAFTA) in 1989, tens of thousands of new jobs have been created in the northern states, which span the Mexico–US border. Most of the manufactured goods produced in the region are destined for North America (USA and Canada) and the broader global market. Globalisation and debt have, in the recent past, combined to make Mexico's economy vulnerable to events on global capital markets. In the financial collapse of 1994, more than one million Mexicans lost their jobs.

Mexico's economic position is now better than it was in the 1990s. In mid-2017, the country's national debt stood at 45.17 per cent of the nation's GDP (or US$477,448,000,000). This compares with Australia's 31.6 per cent of GDP and the USA's 106.39 per cent of GDP. So while the debt is now relatively modest by international standards, interest payments on this accumulated debt (US$29 billion a year) limit Mexico's ability to address the challenges facing its cities.

The challenges of living in Mexico City

Unemployment and poverty

Mexico has one of the world's most unequal distributions of income, with half of the country's wealth in the hands of its richest 1 per cent (see Figure 5.7.8). In terms of income, the top 20 per cent of population appropriate 55.5 per cent of the wealth, while the poorest 40 per cent of people control just 13.9 per cent. Almost 20 per cent of workers earn less than the minimum wage (US$3.90 per day) and two-thirds earn no more than twice the minimum salary. As a result, half of all families lack the necessary income to purchase or rent a dwelling available in the formal real estate sector. Because of this, the majority of the urban poor have been forced to construct their own dwellings in self-help (informal) settlements.

Officially, 3.7 per cent of the city's population are unemployed, but underemployment (where part-time workers are unable to find full-time work) runs to nearly 25 per cent. High levels of underemployment keep wages low. In addition, working conditions are often hazardous and workers may be dismissed if they seek to improve their conditions. Many of those unable to find full-time paid employment are forced to earn a living in the informal sector of the economy.



5.7.8 The striking division between a wealthy, middle-class neighbourhood, and adjacent slums demonstrates inequality in Santa Fe, Mexico City.

Inadequate urban infrastructure

Much of the city's existing urban infrastructure is inadequate, with hospitals, schools, roads and public transport all overcrowded. In some areas there is no infrastructure at all. Access to medical treatment, while still difficult for the urban poor, has improved significantly since the introduction of universal healthcare in 2012. Despite this, life expectancy is still a decade less than that in Australia.

A quarter of the city's dwellings do not have sewerage facilities and 20 per cent do not have access to clean water, a third lack drainage and 12 per cent do not have electricity. Only 70 per cent of the city's garbage is collected and processed. Of the rest, half gets dumped in illegal landfill sites; the rest is left to rot in the streets. Only about 15 per cent of the wastewater is collected. Untreated wastewater is discharged to the drainage system, from where it flows north and is reused in irrigated agriculture.

Impacts on health

The lack of a functioning sewage system in parts of the city has a major impact on public health. Vast amounts of human waste are deposited in gutters and vacant lots every day, attracting rats and swarms of flies. When the wind picks up the dried excrement, a 'fecal snow', often falls on parts of the city. This results in outbreaks of salmonella and hepatitis, especially among children.

The use of untreated wastewater to irrigate vegetables grown for urban food supplies also threatens public health. Cysticercosis, a disease caused by tapeworms that invade the human brain, used to be transmitted primarily by cooked pork. Now people are contracting the disease from vegetables irrigated with the polluted waters of the Tula River. Untreated wastewater also contributes to the high incidence of hepatitis in the city. High levels of cadmium and lead found in local waterways also pose a major health threat.

Attempts to solve the water shortage

Maintaining a constant water supply to the city has been an ongoing struggle. The volume of groundwater pumped out exceeds the rate at which it can be replenished. Additional water must now be brought in from other areas, such as the Cutzamala River. Despite this expense, the poorly maintained infrastructure means that close to 40 per cent of the water is lost because of leaks and breaks in pipes. About 70 per cent of the city has fewer than 12 hours of running water per day. In the hardest-hit areas, 18 per cent of the population have to wait several days for just an hour or two of supply. The situation gets worse in periods of drought. Much of what water is available is unsuitable for drinking. Those who can afford it buy bottled water.

Housing

More than 60 per cent of the city's population live in its sprawling informal settlements. With few alternatives, most urban families must either construct their own dwellings in self-help settlements or rent. In terms of official housing policy, self-help settlements are no longer viewed as a problem. They are now regarded as a solution to be promoted. Such self-help initiatives are seen as playing a critical role in meeting the basic need for residential accommodation in Mexico City.

Most government funding has been directed towards building the following:

- ***Colonias populares*:** These are newer, unconsolidated, informal settlements, which are often built on high-risk sites. Most settlements have been improved to varying degrees as property titles are regularised, utilities provided and houses more solidly built. Such settlements make up roughly half of the urbanised area of Mexico City and house 60 per cent of the population. They include *Vivienda progresiva*—progressive housing that provides a simple core structure that can be gradually expanded by the owner-occupant.
- **Site-and-services:** These are projects in which the beneficiaries receive lots (equipped with access to water, drainage and electricity), on which they may build their own dwelling units from scratch.

The terminology used to differentiate between the various types of self-help settlement varies, but the the most effective system of classification is:

- self-help settlements housing the urban poor
- other types of housing occupied by the urban poor
- middle-class public housing
- middle-class and upper-class private developments
- higher income housing.

The final two classifications are beyond the reach of the vast majority of people who live in Mexico City.

Figure 5.7.9 provides an estimate of each housing type's share of the total housing stock in the city.

Self-help settlements housing the urban poor

Self-help settlements housing the urban poor consist of the following:

- Officially sponsored **site-and-services** (see Figure 5.7.10) and progressive housing projects.
- ***Colonias populares:*** This is the most common type of housing. The self-built structures occupy about 50 per cent of Mexico City's surface area. The illegal nature of these is usually tolerated by authorities.
- ***Colonias de paracaidistas:*** These are settlements formed as a result of land invasion (see Figure 5.7.11). The word *paracaidistas* means 'parachutists'. Dishonest brokers 'sell' lots of vacant land—former dump sites, street right-of-ways and empty lots whose owners live elsewhere—to families seeking home sites, then organise a mass invasion, usually at night. The brokers keep the money, and the squatters keep the land—if government authorities or hired security guards do not evict them. Invasions have become less common as other housing initiatives have been put in place.

In each case, dwellings are typically built by the initial owner-occupants. Over time, the dwellings are improved and the neighbourhood upgraded. *Colonias populares* and *colonias de paracaidistas* begin their existence without legal entitlement to the land. Residents must mobilise themselves to secure legal title to the land they occupy.

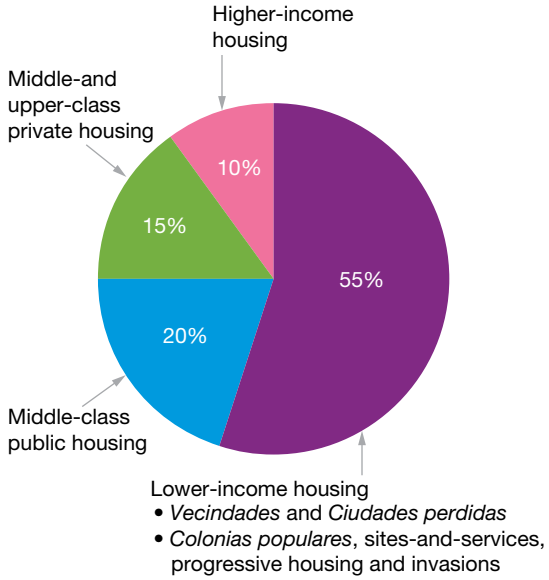
Other types of housing occupied by the urban poor are described below:

- ***Vecindades* (inner-city apartment buildings):** Built before 1940, these structures have one or two storeys. Each building consists of 20 to 50 units, each with one or two rooms. Bath and toilet facilities are shared. They are generally located in the central part of the city.
- ***Ciudades perdidas* (translated as 'lost cities'):** These are densely crowded inner-city slums, lacking reticulated water and drainage.

Traffic congestion

Mexico City's traffic congestion grows worse each year as more and more cars crowd the already congested streets. Of the more than 3.5 million vehicles on the streets of Mexico City, 30 per cent of them are more than 20 years old.

In an attempt to alleviate the problem and curb the city's chronic air pollution, a massive underground rail system has been built. With more than 226 kilometres of track, the subway carries more than 5.6 million passengers a day. Fares are kept low to encourage people to use the system. At rush hours, the crush is so great that authorities have reserved special carriages for women.



5.7.9 Housing types and their share of the total housing stock in Mexico City



5.7.10 Even in site-and-services housing, life remains difficult for the residents of Mexico City.



5.7.11 Despite efforts to improve informal settlements some Mexicans are still forced to live in appalling conditions.

Activities

Understanding the text

1. Outline the problems faced by Mexico City.
2. Describe the extent to which Mexico City dominates the economic, political and cultural life of Mexico.
3. Describe Mexico's physical setting. Explain how the city's geography contributes to the problems it faces.
4. Outline the difficulties experienced in maintaining the city's water supply.
5. Outline the factors that contributed to Mexico City's rapid growth.
6. Explain why Mexico City's growth will continue for the foreseeable future.
7. Outline the social and spatial inequalities evident in Mexico City.
8. Outline the social and economic impacts of globalisation on this city.
9. Identify the extent of unemployment and poverty in Mexico City.
10. Outline the ways in which the city's urban infrastructure is considered inadequate. What impact does the lack of infrastructure have on public health in Mexico City?
11. Explain why Mexico City's self-help housing initiatives are viewed as a solution to the city's housing shortage.
12. Distinguish between the different types of housing occupied by the urban poor.
13. Explain why is it important to grant squatters a legal tenure of the land they occupy.

Air pollution

In 1992, the United Nations named Mexico City the most polluted city on Earth. Following a major clean-up, air pollution is now less of a problem. Carbon monoxide pollution has dropped dramatically, while levels of sulphur dioxide and nitrogen dioxide are just a third of those recorded in the early 1990s. Despite this improvement, ozone pollution remains a problem, with atmospheric concentrations 2.5 times that considered safe by the World Health Organization (WHO). Airborne particulate matter remains an issue that impacts on peoples' health. Despite these improvements there are still, on average, 50 days a year when the air is considered too polluted to exercise outdoors.

The region's geography

The city's air pollution is made worse by the geography of the region. The city lies in a basin surrounded by mountains, and frequent thermal inversions trap pollutants at ground level. The city's altitude also contributes to the problem. The thin air not only contains 30 per cent less oxygen than at sea level but also results in car engines producing nearly twice as much carbon monoxide and hydrocarbon pollution as they would at sea level.

Impacts on health

At its worst, air pollution accounted more than 100 000 deaths a year. For the children of Mexico City, breathing the air was often the cause of chronic, life-long lung problems. A high proportion of young children were found to have levels of lead in their bloodstream. The levels are high enough to cause intellectual defects and damage the nervous system. Fortunately, lead levels have been reduced by 95 per cent.

Ozone concentrations are still considered at levels considered unsafe by the WHO. These are high enough to affect even healthy people. Ozone irritates the eyes and throat and causes respiratory problems.

Government responses

In the past, vehicle emission standards were rarely enforced and the government was unwilling to antagonise business by imposing restrictions on industrial pollution. Corruption was widespread and officials were often 'persuaded' not to enforce existing pollution standards.

The clean-up of Mexico City's air followed the intervention of federal and local government authorities. Companies were required to install pollution reducing technologies. A strict biannual vehicle emission inspections system was introduced, as was a rotating one-weekday ban on private car use. On days of high pollution, the ban extends to every second day and some manufacturing activities are curtailed. Other interventions include mandating low sulphur fuels (that is, diesel and gasoline), regulating emissions from heavy and light duty vehicles, and the introduction of lead-free fuels. The introduction of a metro bus rapid transport network and bike-sharing initiatives were also promoted as greener forms of transportation.

An ongoing problem

While improvements have been made, suspended 'particulate matter' remains a threat to public health throughout the city. It's a catch-all term used to cover pollutants made up of everything from dust, black carbon (soot) to mineral dust. In the poorer part of the city, uncollected or abandoned solid wastes and sewage that dries into dust pollute the air. The winds that carry these body wastes and the excrement from the city's two million dogs are a likely source of many illnesses. These particles lodge in peoples' lungs and cause asthma, emphysema or cancer. Particulate matter produced from human sources is estimated to reduce average life-expectancy by 8.6 months.

Responses to the challenges of living in Mexico City

Mexico's international debt limits the country's ability to respond to the problems that plague its largest city. The debt, most of which is owed to US private banks, soared from US$36.6 billion in 1977 to US$607 billion in 2017. Servicing this debt consumes 13.6 per cent of the country's export earnings (down from a massive 66 per cent in 1979) and 47.9 per cent of its GNP. Spending on education, by comparison, represents only 5.2 per cent of its GNP. Spending on health accounts for a further 6.3 per cent.

Despite the limitations imposed by the country's debt burden, a number of initiatives have been implemented to address the problems faced by the city.

Slowed population growth

Attempts to curb the city's rapid growth have been met with some success. As noted earlier, the city's growth rate has slowed from an annual average of 5.4 per cent in the 1970s and 1980s to 1.5 per cent in 2017. The rate of immigration has declined, while the flow of people to Mexico's smaller urban centres has increased through a government strategy of promoting economic development in other parts of the country. Much of Mexico's recent economic growth has been concentrated along the Mexico–US border. Here, US TNCs, keen to take advantage of cheap Mexican labour, have established new production facilities. This trend has accelerated under the North American Free Trade Agreement. Mexico City's overcrowding and inadequate infrastructure may also be discouraging potential immigrants.

Solutions to water shortages

The city's growing demand for water resources has also been addressed over time. Initially, the Cutzamala system met the demand for water beyond that supplied by groundwater sources. The system is one of the largest water supply systems in the world, in terms of both the total quantity of water supplied (about 485 million cubic meters per year) and in terms of the 1100 meters difference in elevation that has to be overcome. It took six new power stations to power the pumping equipment required. A further six per cent of Mexico City's water is sourced from the Lerma River system and pumped to the city.

The main sources of water (and their approximate contributions to total water supply) are:

- abstraction of groundwater (73 per cent)
- Cutzamala system (18 per cent)
- Lerma system (6 per cent)
- rivers and springs (3 per cent).

Activities

Understanding the text

1 Identify the main sources of Mexico City's air pollution. What factors have contributed to an improvement in recent years?

2 Describe the impact of pollution on public health.

3 Outline the strategies that have been put in place to improve the city's air quality.

4 Identify the other types of pollution that affect air and water quality in the city.

5 Identify the factors that limit the government's ability to address the problems of Mexico City.

6 Specify the steps that have been taken to help reduce the flow of immigrants into Mexico City.

7 Outline how the city's water shortage and pollution problems are being addressed.

8 Explain how the city's vast squatter settlements benefited from various self-help initiatives. How has the government assisted?

Working geographically

9 Study Figure 5.7.2. Using data from the graph, describe the growth of Mexico City and how the rate of growth has changed over time.

10 Study Figures 5.7.3 and 5.7.4. Write a paragraph describing what the map and satellite images tell us about the growth of Mexico City over time.

11 Study Figure 5.7.5. Describe what this photograph tells us about the nature and extent of Mexico City's slums.

12 Study Figure 5.7.9. State the proportion of Mexico's housing stock occupied by lower-income groups.

Air quality improvements

Mexico City's air quality has been the focus of a concentrated international effort. The World Bank has sponsored a project to curb air pollution through public transport improvements, use of emission standards and improvements to air quality monitoring. The Mexican Government has started to shut down polluting factories, is phasing out diesel-powered buses and has mandated emission controls on new cars. All new cars in Mexico must now have catalytic converters (devices for reducing emissions). Trucks must now use only liquefied petroleum gas (LPG).

In 1989, the government instituted a day-without-a-car program, banning 20 per cent of all automobiles from the city each week. Although the air improved slightly during the first year, the problem worsened again as those who could afford to do so bought a second car to avoid the ban. With the number of cars growing by 400 000 a year, the task of reducing the city's air pollution is an ongoing struggle.

Self-help housing initiatives

The city's vast squatter settlements have benefited from a variety of self-help initiatives. Neighbourhood groups work together to improve the quality of life of the people and their communities. The government has assisted in this process by giving squatters legal title to the land they occupy. Given security of tenure, they are more willing to invest their scarce resources in upgrading and enlarging their homes. The government also assists by providing some basic urban infrastructure. It is self-reliance and community based action that holds the greatest hope for the city's future.

Activities

Working geographically

1 Working in small groups, list the ways in which community action groups may work together to improve the quality of life experienced by the people of Mexico City.

2 Undertake internet research to gather additional information dealing with the challenges of living in Mexico City. Outline some responses to these challenges.

3 Undertake internet research. Investigate a megacity in the developing world (other than Mexico City) and prepare a written report that:

- **a** names and locates the city
- **b** describes its physical setting
- **c** provides details about its size and rate of growth
- **d** outlines the social and spatial inequalities experienced by the city's population
- **e** discusses the challenges faced by those living in the selected megacity
- **f** outlines the responses to the challenges of living in the selected megacity
- **g** evaluates the effectiveness of the responses.

Use the information collected to illustrate any extended responses written on this topic.

SPOTLIGHT

National Geographic Channel: Megacities

The National Geographic Channel has screened a series of programs focusing on the world's megacities. Three of these were of particular relevance to this topic.

Mumbai, India (published 2016)

Public transportation is Mumbai's lifeline. The trains of this megacity were built for 1700 passengers, but they now carry three times that number; and the crowding will only get worse. This program examines Mumbai's large-scale lunch delivery known as the dabbawalla system, which is recognised as one of the best-managed supply chains in the world. Forbes magazine awarded the system its highest rating.

São Paulo, Brazil (published 2017)

More than 21 million people live in São Paulo and every day they generate 14 000 tonnes of garbage. But São Paulo is undergoing a green revolution. This program follows one aluminium can from the time it is picked up by one of the *catadores* (trash-pickers, who make their living from collecting recyclables) through pressing, melting and remelting, to the moment it is ready to become a new can.

Mexico City, Mexico (published 2017)

On one side of Mexico City is one of the world's most earthquake-prone hotspots. On the other side is one of the world's most active volcanoes. And beneath its feet lies a shaky foundation of landfill. From subways to freeways, this program examines how Mexico City is harnessing cutting-edge technology to build in safety.

Activities

Working geographically

1 Watch one of the National Geographic Channel's 'Megacities' programs. Write a report outlining the urban challenges featured and the manner in which they are being addressed.

Exam-style questions

Extended responses

- Outline the nature, character and spatial distribution of megacities in the developing world.
- Describe the challenges of living in megacities and evaluate the responses to these challenges.
- Outline three challenges of living in megacities. Explain how people have responded to these challenges.
- Evaluate the role of community-based groups and nongovernmental organisations in addressing one challenge of living in megacities.

Glossary

formal sector the area of economic activity that is formally recorded by the state; that is, the area in which it can intervene either directly or indirectly

guest worker a foreign worker who is permitted to enter a country temporarily in order to take a job for which there is a shortage of domestic labour

informal sector economic activities that are not regulated by labour and taxation laws or monitored for inclusion in gross domestic product estimates; it includes, for example, street vendors

megacity a very large urban agglomeration of at least 10 million inhabitants

microcredit the extension of small loans to entrepreneurs who are too poor to qualify for traditional bank loans; in developing countries especially, microcredit enables very poor people to engage in self-employment projects that generate income

new international division of labour late twentieth century set of global economic relationships characterised by the growing dominance of service industries in the global economic core (that is, the developed countries) and an associated shift of manufacturing to parts of the developing world

over-ruralisation more rural residents than the economy of a rural area can sustain

over-urbanisation more urban residents than the economy of a city can support

primate city a city that dominates the urban system, government, economy and culture of a region or country; primate cities are much larger than the second-ranking urban centres

squatter settlement a roughly built dwelling that is characteristic of those in many cities in the developing world; generally inhabited by migrants from rural areas seeking employment; also known as a spontaneous settlement

CHAPTER

6 Urban dynamics

During the post–World War II era, a house in the suburbs was a focus of the Australian dream. The attractions of suburban living were numerous: a single, spacious home on a quarter-acre block, a garden in the front and back, a two-car garage, a pet or two, a backyard barbecue, separation and privacy and perhaps even a pool. These attracted an ever-increasing number of residents away from the crowded inner city and towards the expanding suburban frontier. In the decaying inner cities, 'push factors' abounded: congestion, pollution, deteriorating infrastructure, declining services, an ageing stock of housing and increasing crime.

The 1990s witnessed a partial reversal of this trend. Inner-city living was again popular, especially with young professionals who saw advantages in living close to work and their preferred entertainment venues. Processes of gentrification, urban renewal and urban consolidation were important urban dynamics that transformed the once blighted inner city into fashionable residential precincts. In recent years this trend has accelerated. Areas close to the city centre are now experiencing a building boom. Former industrial sites are now home to clusters of medium- and high-density housing blocks that typically include commercial space for new, lifestyle-related providers of goods and services—cafes, restaurants, gyms and convenience stores.

When investigating the spatial organisation of large cities, geographers seek out and investigate the processes responsible for any changes taking place. These processes are often referred to as urban dynamics. In this unit we investigate some of the dynamics shaping the morphology of large cities in the developed world. Particular attention is given to the processes of suburbanisation, exurbanisation, counter-urbanisation and decentralisation, as well as urban decay and renewal, urban consolidation, urban villages and spatial exclusion.

> **The test of the quality of life in an advanced economic society is now largely in the quality of urban life. Romance must still belong to the countryside—but the present reality of life abides in the city.**
>
> **John Kenneth Galbraith, economist**

6.0.1 The seemingly endless Australian suburbia



UNIT 6.1

Suburbanisation

The introduction of trams and suburban railway networks in the latter half of the nineteenth century made suburban living possible for an increasing number of people. Mass car ownership from the mid-twentieth century onwards accelerated the trend. These trends, together with the development of the commercial trucking industry, attracted people and industry to suburbia. As a result, the inner city and suburbia became increasingly distant from each other.

Until the 1970s, people typically worked in the central city but lived in the suburbs. The suburbanisation of commerce and industry, already underway in the early twentieth century, intensified during the 1960s and 1970s, resulting in a complete restructuring of the metropolitan economy. This process was led by retail, especially development of the large regional shopping centres (the first in Sydney being the Roselands Shopping Centre which opened in 1965). It was closely followed by an upsurge in the suburbanisation of employment: first manufacturing employment but more recently, office-based activities.

Today, multifunctional urban cores known as 'mini-cities' or 'edge cities', have become a distinctive feature of the urban landscape. Many are now self-sufficient urban entities containing their own economic and cultural activities. Most compete with the central business district (CBD) for economic activities, such as telecommunications, high-tech industries and corporate headquarters. Examples of Sydney's edge cities include Parramatta, Chatswood, North Sydney, Campbelltown, Liverpool and Bondi Junction.

In an era dominated by globalisation and economic restructuring, suburban areas are showing that they have the power to attract activities characteristic of both the 'new' and 'old' economy. This will sustain the suburbanisation process well into the twenty-first century. Government interventions are reinforcing this trend. The relocation of key NSW Government departments to the Parramatta CBD are an example of such interventions.

The flight to the suburbs

The flight to the suburbs is most apparent in 'New World' countries, such as the United States, Canada, Australia and New Zealand. It is not a universal phenomenon. In Europe, with its much older tradition of urban living, suburbanisation has been less evident. Here, new social and community institutions were created to deal with emerging urban ills, such as poor-quality nineteenth-century industrial housing and deteriorating social environments in the inner city. European cities, for the most part, remain dominated by medium- and high-density housing typically served by extensive public transport infrastructure. Examples include London's Underground, Paris' Metro, and the U-Bahns in Vienna, Berlin, Hamburg, and Munich. Rates of car ownership are low by North American and Australian standards.



6.1.1 Housing estate in Milton Keynes, Buckinghamshire. The city, 72 kilometres north-west of London, is now home to 230 000 residents. Development of the city commenced in 1967.

New Towns movement

One of the strategies to tackle the problems of the inner city in the UK and the USA was the New Towns movement. This movement was a response to the urban problems of the nineteenth-century industrial city. The new towns were planned as a response to the overcrowding and congestion of cities such as London, Manchester and Liverpool.
The intent was to decongest larger industrialised cities, rehousing people in freshly built, new and fully planned towns that were completely self-contained and self-sufficient (see Figures 6.1.1 and 6.1.2).

The British New Town was a separate physical entity where people would spend most of their daily lives, living and working. The new towns were planned under the powers of the New Towns Act (1946) and developed in three waves. In the first wave, new towns were developed beyond London's green belt to house people from poor or bombed-out housing following World War II. The second phase (1961–64) was initiated to alleviate housing shortages. The final and last wave of new towns (1967–70) catered for population growth by developing new urban centres further north from those developed in the first wave. These later developments included the expanded towns initiative: existing towns which were substantially expanded to accommodate what was called the 'overspill' population from densely populated areas of deprivation.

The US equivalent of the New Town was more like the suburban development that takes place on the fringes of Australia's large cities. Reston, Virginia, seen in Figure 6.1.3, is one of the few New Town–type developments in the USA. Founded in 1964, Reston was built with the goal of transforming post–World War II concepts of urban land use and residential/corporate development in suburban America. Medium density housing was used to conserve open space and mixed-use areas were developed to integrate industry, business, recreation, education and housing land uses.

A more significant development was the investment in public or government housing. This was a particular feature of European planning for lower income groups. Today, up to 30 per cent of all housing in these countries is public housing. In Australia and New Zealand, there was less emphasis on public housing stock. Greater stress has been placed on maximising access to low-interest housing loans (mortgages), which had interest rates below the market rate for commercial finance. In the United States, there was even less emphasis on public housing.

The successes and failures of the New Towns movement, together with the experience of the poorly planned urban expansion of Australian cities in the 1960s and 1970s, has informed the process of urban planning. The new 'greenfield' suburban developments on the outskirts of Australian cities incorporate many of the lessons learnt—see Figure 6.1.4.



6.1.2 There are 22 'New Towns' across the UK. Together they are home to around two million people. Most, however, never achieved the self-sufficiency planners had hoped for. Those near London, for example, have increasingly become home to those who commute to the capital each day for work.



6.1.3 Reston, Virginia, USA, was established in 1964. Planners sought to integrate medium- and high-density housing and commercial land uses within a planned community.



6.1.4 Oblique aerial photograph of Sydney's Norwest Business Park and Bella Vista. The urban planning lessons learned from earlier eras of suburban development have been applied in the development of Sydney's north-west.

Transport changes and urban morphology

Until the introduction of the railways, cities remained very compact. Because most people walked to work they tended to live close to their place of employment, in rows of terraces and semi-detached housing. The increased mobility offered by the railways led to the development of small, nucleated, suburban areas adjacent to a railway station. Urban areas subsequently developed a star-shaped pattern. The introduction of tram systems, and later buses, led to some infilling of areas between railway lines. Ultimately it was the introduction of the automobile that transformed the urban landscape.

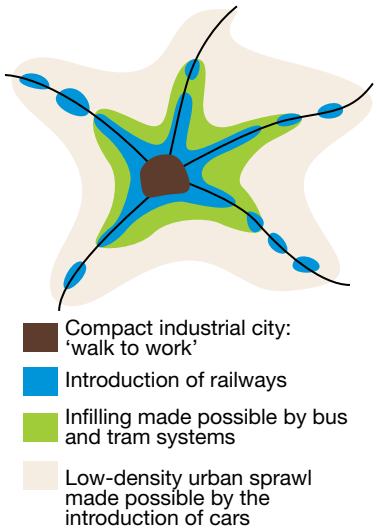
Road systems led to infilling and the extension of urban areas. The infrastructure required by cars now impacts on both the functional form and environmental qualities of urban areas. The car dominates the urban landscape.

Suburban Epping

In Australia, suburban living first developed around the stations on main rail lines radiating out from the CBDs of large cities, resulting in the star shaped pattern shown in Figure 6.1.5. Buses and trams allowed for suburban infilling between rail lines. The introduction of widespread car ownership in the 1950s and 1960s liberated people from a reliance on public transport and led to the development of urban sprawl.

One of Sydney's early railway suburbs was Epping, shown in Figure 6.1.6. Epping was established shortly after the opening of the railway station in 1886. A post office opened in 1887 and homes soon lined the streets surrounding the station. Development further away from the station was, however, slow until the end of World War II when the demand for housing led to a surge in development.

Today, Epping's town centre is undergoing a major redevelopment as part of the NSW Government's 'Urban Renewal Area' initiative—a policy promoting urban consolidation. This initiative follows the decision to make Epping a junction station on the new rapid transit Sydney Metro Northwest line to be completed in 2019. The changes to zoning cover 54 hectares surrounding the station. It will permit building heights of eight to 22 storeys within a 400-metre radius of the railway station. About 3750 additional homes will be accommodated within the designated development zone. Many residents are concerned about the scale of the development. Of particular concern are the issues of traffic management, lack of parking, stormwater drainage, and access to schools.



6.1.5 Development of a hypothetical city showing the influences of technological developments in transport.

Suburbanisation in Australia

Suburbanisation in Australian cities largely commenced with the introduction of trams (see Figure 6.1.7) and the development of the rail network, which led to the suburban railway era. The railways were the dominant influence on the form of cities from the 1860s to about 1920, when residential corridors developed along railway lines.

The arrival of the automobile era released households from the constraint of having to locate near railway lines. Its effect on the form of cities was twofold: infilling occurred between the major transport corridors and growth continued outwards, often referred to as 'urban sprawl'.

As transport became cheaper and more readily available, more and more Australians were able to purchase their own detached house on its own block of land, which came with privacy, seclusion and security. Until the early 1970s, the idea of the owner-occupied family home on a quarter acre block (see Figure 6.1.8) was considered by many Australians to be the basic right of every family. Any other form of housing was seen as temporary rather than a permanent substitute.



6.1.6 Epping was one of the many Sydney suburbs to develop around a suburban railway station. In the future it will become an edge city, featuring a cluster of commercial and residential towers.



6.1.7 Sydney trams in George Street outside the Queen Victoria Building, 1920. Suburbanisation in Australian cities commenced with the introduction of trams and the development of the rail network.

Other factors that 'drove' the process of suburbanisation include the following:

- High birth rates and immigration generated a demand for housing. New migrants, predominantly from non-Anglo-Celtic European countries, took up residence in the inner-city locations vacated by suburbanising households. Immigrants from the United Kingdom, Ireland, the Netherlands and Germany tended to settle in suburban locations with Australian households. The outcome was a distinct pattern of ethnic residential segregation.
- There was an expansion in home ownership. Some consider this to be a politically motivated program designed (by conservatives) to dampen the radial political ambitions of the working class. This view is held by those who see home ownership as a way to build a vested interest in the maintenance of the capitalist, free market economy. In the 1920s, government policies favoured lower-density suburban development; and included policies like the War Service Homes Scheme, which financed the building of separate houses on individually owned blocks.
- Rising standards of living enabled working-class and middle-class families to move from the crowded, inner localities to the low-density, detached housing of the new middle and outer ring suburbs.

Changing suburbia

Today's Australians continue to live in the broad sweep of post–World War II suburbs that ring our cities. Many young couples still migrate to the urban fringe, where house-and-land packages provide them with their first home more cheaply than elsewhere in the urban area. Economic change associated with the restructuring of the global economy has had major impacts on the social and economic life of suburbia.

Manufacturing jobs were traditionally the mainstay of middle-class and lower-class suburbia. The impact of mechanisation and economic restructuring (driven by financial deregulation and tariff cuts) has meant the number of manufacturing jobs has sharply declined. In 2017, only 7 per cent of Sydney's jobs were in manufacturing. In 1991 it was 14 per cent which, in turn, was less than half the proportion four decades earlier when manufacturing-based employment helped promote the suburban dream for so many families.

There have been significant increases in inequalities among suburbs. The income gap between the least and most well off 5 per cent of urban Australians more than doubled between 1976 and the mid-1990s. During the late 1990s and early 2000s, relatively strong economic growth led to a decline in unemployment, but inequalities continued to grow. The shift to the new economy resulted in rapidly rising incomes for some (especially those employed in the information-based industries) but not all. For many, getting a job meant working in the relatively low-paid segment of the expanding service sector, such as retailing and hospitality.

The Australian dream of a house and land in suburbia is receding. Since the 1960s, housing has become less affordable relative to income. Households have fewer members. The population is ageing. There are more single-parent families. A smaller (and declining) proportion of the urban population now live in large, detached suburban dwellings (see Figure 6.1.9).

Gentrification, urban consolidation (processes encouraging a surge in inner-city residential development) and an apartment-building boom that dates back as far as the 1960s, have all contributed to the end of the long post-war boom in suburban (residential) development. Tony Dingle, a prominent British geographer, refers to this era as a time of 'fading dreams'. The 1996 Census showed that, for the first time since Federation, the population of Sydney's inner city had grown in the previous five-year period, this growth continued as indicated in the 2011 and 2016 census data.



6.1.8 The 1960s Australian (suburban) dream

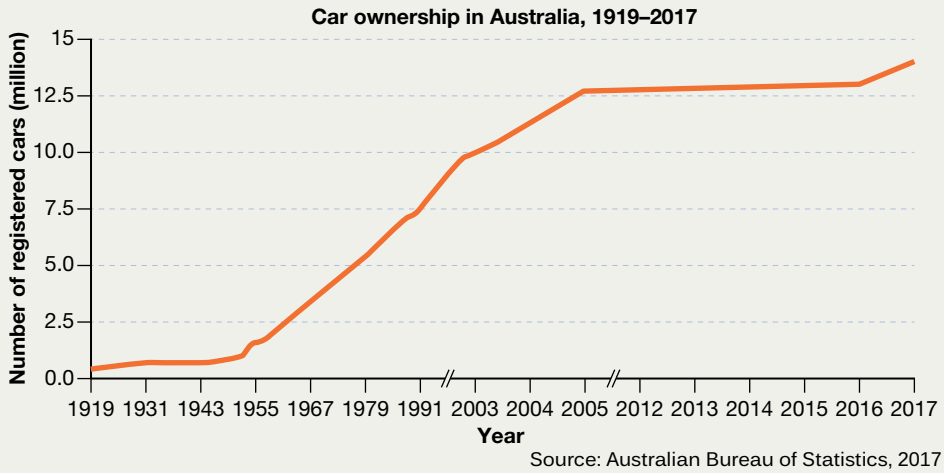


6.1.9 Suburban growth in metropolitan Sydney: areas that were once dominated by detached dwellings, such as the houses shown here, are now being replaced by medium-density apartment complexes. The red rectangle marks the location of a proposed apartment.

SPOTLIGHT

Car ownership

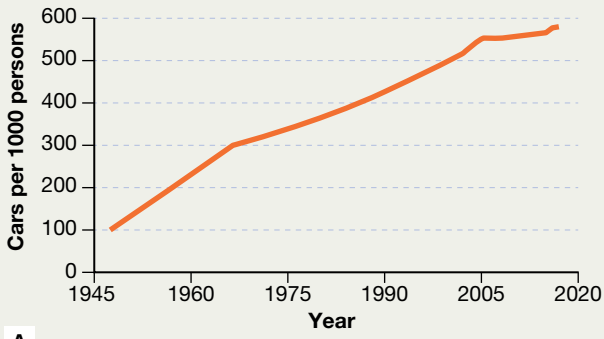
Since the 1950s, the number of private cars has risen dramatically, and continues to rise. In 2017, there were 14.1 million registered passenger vehicles, compared with 769 000 in 1950 and 76 000 in 1920. This dramatic rise in private car ownership seen in Figure 6.1.10, has, until relatively recently, been accompanied by a corresponding shift away from the use of urban public transport.



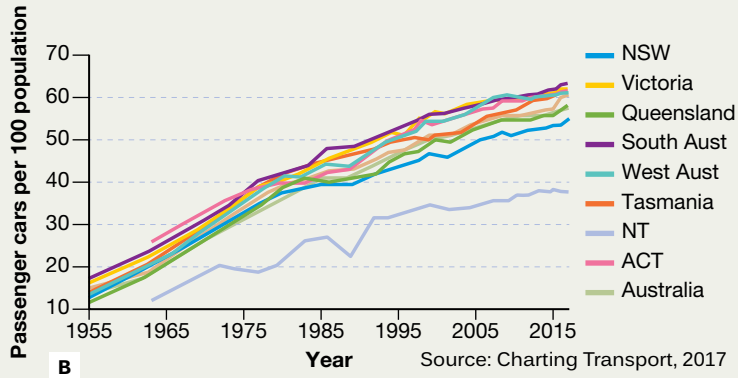
Source: Australian Bureau of Statistics, 2017

6.1.10 Car ownership in Australia, 1919–2017

Australia already had the world's fourth highest number of cars per head of population in the 1950s. Between 1945 and 1970, the number of cars owned per 1000 persons increased from 100 to 300. By 2017, there were 581 passenger vehicles per 1000 persons. Figures 6.1.10 and 6.1.11 outline this trend, including a plateauing of car ownership.



A



B

Source: Australian Bureau of Statistics, 2017

Source: Charting Transport, 2017

6.1.11 **A** Per capita car ownership in Australia, 1945–2017 **B** Per capita car ownership by state and territory, 1955–2017

Activities

Understanding the text

1 Explain what is meant by the term urban dynamics.

2 Define the term urban morphology.

3 List the developments that made suburban living possible.

4 Outline, in brief, the process that led to the complete restructuring of the metropolitan economy and the development of mini-cities or edge cities.

5 Explain why suburbanisation is likely to persist well into the twenty-first century.

6 Explain why the process of suburbanisation is less pronounced in European cities. How has Europe responded to the problems of the inner city?

7 Explain what New Towns are. How did the New Towns of North America differ from the New Towns of Britain?

8 Explain why there is less emphasis on public housing in Australian and New Zealand compared with Europe.

9 Outline the process of suburbanisation in Australia.

Working geographically

10 With the aid of a sketch diagram, explain how the shape of cities responded to advances in transport technologies.

11 Explain how the development of suburban Epping responded to the development of Sydney's rail and metro network.

12 Using Google Earth, compare the urban environment surrounding Quakers Hill, Stanhope Gardens, Kellyville and the Norwest business park at Baulkham Hills with that of Leichhardt, Petersham, Annandale, Camperdown and Newtown. Write a paragraph or two describing the difference between these urban areas in Sydney.

13 Working in groups, compile a list of the advantages and disadvantages of life in the suburbs. Use this information to conduct a class debate. Topic: 'Suburban living is better than life in the inner city.' Having participated in the debate, write an extended response (a discussion) outlining the advantages and disadvantages of suburban living.

14 Study Figures 6.1.10 and 6.1.11. Write a paragraph or two describing the trends in car ownership in Australia.

CASE STUDY

Suburbanisation: the American experience

In the United States, 53 per cent of people live in the suburbs, up from 23 per cent in 1950 and 37 per cent in 1970. The remaining 47 per cent are divided between the inner city (29 per cent) and non-metropolitan or rural areas (18 per cent). Only 40 per cent of people living in a city live in the central city. This is a sharp decline from 1948 when the inner city's share of the metropolitan population exceeded 65 per cent.

Modern suburbanisation

Modern suburbanisation developed in the mid–twentieth century, encouraged by the widespread ownership of automobiles. Another feature was residential differentiation by socioeconomic class (and ethnicity). From the 1920s to 1945, developments in automotive engineering led to mass automobile ownership and mass suburbanisation—processes that persist to this day.

From 1945 to the present, mass automobile use and the construction of freeways ushered in an accelerated period of urban growth that swamped both the rate and scale of everything that came before it. This was the period of urban sprawl, of a housing boom driven by the accommodation needs of the baby boomers of the 1950s and early 1960s.

All the advantages of accessibility to the goods and services once offered by CBD locations became available in suburbia. Also available was abundant and relatively cheap land for expansion, free of traffic congestion and with ready access to both labour and customers. Major suburban shopping centres were developed and a growing number of manufacturing enterprises and office activities chose to decentralise from inner-city locations to the suburbs.



6.1.12 US urban sprawl Las Vegas style

By the 1970s, many suburban areas were performing the functions that had previously been closely linked to the central city. Suburbia continued to sprawl across the US landscape, as seen in Figure 6.1.12, which shows the suburbanisation of Las Vegas.

Decay of inner cities

Accompanying the process of suburbanisation has been the decay of the inner cities. As the middle class moved to the suburbs, inner-city areas became dominated by lower-income groups and minorities. The result was a decline in the tax base of municipal authorities. Falling revenues meant that the money available to support city schools, hospitals and law and order agencies declined. This resulted in a loss of services and a downward spiral in the amenity of the inner city. This deterioration encouraged others to leave, thereby accelerating the drift to the suburbs.

Unlike Australia, few US cities have experienced the large-scale urban regeneration of inner-city neighbourhoods. The inner-city residential areas of many US cities continue to exhibit the characteristics typically associated with economic and social disadvantage (see Figure 6.1.13).



6.1.13 Riots in Baltimore, Maryland. The move to the suburbs contributed to the downward spiral in the amenities of inner city.

Activities

Understanding the text

1 Describe the nature and extent of suburbanisation in the United States.

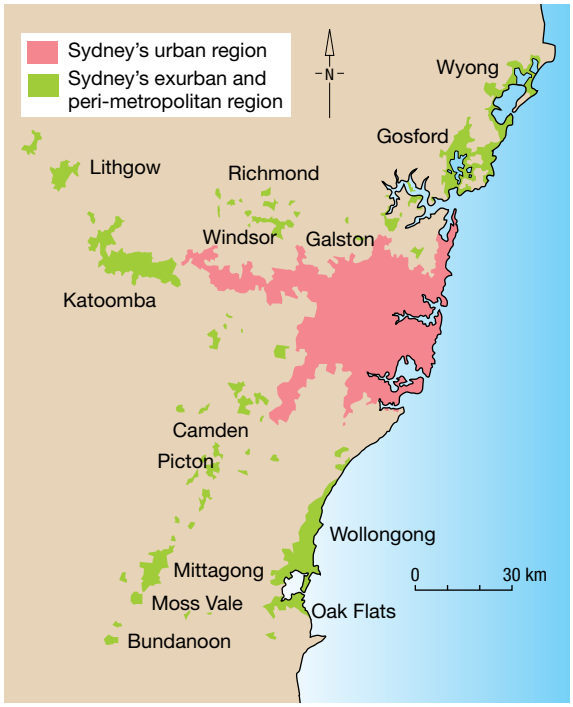
2 Explain the impacts of urban decline on US cities.

UNIT 6.2

Exurbanisation

In the 1990s, urban geographers identified a new urban dynamic—the movement of mainly wealthy city dwellers to high-end housing on acreage in rural areas just beyond the outer edge of a city. They called this process 'exurbanisation'.

Exurbanisation involves the growth of low-density, semi-rural settlements beyond the built-up urban periphery (the outer edge) of cities. People who live in these settlements typically remain functionally linked to the city and many commute to the city for work. Exurbia usually excludes the townships lying beyond the urban fringe.



6.2.1 Sydney's exurban and peri-metropolitan region

Exurbanisation in Australia

The peri-metropolitan region around Sydney (see Figure 6.2.1), within which exurbia is located, is defined as the region bounded by the furthest extent from where it is possible to commute to metropolitan jobs. Closer to the outer suburban edge are exurban areas, such as Dural (see Figure 6.2.2), Galston and Kenthurst. Further out are Windsor and Richmond to the north-west and Picton and Camden to the south-west. Even further out lie the Bowral–Mittagong region to the south-west; the Lithgow district to the west; and Gosford–Wyong to the north.

Urban townships beyond the metropolitan area are not part of exurbia. These include Katoomba (located amid the natural beauty of the Blue Mountains west of Sydney) and Bowral, Mittagong and Berrima (located in the southern highlands). The peri-metropolitan region is often characterised by a mix of land use activities. For example, the Galston–Dural area has a number of commercial and wholesale nurseries. The Bowral–Mittagong area has a number of hotels, resorts and guesthouses that are popular with Sydneysiders seeking a weekend getaway.

While Sydney's peri-metropolitan region has proven attractive for the wealthy, the exurban population is more diverse. Many people moving to the region are younger families (25–34 years); in managerial, professional and skilled trade-based occupations; and, for the most part, middle-income rather than high-income earners.



6.2.2 An independent house in Dural. Sydney's peri-metropolitan region has become popular with families wanting a large home, on acreage, in a semi-rural setting.

Among the reasons for moving to exurbia, higher-quality, larger dwellings and the rural lifestyle rate highly. While travel times to work are increased significantly for those opting for these semi-rural locations, there has also been a marked rise in the proportion of residents working at home, for at least part of the working week.

Except for the emphasis on middle-income rather than higher-income earners, these characteristics of Australia's exurbanites are consistent with the overseas experience; the income factor can be accounted for by the younger ages of those moving into Sydney's exurbia.

Exurbanisation in the Southern Highlands

Straddling a spur of the Great Dividing Range to the south-west of Sydney, the southern highlands region is noted for its lush, rolling fields and quaint villages famous for their cool-climate gardens. Over the last decade or so there has been a marked increase in the number of Sydneysiders moving there to lead a semi-rural lifestyle. The region is an easy 90-minute drive via the M5 motorway, as seen in Figure 6.2.3. Some residents commute, while others stay in the city a few nights a week and spend the rest of their time in the highlands. Others just visit for the weekend. Technology allows an increasing number of people to work from home, at least for part of the week.

Interest in the region as a retreat from city living dates back to Australia's colonial era. People went there to escape Sydney's summer humidity, and enjoy a climate marked by four distinct seasons. In the late 1880s, affluent city folk purchased land around Bowral and built grand mansions surrounded by extensive English-style gardens—see Figure 6.2.4.

The area is popular with retirees and young families wanting to raise their children in a rural setting. It is particularly popular with those interested in equestrian sports.

The US experience of exurbanisation

Exurbia provides semi-rural or very low-density residential living for some 60 million Americans who daily travel 100 kilometres (and often much further) to work, just to maintain a rural lifestyle. Obvious examples include the Cape Cod area outside Boston, the Front Range of the Rockies near Denver and the central California coast near San Francisco. Exurban growth has commonly occurred in areas endowed with superior natural amenity.

Exurbanisation is a form of counter-urbanisation, comprising people who are 'of the city but not in it'. This desire for a rural lifestyle has long been a feature of US culture, even though in practice it is available only to the better off. However, there are differences between ruralites and exurbanites. Today's exurbanites do not have to forego modern conveniences and urban opportunities. Exurban households may share more rural than urban or suburban values. However, they may not appreciate essentially rural attributes, such as church or club participation or the degree of face-to-face socialising that is characteristic of rural households.

Much of exurbia in the United States comprises prestige residential developments, often hobby farms or 'country estates'. In these, the settlement pattern is characterised by widely spaced housing, quaint villages and semi-rural landscapes dedicated to the recreational pursuits of the affluent (see Figure 6.2.5).

Activities

Understanding the text

1. Define the term exurbanisation. Where does it occur?
2. Explain what is meant by the term peri-metropolitan region.
3. Describe the nature of Sydney's peri-metropolitan region.
4. Outline the US experience of exurbanisation.
5. Explain what it is meant by the term 'of the city but not in it'.

Working geographically

6. Explain what has attracted exurbanites to the Southern Highlands.
7. Using Google Earth, investigate the settlement pattern of Galston and Dural. Describe what you observe.



6.2.3 The Bowral–Mittagong region is favoured by exurbanites.



6.2.4 Bowral, in the Southern Highlands, is a popular base for Sydney's exurbanites.



6.2.5 Montclair, New Jersey, is one of the 500 semi-rural towns within commuting distance of New York City. Exurbia in the United States is characterised by semi-rural landscapes dedicated to the recreational pursuits of the affluent.

UNIT 6.3

Counter-urbanisation and decentralisation

The relocation of people and employment from large to smaller urban centres or rural areas is known as 'counter-urbanisation'. This decentralisation process was first detected in the early 1970s in the United States and also observed in Australia, Canada, Western Europe and Japan. In the USA, at least for a short time, it replaced urbanisation as the dominant force shaping the country's settlement pattern. Counter-urbanisation was a reversal of the drift to the cities.

Counter-urbanisation in Australia

In some developed countries, including Australia, decentralisation became official government policy. Incentives (including transport subsidies, low-interest loans and cheap land) were given to companies willing to relocate their activities to smaller, often regional, centres. In New South Wales, Bathurst and Orange were designated Regional Growth Centres in 1972 and a range of incentives were offered to encourage businesses to relocate there. The Swedish-owned Electrolux produced white goods under the Kelvinator and Westinghouse brands in an Orange factory complex previously used to produce munitions during World War II. At its peak, the factory employed 2000 people. In October 2013 the factory closed, with the loss of 544 jobs. Like many Australian-based manufactures, the company could not compete against imported goods from low-cost plants in Asia.



6.3.1 Armidale, the new home of the Australian Pesticides and Veterinary Medicines Authority

Contemporary examples of decentralisation in Australia are relatively rare. One possible exception is the relocation of Government departments and function from Canberra, and the state capitals, to the larger rural centres. The decision to move the Australian Pesticides and Veterinary Medicines Authority from Canberra to Armidale (see Figure 6.3.1) is one of the more recent examples of this politically motivated strategy. Earlier examples include the relocation of NSW's Land and Property Information agency to Bathurst and the Department of Primary Industries to Orange. The Australian Tax Office (ATO) is also a decentralised government agency. Albury–Wodonga is home to about 1000 ATO employees and their families.

Counter-urbanisation: the American experience

By the 1970s, while urban population growth was accelerating rapidly across the developing world, urbanisation appeared to be going into reverse in the developed world.

In the 1960s, non-metropolitan areas of the United States lost almost 3 million people to cities through net out-migration (urbanisation). In just the first three years of the 1970s, those areas gained more than 1.1 million people through net in-migration (counter-urbanisation). The most marked population growth occurred in entirely rural counties (not in areas adjacent to metropolitan regions) and in non-metropolitan counties with a tradition of strong retirement in-migration.

These trends were not confined to the United States. In Western Europe and the United Kingdom, the growth of medium-sized and smaller urban areas was at the expense of the largest cities. Metropolitan growth rates slowed in Japan, Sweden, Norway, Italy, Denmark, New Zealand, Belgium, France, Germany and the Netherlands.

The end of counter-urbanisation

Since the 1970s, the rate of counter-urbanisation has diminished, and in many countries the process has been reversed.

Overseas

By 1982, metropolitan populations in the United States were again growing faster than non-metropolitan populations—a return to the pattern of the 1960s.

While the proportion of Americans living in urban centres barely changed during the 1970s, it increased sharply during the 1980s: from 73.7 per cent to 75.2 per cent. This rate of growth was sustained during the 1990s and into the 2000s. Rural areas have continued their relative, and in many cases absolute, decline. The population of North Dakota's Logan County, for example, has declined from a population peak of 8100 in 1930 to 2099 in 2004 and just 1941 in 2016. Between 2004 and 2016 the county's population decreased by 8 per cent.

Counter-urbanisation in the United Kingdom reached a high point during 1970–73, and then slowed. By the mid-1980s, population change in the Greater London area stabilised and then started to increase as the popularity of inner-city living gathered pace. Greater London is now the fastest growing region in the UK. Between mid-2011 and mid-2015 the city's population increased by 5.7 per cent.

Australia

The same overall trend is apparent in Australia. By the late 1990s, the growth rate of the large metropolitan centres had increased significantly. Sydney was growing at a rate not achieved since the mid-1980s. In 1998–99 the city's population grew by 1.5 per cent (adding almost 60 000 people), compared with a growth rate of 1.2 per cent for New South Wales as a whole. Between 2011 and 2016, the city's population increased by an average 6.15 per cent. Over this period, 1.2 million people were added to the city's population.

When studying the growth of cities, the focus is on net movements. People will always move to and from cities. In Sydney, some leave for employment-related reasons or to make a 'sea change' or 'tree change'; that is, lifestyle-related motives. For the most part, the inflow of new residents (immigrants and those arriving from non-metropolitan areas) exceeds the number leaving.

Urbanisation in Australia

There are several significant features of post–World War II urbanisation in Australia.

In the 25 years following World War II, Australia's population grew rapidly, due to both relatively high rates of natural increase and immigration. A growing proportion of the expanding population chose to live in urban areas. As in most developed countries, this pattern of urbanisation was reversed in the early 1970s. The trend away from major metropolitan centres was maintained throughout the 1970s and (unlike many other developed countries) into the 1980s but occurred much more slowly. During this period, the proportion of the population living in rural areas continued to decline, but was more than offset by the growth of regional centres. Between 1970 and 2006, Dubbo's population more than doubled (a trend that was still evident at the 2016 Census). Much of this growth was at the expense of smaller surrounding centres; for example, Narromine, Parkes and Gilgandra. These trends were regionally concentrated. In the non-metropolitan sector, growth focused on the built-up parts of coastal Queensland, New South Wales and south-west Western Australia, driven, in part by the increasing popularity of the coastal lifestyle.

Beginning in the late 1980s, more-traditional urbanisation patterns returned, with metropolitan rather than non-metropolitan growth. Sydney grew by 60 000 people in 1999 and by 2016 was experiencing an annual population increase in excess of 200 000. Overall, non-metropolitan growth rates have noticeably fallen since the late 1970s, while those of large metropolitan areas have increased (some significantly).

Wheat belt decline

The pattern of population change in non-metropolitan areas is characterised by a depopulation of the rural (wheat-belt) regions and population growth in coastal areas and the more accessible parts of non-metropolitan Australia. The greatest population declines have occurred in Australia's wheat belt. Western Australia's Perenjori Shire (350 kilometres to the north-east of Perth) has lost almost half its population over the past 30 years (from 1210 in 1986 to 924 at the 2016 Census)—see Figure 6.3.2. Fifty-seven local government areas, strung out across the Australian wheat belt, from outback New South Wales down into the Wimmera in Victoria, northern South Australia and the midlands in Western Australia have all experienced population decline.



6.3.2 Perenjori, the West Australian wheat belt town is one of the regions experiencing population decline.



6.3.3 Melbourne's population growth is the highest in the country.

International migration

Urbanisation in Australia has also been affected by international migration. Today, 28 per cent of Australians were born overseas (2016 Census), and they have settled disproportionately in the largest urban centres, especially Sydney and Melbourne. In Sydney, the net gain from international migration has more than offset any loss from internal migration. The same applies to Melbourne. Ninety per cent of immigrants settling in Australia do so in either Sydney or Melbourne.

Melbourne versus Sydney

Shown in Figure 6.3.3, Melbourne's annual population growth rate now exceeds Sydney's. The 2016 Census reported the population of Melbourne as 4.49 million, a figure that shows it increasing faster than Sydney, which has 4.82 million people. Between 2004 and 2016, Melbourne's population grew by almost a million compared with a rise of 821 000 in Sydney. If the current pattern of growth is sustained, Melbourne's population will exceed Sydney by the mid-2050s.

Sea change

For generations, Australians have had a close affinity with the beach. They are attracted by the lifestyle the beach offers. In the latter half of the twentieth century, this lifestyle attraction led to the development of new coastal communities. The Gold Coast is the most notable example (see Figure 6.3.4). The Gold Coast did not exist in 1945. By 2017, it was home to 560 000 people, the country's sixth largest city and the biggest non-capital urban area. For more than thirty years the Gold Coast has been the single largest destination for Australians on the move. Other new beach-based cities include the Sunshine Coast and Hervey Bay in Queensland and Ballina, Coffs Harbour, Port Macquarie and Byron Bay in New South Wales.

In addition to changing lifestyle preferences, longer life expectancy has transformed these once-sleepy coastal communities into desirable retirement destinations.



6.3.4 None of this development existed in 1945! Queensland's Gold Coast—Australia's sixth largest city. Some argue that the emergence of the Gold Coast lifestyle is indicative of a fundamental shift in the way Australians think about Australian culture.

An expanding peri-metropolitan area

The peri-metropolitan area is an extension of the metropolitan commuter hinterland; that is, the distance people are willing to travel from home to work. Large urban centres continue to influence the location of new employment opportunities. They do this via:

- improved rail access (the construction of Sydney's new metro lines—the Metro Northwest and Metro Southwest)
- new light rail links (from the city to Randwick)
- new motorways (Sydney's WestConnex, NorthConnex and M5 East tunnel duplication; the upgrading of the M4, M5 and M2 motorways; and the yet to be funded M9 Outer Orbital and M6 motorways)
- real increases in personal incomes leading to expanded options in terms of where to live
- real reductions in the unit cost of travel.

The construction of high-speed rail links would further expand the city's commuter hinterland. (See Figure 6.3.5.)

The major factors affecting the balance of growth between metropolitan and non-metropolitan areas in Australia include employment, residential preference, welfare dependency and the alternative lifestyle movement.



6.3.5 Sydney's Northwest Metro will greatly enhance the accessibility of the employment-rich CBD for those living in the city's north-west.

Employment

About half those moving to metropolitan areas do so for work-related reasons. This compares with about 40 per cent moving from metropolitan to non-metropolitan regions for the same reason. About 10 per cent of those leaving metropolitan regions do so for retirement or health reasons. In the early 2000s, Sydney's population growth was being driven by the city's relatively high rate of economic growth. This was brought about, in part, by the burgeoning information-based economy and the construction boom associated with the development of the city's transport infrastructure, the city's status as a world city and the need to accommodate the city's rapidly growing population. The city's unemployment rate of 4.4 per cent (mid-2017) was more than a whole percentage point lower than the national rate (5.7 per cent). Also adding to the city's growth rate was a decline in the number of people leaving the city for other states, especially Queensland.

Residential preference

Lifestyle factors play an important role in the migration from metropolitan to non-metropolitan areas, and the retention of residents in the latter. Groups involved in such movements include retirees, long-distance commuters and people seeking alternative lifestyles.

Welfare dependency

A significant number of those involved in migrations from metropolitan to non-metropolitan areas rely on welfare benefits, including retirees on the aged pension. Among this group there is a tendency to concentrate in areas that are scenically and climatically attractive, where seasonal work is often available to supplement welfare-based incomes and where housing is often cheaper than in the large metropolitan areas. The latter is an important consideration for those on fixed incomes or retirees who may wish to capitalise on the higher prices of their homes in the major cities.

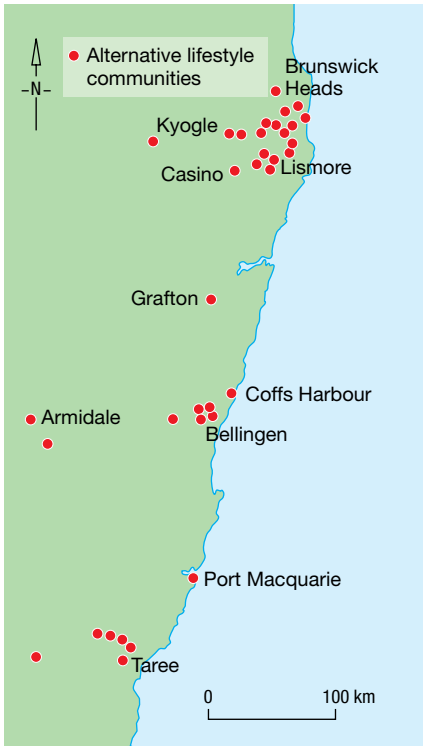


6.3.6 Nimbin, an alternative lifestyle community

The alternative lifestyle movement

The ultimate form of counter-urbanisation can be found among those seeking alternative lifestyles (see Figure 6.3.6). While the alternative lifestyle movement is in part a response to unemployment and a concern about environmental quality, it also finds strength from the Utopian tradition within Western society: the attempt to create a new social order free from social problems.

In New South Wales, most alternative lifestyle communities are located in the coastal belt north of Newcastle, with the largest clusters on the far north coast (around Lismore, Kyogle, Nimbin, Byron Bay and Mullumbimby), and smaller clusters near Coffs Harbour and Taree, shown in Figure 6.3.7. While most communities are of the secular (non-religious) and self-sufficiency type, a small number operate as rural cooperatives.



6.3.7 Alternative lifestyle communities in New South Wales

Activities

Understanding the text

1 Explain the meaning of the terms counter-urbanisation and decentralisation. Where were these processes first detected? What parts of the world were affected by these processes?

2 Outline the nature of decentralisation attempts in Australia over time.

3 Explain the population trends that have led to the popularity of the 'sea change' lifestyle.

4 Outline the population trends apparent in Australia, in particular NSW.

5 Explain what is meant by the term peri-metropolitan region. Under what circumstances might it expand?

Working geographically

6 As a class, discuss the proposition that counter-urbanisation was a short-lived phenomenon that scarcely lasted beyond the 1970s. Write an extended response (an exposition) supporting such a viewpoint.

7 Outline the extent of counter-urbanisation in the United States during the 1970s. What has happened since that decade?

8 Collect media reports dealing with population movements in Australia. Do any of these reports provide information that would help you determine whether there are any counter-urbanisation trends emerging in Australia? What other types of movement do the data highlight?

9 a Summarise the key features of post–World War II urbanisation in Australia.

b Outline the major factors affecting the balance of growth between metropolitan and non-metropolitan areas in Australia.

10 Explain what is meant by the term 'sea change'. What factors are driving the process? Which parts of Australia have been most affected by the process?

11 a Identify the factors that have contributed to the development of alternative lifestyle movements.

b Specify where in New South Wales most alternative lifestyle communities are located.

c Outline the various types of lifestyle community.

UNIT 6.4

Urban decay and renewal

The deterioration of the urban environment is known as urban decay. It occurs when urban infrastructure falls into disrepair and buildings are left empty for long periods of time. The redevelopment of such areas, so that they better meet the needs of people, is referred to as urban renewal (see Figure 6.4.1).

Before the resurgence in inner-city living (which can be traced to the 1980s) Sydney's inner city (like the inner-city precincts of many developed world cities) experienced urban decay. This involved:

- the deterioration of residential areas, especially those dominated by nineteenth-century working-class housing
- the decline in inner-city investment as a result of the suburbanisation of manufacturing and warehousing, retail and office-based activities.

Urban renewal also takes place in urban precincts that could not be described as experiencing urban decay. In some instances the potential economic return offered by a site is greater than for existing land uses. In Sydney, there are numerous examples. The redevelopment of Sydney's Convention and Exhibition Centre, the Sydney Entertainment Centre site, the demolition and replacement of the IMAX theatre complex and the planned redevelopment of the Harbourside Shopping Centre and Cockle Bay Wharf restaurant precinct at Darling Harbour, all developed in the 1980s and 1990s, are examples of urban renewal projects driven by economic considerations rather than obsolescence and urban decay.

Urban decay and renewal in Sydney

Since the late 1980s there has been evidence of fundamental changes in the balance of investment and population growth between the inner city and the suburbs. Prior to this, most residential and non-residential development occurred in suburbia. Since then the balance has shifted towards the inner city.

The 1996 Census revealed that, for the first time since 1911, there was a dramatic change from negative to substantial positive growth in Sydney's inner-city population. This growth has continued. Between 1996 and 2016 the population of the City of Sydney local government area grew from 87 874 to 208 374. In the five years to 2016, 40 per cent of all jobs growth across the Sydney metropolitan areas occurred in the city's CBD.

Much of this new inner-city residential construction is on land previously occupied by non-residential land uses. This has occurred through land clearance or conversion; for example, of former warehouses. Some of it takes the traditional form of gentrification: the refurbishment of nineteenth-century terraces by middle-income to higher-income earners. Paddington, Surry Hills and Glebe are good examples of gentrified suburbs; although Glebe also includes lower-income redevelopment subsidised by the government. Apartments and units make up 73.6 per cent of dwellings in the City of Sydney, which is substantially different from the Australian average of 13.6 per cent.

An outline of central Sydney's major urban renewal projects can be accessed on the City of Sydney's website under the 'Vision' tab, and 'Changing urban precincts'. Examples include the Carlton & United Breweries site (Central Park), Barangaroo, Green Square, Ashmore, Harold Park and the Southern Employment Zone. Information about urban renewal projects throughout the metropolitan area can be accessed on the NSW Department of Planning and Environment website. Non-Sydney examples of large-scale urban renewal projects include Newcastle's Honeysuckle redevelopment, a 50 hectare commercial and urban redevelopment of former industrial land on the harbour. Information relating to Newcastle's redevelopment projects can also be found on the Department of Planning's website.



6.4.1 From a graffiti-ridden derelict site **(A)** to a $34 million food-lover's paradise **(B)**, the heritage-listed Rozelle Tram Depot has undergone a dramatic transformation into an exciting new bar and restaurant destination.

The suburbanisation of manufacturing and warehousing

A feature of Sydney's changing urban geography throughout the twentieth century was decentralisation of manufacturing and warehousing activities. This involved both centrifugal and centripetal forces. Centrifugal forces are those directed away from the centre while centripetal forces are those directed towards the centre. The centrifugal forces included downtown congestion, lack of space and rising land values. The centripetal forces consisted of cheap and abundant land in the (inner ring) suburbs, low land taxes, and good railroad and highway access. Most smaller manufacturing operations (such as textiles, footwear and clothing), which required frequent contact with local buyers and other firms, remained in the inner city well into the 1960s. These were clustered in the inner-city suburbs of Surry Hills and Ultimo.

Major technological advances were required to break the association between the inner city and manufacturing and warehousing. These included:

- changes in factory production technology
- the development of major urban freeway networks
- cost reductions in short-distance trucking operations.



6.4.2 Eastern Creek distribution centre (Huntingwood). Large-scale distribution centres cluster in areas accessible to Sydney's motorways.

The last two are closely related. Wholesalers also benefited from improved overall accessibility. Smaller warehouses scattered throughout the metropolitan area could be combined into a single, large, freeway-orientated facility. Product distribution was transformed from a centre-outward to a suburbia-inwards operation. These changes date from the mid-1960s. After this time, inner-city industrial and storage land became vacant or derelict.

The other major factor was economic restructuring and deregulation of economic activity from the mid-1970s. Its impacts were felt most keenly in the manufacturing sector. Highly protected industries (such as footwear, textiles and clothing) were most affected. Many were forced to close down, with the greatest impacts on inner-city manufacturing land uses. In Sydney, this adversely affected inner-city areas, such as Ultimo, Chippendale and Surry Hills.

Today, the large-scale distribution centres cluster in well-positioned industrial estates such as Eastern Creek, at the intersection of the M4 and M7 motorways, 35 kilometres west of Sydney's CBD, see Figure 6.4.2.

Economics of land-use change

As a general rule, the economics of land-use change are governed by three factors. These are:

1. annual operating costs, or the fixed costs of maintaining a building or existing land use
2. the value of the locality and fittings
3. the annual return on the fixed asset—buildings, plant and equipment. This is important, because land has no economic value except in terms of what it can be used for.

The third factor (the idea of value in use) is what governs, for instance, demolishing a several-storey office building, perhaps only a decade old, and replacing it with a much higher intensity land use, say a multistorey building. This principle is the same for all land uses, residential and non-residential. That is why in some areas it is profitable to buy an older house on a large block of land, tear down the dwelling and erect several townhouses on the same site: the sale or rental value from the new use exceeds the sale or rental value of the former use, despite the value destroyed in changing the use.

The key to the economics of land-use change, including urban decay and renewal, hinges on investment opportunities associated with a particular site. If a greater economic return can be gained from an alternative land use, the land use may indeed change. As the financial return of a site declines it may be abandoned or given over to another activity. If the potential exists for a higher return, the existing buildings may be demolished or upgraded and given over to an activity that provides a greater return on the money invested.

The obsolescence of Sydney's maritime infrastructure

Sydney's maritime landscapes have been transformed many times since the city was founded in 1788. These changes reflected the change in shipping technologies including the transition from sail to steam and then oil. By the early twentieth century, principal maritime precincts were dominated by a series of finger wharfs that best accommodated the ships and cargo handling methods of the time. However, the technology of cargo handling was about to change.

Beginning in the 1950s, containerisation was introduced. Before the introduction of containers, goods were mostly carried as general cargo. Goods were delivered to the dock by horse-drawn dray, rail or later motorised lorry in advance of the ship's arrival, and stored in warehouses. When the vessel arrived the cargo was taken from the warehouse to the wharf then loaded on board using either the ship's cranes or those installed dockside. The unloading of vessels was the reverse of the loading operation.

By the 1960s the increasing size of ships, together with containerisation, would bring about the most dramatic transformation in the history of the Port of Sydney. At Barangaroo, for example, the reclamation of the foreshore zone and the construction of a large concrete apron would eventually replace the previous built environment. For a time, the concrete platform was used as a container terminal; however, the site's limitations soon became apparent. The lack of a heavy rail link meant that containers had to be trucked though the congested streets of the Sydney CBD. As container ships got bigger this problem only got worse. The construction of the new port facility at Port Botany in 1979 led to the demise of commercial shipping in Darling Harbour, and ultimately Sydney Harbour as a working port. In 2003, it was announced that the container terminal at Barangaroo would close.

Activities

Understanding the text

1 Distinguish between urban decay and renewal.

2 Outline the nature of urban decay in inner Sydney until the 1980s.

3 Outline the circumstances in which urban renewal can occur even though urban decay might not have been apparent. Give examples.

4 Explain what is meant by the process of gentrification. What developments led to the growth of investment in the inner city?

5 Outline how the balance of investment and population growth have changed in Sydney since the late 1980s.

6 Describe the trend in the inner-city population of Sydney since 1996. How has the residential construction industry responded? Where has most new residential development occurred?

Working geographically

7 Use Google Earth to familiarise yourself with some of Sydney's major urban renewal projects, such as the Carlton & United Breweries site (Central Park), Barangaroo, Green Square, Ashmore, Harold Park, Rhodes and Wentworth Point, Olympic Park and the developments along South Dowling Street. Use a map of metropolitan Sydney to help determine the relative location of these sites.

8 As a class, discuss the advantages and disadvantages of high-rise living in inner-city locations.

9 As a class, discuss the advantages and disadvantages of converting warehouses and other industrial buildings rather than demolishing and redeveloping the site.

10 a Outline the centrifugal and centripetal forces that led to the suburbanisation of manufacturing and warehousing in Sydney. What was the impact of the relocation of manufacturing and warehousing?

b Explain why some smaller manufacturing operations retain their inner-city location.

c Outline the major technological advances required to break the association between the inner city and manufacturing and warehousing.

d How has the manufacturing and distribution of products changed? What impact did this have on inner-city industrial and storage sites?

e What impact did economic restructuring and deregulation have on economic activity?

11 Outline the factors affecting the economics of land-use change. What is the 'key' to the economics of land-use change?

12 Write a paragraph or two outlining how technological changes in maritime transport and cargo handling have impacted on Sydney's morphology, its functional form and character.

CASE STUDY

Sydney: examples of urban renewal

The following compares four different cases of urban renewal.

Paddington: an example of gentrification

Paddington (see Figure 6.4.3) is an inner-city suburb 3 kilometres to the east of Sydney's CBD. Over time the suburb has been subject to the processes of urban decay and renewal.

Housing in the suburb was first developed to accommodate the artisans (stonemasons, quarrymen, carpenters and labourers) building Victoria Barracks, which commenced construction in 1841. Rapid growth followed, with larger estates being subdivided for terrace-style housing. By 1862 there were 535 houses with 2800 residents. By 1883, the number of houses had increased to 2347. In the first decade of the twentieth century Paddington had 4800 houses accommodating a population of 26 000. The general amenity of the suburb had improved and the area was sewered. Paddington was popular with the families of military personnel based at Victoria Barracks. A village-based atmosphere developed with a mix of retail outlets lining Oxford Street.

Following World War I, Paddington went into a long period of decline. The war had left a legacy of social problems and alcohol abuse, and the influenza epidemic of 1919 hit the area particularly hard. As a result, densely settled areas such as Paddington fell out of favour. This was reinforced by the promotion of new, planned garden suburbs such as Haberfield by developers. The Great Depression of the 1930s hit the area particularly hard. Unemployment reached 30 per cent with unskilled workers and tradesmen particularly affected.

In the post–World War II era, Paddington was officially designated as a slum area ripe for total redevelopment. A 1947 plan proposed the demolition of almost all the housing to be replaced with blocks of flats. However, with the newly arrived migrants from Europe finding Paddington affordable and a convenient place to live, the redevelopment plans were dropped.

Beginning in the 1970s, many professional people recognised Paddington's potential, particularly the suburb's location close to the CBD. With the restoration of often-derelict terrace houses and cottages, a new appreciation of the history and aesthetic qualities of the area developed. In 1968, 160 hectares of terrace housing was rezoned as a conservation area. Paddington was recognised as a rare and largely intact example of an early Victorian residential suburb (see Figure 6.4.4). The median property sale price for a Paddington home in mid-2017 was $2.3 million—for homes once thought of as slums!

Green Square: urban renewal on a 'brownfield' site

Green Square lies 4 kilometres south of Sydney's CBD. At the centre of the precinct, which takes in parts of Alexandra, Zetland, Waterloo and Beaconsfield, is Green Square Town Centre and the Green Square Station. The opening of the station in 2000 was a key development that initiated the process of urban renewal in the area.

Traditionally, the area had been dominated by light industry, much of which had become obsolete as a result of the suburbanisation of manufacturing or closure as a result of economic restructuring in the 1990s.

Today, Green Square is at the centre of one of Australia's largest urban renewal projects. The 278-hectare site is being transformed at a cost of $13 billon. When complete, Green Square Development (see Figures 6.4.5 and 6.4.6) will provide 35 500 new homes, housing 61 000 residents. The development's commercial elements will house up to 22 000 workers. The Green Square Town Centre, which forms part of the overall development, will accommodate 5800 residents and 9300 workers.



6.4.3 Housing in Paddington was first developed in the 1840s to accommodate the artisans working on the Victoria Barracks.



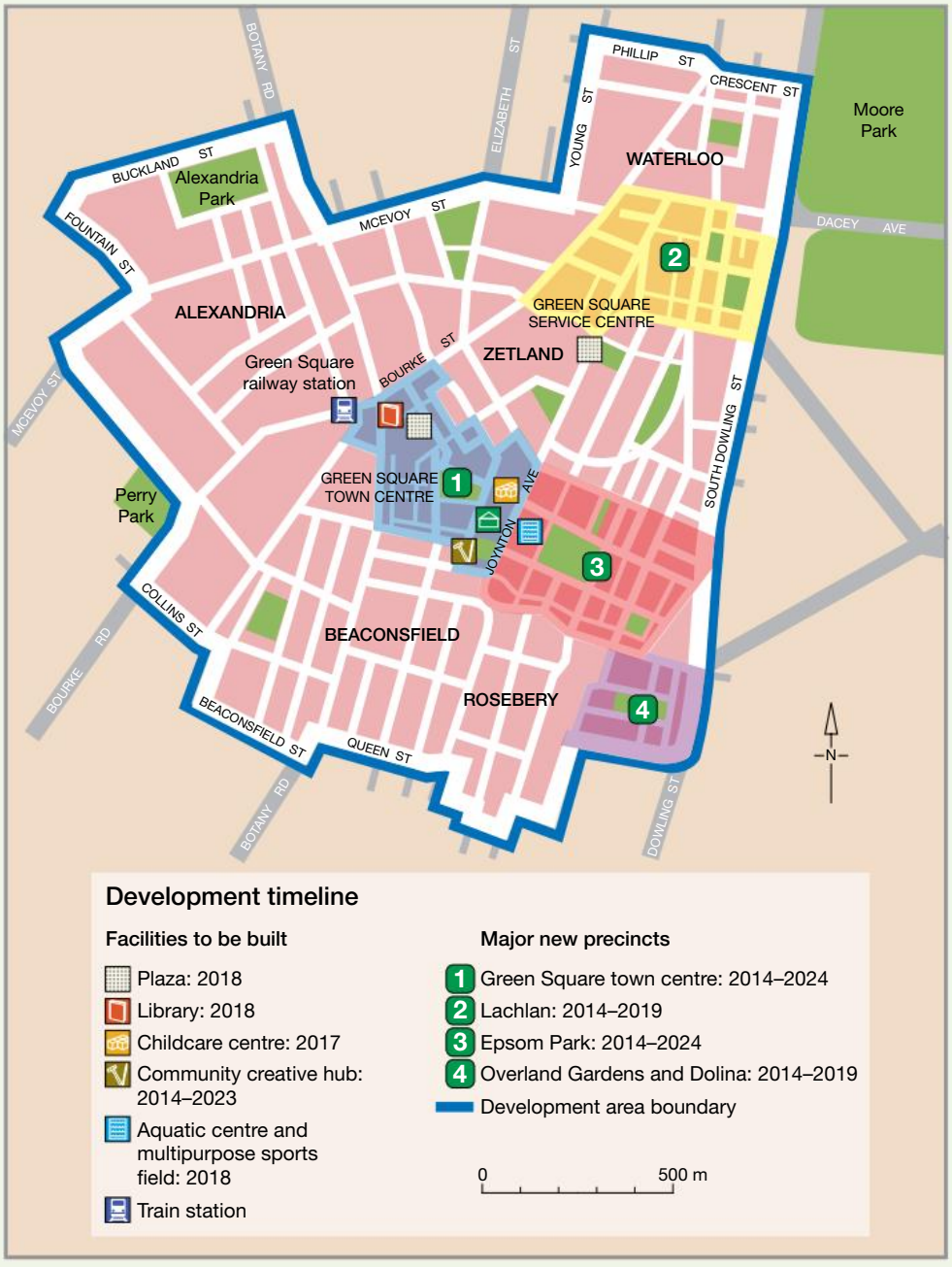
6.4.4 Victorian terraces in Paddington—gentrification transformed a once decaying suburb into one of Sydney's most desirable residential precincts.

The Green Square Town Centre at the intersection of Botany Road, O'Riordan and Bourke Streets is being developed on the site of the obsolete Waterloo Incinerator, the abandoned Royal South Sydney hospital and numerous other abandoned industrial buildings.

A new community library and plaza is being built adjacent to the Green Square Station as part of the area's new retailing and commercial hub.

Barangaroo: replacing obsolete maritime infrastructure

With the decline of Sydney as a port, the industrial sites that once lined parts of the harbour foreshore were gradually abandoned. Pyrmont, for example, was once home to a number of large industrial complexes, most notably the Colonial Sugar Refinery. The closure of the industrial complexes, together with the obsolescence of Sydney's maritime infrastructure, resulted in widespread urban decay and opened large areas of foreshore land for urban renewal, as seen in Figure 6.4.7.



6.4.5 The Green Square Development Area



6.4.6 Large-scale urban renewal in Sydney's Green Square. On the left is a mixed-use Crown Group building, designed by Koichi Takada Architects.



6.4.7 Finger wharfs at Walsh Bay and Millers Point were typical of Sydney's maritime infrastructure in 1937.

Barangaroo is an urban precinct undergoing the process of urban renewal. The maritime infrastructure that once lined Millers Point, just to the west of Sydney's CBD, gradually fell into obsolescence as the technologies of shipping and cargo handling changed. In 2003, the New South Wales Government announced that the site would be transformed into a new waterfront precinct.

Today, Barangaroo is Australia's largest urban renewal project. When complete in the early 2020s, more than $6 billion will have been spent transforming the site. More than 23 000 people will work in the precinct and thousands will call it home. Millions of Sydneysiders and tourists will visit the area (see Figure 6.4.8).

Rhodes: an urban precinct transformed

Suburban Rhodes has been associated with Sydney's industrial history since the early twentieth century. In 1928, Timbrol, one of the first chemical factories to locate in the Rhodes peninsula, commenced the manufacture of timber preservatives from coal tar oil. In 1955, Union Carbide purchased the Timbrol factory and commenced the production of pesticides, including DDT and the defoliant Agent Orange, which was manufactured there during the Vietnam War. Dioxins were produced as an unwanted by-product. Nearby, the Orica (ICI) facility commenced making paint, pigment, resins and phthalates in the 1940s. By the late 1980s most industrial activity on the peninsula had ceased, but the land was too contaminated to be used for residential or commercial development.

In the late 1990s the Walker Corporation, recognising the commercial potential of the site, commenced redevelopment of the southern end of the peninsula, shown in Figure 6.4.9. Because the 23 hectare Rhodes Waterside site was contaminated with toxic substances it had to be fully rehabilitated before construction could begin. This process was supervised by the Environment Protection Agency (EPA).

The Rhodes Waterside development includes a large shopping mall and cinema complex, commercial office spaces and residential apartments.

Other developers have taken responsibility for the redevelopment of the former Allied Feeds site (Meriton's Sienna project), Australand's Corporate Park project on the eastern side of the railway and the former Lednez/Union Carbide site, which was owned by the NSW Maritime Authority.

Once completed, the Rhodes peninsula will be home to more than 7300 Sydneysiders. Firms now operating out of Rhodes include Nestlé, National Australia Bank and Frasers Property Australia.



6.4.8 Barangaroo 2016—the process of urban renewal is well advanced.



6.4.9 The Rhodes redevelopment, 2017, viewed from the north-west

Activities

Working geographically

1 Explain how the urban renewal evident in Paddington differs from that occurring in Green Square, Barangaroo and Rhodes.

2 Complete the following table.

Project	What do these urban renewal projects have in common?	How do these urban renewal projects differ?
Green Square		
Barangaroo		
Rhodes		

3 Access the website of Newcastle's Honeysuckle redevelopment project. Write a report outlining the main features of the urban renewal project.

4 Study Figures 6.4.7 and 6.4.8. Describe the nature of the port infrastructure in Walsh Bay and Millers Point in 1937. Describe the nature of the transformation evident in Figure 6.4.8.

5 Visit an area of a large city undergoing large-scale urban renewal. Use photography and field notes to record your observations. Use secondary research to identify the area's previous land uses. Write a report outlining your findings.

CASE STUDY

Urban decline in Baltimore

The US experience of urban decay and renewal

Urban decay is much more apparent in the cities of the USA compared to Australia, Japan and Europe. The reasons for this lie in the way US cities fund the provision of urban infrastructure.

The urban decline of Baltimore (shown in Figure 6.4.10) illustrates this point. Baltimore provides an insight into the processes that influence both urban form and character in the USA. It illustrates how the contemporary social divisions that are apparent within US society are reflected in a city's morphology (its functional form and character) and the important role of government in influencing that morphology.

Boom and bust

During World War II, the city's population reached 1.2 million. In 1968, Baltimore's population was 910 000. Today that number sits at 614 000 (a decline of a staggering 50 per cent).

The city's economy was built on the shipbuilding and steel industries but ultimately these industries collapsed and the jobs went overseas. The city's high unemployment, low incomes, and widespread housing foreclosures have their roots in the collapse of these industries. Bethlehem Steel acquired the Sparrows Point steel mill in the early 1900s and the industry boomed during World War II, employing 35 000 workers at its peak in 1959. But American manufacturing began its decline in the 1970s, and Sparrows Point laid off 3000 workers in 1971, then another 7000 in 1975. By the 1980s, just 8000 people were employed at the mill.

Overall, the city lost more than 100 000 manufacturing jobs between 1950 and 1995—a trend that continued well into the 2000s. The plant closed in 2012, as did the giant Bethlehem shipyards.

The economic decline of the city resulted in widespread urban decay. Tens of thousands of homes and apartments have been left vacant and boarded up. This, in turn, led to more and more people leaving the city.

Demographics

There is a strong racial element to the decline of Baltimore. The city has long been associated with America's African-American community. Sixty-four per cent of the population is African-American. European-Americans account for 29.6 per cent of the population and Asian-Americans for 2.3 per cent. Incomes are well below the national average and unemployment is high, especially in the African-American community (37 per cent among young males aged 20–24, compared with 10 per cent unemployment for European-Americans of that age group). Twenty-four per cent live below the poverty line (US$20 090) compared to 13.5 per cent nationwide. In Sandtown-Winchester, one of the city's more troubled neighbourhoods, most of the people between the ages of 16 and 64 are out of work and the unemployment rate is double that for the city at one in five.



6.4.10 A former resident walks through derelict and largely abandoned housing in East Baltimore.

The underlying demographic, economic and structural changes taking place in cities such as Baltimore are much the same as those occurring in most cities in the United States: a population drain away from inner suburbs, the relocation of employment and industry in outer areas, and degradation of the social and physical infrastructure in the inner city. The outcome has been the creation of the urban wastelands that now dominate the largest cities in the United States.

Role of government

US city authorities have traditionally been responsible for a wide range of urban services. Throughout the 1960s and most of the 1970s, the Federal Government assumed a greater role with the introduction of a range of well-funded programs designed to assist urban areas.

During the 1980s, however, under successive Republican administrations there was a dramatic reduction in the level of federal support for cities. The policy of 'fiscal federalism' shifted responsibility for housing, urban infrastructure, education, law and order and most social services (except welfare and health) to cities and municipalities. Federal housing assistance, for example, was cut by as much as 80 per cent.

City authorities funded their responsibilities largely through the imposition of property taxes. As the process of suburbanisation gathered pace, the tax base of inner-city areas declined sharply. Increasing property taxes to make up for federal cutbacks simply encouraged more people to leave. The only response available was to cut the level of services provided at a community level. This led to a downward spiral in the quality of the inner-urban environment. The urban infrastructure has been left to crumble and the range of social problems has escalated. Urban gangs, the devastating effects of drugs and alcohol, and the sense of isolation and rejection that come with poverty have been debilitating. People who are able to leave do, others are left behind in the downward spiral of decline.

Urban renewal projects

Despite the declining economic and social fortunes of Baltimore, authorities have initiated a number of urban renewal projects in the downtown area and surrounding neighbourhoods. Funding has been allocated to demolish abandoned housing and incentives provided to redevelop whole neighbourhoods. These urban renewal initiatives date from 1970 when the city's inner harbour was redeveloped. Fells Point is a historic waterfront neighbourhood on the north shore of the Baltimore Harbor just east of the famous 'inner harbour' (known as 'the basin') adjacent to the city's CBD.

Fells Point features the city's greatest concentration of restaurants, cafes, music stores, markets and more than 120 bars. The area's historic buildings have been restored in ways that enhance the area's historical character (see Figure 6.4.11).



6.4.11 Restored building in Baltimore's historic Fells Point district

Activities

Working geographically

1 **a** Write a short report outlining the extent of the social divisions in Baltimore.

b Explain why Australian cities do not have the extent of urban decay apparent in Baltimore's inner-city areas.

UNIT 6.5

Urban consolidation

Urban consolidation is the term applied to policies designed to increase population densities in existing urban areas. This is done in order to make more efficient use of existing infrastructure, and to limit spread of urban land uses into surrounding rural areas (urban sprawl). It involves construction of medium-density to high-density housing in already built-up areas, often on former industrial sites. It also widens the range of housing types available to urban residents. Urban consolidation is also referred to as 'urban intensification'.

Policies promoting urban consolidation are now at the centre of an ongoing political debate. People in favour of urban consolidation see it as a means of slowing the growth of urban sprawl and of making greater use of existing urban infrastructure. People opposed to urban consolidation see it as a threat to the character of existing urban precincts.

Advocates of urban consolidation highlight the impacts of urban sprawl and car dependence in cities. People opposed to urban consolidation argue that the so-called benefits of higher living densities are a myth at odds with contemporary urban life, and incapable of meeting the objectives of its advocates.

A case in favour of urban consolidation

Advocates of urban consolidation argue that it:

- slows the rate of urban sprawl. In Australia the average loss of land per capita is about 1200 square metres for each additional urban dweller.
- reduces the call on governments to fund expensive urban infrastructure. Low-density sprawl is expensive to service in terms of both physical and social infrastructure—utilities such as water, sewage and power; roads and public transport; and schools and hospitals. Urban consolidation results in the more efficient use of existing physical and social infrastructure.
- reduces car dependency and promotes the use of public transport. Providing public transport in cities dominated by low-density urban sprawl is very expensive.
- reduces greenhouse gas emissions. Cars are the largest source of emissions in urban areas. The burning of fossil fuels (in this case, oil) is a major contributor to global climate change.
- reduces social isolation and locational inequality. The excessive dependence on the car in the low-density outer suburbs has created new ghettos of poverty. There are limited local services and few transport alternatives to the car. The elderly, women and young teenagers are particularly disadvantaged.
- prevents the loss of the public realm. The priority given to private transport and private low-density housing means that public transport and public spaces, particularly in the inner city, become neglected.
- meets the changing housing needs of a more diverse population. The demand for low-density housing has declined and there is a growing preference for medium and high-density housing close to the city centre.

Promoters of urban consolidation often seek to portray low-density urban sprawl as being unsustainable and boring. They argue that high-density urban forms are progressive, vibrant, socially diverse and sustainable.

DID YOU KNOW?

Between the 2011 and 2016 census dates, the growth in medium and high-density dwellings was far greater than that for separate dwellings—18 per cent compared to 3 per cent over the five years. This trend is a result of contemporary planning policies which aim to enhance existing urban areas in order to slow the outward expansion of the city (urban consolidation).

A case against urban consolidation

Critics of urban consolidation argue that:



6.5.1 Leunig's view of urban consolidation. While policies promoting urban consolidation have been widely embraced to produce a more compact form, reduce car reliance and enhance social interactions they have received criticism in terms of their impact on peoples' quality of life due to traffic congestion, noise, perceptions of overcrowding and loss of privacy.

- 'greenfield' developments on the periphery of urban areas need not be as costly as advocates of urban consolidation state. Building blocks are considerably smaller than in the 1960s and 1970s and new suburban developments typically feature a mix of housing densities. These range from detached dwellings to multi-unit developments.
- increasing population densities in inner-urban areas will overwhelm the existing physical and social infrastructure, thereby negating any savings achieved.
- increasing the supply of housing in inner-city areas has not reduced the cost of housing. The demand for housing close to CBD-based employment and the attractions of the inner city have pushed up the cost of housing in accessible locations.
- increasing the density of housing in already crowded parts of the city only increases congestion.
- parking becomes an issue as residents appear unwilling to abandon their cars in favour of public transport.
- the construction of medium and high-density housing results in a loss of amenity and privacy in established urban precincts (see Figure 6.5.1).

Critics of urban consolidation often portray low-density suburbia as safe, healthy, family friendly and sustainable. They argue that high-density living is dangerous, unhealthy, family unfriendly and unsustainable.

Urban consolidation in Sydney

Signs of urban consolidation are evident throughout metropolitan Sydney. It is especially apparent in areas around the city's suburban railway stations and more desirable residential precincts. The process takes a variety of forms:



6.5.2 Types of urban consolidation: **A** townhouse and villa development, **B** duplex housing, **C** three-storey 'walk-up' apartment building, **D** high-density housing

- **Medium-density urban renewal:** This typically involves the demolition of a row of three to four detached dwellings and their replacement with townhouses, villas and duplexes (see Figures 6.5.2 A and B) or three-storey 'walk-up' apartment blocks (see Figure 6.5.2 C).
- **High-density urban renewal:** In sought-after locations, where land is often much more expensive, multistorey apartment buildings are constructed. In inner-city locations, old industrial sites and land occupied by obsolete port facilities are being redeveloped into high-density residential and commercial precincts (see Figure 6.5.2 D).

To be effective, urban consolidation depends on striking a balance being between the demand generated by households that would prefer medium and high density dwellings (the demand side) and the availability of such housing (the supply side). Household type is especially important. The social and demographic changes apparent in Australian society have led to a diversification in the types of accommodation required. In many instances these changes favoured the construction of higher-density housing types, which reinforced the process of urban consolidation.

Impacts of demographic changes

In general, people living alone and couples without children are more likely to opt for higher-density housing, shown in Figure 6.5.3.

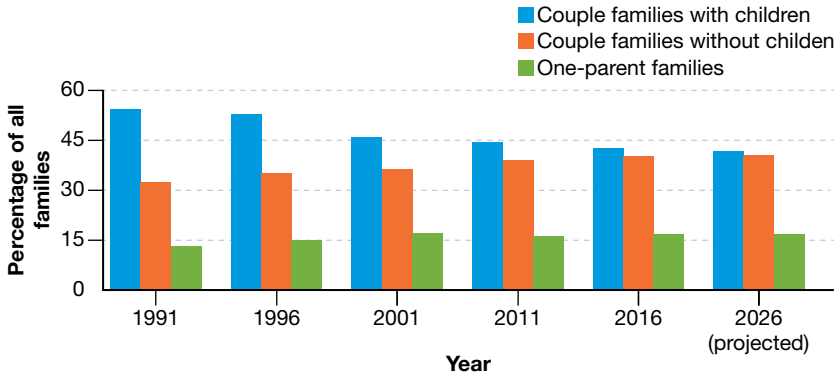
Demographic and social changes that affect urban consolidation include the following.

An ageing population

The proportion of the population over 65 years of age is increasing. At the 2016 Census, 17 per cent of Australians were over the age of 65, compared to 8 per cent in 1968 and just 4 per cent in 1911. This trend will continue, with 25 per cent of the population projected to be over the age of 65 by the middle of the century. People in the 65-plus age group are opting for a greater range of housing options, including townhouses, villas and apartments.



6.5.3 Inner-city apartment towers are increasingly popular with wealthy young professionals and baby boomers.



Source: Australian Bureau of Statistics, 2016

6.5.4 Selected family types in Australia, 1991, 1996, 2001, 2011, 2016 and 2026 (projected)

Family units

The number of lone-person households increased from 19.8 per cent in 1991 to 24.4 per cent in 2016. Lone-person households are projected to grow at the fastest rate of all types and make up to 34 per cent of all households by 2026. The aging of the population is the principal reason for this trend.

While couples with children (the nuclear family) remains the most common family type, as shown in Figure 6.5.4, they have declined from 53.7 per cent in 1991 to 44.7 per cent of family units in 2016. By 2026 they are projected to make up just 41.5 per cent of families, and possibly as low as 30 per cent if the trend of the last 20 years continues.

In 2016, 72 per cent of households had no children under the age of 15 years. Twelve per cent had only one child. Only 6 per cent had three or more children under the age of 15 years.

The number of couples without children (those who will never have children, those who are yet to have children and the older 'empty nesters') increased from 32.5 per cent of family units in 1991 to 37.2 per cent in 2016. By 2026, the proportion of family units without children is projected to increase to at least 41 per cent and perhaps as high as 49 per cent of all family units. While this growth is principally related to the ageing of the population, with the baby boomers becoming empty nesters, it is also a result of delayed family formation and the declining fertility rate of younger couples.

One-parent families increased from 12.8 per cent of family units in 1991 to 16.5 per cent in 2016. One-parent families are projected to increase to as many as 20 per cent of all households by 2026.

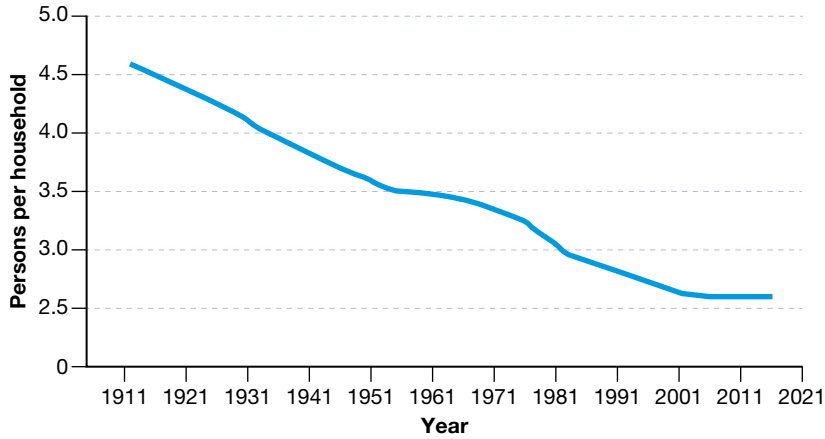
There has been growing acceptance of same-sex couple family units. Between the 2001 and 2016 Censuses the number of same-sex family units increased from 3400 to 47 000. Only 12 per cent of same-sex couples have children compared with 54 per cent of opposite-sex couples.

Later age of marriage

In 2015, the median age at marriage (the age at which there are as many people marrying above the age as there are below it) for men was 31.8 years, an increase from 28.8 years in 1993. For women, the median age at marriage rose to 29.8 years, up from 26.4 years in 1993. In general, the housing preference for married couples with children is low-density housing.

Decreasing size of households

The average size of Australian households has declined from 3.2 persons in late 1979 to 2.6 persons in 2006–2016, as shown in Figure 6.5.5. It is projected to decrease to 2.3 persons per household by 2026.



6.5.5 Average household size (persons per household), 1911–2016

Source: Australian Bureau of Statistics, 2016

Changing lifestyle expectations

Older Australians are experiencing an increase in life expectancy. The growth in retirement incomes and the wealth accumulated (at least by some) during the property and share market booms of the 1990s and early 2000s has had an impact on lifestyle expectations and aspirations. The desire to travel and a renewed interest in the purchase of vacation homes has, for example, encouraged some empty nesters to downsize their housing needs. They are selling the family home in the suburbs and moving to medium-density or high-density developments, often featuring shared resort-style facilities.

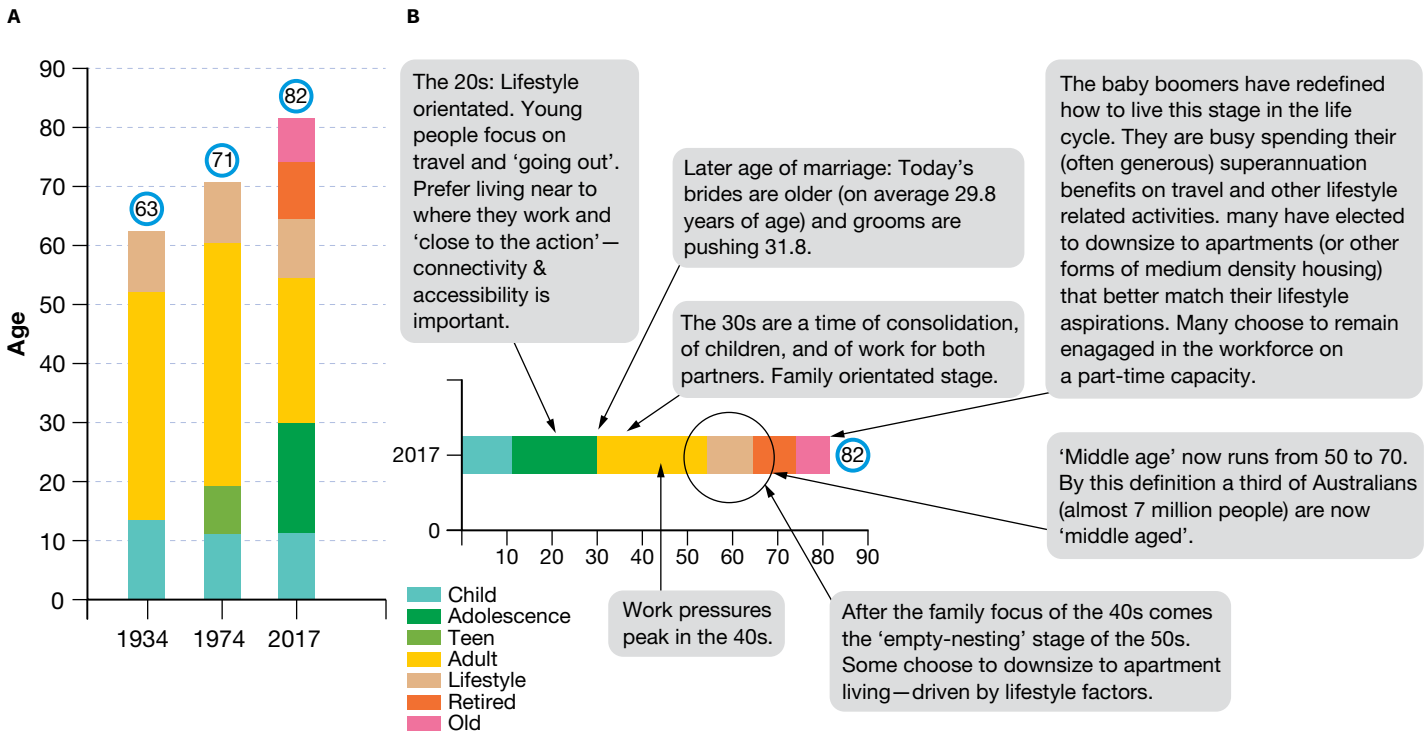
For the young, later marriage and childrearing, changed lifestyle aspirations and an increase in the number of couples choosing not to have children have helped fuel demand for medium-density or high-density housing close to the city centre.

Immigration

During the 1980s and 1990s, the source of Australia's immigrants shifted from Europe to Asia and the Middle East. Many Asians, in particular, are accustomed to high-density living. An increasing proportion of new migrants to Sydney now rent high-density accommodation in inner and middle suburbs. Migration has therefore contributed to the new medium- to high-density housing in Sydney's inner and middle suburbs. To that extent, urban consolidation is a result of the immigration program, not just local demand. It follows, then, that urban consolidation (especially when viewed as a city-wide context) may be impacted by the Australian government's changes to the intake of migrants.

The changing geography of consumer choice

The geography of consumer demand is equally important. Until the 1990s, Sydney experienced growth on the fringes and population loss in the city centre. This is the so-called 'doughnut effect'. The pattern of growth is now quite different. Some of the fastest-growing areas are now found in the inner city. Generally, the rapid growth on the city's fringe, which once dominated the city's pattern of growth, has given way to more consistent growth across the city as a whole.



6.5.6 **A** Changing life-stage cycles, 1934–2017 **B** Life-stage cycle, 2017

Life-cycle stages

The life-cycle stages have changed significantly over time. These changes have been described by demographer Bernard Salt and are presented in Figure 6.5.6.

Life-cycle stages in the 1930s

In the 1930s, people typically left school and joined the workforce at the age of 15 years. Adulthood stretched through to the early to mid-fifties when most people were considered to be 'old'. Life expectancy was 63 years.

Life-cycle stages in the 1970s

In mid-1970, young people were expected to stay engaged in education until their late teens. The transition to 'adulthood' was, as a result, deferred to 18–19 years of age and lasted to the early sixties. People were then considered 'old' and could expect to live until about 71 years of age.

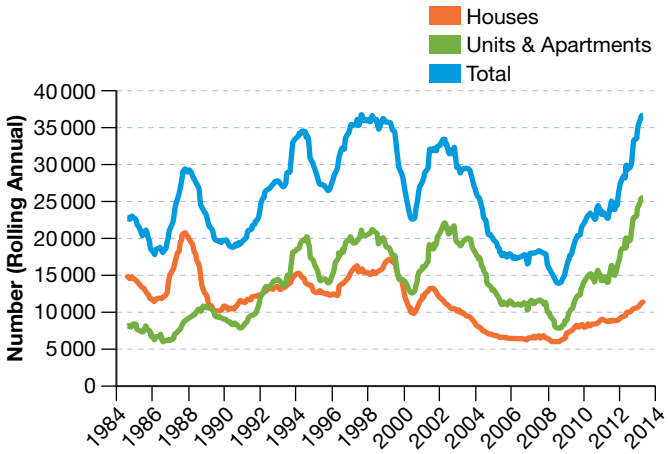
Life-cycle stages today

By 2017, the 'adolescence' stage extended throughout a person's twenties—driven by the later age of marriage. Unencumbered by the responsibilities associated with supporting a family, there is little incentive for this age group to acquire or even rent detached homes in suburbia. Most want to live close to work and their favoured entertainment venues. In their mid-50s people enter what is described as a 'lifestyle-focused' stage of life, followed by retirement, before becoming 'old' in their mid-70s. Longer life expectancy has prompted many people to change their housing to a style that best suits their lifestyle aspirations.

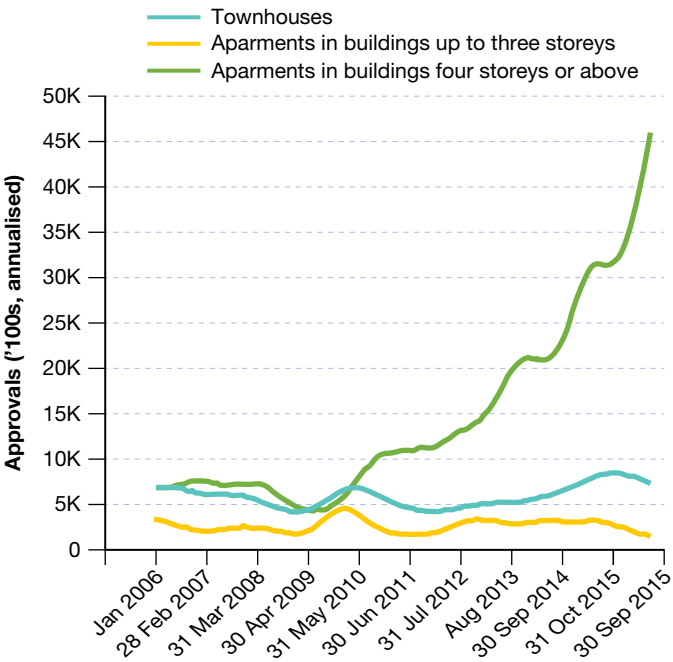
SPOTLIGHT

Transport by region

- Urban Australians use 30 000 megajoules of petrol per city dweller, compared with 58 000 megajoules in the United States and 13 300 megajoules in Europe.
- Only 8 per cent of total travel by urban Australians is by public transport, compared with 4 per cent by those in the United States and 25 per cent by Europeans.
- Australian cities have 8.7 metres of urban road per city dweller, compared with 6.6 metres in the United States and 2.1 metres in Europe.
- Only 5 per cent of urban Australians and Americans cycle or walk to work compared with 23 per cent of Europeans.
- Sydney has a population density of 52 people per hectare, compared with 97 per hectare in Greater London. Melbourne has the lowest population density (25–32 people per hectare) of any Australian capital.



6.5.7 Sydney dwelling approvals by type, 1984–2013



6.5.8 NSW building approvals for high-rise apartments, 2006–2015

Changes in Australia's housing stock

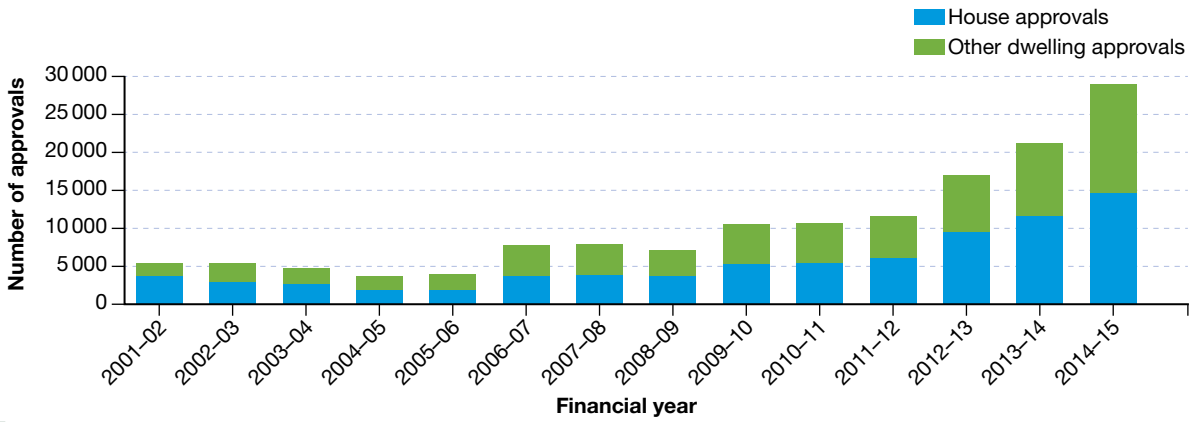
Demographic changes—and the social trends that underpin them—have contributed to a shift in people's housing preferences. This has resulted in a change in the mix of accommodation built by developers. Many of these are medium-density and high-density developments on land that has been rezoned. Former industrial sites and the areas occupied by obsolete port facilities have often undergone large-scale urban renewal, incorporating a mix of residential and commercial activities. This trend has amplified the process of urban consolidation: one reinforcing and accommodating the other.

The number of building approvals for units and apartments in Sydney has outstripped that for detached dwellings (houses) since the turn of the century. There are now twice as many units and apartments being built than houses, as indicated in Figure 6.5.7. The trend is clearly towards high-rise living as shown in Figure 6.5.8.

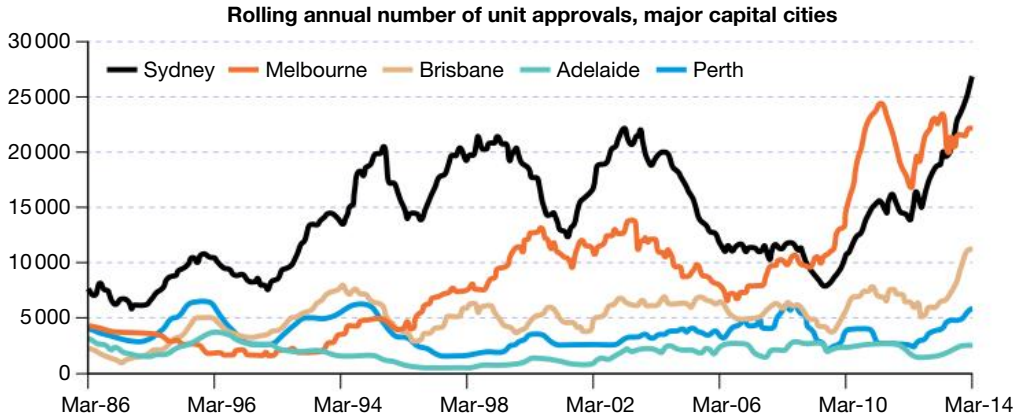
This trend is not limited to Sydney's inner suburbs. In Sydney's west, as many medium and high-density housing units are being built as detached dwellings (see Figure 6.5.9). Significantly, the pattern of approvals in Sydney and Melbourne differs from that experienced in other Australian capitals. The shift to medium and high-density housing is heavily concentrated in Sydney and Melbourne with Brisbane emerging as a third contender as seen in Figure 6.5.10.

These trends reflect the demographic and social changes outlined above. These changes are significant, as outlined below.

- The proportion of family-based households has decreased from 75.4 per cent in 1991 to 71.5 per cent in 2016.
- Couples with no offspring accounted for 32 per cent of these family-based households in 1991 and 38 per cent in 2016.
- The share of one-parent households has increased from 12.8 per cent in 1991 to 16 per cent in 2016.
- The proportion of one-person households has increased from 20 per cent in 1991 to 24.4 per cent in 2016.
- The data in Figure 6.5.10 show the impact of these trends on Australia's stock of housing.



6.5.9 Greater Western Sydney dwelling approvals by type, 2001–02 to 2014–15



6.5.10 Unit approvals, selected capital cities, 1986–2014

Sydney

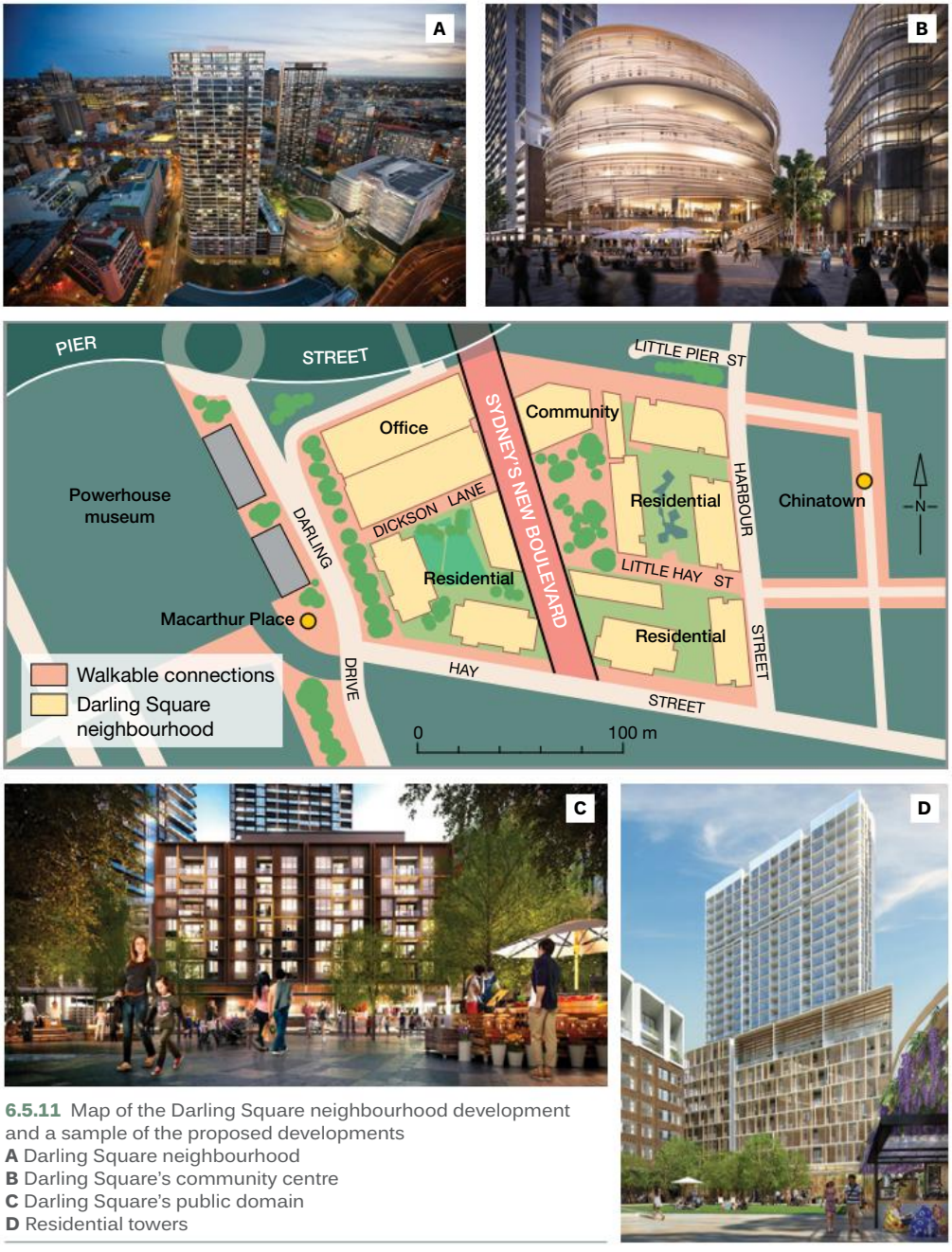
Sydney is set to grow by more than 1.5 million people in just over 20 years, from 5.07 million in 2017 to 6.62 million people in 2040 and will require a range of housing options that differ significantly from today's housing stock. Much of the new housing will be built along transport corridors and via intensive (high-density) residential development.

In 2017 Sydney had approximately 1.85 million dwellings. By 2031 the city will need to have added another 664 000 dwellings. Most of these will be built within existing suburbs.

The NSW Government's Housing Strategy concentrates on developments that strengthen existing urban centres and neighbourhoods focused on public transport. New housing will focus on better-designed medium-density developments, incorporating areas of open space.

Darling Square development

The transformation of the Sydney Entertainment Centre precinct into a new high-density neighbourhood (to be known as Darling Square) is an example of both urban consolidation (or intensification) and urban renewal, as seen in Figure 6.5.11.



6.5.11 Map of the Darling Square neighbourhood development and a sample of the proposed developments
A Darling Square neighbourhood
B Darling Square's community centre
C Darling Square's public domain
D Residential towers

Demographic and social change is driving the demand for inner-city living. The Entertainment Centre (opened in 1983) and the adjacent multi-story car park are being replaced with apartment towers, student housing, commercial office space, and a mix of lifestyle related retail outlets and attractive and accessible public spaces.

When complete, Darling Square will be home to 4200 residents and the workplaces of a further 2500 people. There will be over 1500 apartments and accommodation for 1000 students in buildings of varying heights. At ground level more than 60 shops, bars and restaurants will line new streets and laneways. Commercial office space will also be included in the expectation that the area will become a new centre for firms engaged in technical innovation. Twenty-five percent of the area will be open space. The Commonwealth Bank will lease the precinct's largest commercial building.

A new urban square will be at the heart of the development and its bordering streets and laneways will connect the precinct with adjacent neighbourhoods—Chinatown and Ultimo. Running through the centre of Darling Square, and linking it to ICC Sydney and Cockle Bay, will be a new tree-lined pedestrian boulevard. Darling Square will be completed in stages, from 2016 to 2019.

Activities

Understanding the text

1 Define urban consolidation. What does it involve?

2 Explain why urban consolidation is at the centre of an ongoing political debate.

3 Summarise the arguments used by those promoting policies of urban consolidation.

4 Outline the arguments used by those who oppose policies promoting urban consolidation.

5 Distinguish between medium- and high-density housing as found in Sydney.

6 Outline the demographic and social trends that have favoured the construction of medium- and high-density housing.

7 Explain how Australia's immigration program favours urban consolidation.

8 Outline how Sydney's geography of consumer demand has changed since the 1990s.

9 List the reasons why local residents sometimes oppose medium-density to high-density residential developments in established residential areas.

Working geographically

10 Study the arguments for and against urban consolidation. Debate the proposal: 'Policies that encourage urban consolidation are essential to the future wellbeing of Australian cities.'

11 Urban consolidation aims to:

- **a** increase population in inner to middle suburbia
- **b** increase housing choice and opportunities
- **c** widen the range of housing types available in established areas.

Working in groups of four, discuss what is meant by each of these statements. Is urban consolidation the best way to achieve these aims? Are there any alternatives?

12 Study Figure 6.5.1. Explain, in your own words, the point made by Leunig in his cartoon. Do you agree with such a view?

13 Explain what is meant by 'connectivity' in the context of urban consolidation.

14 Write a report outlining how the changes in the life-cycle stages of Australians is impacting on their housing choices.

15 Construct a mind map outlining the demographic and social factors influencing the housing market in Australia.

16 Write a report outlining the trends apparent in the supply of housing stock. Use data from Figures 6.5.7–6.5.10 to illustrate the points you make in the report.

17 Explain why developments such as Darling Square are a response to the changing demographic and social character of Australia.

18 Using the real estate section of a newspaper, collect examples of medium-density and high-density housing types. Categorise the housing types you have selected.

19 Gather media reports dealing with the debate about the issue of urban consolidation. Outline the arguments used to oppose medium-density and high-density residential developments. Local newspapers are often an excellent source of such material.

20 Contact your local council and ask for information relating to urban consolidation in the local area.

- **a** What limits are there on such developments?
- **b** What areas are zoned for this type of land use?
- **c** What rights do local residents have to oppose such developments?

21 Use photography to record examples of urban consolidation in your local area. Organise these by type: villa, townhouse, duplex, dual occupancy, three-storey 'walk-up' apartment and multi-unit high-rise.

22 Write a discussion outlining the arguments for and against urban consolidation, or write an exposition arguing either in favour of or against policies that promote urban consolidation.

UNIT 6.6

Urban villages

An urban village is a distinctive residential (and/or commercial) district whose functional form and character are influenced by a particular community.

The concept of 'community' relates to two main elements: community as a place and community as society. Community as place is based on shared space; the other, community as society, is based on shared social organisation and interest. Thus, an urban village is a distinctive residential district made up of groups of people with a common culture and an identifiable local focus.



6.6.1 The Rocks Market—the Rocks is one of the City of Sydney's 'villages'. Each area has its own unique character.

Sydney: 'city of villages'

The City of Sydney Council has adopted the vision of Sydney as a 'city of villages'. The council's aim is to re-establish traditional neighbourhood patterns to promote vibrant, liveable and sustainable communities. Each village has its own unique local characteristics. These can be grouped according to their geographical location:

- **city central:** Haymarket and Chinatown, Walsh Bay, The Rocks (shown in Figure 6.6.1) and Darling Harbour
- **city east:** Potts Point and Kings Cross, Paddington, Darlinghurst and Surry Hills
- **city west:** Pyrmont, Glebe, and Newtown/Erskineville
- **city south:** Chippendale, Redfern and Waterloo, Green Square.

Cities within cities

Another level of community is best described as 'urban nodes' or 'regional cities'. There is an increasing tendency for particular parts of large cities to focus on employment as well as of social activity. This is brought about by the suburbanisation of employment; advances in telecommunications; technological innovations in transport, distribution and information processing; and the growth of edge cities with their major concentrations of retail, office and advanced manufacturing activities.

Such economic concentrations reinforce the social regionalism and residential segregation within cities on the basis of socioeconomic status. These characteristics have long been a feature of economically advanced Western societies. As journey-to-work times have been reduced, so too have journey-to-leisure times. This has reinforced the edge city concept. Fewer people are attracted to the central city. As more facilities become available in Sydney's west—such as cinema complexes and the vast Westfield shopping centres—the trip to the city becomes less necessary.

This process is leading to the emergence of the 'diversified-integrated' city, or cities within cities. Sydney examples include:

- Parramatta, Campbelltown-Macarthur, Liverpool, Penrith—defined as either a CBD (in the case of Parramatta) or a Regional City Centre by the NSW Government's Plan for Growing Sydney
- Brookvale, Dee Why, Macquarie Park, Chatswood, St Leonards, Rhodes, Sydney Olympic Park, Bondi Junction, Green Square, Kogarah, Hurstville, Burwood, Bankstown, Castle Hill, Norwest, Blacktown, Rouse Hill, Hornsby, Marsden Park and Leppington—defined as 'Strategic Centres'.

A considerable share of the commuting undertaken by people living in the Sydney urban area, as in other Australian metropolitan centres, is now suburb to suburb. Fewer than 20 per cent of today's work-related trips are to the city centre. The journey to shops follows the same pattern. Today, only about 8 per cent of Sydney's shopping dollar is spent in the CBD, well below the peaks of 15 per cent during the 1970s. CBD retailing has become a high-end niche market, a regional shopping centre in its own right.

Increasing regionalisation of Sydney's journey to work is important because of established relationships between patterns of work, leisure and everyday activities. When work is far from home, involving hours of travel, little time is left for leisure or domestic pursuits during the week. Regionalisation of the city, bringing place of work and place of residence closer together (combined with the development of a leisure infrastructure), contributes to the development of regional cultures and identification. People living to the south of Sydney's Georges River have developed a regional identity focusing on 'the Shire' (that is, the Sutherland Shire), which stretches from the beaches of Cronulla in the east to Menai in the west.

Community as society focuses on groups of people, such as business people, the gay community, university students, ethnic communities, and people who follow a particular football team. These people may come from a broad region or even the city as a whole. Sometimes these intersect, creating distinctive urban spaces or 'urban villages'.

Examples of urban villages in Sydney can be seen in Figures 6.6.2 to 6.6.7.

Some other cases are less readily identifiable as villages. For example, Cabramatta in Sydney's Fairfield is often associated with Vietnamese immigrants. However, that only highlights the high concentration of Vietnamese people living in this area and overlooks the large numbers of other community groups who live there. Going further afield, local concentrations of, say, Korean immigrants in the Eastwood area in Sydney's north-west highlight a 'community within a community', not an urban village as such.

SPOTLIGHT

It's all about connectivity!

Connectivity, together with affordability and accessibility, is now one of the most important qualities people demand in urban living.

A key to creating a better environment for people living in cities involves enhancing connections to all elements of the city—public transport, open spaces, parks, work, entertainment, shops, cafes and restaurants. A better quality of life can be achieved with quality infrastructure, good communal spaces and efficient transport links so people aren't isolated within the city. Things like the aesthetics of an area, the quality of the public domain, recognisable landmarks, the sights and sounds and even smells all contribute to the creation of a sense of place.



6.6.2 Double Bay and Mosman—significant shopping and social precincts for higher socioeconomic status groups



6.6.3 Norton Street, Leichhardt—a focus of local cafe society, with a strong Italian presence



6.6.4 King Street, Newtown—a mix of students and young professionals



6.6.5 Chinatown in the CBD—partly as a tourist attraction, but more importantly as a focus for Chinese–Australian interests



6.6.6 Brighton-Le-Sands—a strong Greek community focus



6.6.7 Darlinghurst—the centre of Sydney's gay and lesbian community

Activities

Understanding the text

1 Explain what an urban village is. Give examples of urban villages with which you are familiar.

2 Explain what is meant by the term community. Differentiate between the concepts of community as place and community as society.

Working geographically

3 If you live in Sydney, brainstorm and compile a list of urban precincts that you think qualify for the title 'urban village'.

4 Visit an urban village and observe the types of commercial activities that occur there. How do these activities reflect the needs of the community with which it is identified? How do the streetscape and ambience of the area reflect the interests of the community it serves?

5 Visit an urban village with which you are unfamiliar. Based on your observations, construct a profile of the type of community with which you think the precinct is associated.

6 **a** Define the term regional city when it used to describe a city within a city.

b What developments have led to the emergence of such centres?

c What tendencies do the development of such centres reinforce?

d How has this affected the central city?

e Use information from the text to describe the relative importance of Sydney's CBD.

7 Visit a regional city located within a large metropolitan centre. Observe and record the types of commercial, cultural and recreational activities available there. How have these changed over time? (This may require some library research or interviews with older residents.) Describe the nature of the built environment. Investigate its transport links to the surrounding area.

8 If you live in a large urban centre, survey a group of students to determine their family's pattern of movement within the urban area. For example, ask them about their family's journey-to-work, journey-to-shop and journey-to-leisure movements. These can be mapped. How often do they travel to the city centre for work, leisure and shopping? Select the most appropriate graphical forms to display the findings of your survey. Mount a wall display.

9 Using Google Earth, explore at least two of the cities within a city or 'edge cities' listed in this unit.

UNIT 6.7

Spatial exclusion and fortified suburbs

In the cities of both the developed and developing worlds, the desire of the urban elite to protect their privileged lifestyles has resulted in practices that limit the access and movement of other urban dwellers. Examples include high-security suburbs (walled estates) and security conscious shopping malls and business centres. This process is known as spatial exclusion. The control and regulation of land use is the usual means by which 'undesirable elements' are excluded from a particular urban space. This practice is often referred to as exclusionary zoning.

Exclusionary zoning is an offshoot of the economic or class segregation in the United States (and elsewhere) and dates from the 1920s. The desire of the emerging suburbanising middle class was to maintain a social distance from the immigrant underclass, racial minorities and the poor of the inner city. Its purpose was to guard against a widespread fear of crime: the threat to property and person. The most common example of exclusionary zoning is the 'gated community'.



6.7.1 A cartoonist's view of gated communities

Gated communities

Gated communities are residential areas with restricted access in which normally public spaces are privatised. They are secure residential developments with defined perimeters, usually walls or fences, and controlled entrances that are intended to prevent access by non-residents (see Figure 6.7.1). They include new developments and older areas retrofitted with gates and fences, and can be found in the inner cities and the suburbs, as well as the richest neighbourhoods and the poorest.

While gated urban communities and 'exclusionary zoning' is primarily a product of developments in the United States, there are examples in Australia.

In Australia, and elsewhere, gated communities have fallen out of fashion. Developers now prefer to build 'master-planned' estates with shops, offices and communal facilities that attract people, rather than turn them away.

Australia's gated communities

In Australia, the division between the rich and poor is not as great as that found in the United States and many other countries. Despite this, 'moral panics' associated with the presence of undesirable elements have led to the development of some 'enclosed' housing estates. Quite often, these take the form of elite residential development. Some inner-city gated communities are located near or adjacent to lower-class to middle-class residential precincts. Here the social divisions are often more stark. The Macquarie Links Estate is, for example, surrounded by a number of Sydney's less affluent suburbs.

A more typical example of spatial exclusion is the emergence of the exclusive lifestyle estate as the principal form of 'greenfield' residential development. Such master-planned estates are rarely walled. Exclusiveness is maintained by the expense involved in buying into such developments. The use of landscaped embankments and the posting of signs to remind outsiders that the facilities are for the exclusive use of residents are examples of strategies that 'design out' non-residents.

Some master-planned estates actively practise exclusion to gain a market advantage. They promise safety and isolation from perceived cultural and socioeconomic difference. However, others argue that social conformity and homogeneity are instead being sold.

Macquarie Links Estate

Sydney has fourteen gated communities. Most are small, with fewer than fifty homes. One of these is the Macquarie Links Estate at Ingleburn in the city's south-west, shown in Figure 6.7.2. With 300 homes and 900 residents, it is Sydney's largest such development. While the community's assets were initially controlled by the developer, these have now been handed over to a community association that effectively runs the estate. Most of those living in the community were attracted by the 24 hour security provided by the estate. Also important was the 'sense of community' and 'exclusivity' experienced by residents.



6.7.2 Sydney's largest gated community, Macquarie Links Estate, Ingleburn

Fortress America

In the United States they now talk of 'Fortress America': the mainly European-American, suburban fortresses referred to by some as 'privatopias' (see Figures 6.7.3 and 6.7.4). They include gated estates, homeowner associations and apartment buildings with surveillance cameras and doormen. For the most part they house people who wish to isolate themselves from the wider community. The perception of increasing suburban crime is often cited as the main reason for moving to such developments. These fears are often a result of a 'moral panic' propagated by the media.



6.7.3 Concentrations of gated communities in the United States

The number of people in the United States living in these security communities increased from 4 million in 1996 to 15 million in 2016.

The municipality of Mt Laurel in New Jersey provides a good example of exclusionary zoning in practice. Local authorities banned apartments and single-family homes on blocks smaller than a quarter of an acre. This made them very expensive. Although this zoning restriction was later declared illegal, it was typical of exclusionary practices exercised by many suburban municipalities. Even today, an extreme form of spatial exclusion can be found in parts of Los Angeles, where walled suburban communities are policed by armed guards who turn away 'undesirable elements'.



6.7.4 Brickell Key in Miami, Florida—an artificial community on an artificial island separated from the mainland by water, requiring access by bridge

Pebble Beach, California

Located on the coastal strip between Monterey and Carmel, south of San Francisco, California's Pebble Beach is one of the world's most readily recognised gated communities. It is built around some of the world's most famous golf courses—Cypress Point Club, Monterey Peninsula Country Club and Pebble Beach Golf Links, shown in Figure 6.7.5.

Pebble Beach is home to 4500 mainly affluent residents. While this part of California has a very large Hispanic population, Pebble Beach's population is racially homogeneous with European-Americans accounting for 91.4 per cent of residents. Asian-Americans make up 5.3 per cent of residents, Hispanic or Latino 2.3 per cent and African-Americans 0.4 per cent.

While Pebble Beach is a gated community, it differs from other such communities in the USA. For an entrance fee of US$10 per vehicle, tourists can enter the community and drive the length of the famous '17-Mile Drive' scenic coastal route (shown in Figure 6.7.6) and visit the community's resorts and restaurants.



6.7.5 Pebble Beach Golf Links



6.7.6 Pebble Beach's spectacular 17-Mile Drive

Activities

Understanding the text

1. Explain what is meant by the terms spatial exclusion and exclusionary zoning.
2. Explain what motivates people to buy into gated communities
3. Outline the origins of gated communities and exclusionary zoning.
4. Cite examples of how exclusionary zoning is used to keep away 'undesirable elements'.
5. Outline the nature of spatial exclusion taking place in Australia.

Working geographically

6. Study Figure 6.7.1. Explain, in your own words, the point of view the cartoonist is trying to communicate.
7. Study Figure 6.7.3. Write a paragraph describing the spatial distribution of gated communities in the United States.
8. Using Google Earth, explore the gated communities showcased in Unit 6.7. Start with Pebble Beach.
9. Conduct a class discussion. List the advantages and disadvantages of living in a gated community.
10. Conduct a class debate. Topic: 'Gated communities have no place in Australian cities.'
11. Use the real estate section of a city-based newspaper (a Saturday edition would be best) to find examples of master-planned residential developments. How are the developments being marketed?
12. Use the internet to locate the websites of companies developing gated communities in the United States. Study the language used on the site. Comment on how the development is being promoted to prospective customers.
13. Construct a mind map using 'urban dynamics' as the central theme.

UNIT 6.8

Fieldwork: Investigating an urban dynamic

TASK: Develop and implement a research action plan investigating an urban dynamic operating in a suburb or country town.

Stage 1: Develop the research action plan

The first stage of this task involves the development of a research action plan. This is the means by which a selected urban dynamic can be investigated within a specific spatial context; that is, a suburb or country town.

In preparing your research framework, you will develop a range of geographical skills and make progress towards the mastery of a number of important syllabus outcomes. The research action plan should include:

- a title that includes the name of the selected urban dynamic and the suburb or country town being investigated
- a statement (and map, if appropriate) giving the location of the suburb or country town selected for the fieldwork investigation (100 words maximum) (H13)
- a definition and brief explanation of the selected urban dynamic (300 words maximum) (H3, H13)
- a list of secondary sources relevant to the selected urban dynamic and an evaluation of their usefulness, validity and reliability (200 words maximum) (H8, H9)
- two or three geographical inquiry questions relevant to the selected urban dynamic (H8)
- a hypothesis derived from one of the geographical inquiry questions considered relevant to the selected urban dynamic (H8)
- an explanation of two inquiry based methodologies that could be used to investigate the questions identified as being relevant to the selected urban dynamic and to test your stated hypothesis (H8)
- an outline of how the anticipated research findings could be presented (200 words maximum) (H10, H12, H13)
- an outline of how the effectiveness of the research framework might be evaluated (100 words maximum) (H8).

Urban dynamics

Choose one of the following urban dynamics to investigate in your selected country town or suburb:

- suburbanisation
- exurbanisation
- counter-urbanisation
- decentralisation
- urban decay and renewal
- urban villages
- spatial exclusion.

Targeted syllabus outcomes

In order to achieve a high-level mark, your research action plan should demonstrate that it meets the course requirements.

Stage 2: Implement the research action plan

This second stage of the task provides you with an opportunity to implement the research action plan you have developed. Fieldwork involves the application of geography's inquiry-based methodology. By engaging in fieldwork you will develop a number of geographical skills and make progress towards the mastery of a number of important syllabus outcomes.

When implementing the research action plan you should:

- name the urban dynamic and locate the suburb or country town being investigated
- develop and trial the methods you intend to use to gather and record data in the field (H8)
- gather and process the relevant primary and secondary data (H8)
- communicate the findings of your research in the most appropriate written and/or graphic form (300 words maximum) (H13)
- evaluate, analyse and synthesise the data presented (H8, H9)
- use the data collected to answer your geographical inquiry questions and to prove or disprove the hypothesis that is under investigation (500 words maximum) (H3, H12, H13)
- evaluate the effectiveness of the research framework (200 words maximum) (H8).

Note: Ensure your research is conducted in an ethical manner.

Your fieldwork report

When writing up your fieldwork you should include:

- a title that includes the name of the selected urban dynamic and the suburb or country town being investigated
- a statement (and map, if appropriate) giving the location of the suburb or country town selected for the fieldwork investigation
- a definition and brief explanation of the selected urban dynamic being investigated
- a list of secondary sources relevant to the selected urban dynamic
- the geographical inquiry questions being considered
- the hypothesis being tested
- an outline of the inquiry based methodologies used to test your hypothesis
- the presentation of the data collected in a written and/or graphic form
- a discussion of the research findings
- an evaluation of the research framework.

Activities: Investigating urban consolidation

Pre-fieldwork activities

1 Review the section of the text dealing with urban consolidation to ensure that you have a sound understanding of the relevant concepts and the arguments for and against urban consolidation.

2 Gather additional secondary data from the internet, the NSW Department of Planning and Environment, the relevant local government authority and any community based interest groups with an interest in the issue.

3 Synthesise the main issues raised in the material gathered. Evaluate these sources for their usefulness, validity and reliability.

4 Using small-area data collected by the Australian Bureau of Statistics, construct a profile of the suburb or country town being investigated. Include both demographic and socioeconomic data. Compare the profile developed with that of Australia as a whole. How 'typical' is the area under investigation?

Fieldwork-based activities

5 Select a suburban area or a country town.

6 Prepare a base map of the area selected.

7 Develop a classification system covering the main types of residential development in the area being studied. For example, classify residential land uses by density (low, medium or high) or by type (townhouse and villa developments, duplexes, three-storey 'walk-up' apartment/flat developments, multistorey housing units, shared-facility cluster-type housing). Use photography to illustrate each category of housing.

8 Contact the relevant local government authority and do the following.

- **a** Request information relating to the council's policy on urban consolidation. Does the council actively promote urban consolidation or does it use its planning powers to limit such developments?
- **b** Find out whether there are any State Government regulations that restrict the council's autonomy in matters dealing with urban consolidation.
- **c** Obtain a copy of the council's zoning regulations relating to the construction of medium-density and high-density housing in the area studied.

9 Interview a local real estate agent. Ask the agent about:

- **a** the demand for medium-density and high-density housing in the area being studied
- **b** the price range for this type of residential development compared with low-density, detached dwellings
- **c** which demographic groups are attracted to this type of housing
- **d** the attitude of the local council and residents to this type of residential development.

10 Using your system of classification, map the types of residential development in the area studied. Compare your map with the council's map of areas zoned for low-density, medium-density and high-density housing. Note any pattern evident. For example, are the areas zoned for medium-density and high-density housing adjacent to railway stations?

11 Develop and undertake a survey to ascertain the level of community support for medium-density and high-density residential developments in established residential areas.

12 Undertake qualitative research to ascertain why local residents support or oppose such developments. Then complete the following tasks.

- **a** Present the data in the most appropriate graphic form.
- **b** Comment on the views of local residents.

Exam-style questions

Extended responses

- Discuss the operation of an urban dynamic in a large city of the developed world.
- Analyse the impacts of a contemporary urban dynamic in a large city of the developing world.
- Analyse an urban dynamic as an agent of change in a suburb or country town.
- Outline the steps you would take to investigate the operation of an urban dynamic in a suburb or country town.

Glossary

alternative lifestyle a conscious attempt to create a new way of life free of the constraints and stresses of mainstream urban living; often a back-to-nature perspective

counter-urbanisation a reversal of the rural to large city movement associated with urbanisation

decentralisation the dispersal of activities and people from large urban centres to smaller urban centres and rural communities

exclusionary zoning land use regulations or controls that are designed to exclude 'undesirable elements' from a particular urban space

exurbanisation a process whereby people, usually those who are quite affluent, move from the city to rural areas but continue to maintain an urban way of life either through long-distance commuting or technology

gentrification the renewal of inner-city residential precincts; dilapidated homes are purchased, refurbished and occupied by middle-income and high-income earners; the process is a product of the preference of people for access to employment and entertainment in and around the central business district

morphology the functional form and character of an urban environment

new economy the high-tech information- based economy arising largely from new developments in the internet, telecommunications and computer sectors

peri-metropolitan region the area bounded by the furthest extent of commuting to metropolitan jobs

spatial exclusion the protection of luxury lifestyles, which has resulted in restrictions in spatial access and the freedom of movement of other urban dwellers; examples include high-security suburbs, walled estates and security conscious shopping malls and business centres

suburb an urban area surrounding and connected to the central city; many are exclusively residential, others have their own commercial centres

suburbanisation the movement of people, employment and facilities away from the inner city towards outer urban areas

urban consolidation policies that encourage higher population densities in established suburban areas, usually through planning regulations allowing more dwelling units on a given area of land through subdivision or strata title

urban decay the deterioration of the built environment. Urban infrastructure falls into a state of disrepair and buildings are left empty for long periods of time

urban morphology both the functional form and character of the urban environment. The factors that contribute to a city's morphology include its land use and street patterns; its architectural styles, building types and materials, streetscapes and density of development; the nature of the biophysical environment, such as topography; and a wide range of socioeconomic and cultural influences

urban periphery the outer edge of an urban area

urban renewal the redevelopment of an urban area

urban sprawl the continuous, and often unplanned, outward growth of an urban area

urban village distinctive residential districts comprising a clustering of people with a common culture and forming an identifiable community

CHAPTER

7 Sydney: a global city

Global economic restructuring has transformed the way in which we look at large cities in the developed world. First, the roles of large cities are changing. These changes not only impact on the city's position within the world system of cities but also on its position within the national urban hierarchy. Second, global economic restructuring and deregulation have an impact on the social, economic and political relationships within the city itself. In all these respects, Sydney, as an emerging 'world city', makes for a particularly interesting case study.

This chapter focuses on the processes shaping the urban geography of Sydney: an example of a large city in the developed world. Particular attention is paid to the city's:

- changing economic character, nature and location of residential land, commercial and industrial development
- social structure and spatial patterns of advantage and disadvantage, wealth and poverty, and ethnicity
- culture of place as expressed in the architecture, streetscape, heritage, noise, colour, street life, energy and lifestyles
- future growth and development and how this can be managed in an ecologically sustainable way.

> **In one sense, even by jet, we're a long way from the world yet we entertain the world—that's the aspect of Sydney I like very much. The diversity of the face of Sydney is what I really like ....**
>
> **Thomas Keneally, author**

7.0.1 The colours of Sydney at night



UNIT 7.1

Sydney: physical setting and development



7.1.1 Sydney occupies an area of 12 367 square kilometres. It is bounded by the Blue Mountains to the west, the Royal National Park to the south and the rugged sandstone topography of the Hawkesbury River to the north. To the east lies the South Pacific Ocean.

In just 230 years, Sydney has grown from a small, struggling convict settlement into a vast urban metropolis housing more than five million people, most of whom continue to live in low-density suburbs that sprawl over an area of more than 12 367 square kilometres.

Suburban Sydney radiates out from Port Jackson (Sydney Harbour). The harbour and its surrounding topography (see Figure 7.1.1) play an important role in shaping the city's morphology; that is, its functional form and character. The relatively flat Cumberland Plain, stretching to the south and west of the harbour, has accommodated widespread industrial and urban expansion. In contrast, the rugged sandstone country to the north of the harbour initially proved unsuitable for industry and large-scale urban development.

Many people find Sydney a pleasant and exciting place to live. It has an attractive physical setting and its mild climate and coastal location favour water-based sports and a relaxed lifestyle. The city is also a major focus of culture and entertainment. It is an administrative centre and contains a number of Australia's largest educational institutions. In 2017, the Economist Intelligence Unit ranked Sydney as the world's 11th most liveable city.

Sydney's status as a major link in the global network of large cities is reflected in the number of transnational corporations (TNCs) that use it as the base for their Asia–Pacific headquarters. The city's selection as the host of the 2000 Olympic Games confirmed its growing global stature.

Transport developments changing Sydney

It was not until the opening of the Harbour Bridge in 1932, and the widespread ownership of cars in the period following World War II, that the city's northern suburbs became fully developed. The harbour continues to provide an important focus for the city. It is the centrepiece of many of the city's celebrations, including the annual New Year's Eve fireworks display. The city's harbour setting makes a major contribution to the city's identity and its 'culture of place' (see Figure 7.1.2).

The construction of the railways resulted in the linear spread of urban settlement along the railway corridors. Sydney's tramways, which were built in the period from 1890 to 1920, stimulated urban development in the areas between the radiating railway lines. The introduction of buses continued this process.

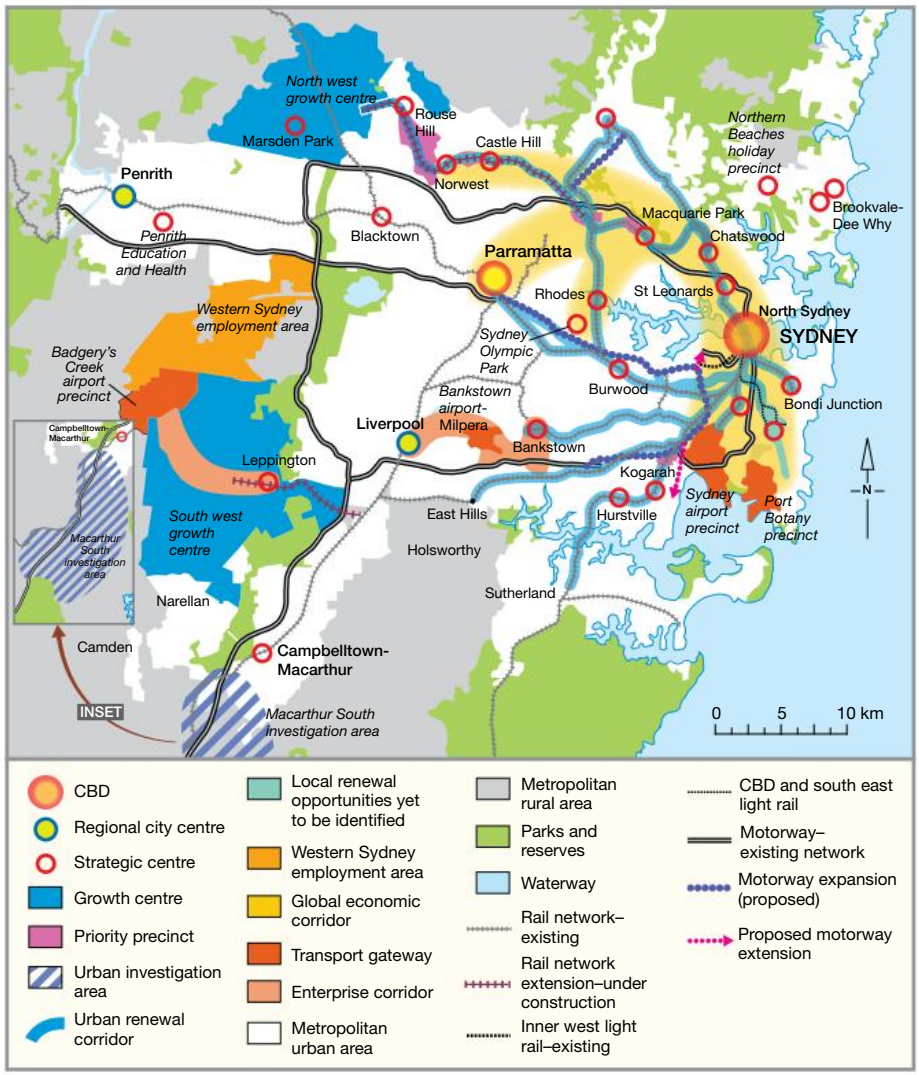
In the period after World War II, the widespread ownership of cars facilitated a period of rapid low-density suburban growth on the fringes of the existing urban area, beyond the reach of public transport. Growth was most rapid in the south-west, north-west and west around small communities that had once served as rural service centres. Centres such as Bankstown, Blacktown, Fairfield, Liverpool, Parramatta and Penrith have grown rapidly and become centres of industrial and commercial development. The car changed Sydney from a single-centred city focused around a central business district (CBD) to a multi-centred city shown in Figure 7.1.3.

DID YOU KNOW?

Sydney is Australia's financial and economic capital. Forty-five per cent of the top 500 Australian companies are based in Sydney. It drives around 70 per cent of New South Wales' total economic output and over one-fifth of the nation's Gross Domestic Product (GDP).



7.1.2 The city's physical setting makes a major contribution to the city's identity and its 'culture of place'.



Source: NSW Planning & Environment, *A Plan For Growing Sydney*, 2014

7.1.3 NSW Government's *A Plan For Growing Sydney*

Everywhere one looks in Sydney there is evidence of change. The city's skyline is being transformed by the glass and granite-clad skyscrapers built to house the growing number of TNCs selecting the city as the site of their regional headquarters; new railways, freeways and tunnels whisk commuters under and through the city; apartment towers, housing those attracted by the inner-city lifestyle, now dot the CBD and surrounding suburbs; four-star and five-star hotels open to cater for the needs of the growing number of international tourists and business people putting Sydney at the top of their travel itinerary; new inner-city suburbs are built on land once devoted to industry; exclusive harbourside apartment complexes provide resort-style living for those who can afford it; shops selling the latest designer labels line Castlereagh Street, George Street and Martin Place. Out in the leafy suburbs of the North Shore, landscaped corporate parks house the gleaming edifices of the new economy. Those marginalised by the new global economy are assigned to the vast low-density sprawl of middle and outer suburbia.

Grant Kleeman

The urban dynamics transforming large cities

The principal urban dynamics that are transforming the morphology of large cities in the developed world are technological, economic and social and cultural change.

New kinds of cities, new urban geographies

Since the early 1970s, changes to the global economy have transformed the economic, social, cultural and political lives of countries, regions, communities and individuals.

Signs of significant change are apparent in many large cities of the developed world, including Sydney. They include:

- the revitalisation of city centres through the large-scale redevelopment of derelict former industrial and storage areas (for example, Sydney's Darling Harbour and Barangaroo)
- the use of industrial and architectural heritage in new commercial and residential developments (for example, Walsh Bay)
- the social, economic and environmental transformation of inner-city neighbourhoods by young, middle-class professionals (for example, Paddington, Pyrmont–Ultimo, Glebe and Newtown)
- the growth of 'city-like' settlements at accessible locations throughout the existing urban areas (for example, Parramatta, Bondi Junction, Chatswood and Penrith)
- the development of new business parks housing the 'factories' of the new economy (for example, Macquarie Park and Norwest)
- the emergence of spatial inequalities, including areas of poverty and social disadvantage, especially in the migrant-dominated suburbs and the public housing estates in outer suburbia (for example, Claymore, Macquarie Fields, Mount Druitt and Minto).

Explaining the emerging new urban form as a product of an economic process has its limitations because it tends to ignore social and cultural processes. To fully understand the processes shaping large cities it is necessary to also consider the nature of social change and the impacts of cultural processes.

Economic restructuring and its urban impacts

The principal impacts of economic restructuring (itself the result of the process of global economic integration) on the economies of developed world cities can be summarised as follows:



7.1.4 Economic restructuring led to the transition from a manufacturing dominated economy (which meant the shut-down of factories such as this one) to a new service-dominated economy.

- **The increasing concentration of capital:** Large corporations are concentrating on diversified industrial production, finance, real estate, information processing and other service activities in major urban centres. Hence Sydney's emergence as a world city.
- **The internationalisation of the financial sector:** This has been accompanied by a loss of local control and regulation over ever more 'footloose' capital, and increased government expenditure to attract or maintain capital investment.
- **The rationalisation of the manufacturing sector:** This has occurred by a mix of plant closures (see Figure 7.1.4), the transfer of labour-intensive manufacturing process to developing countries where labour costs are low, outsourcing, the introduction of labour-saving technologies and the deregulation of the labour market.

- **Selective re-industrialisation:** This has mainly focused on the high-tech industrial (information-based) processes in the less unionised workforce sectors of the economy. These are the sectors that are best able to compete internationally. These industrial processes include complex manufacturing, such as of pharmaceuticals.
- **An overall decrease in the relative importance of manufacturing employment in the older heavy industries:** This was matched with a rapid increase in the service and information sectors of the economy.
- **Greater segmentation in the labour market:** An outcome of this has been a more pronounced polarisation between highly paid, highly skilled (and multiskilled) workers and lower-paid, lower-skilled (deskilled) workers. This, in turn, has led to greater segregation within cities, based on socioeconomic status; that is, the differences between affluent urban areas and poorer urban areas have become more stark.
- **A decline in public sector funding:** There has been growing pressure to abandon the provision of public services (including infrastructure) and more generally transform (reduce) the role of the state.

The impacts of economic restructuring on developed world cities included the transition from a dynamic, high-growth manufacturing dominated economy (which had raised wages, reduced inequality, and contributed to the formation of a middle class) to a new service-dominated economy involving changes in the organisation of work.

The changes in the nature of work included a shift towards part-time and casual employment and the polarisation in the income and occupational distribution of workers. The latter includes a greater number of jobs in the high- and low-paying ends of the scale than in industries now in decline. Almost half the jobs in the service sectors are lower-income jobs, and half are in the two highest income groups. In contrast, a large share of manufacturing workers were employed in the middle-income jobs when these industries were growing strongly in the post-war period.

The growth of small firms is a feature of the service and information-based economy. While there is no evidence that this has significantly affected the concentration of economic activities within the city, it has meant a shift of employment away from areas of manufacturing activity in lower-income areas towards industrial parks and commercial centres in more middle class parts of the city. Meanwhile, in the service sector generally, there has been a considerable move towards rationalisation. In the retail sector this has led to the growth of large regional shopping centres, chain stores and bulky goods outlets at the expense of the small, independent retailer.

SPOTLIGHT

Out with the old, in with the new

When we talk about the new economy we are focusing on two broad trends. The first trend is global economic (and cultural) integration, or globalisation. The second trend is the revolution in information technology. It is all around us: personal computers, modems, smart phones, interactive TV and the internet. But it is more than this; it is also the digitalisation of information (text, sound, images and video). New, convergent technologies allow digitised information to be transmitted and received via the same technological platform.

The new economy is information-based. It involves ideas, knowledge or inventions used as a means of gaining material wealth through a business enterprise. In developed countries, information technology now accounts for one-quarter to one-third of economic growth. Digital technology is creating new areas of economic activity. Internet-based electronic commerce is just one example.

Firms involved in more-traditional forms of economic activity (especially agriculture, mining and manufacturing) are often classified as belonging to the old economy. Many labour-intensive manufacturing industries have relocated to low-cost countries in the developing world.

The shift from the old economy to the new economy is known as economic restructuring.

Technological change and its urban impacts

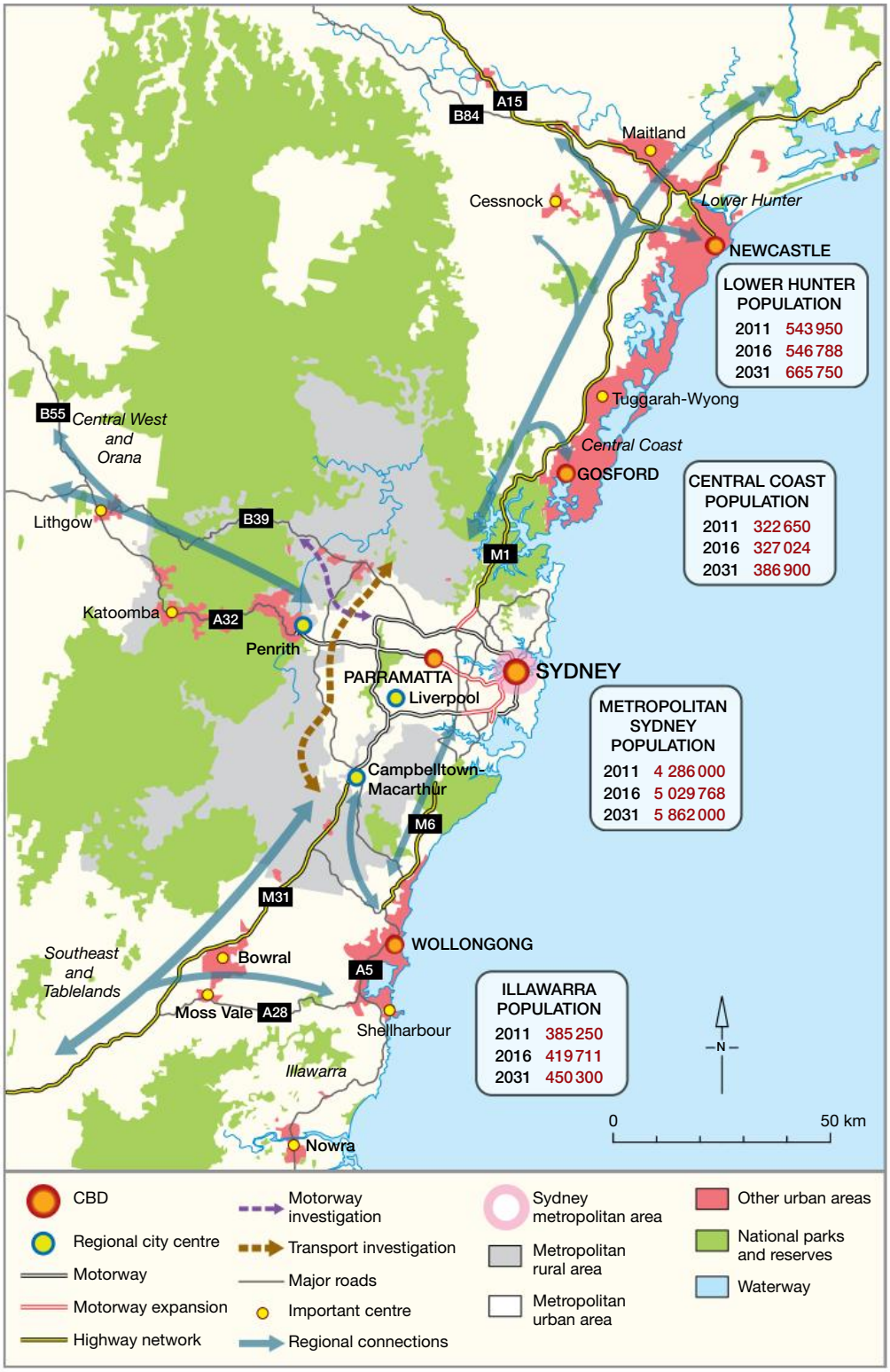
There are two main aspects of technological change: transportation and telecommunications.

TRANSPORTATION

Technological developments in transportation, especially mass production and use of the private motorcar, as well as the introduction of the large truck were, as we have already seen, responsible for 'the flight to the suburbs' of both residential and non-residential activities. Transportation technology is also responsible for the extension of urban living well beyond the existing metropolitan fringe.

In Sydney, improvements in public and private transportation, and the upgrading of road networks, have greatly extended the range of commuting into Sydney. This range now extends to the Central Coast in the north, Wollongong in the south, and the Blue Mountains in the west. (See Figures 7.1.5 and 7.1.6.)

Technological developments in shipping and cargo handling have also had a major impact on port cities, such as Sydney. The increasing size of ocean-going vessels, the introduction of specialised shipping (replacing general cargo vessels) and the switch to containerisation resulted in the city's port facilities and adjacent warehouses becoming obsolete. Their abandonment resulted in large areas of valuable harbour-side land becoming vacant and available for large-scale urban renewal projects; for example, Darling Harbour, Walsh Bay and City West.



7.1.5 Sydney's regional connections

TELECOMMUNICATIONS

Technological advances in telecommunications, including high-speed broadband with all its various applications, have freed many aspects of employment from their former spatial constraints. Such developments impact on the physical form of the city in various ways. For example, they:

- reinforce the dominance of world cities
- facilitate the decentralisation of some activities; for example, call centres, data processing and a wide range of business-related functions
- replace physical flows with electronic flows, thus removing a barrier to further urban expansion
- greatly expand the opportunities for an exurban lifestyle
- may result in the withdrawal of the physical presence of basic services (such as banking, shopping and other information services) from many suburbs and towns due to the growing use of the internet. Those without access to technology (for example, low-income households and some older people) may experience difficulty accessing basic services as they are withdrawn from non-profitable and marginal locations.



7.1.6 The construction of the F1 extended Sydney's commuting zone to the Central Coast.

Social and cultural change

Social and cultural changes impacting on the morphology of Sydney include:

- increased life expectancy and ageing of the population. This has increased the demand for medium-density and high-density housing and services, such as restaurants and other entertainment venues.
- a later medium age of marriage, a delay in parenthood and increasing number of couples choosing not to have children. All these trends increase the demand for non-traditional types of housing and discretionary goods and services. The medium age of marriage has, for example, increased from 24.2 years of age for women and 26.7 years for men in 1984, to 29.8 years of age and 31.8 years of age, respectively, in 2016. The proportion of couples in the 20–29 years age group with children has declined from 40 per cent in 1984 to just 13 per cent in 2016.

Privatisation of the public realm

The public realm—including public spaces, institutions, places and events—is under attack. It is being neglected and, in some cases, privatised.

In recent decades, State and Federal Government funding priorities have shifted massively. The Government's commitment to the public realm has declined in order to enhance the subsidised provision of private health and education. The rhetoric of 'choice' has been used to justify this transfer of resources from the public to private realms.

While individual choice has increased (especially for those who can afford to exercise it) the neglect of the public realm has diminished its appeal and viability. The result of this process has been a growing mood of separatism. This, in turn, feeds the sense of frustration and alienation, especially among the young living in disadvantaged and marginalised communities.

Some geographers fear that Australia is becoming an 'opt-out' society. The middle classes appear to be fleeing the public education and health systems, which increasingly service the disadvantaged. The opportunity for mutually enriching social integration is diminishing while the risk of cultural segmentation is increasing. This in turn could impact upon social harmony and national democracy.

The new economy

'[The new economy is] a world in which people work with their brains instead of their hands. A world in which communications technology creates global competition—not just for running shoes and laptop computers, but also other services that can't be packed into a crate and shipped.

A world in which innovation is more important than mass production. A world in which investment buys new concepts of the means to create them, rather than new machines. A world in which rapid change is a constant. A world at least as different from what came before it as the industrial age was from its agricultural predecessor. A world so different its emergence can only be described as a revolution.'

Wired Digital Inc., *Encyclopedia of the New Economy*, 2000

Activities

Understanding the text

1. Describe Sydney's location and physical setting. How have these shaped the city's morphology?
2. Outline the developments in transport technologies and how these have influenced the city's growth.
3. Explain what is meant by the term multicentred city.
4. Outline why many people find Sydney a pleasant and exciting place to live.
5. Outline the evidence that supports the assertion that Sydney is a world city.
6. Distinguish between the 'old economy' and 'new economy'.
7. Explain what is meant by the term economic restructuring.

Working geographically

8. During your HSC studies, develop a media portfolio of newspaper and magazine articles about Sydney. Write a 100-word synopsis of each article. Share your material with others in the class. Use this information to enhance the quality of your written responses.
9. Study Figure 7.1.3.
   - a Identify Sydney's 'regional city centres' and 'strategic centres'. Distinguish between the two.
   - b Identify the location of Sydney's growth centres slated for 'future urban development' and the priority precincts for 'major urban renewal'.
   - c Identify Sydney's principal transport gateways and ports.
   - d State the location of Sydney's 'enterprise corridors'.
   - e Explain the distribution of Sydney's 'urban renewal corridors'.
   - f Locate Sydney's planned employment areas.
   - g Locate and describe Sydney's Global Economic Corridors.
   - h Identify those parts of the city to be linked by new rail links and motorways.
10. Study Figures 7.1.1 and 7.1.3, and an atlas.
    - a Locate the following features on the satellite image:
      - i Sydney's CBD
      - ii Manly and Bondi beaches
      - iii Nepean and Georges rivers
      - iv Sydney (Kingsford Smith) Airport
      - v Port Botany
      - vi the rural–urban fringe.
    - b Describe the nature of the biophysical environment to the north of Sydney.
    - c What restricts Sydney's expansion to the south?
    - d Describe the type of land use evident to the west of Sydney.
11. a Summarise the impacts of economic restructuring on the economies of developed world cities.
    - b Explain what is meant by the statement 'the rationalisation of the manufacturing sector'.
    - c Explain what is meant by the 'segmentation' of the labour market. What has been the outcome of this process?
    - d Identify the impact that the growth of small firms in the emerging service and information sectors has had on the location of economic activity within a city such as Sydney.
    - e Outline the impact of technological developments in transport on large cities such as Sydney.
    - f Outline the impact of developments in telecommunications on large cities.
    - g List the social and cultural changes impacting on the morphology of Sydney.
12. Study Figure 7.1.5. Identify the principal links between Sydney and other nearby population centres.
13. A major implication of economic restructuring is a change from a fairly equitable society built on high-growth manufacturing to an economy characterised by a polarisation of employment and income within a knowledge-based service economy. What are the causes of this process?
14. a Define the concept of the public realm.
    - b Explain why the public realm is described as being under threat.
    - c Outline the likely social impacts of a neglected public realm.
15. Study the extract from Wired Digital Inc., Encyclopedia of the New Economy. This extract was written in the year 2000. As a class, discuss whether it is still relevant today, nearly two decades after it was written. How effective was it in foreshadowing changes in the nature of economic activity?

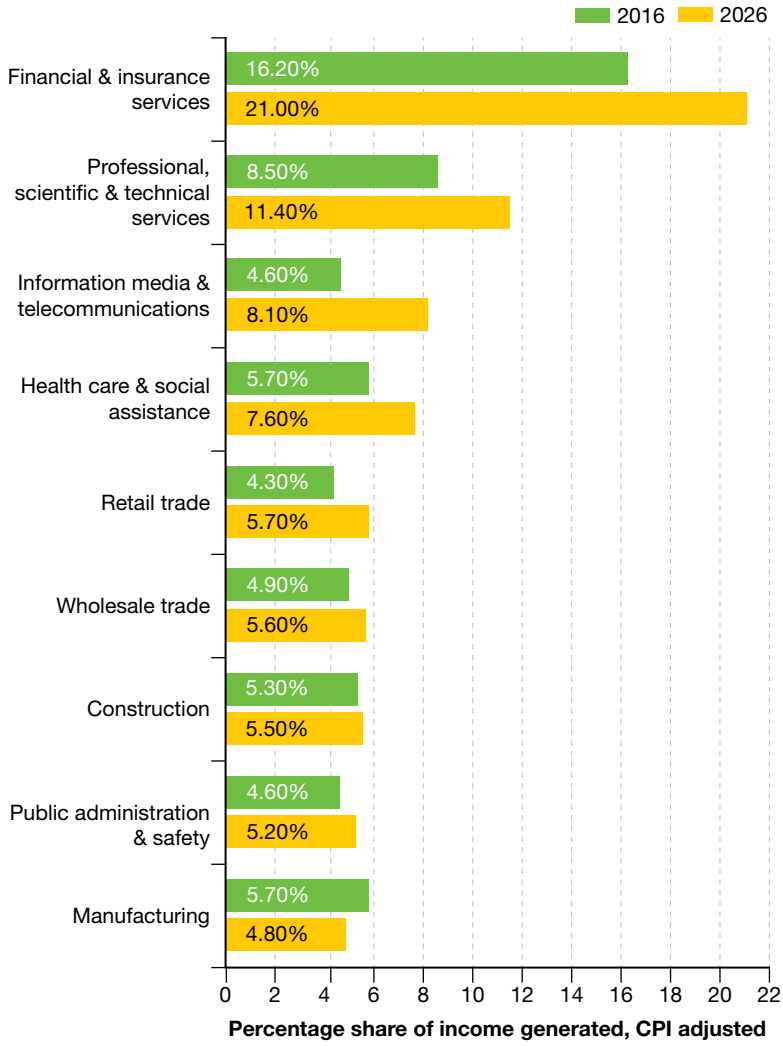
UNIT 7.2

Changing economic character

Sydney is an international city—an increasingly important link in the global network of world cities. In addition to being Australia's largest city, it is the country's financial capital and the regional corporate base for a growing number of TNCs with investments throughout South-East Asia and the Pacific.

Sydney also illustrates the impacts of economic restructuring. Economic restructuring involves major long-term shifts in the productive base of an economy and associated changes in the pattern of employment. It generally involves job losses in manufacturing industries and job gains in the service (or non-goods) sector, especially the business and information services sectors of the economy.

As in other countries of the developed world, the service and information sectors (sometimes referred to as the 'new economy') have been the major growth areas since the 1980s. Increasingly, Sydney and Melbourne have emerged as Australia's world cities. Following the internationalisation of the financial markets, both cities have developed as the focus of foreign capital investment in this country. However, Sydney, rather than Melbourne, has gained most from its association with the global economy. Sydney is now the favoured location for corporate headquarters. Two-thirds of TNCs have chosen Sydney rather than Melbourne as the site of their Asia-Pacific headquarters.



Source: SGS Economics and Planning

7.2.1 Finance and insurance services are projected to remain Sydney's main income generators followed by professional, scientific and technical services, and information media and telecommunications. All three are knowledge-based industries.

Information-based industries

Today, Sydney's economy is dominated by information intensive industries, as seen in Figure 7.2.1. The finance and insurance sectors command a 16.2 per cent share of Sydney's economic output. This is forecast to increase to 21 per cent within a decade. By 2026 just three information-service industries (finance, professional services and information media and telecommunications) will together account for more than 40 per cent of the city's economy.

Sydney's status as a regional financial centre, and its emergence as a world city, has its foundations in Australia's sizeable domestic economy (the fourth largest in the Asia Pacific, after Japan, China and India); its sophisticated and diverse finance and insurance sector; the country's highly skilled and multilingual workforce (1.4 million Australians speak an Asian language); and the existence of advanced business and IT infrastructure, sound regulation and an attractive lifestyle. The latter being an important consideration in the locational decision-making processes of corporate executives.

Sydney is home to a host of large corporations, including the head offices of Australia's two big banks, Commonwealth and Westpac, as well as the two smaller Macquarie Bank and Reserve Bank. Businesses such as AMP, super funds, private equity groups, Lendlease, Qantas, Woolworths and Westfields are all based in Sydney, as are global businesses such as IBM, Apple and Google.

SPOTLIGHT

Australia's economic transformation

Over the past 40 years, Australia's economy has been transformed. Manufacturing has declined from 28 per cent of total employment in 1966 to less than 8 per cent today. Employment in the labour intensive manufacturing sector has been most seriously affected as corporations relocated their operations to the low cost countries of South and Southeast Asia. Fortunately, the decline in manufacturing employment has been more than offset by the growth of the service sector, including financial and corporate services.

The financial services industry is one of the fastest growing sectors of economic activity in Australia. This growth is underpinned by Australia's government-mandated Superannuation Guarantee system. Since its introduction by the Keating Labor Government in 1992, employers have been required to put aside a proportion of their workers' salaries as a form of retirement savings. This requirement increased to 9.25 per cent in 2013 and will increase further until it reaches 12 per cent of salary by 2021–2022.

Since the introduction of the Superannuation Guarantee, more than $2.2 trillion dollars in retirement savings have accumulated. This vast pool of retirement savings—the fourth largest of its type in the world—needs to be managed. This has attracted the world's largest investment managers, primarily from the United States and Europe. Seventeen of the top twenty global investment managers have an established presence in Australia. Of the three remaining from the top twenty, two have established distribution arrangements for their products into Australia.

The continued growth of Australia's banking and finance sector seems assured; the pool of the Australian superannuation funds is projected to double to $4 trillion in the next 10 years and reach $9.5 trillion by 2035.

Global Sydney

'Global Sydney'—an urban corridor stretching from Macquarie University and Macquarie Park in the northwest (see Figure 7.2.2), through North Sydney and the CBD south to Sydney International Airport—contains the highest concentration of economic and cultural activity in Australia, along with some of the country's highest density residential suburbs. The latter includes the inner urban communities of the City of Sydney, the Eastern Suburbs, the Inner West and the lower North Shore.

The corridor is also one of the world's most successful professional services clusters (see Figure 7.2.3). It has become a magnet for workers, especially the highly skilled. Since 2008, employment growth in the corridor has been three times higher than the rest of Sydney and about 40 per cent above the national average. An additional 93 000 jobs were added to the corridor between 2008 and 2013, which equates to an average annual growth rate of 2.1 per cent. By comparison, average jobs growth in the rest of Sydney was just 0.7 per cent in that period and national employment grew by 1.3 per cent.



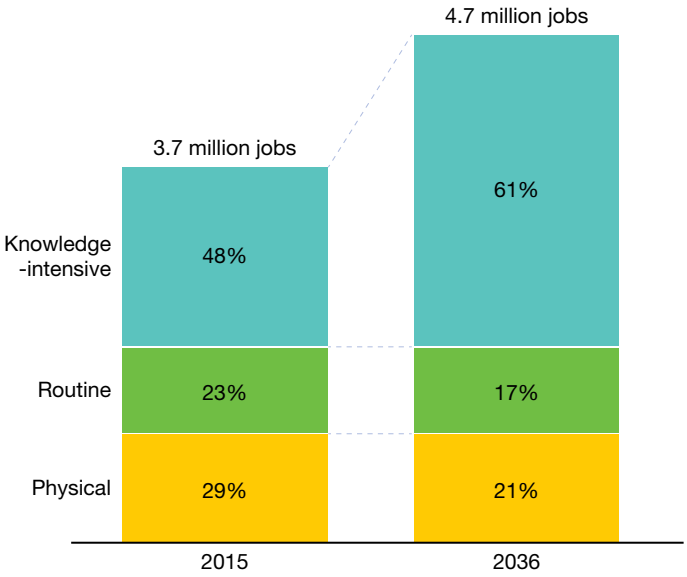
7.2.2 Cochlear Global Headquarters and manufacturing facility located on Macquarie University's campus at North Ryde, Sydney: an example of the 'factories' of the new economy.



7.2.3 Sydney's CBD is at the heart of global Sydney. The three office towers of Barangaroo (upper right) have been built to accommodate the city's rapidly growing finance and business services sector.

Employment in Sydney

The share of knowledge-intensive jobs in New South Wales is projected to grow from 48 per cent to 61 per cent over the next two decades (see Figure 7.2.4). This will place demands on the education sector to develop the necessary skills base and further boost wages in Sydney given that the average wage for knowledge-intensive jobs is 22 per cent higher than the New South Wales average. Income per person in Sydney climbed to $80 000 a year in 2015, eclipsing the rest of New South Wales by $32 000, and the rest of Australia by $10 600.



7.2.4 Employment in NSW's knowledge-intensive industries will boom in the period to 2036.

SPOTLIGHT

Sydney's economy

Sydney is the sixteenth largest city economy in the world, ahead of major cities such as Singapore, Shanghai and Hong Kong. In 2015–16, the value of goods and services produced in Sydney topped $400 billion. Forty per cent of Australia's economic growth took place in Sydney over the same period.

Activities

Understanding the text

1 Define the term economic restructuring.

2 Identify the sector of economic activity that has dominated Sydney's economic growth since the 1980s.

3 Describe the nature of Sydney's economy today.

4 Identify the basis of Sydney's emergence as a world city.

Working geographically

5 Study the Spotlight box, 'Australia's economic transformation' and then complete the following tasks.

- **a** Describe the nature of Australia's economic transformations over the past four decades.
- **b** Identify the Federal Government initiative that contributed to the rapid expansion of the financial sector in Australia.

6 **a** Describe the spatial extent of 'global Sydney'.

- **b** Describe the nature and relative economic importance of the global corridor.

7 Study Figure 7.2.1. Using data from the graph, identify the sectors of the economy projected to be Sydney's main income generators in the period to 2026.

8 Using information in this unit and Figure 7.2.4, state the expected increase in the number and percentage of knowledge-intensive jobs in the period to 2036. What are the implications of this trend for education and incomes?

UNIT 7.3

Changing nature and location of industrial land uses

Sydney's urban landscape is changing in response to a range of economic and technological factors. Since the 1960s, the loss of manufacturing jobs in Sydney's central industrial area (CIA) has gone hand in hand with the creation of new forms of industrial land uses (including modern high-tech manufacturing, warehousing and freight handling) in suburban locations.

The suburbanisation of manufacturing commenced during the long economic boom from the late 1940s to the late 1960s and was driven by the disadvantages of inner-city locations: obsolete plants and equipment, ageing infrastructure, traffic congestion, limited scope for expansion and the high cost of land. This process accelerated during the restructuring of the Australian economy, the key feature of which was the relocation of labour-intensive manufacturing to low cost countries of South and East Asia.

When combined, the suburbanisation of manufacturing and the process of economic restructuring transformed Sydney's industrial landscape. Key features of this transformation included the progressive decline of Sydney's CIA, Sydney Harbour's decline as a working port (which coincided with the introduction of larger, specialised vessels, technological advances in cargo handling and the development of the container terminals at Port Botany) and the development of new business parks housing the economic activities that are characteristic of the new economy.

Sydney's Central Industrial Area (CIA)

Australia's industrial heartland once occupied large tracts of land in the suburbs to the immediate west and south of Sydney's CBD. However, during the long economic boom of the 1950s and 1960s, and into the 1970s, the CIA lost manufacturing activity and employment to new industrial estates in the middle and outer suburbia. The suburbs adversely affected included Ultimo, Surry Hills, Leichhardt, Alexandria, Zetland, Marrickville, Botany–Banksmeadow and South Sydney.

At its peak, the northern end of the CIA was dominated by a large number of small plants, which were engaged in clothing and textile production (Ultimo and Surry Hills), the engineering and metal trades and printing and packaging. Clustered in and around Botany–Banksmeadow were larger plants manufacturing chemicals, paper, food and tobacco products, and the assembling of motor vehicles (the General Motors Holden plant at Pagewood and the British Leyland assembly plant at Zetland/Waterloo).

Central Industrial Area decline

Sydney's CIA has experienced a prolonged period of decline. The Pyrmont–Ultimo area is now almost devoid of the industry that once dominated the landscape. Abandoned port facilities have been transformed into parklands, residential areas, commercial office towers, hotels, shopping centres and a major entertainment and exhibition precinct. Landmark industrial structures and the warehouses, which once played such an important role in Australia's maritime trade, have been converted to a range of commercial and non-commercial uses. These include places of higher learning (the University of Technology Sydney), office accommodation, museums and residential accommodation. The cottages once occupied by Sydney's working class have been replaced by apartment buildings housing well-paid professionals who see access to the CBD as an important lifestyle choice.

The industrial areas to the south of the CBD have also experienced significant change. This is most apparent along South Dowling Street, where a vast tract of land has been transformed into a new high-density community with a mix of residential and commercial land uses. This land was once occupied by Resch's Waverley Brewery, the giant ACI glass manufacturing complex, and the British Leyland car assembly plant, shown in Figure 7.3.1.



7.3.1 The industrial areas of South Sydney have experienced significant change. **A** The now demolished British Leyland car assembly plant at Zetland/Waterloo was typical of the industrial land uses that once dominated south Sydney's industrial area. **B** New high-density housing and commercial activities on the former Leyland site

Manufacturing in the suburbs

Middle and outer suburbia benefited most from the suburbanisation of manufacturing. Middle suburban industrial areas (especially Rosehill, Auburn, Parramatta and Bankstown) all increased their share of manufacturing employment.

Changing dynamics: 1950s to late 1980s

While the suburbanisation of manufacturing adversely affected the inner city and inner-city fringe districts during the 1950s to 1970s, it was the impacts of international competition, tariff reduction, deregulation and company reorganisation (that is, economic restructuring) that had increasingly across-the-board effects from the mid-1970s. The impact of structural change was uneven among different subsectors of manufacturing activity and from place to place.

Some of Western Sydney's most important industries were adversely affected by economic restructuring, with significant closures and rationalisations in the metal fabrication, industrial and electrical machinery subsectors. This was, however, more than offset by growth in the pharmaceutical and chemical industries, food processing, packaging, building materials manufacturing and specialised engineering. In general, local plants, which originated in the western suburbs to supply local and regional markets, avoided becoming victims of global economic restructuring.

Changing dynamics: 1990 and beyond

The recession of the early 1990s, combined with the ongoing impacts of global economic integration, merely accelerated the rate of change. When strong economic growth resumed in the latter half of the 1990s, it was the industries representative of the new economy, rather than the traditional forms of manufacturing, that benefited most. Traditional and the new economy were located in different parts of Sydney, and the demise of the traditional and the rise of the new economy has helped increase spatial inequalities within Sydney.

By the early 2000s, Blacktown, Fairfield and Liverpool were home to some of Sydney's largest factory agglomerations. With the filling up of industrial estates, such as Smithfield–Wetherill Park, new manufacturing plants located in low-land-cost areas at Campbelltown, Baulkham Hills to the north-west and Gosford–Wyong to the north. However, manufacturing employment declined in other western areas, such as Holroyd and Penrith.

Information technology and the office sector

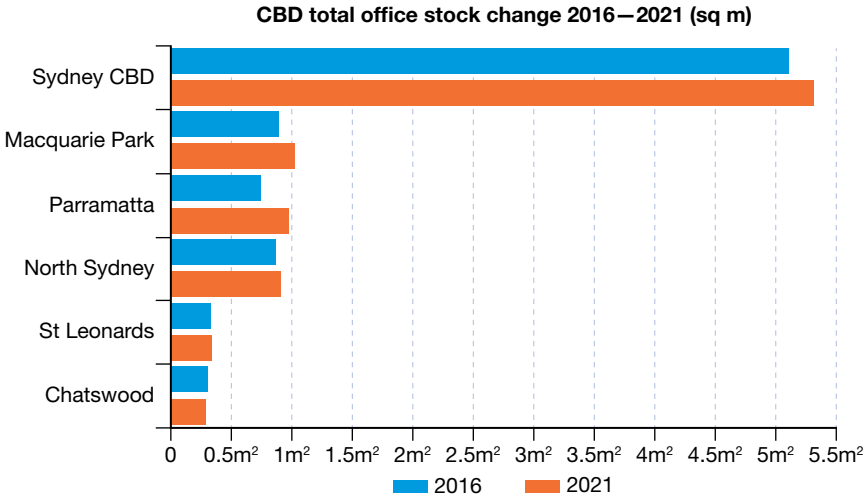
The introduction of new office-based information technologies was initially seen as providing an opportunity to shift routine administrative activities out of high-rent central-city areas, to low-cost suburban locations. This would leave only the higher-level office functions that rely on face-to-face contact. In the United States, improved telecommunications and the widespread adoption of information technologies has encouraged some firms to move the entire head office into suburban locations. However, while some routine and head office functions are leaving Sydney's CBD, those same information technologies also act in the opposite direction: they attract other forms of activity back into the CBD.

The trend today is to concentrate the 'high-end' functions of financial institutions in the CBD while relocating a range of supporting services and functions to campus-style developments, either in suburban locations or around the periphery of the CBD on former industrial sites (for example, the Australian Technology Park, part of the Eveleigh–Central Station corridor). Optus, for example, relocated from North Sydney to a campus-style complex at Macquarie Park.

This process is, however, not always clear-cut. The Commonwealth Bank, for example, transferred thousands or staff from the CBD to Parramatta, Lidcombe and a newly built facility at Homebush Bay in 2007 only to announce that by 2020, 10 000 staff will be moved to a new campus-style complex at the Australian Technology Park near Redfern. The Bank claims that the proximity of Australian Technology Park to their existing Sydney CBD offices (Darling Park, Commonwealth Bank Place and Darling Square) will allow for better integration and enhanced collaboration.

The CBD

Despite the suburbanisation of some routine administrative functions, the CBD continues to add jobs at an impressive rate. This growth has been driven by the number of financial institutions electing to locate in Sydney. Associated information services (such as corporate accountants, advertising agencies and financial consultants) have reinforced this trend.



7.3.2 Projected change in office space 2016–2021

This tendency for firms to concentrate employment in Sydney reflects an urban dynamic occurring worldwide. High-value, knowledge-intensive industries tend to cluster around well-located economic hubs—a trend that is expected to intensify in the decade ahead. Sydney's employment-rich 'knowledge hubs' include Sydney's CBD (financial services and professional services), Ultimo/Pyrmont (creative digital technology), Macquarie Park (medical technology) and Parramatta (specialised health and education precincts). Figure 7.3.2, showing the projected change in office space, illustrates the continued dominance of the CBD as an employment hub.

Activities

Understanding the text

1. Identify the factors that contributed to the suburbanisation of manufacturing during the long economic boom from the late 1950s to the late 1980s.
2. Explain how the suburbanisation of manufacturing transformed Sydney's industrial landscape.
3. Outline how the economic restructuring from the mid-1970s and the recession of the early 1990s impacted on Sydney's manufacturing industries.
4. Outline the impact of information technologies on employment in Sydney.
5. Identify the factors that have reinforced the CBD's employment focus.

Working geographically

6. Study the section, 'Sydney's Central Industrial Area (CIA)'. Describe the nature and spatial extent of the CIA.
7. Study the section 'Information technology and the office sector'. As a class, discuss the advantages and disadvantages of suburban-based corporate headquarters such as the Optus complex.
8. Study Figure 7.3.2. Using data from the graph, describe the distribution of Sydney's office space, actual and projected, 2016–2021.

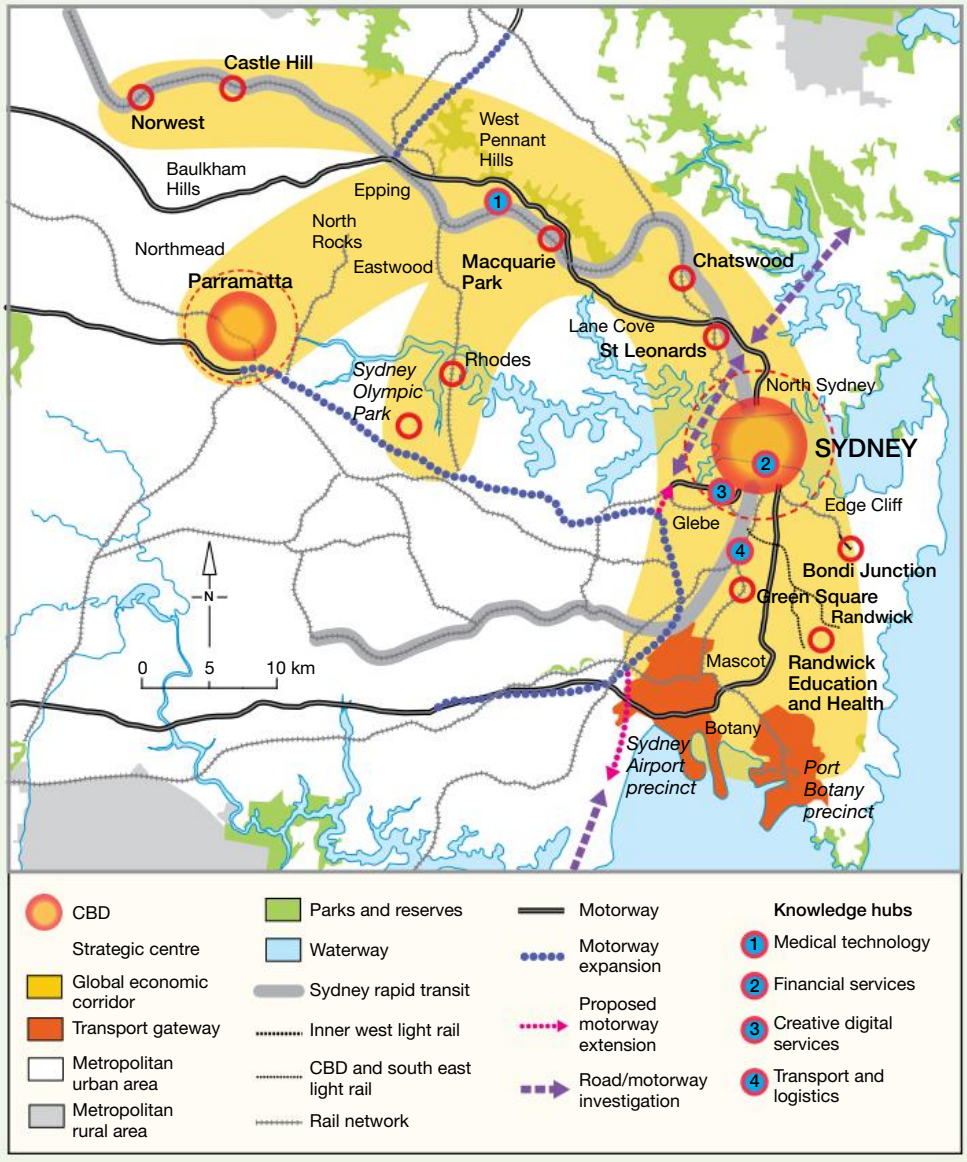
CASE STUDY

Sydney's global economic corridor

Perhaps the best example of new economy development is Sydney's global economic corridor (see Figures 7.3.3 and 7.3.4). It stretches from the Sydney Airport through the CBD and North Sydney to Macquarie Park at North Ryde. In the future, the NSW State Government is proposing to expand the corridor to take in the Norwest office park, Parramatta and Sydney Olympic Park. Over the last 20 years the area has been transformed into Australia's high-tech heartland, accommodating some of the biggest names in the information-based economy. The image is clean and corporate. The 'factories' of the new economy occupy a landscaped setting surrounded by some of Sydney's most prosperous suburbs.

More than 600 high-tech companies and related service firms are now located in the corridor. The Optus headquarters at Macquarie Park is one such example. It is a self-contained state-of-the-art campus-style corporate complex of six interconnected, low-rise buildings set on seven hectares of landscaped grounds. The emphasis is on open-plan design and shared spaces where ideas can be exchanged. Each floor has its own 'Town Square' acting as the focal point of business and social activity. Opened in 2007, 6500 people now work in the complex. Macquarie Park is now the fastest growing concentration of employment outside the CBD, having overtaken North Sydney in 2013. The construction of the M2 motorway, the Lane Cove Tunnel and the upgraded Gore Hill Freeway links Macquarie Park and other elements of the corridor with the CBD and the dormitory suburbs of the north-west. The dormitory suburbs are those that are dominated by residential rather than commercial land uses.

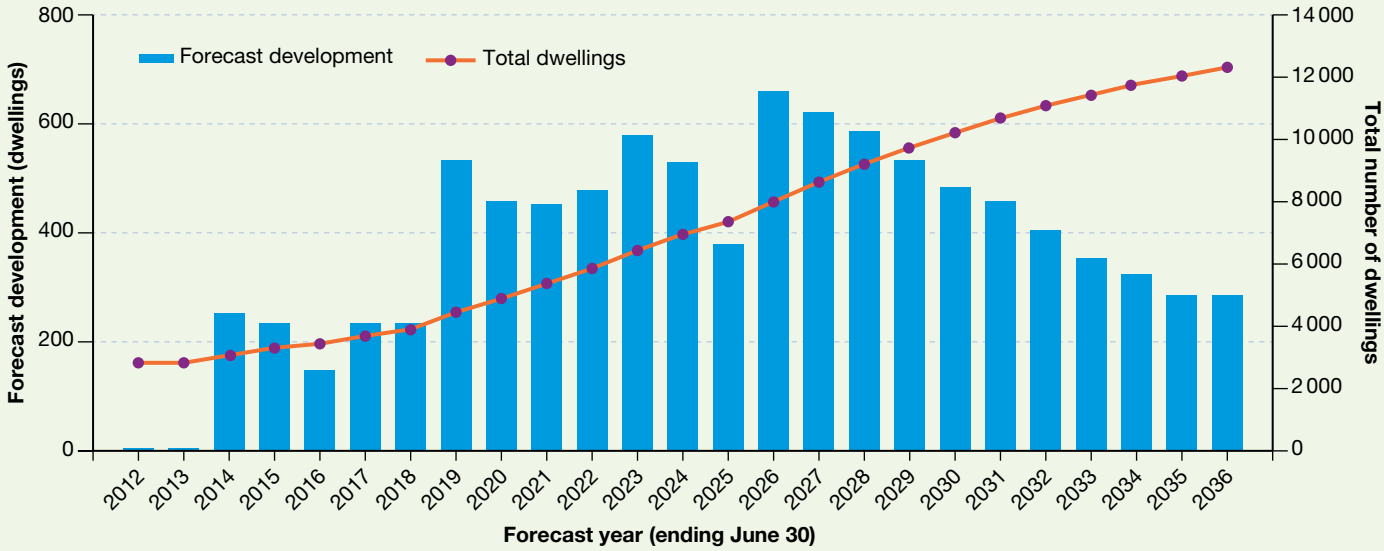
The completion of the Chatswood–Epping rail link in 2008 enhanced the corridor's accessibility, as will the line's integration into the Sydney Metro Northwest in 2019.



7.3.3 Sydney's global economic corridor, showing not only the Sydney Airport–Macquarie Park arc but also the proposed extensions to Norwest, Parramatta and Sydney Olympic Park.



7.3.4 Macquarie Park boasts the fastest growing concentration of employment outside the city's CBD.



7.3.5 Forecast residential development in Sydney's Macquarie Park, 2012–2036

The total workforce in the Macquarie Park area is forecast to grow from 45 000 in 2017 to 55 800 in 2025 and an estimated 173 000 by 2065. Macquarie Park overtook North Sydney to become Sydney's second largest concentration of employment. Only the CBD has a higher concentration of employment.

Other concentrations

Other concentrations of new economy firms are found within the corridor and include those at Lane Cove, Chatswood, Artarmon, St Leonards, Crows Nest and North Sydney. The area between the CBD and the airport is in the midst of one of the biggest urban transformations in the city's history. Once dominated by industry, the area is being transformed by massive commercial and high-density residential construction projects.

There is also a degree of land use diversification taking place within the global economic corridor. Urban consolidation policies (principally land use zoning) have led to the construction of high-density housing developments at strategic points on major transport routes, especially in areas surrounding railway and metro stations. Figure 7.3.5 shows the forecast developments for Macquarie Park, which is serviced by three metro stations (Macquarie University, Macquarie Park and the North Ryde stations; there are currently more than 1500 residential units either under construction or planned, and the total number of apartments projected to reach 12 276 by 2036). The aim of such developments is to reduce congestion by increasing population densities in areas close to major concentrations of employment and/or mass public transport.

Activities

Working geographically

1 Identify the transport infrastructure that has helped facilitate the development of the global economic corridor.

2 a Outline the nature of the enterprises located in the global corridor.

b Explain why there is so much medium-density and high-density residential development taking place in the global corridor.

3 Study Figure 7.3.5.

a Using data from the graph, describe the trend in residential development in Macquarie Park, 2012–36.

b How much will the area's residential population increase over the period?

c Access the Macquarie Park website and explain why the number of residential developments varies greatly in different years.

4 Visit Macquarie Park. List the types of firms located in the area. Describe the nature of the area's built environment. What are the area's locational advantages? How does the area compare with Sydney's older industrial areas?

5 Use Google Earth to locate and explore some of Sydney's corporate parks. Start with Macquarie Park and Norwest.

6 As a class, discuss the view that Australia's economic future lies in promoting the types of productive activities represented in the corporate parks of northern Sydney. What are some of the social implications of becoming increasingly reliant on such industries? How may a growing reliance on such industries increase existing socioeconomic inequalities? Speculate on the spatial outcomes of this process.

UNIT 7.4

Impacts of economic change: Sydney's retail sector

Sydney's retailing sector can be considered at two levels:

- the existing structure of retailing and the forces acting to restructure the sector
- the types of retail outlets being developed to meet changing patterns of consumer demand.

Outcomes to consider that have resulted from the above two factors include the development of large, planned shopping centres; the growth of bulk goods and 'big box' retailing; the increasing role played by online retailers and the infrastructure they require to warehouse and distribute goods; the increasing role played by global retail brands; and the demise of the small, independent retailer (see Figure 7.4.1).

Processes affecting retailing

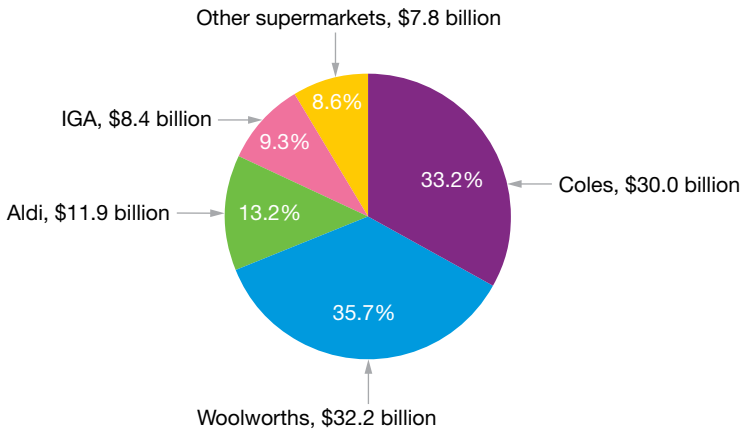
Processes		Outcomes
Retail restructuring: ■ Retailer vs wholesaler ■ Retailer vs retailer ■ Trading hours (government deregulation) ■ Meeting changing consumer tastes ■ New entrants (global brands) ■ Online retailing	**Link** → Competition for market share	**Retail responses:** ■ New retail formats and planned shopping centres ■ The increasing corporatisation of retailing ■ Revamped supply lines ■ Increased advertising and the use of generic brands ■ Centralisation and rationalisation of distribution ■ Deregulation of awards and the restructuring of the retail workforce

7.4.1 Processes affecting retailing

Concentration of ownership

The retail sector has experienced a rapid increase in corporate mergers and takeovers since the 1960s. The result is a retail industry dominated by large, multi-outlet firms. These are increasing in both size and market share at the expense of the smaller, independent retailers. This is indicative of the general process of increased retail concentration.

The market share of the major food retailers, Woolworths and Coles, remained significant despite increased competition by new entrants such as Aldi. However, the impact of this new competition on the small, independent retailer has been considerable. The large chains have bulk purchasing power, economies of scale, high turnover and high labour productivity. They have forced many smaller players out of business. Woolworths and Coles increased their market share from less than 40 per cent in the mid-1970s to almost 70 per cent in 2017 (see Figure 7.4.2). Overall, the concentration of retail activity has resulted in a decrease in the number of retail outlets, an increase in store size and, in some important sectors such as hardware, less competition.



Source: Roy Morgan Research

7.4.2 Share of the A$90.3 billion spent at Australian supermarkets in the 12 months to March 2017

Franchising is another form of centralised planning in retailing. This is where a company (called the franchiser) sets up retail outlets and then leases them to independent owner-operators. Examples include McDonald's, Jamaica Blue, Bakers Delight and Starbucks.

Improving efficiency

All the large retailers have sought to increase operational efficiency by reducing overhead costs. This has led to the following outcomes:

- **Centralised purchasing and distribution networks:** Large retailers act to restrict the range of brands to a point where they are increasingly able to dictate prices and volumes to the suppliers themselves. Large retail chains are in a good bargaining position and can determine what commodities are supplied to consumers. The retailing of wine and other alcoholic beverages is, for example, dominated by retailers owned by Coles (Liquorland, First Choice and Vintage Cellars) and Woolworths (BWS and Dan Murphy's). Together Coles (Westfarmers) and Woolworths control 60 per cent of the domestic wine sales. Many smaller, independent, retailers have been forced out of the sector; or forced to adjust their business model, such as selling wine online only.
- **Significant workforce restructuring:** There has been an increase in part-time and casual employment, permitting increased flexibility of retail opening hours. The competitive advantage of longer trading hours, once the preserve of the independent trader, has now been lost.
- **Adaptation to changing consumer tastes and behavior:** The growth of online retailing has presented a major challenge for the 'brick-and-mortar' retailers, as has the arrival of 'fast fashion' global brands such as Zara and H&M. Wage stagnation and other cost of living pressures tend to increase price sensitivity and consumer preference for cheaper generic brands.

DID YOU KNOW?

Planned shopping centres account for 38 per cent of retail space and more than a third of Australia's retail outlets.

The large, planned regional shopping centres

A major spatial outcome of retail restructuring has been the development of large, suburban shopping centres. Their development was in response to demand from relatively affluent, mobile customers in Sydney's rapidly expanding suburbs in the post–World War II era, and the increased economies of scale that such centres can achieve. One significant effect of this development has been the upgrading of local and neighbourhood shopping centres in an effort to retain customers. Another outcome was the demise of many independent, local retailers. Empty shops in the older-style retail strips, especially where parking is in short supply, are a frequent reminder of the latter.

From the consumer's perspective, planned shopping centres provide for one-stop shopping in a safe, comfortable (air-conditioned) environment—one that encourages customers to come, stay and spend.

The distribution of these centres in Sydney is shown in Figure 7.4.3. Planned shopping centres differ from other forms of retail in that they are conceived, developed and operated in a way that provides an advantage to individual retailers.



7.4.3 Existing shopping centres, Sydney metropolitan area

A major store (such as David Jones or Myer) acts as a magnet to the centre as a whole, as does the addition of entertainment venues (multi-screen cinema complexes, food courts and more recently, clusters of up-market restaurants offering indoor and alfresco dining, and a range of cuisines.

Given the highly competitive nature of the industry, owners of shopping centres need to remain focused on both maintaining and expanding their existing customer base. They do this by regularly refurbishing their properties in order to maintain a contemporary image. They have also moved away from the 'themed' shopping centre concept to focus on a more sophisticated shopping experience. This has involved the use of expensive stone flooring and glass, and the addition of a range of lifestyle related retail outlets (focusing on food, entertainment and personal services)—all aimed at increasing the number of customer visitations and the length of stay.

DID YOU KNOW?

Scentre Group (an offshoot of the Westfield Group) is Australia's largest shopping centre operator. Its 38 Westfield shopping centres account for 11 135 retail outlets and 3.4 million square metres of retail space.

CBD retailing

The traditional city-based department stores have responded to the popularity of the suburban shopping centre by differentiating their product. David Jones, for example, targets the 'top end' of the retail market. Myer (formerly Grace Brothers in New South Wales) has struggled to define its market. It has variously tried to position itself as an 'up-market' retailer and as a 'value-for-money' or discount retailer before trying to reposition itself somewhere between Target and David Jones.

The biggest change to CBD retailing has been the influx of the high-end luxury retailers (see Figures 7.4.4. and 7.4.5), which have clustered in and around Westfield Sydney City, Castlereagh Street, Marin Place, and the nearby section of George Street.

Another trend has been the influx of 'affordable' international fashion retailers such as Zara, H&M and Topshop Topman. These have presented a major challenge to Australian-based fashion houses and the big department stores that struggle to respond to changes in consumer preferences as quickly as these international retailers.

Independent retailers, if they are to survive the influx of global brands, must use 'store and brand image' to attract and hold customers. A good store image is one that acts to differentiate a shop from its competitors. This enables the shop owner to avoid price competition, and to stimulate customer interest by its very difference. The various elements that make up retail image are listed in Figure 7.4.6.



7.4.4 The influx of the high-end luxury retailers reflects Sydney's status as a world city and a major tourist destination.



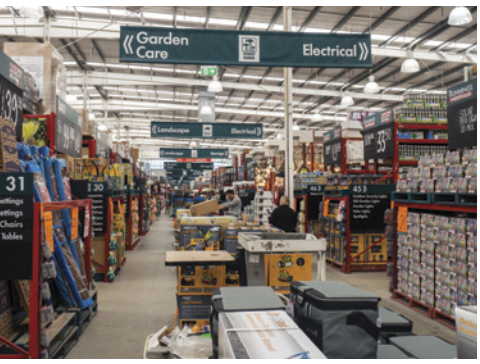
7.4.5 The Pitt Street Mall is the seventh-most expensive retail area in the world, with rents of about $13 300 per square metre, per year.

Elements of the retail image

- Merchandise quality and range
- General ambience, such as the design of the store, its layout and 'attractiveness'
- Price levels or points for goods on offer (whether low, medium or high) and the cost of a typical 'shopping basket'
- Promotional activities, such as advertising or special events
- People and staff: appearance of sales assistants and of other customers
- Service and interpersonal skills of staff
- Post-transaction service (if applicable) and policy on returns, etc.
- Ability to shop in one's own language and buy foods and other items relevant to one's culture

7.4.6 Elements of retail image

New types of retailing



7.4.7 Bunnings, an example of a 'big box' retailer: the company's dominance of the hardware sector has forced many smaller hardware retailers out of business.

New types of retailing have emerged throughout Sydney to cater for changing patterns of consumption. One important development has been the bulky goods complex. Some retail outlets find it difficult to sustain the very high rents demanded by the operators of the large suburban shopping centre. These retailers include those that sell goods such as furniture, whitegoods, electronic equipment, carpet and lighting. The response has been the development of the bulky-good 'super centre'. These large warehouse-type complexes often lack the amenity and facilities of the suburban shopping centre. However, they allow the sellers of household products to achieve many of the benefits of a mall-type complex: greater customer choice and the convenience of one-stop shopping. Examples of retailers attracted to such outlets include Harvey Norman, Freedom, Rebel Sport and Toys 'R' Us. By locating in such complexes, retailers benefit from the increased customer flow and the advantages associated with being close to the sellers of complementary products.

Other retail trends include the factory outlet complex (for example, DFO); 'big box' retailing (examples include IKEA, Costco and Bunnings, shown in Figure 7.4.7); and the development of the 'category buster' outlet (for example, Officeworks).

Activities

Understanding the text

1 Identify the aspects of retailing that interest geographers. What are the key developments in the sector?
2 Outline the main trends in the retail sector since the 1960s.
3 Outline the advantages that large, multi-outlet firms have. What has been the impact on small, independent retailers?
4 Explain the franchise-based model of retailing.
5 Outline the ways in which large retailers seek to increase their operational efficiency.
6 Identify, from the consumer's perspective, the advantages of the large planned shopping centre.
7 Explain how large shopping centres maintain and expand their customer base.
8 Explain what is meant by store (or centre) 'image'.
9 List the new types of retailing highlighted in the text. Can you think of any others?
10 Explain what a 'bulky good' retail complex is. Why have they developed? How do they differ from the large shopping centre?

Working geographically

11 Study Figure 7.4.1. Write a report outlining the processes affecting retailing and their outcomes.
12 Study Figure 7.4.2. State Coles' and Woolworth's combined share of Australian supermarket spending. How much revenue does this represent?
13 Visit a large regional shopping centre. Identify and name the centre's large 'anchor' stores and any lifestyle oriented services the centre offers. Locate and name any franchise-based retailers operating in the centre.
14 Working in groups, brainstorm the names of franchise-type stores with which you are familiar. Share your group's list with those compiled by other groups. Develop a consolidated list. How many of these are represented in your local regional shopping centre?
15 Working in groups, compile a list of the advantages and disadvantages for franchise owners of franchise-based retailing. Share the points raised in your group's discussion with the rest of the class.
16 Study Figure 7.4.3. Describe the spatial distribution of large shopping centres. How does the distribution of Myer stores differ from that of David Jones stores?
17 Visit a major shopping centre. How has the centre attempted to attract customers and to retain them within the centre? Does the centre have any special architectural features that help to distinguish it from other centres?
18 Visit a small local shopping centre near your home. Has anything been done to make the neighbourhood shopping strip more attractive to customers, such as parking or landscaping?
19 At the level of the individual store, do you have any local examples of a shop that has taken steps to attract customers? If so, what steps did they take?
20 Visit the Sydney CBD. Start at the corner of George Street at the western end of Martin Place, and walk east along Martin Place. When you reach Castlereagh Street, turn south and walk until you reach Market Street; turn east and finish at Elizabeth St. As you walk, compile a list of the international designer brands available in the shops lining these streets. Note the country of origin of each brand. Map the location of each store.

CASE STUDY

The revival in inner-city retailing

Sydney's grand emporiums

Before the introduction of the car-dependent suburban shopping centre, Sydney's shoppers mostly came to the city by train to shop. The CBD was home to a number of large department stores. They included Buckingham's, Marcus Clark's, Anthony Hordern's, Snow's, Farmers, McDowell's and Waltons. All are now gone, their disappearance a result of financial collapse, take-overs and closure.

Just across from the Sydney Town Hall was Bebarfald's— a furniture store for many years, and a department store in its later years. The site now is a Woolworth's store.

Farmer and Company, a competitor with David Jones, was located on the corner of Market and George Streets, now the site of the Myer department store. Opposite, in George Street was Nock and Kirby, the hardware specialists.

The biggest department store, Anthony Hordern's 'The New Palace Emporium' (see Figure 7.4.8), was on a block bounded by George, Liverpool, Pitt and Goulburn streets. The enormous six-story complex covered almost an entire city block and housed 21 hectares of retail space. Today the site is home to the World Square complex.

In Railway Square, Marcus Clark had a two-building department store. The largest of the two featured a revolving coloured light on its roof and is now occupied by Sydney TAFE. The second, the wedge-shaped 'Flatiron' building on the corner of George and Pitt Streets, Railway Square, is now a hostel.

Up in Oxford Street, fronting what is now Whitlam Square, was Buckingham's. On the corner of Liverpool and Elizabeth Street was Mark Foy's which is now the Downing Centre court complex (see Figure 7.4.9).

David Jones and Grace Bros (now Myer) survived because they established stores in the newly developed suburban shopping centres.



7.4.8 Anthony Hordern's The New Palace Emporium (1939) sold virtually everything a family might need—furniture, household goods of all types, clothing, manchester and many of the items required by country people. The Anthony Hordern's catalogue was eagerly awaited in the bush and orders flowed in.



7.4.9 The Mark Foy's department store in Liverpool Street, 1936. The building was modelled on the Parisian Le Bon Marché department store, and featured chandeliers and marble floors. For many years it was one of Australia's foremost fashion stores. Its lavish ballroom made it a Sydney institution. The store had Australia's first escalator. It closed in 1980.

The revival

The revival of inner-city retailing dates from mid-1990. Strong growth in CBD-based economic activity, rising incomes (for some), an increase in the CBD resident population, the surge in international tourism and the millions spent on upgrading the physical environment of the CBD have combined to significantly increase the number of CBD shoppers.

After four decades of decline the large, city based department store is making a comeback. Sydney's two remaining emporiums (department stores)—David Jones and Myer—are planning to spend tens of millions refurbishing their 'flagship' city stores. The Westfield Sydney complex, built at a cost of a $1 billion, has also helped reinstate the CBD's status as a major retail destination (see Figures 7.4.10 and 7.4.11).

Retail in numbers

- Sydney's CBD accounts for about 8 per cent of retail spending in New South Wales.
- Retailing makes up 15.14 per cent of the City of Sydney's workforce.
- Sydney's Pitt Street Mall retains its position as the seventh-most expensive retail area in the world, with rents of about $13 300 per square metre per year in 2017. New York's Upper Fifth Avenue is the most expensive, with rents of $41 800 per square metre a year.
- Pitt Street Mall is now ranked among the world's busiest shopping precincts, with an estimated 70 million pedestrians visiting the area annually.
- Each weekday, Town Hall station delivers 77 500 potential customers into the CBD.



7.4.10 Westfield Sydney, the centre of Sydney's high-end retail precinct



7.4.11 The lavish interiors of Westfield Sydney are used to promote the shopping experience.

Activities

Understanding the text

1 Outline the factors that have contributed to the revival of inner-city retailing in the 1990s.

2 State why David Jones and Myer survive when so many city-based emporiums have disappeared.

Working geographically

3 Study Figure 7.4.11. Write a report outlining the elements of retail image. As a class, comment on the type of retail image promoted by a large, planned shopping centre in your local area. Use the elements identified in Figure 7.4.6 to help structure your discussion.

4 Outline the factors that have contributed to the revival of inner-city retailing.

UNIT 7.5

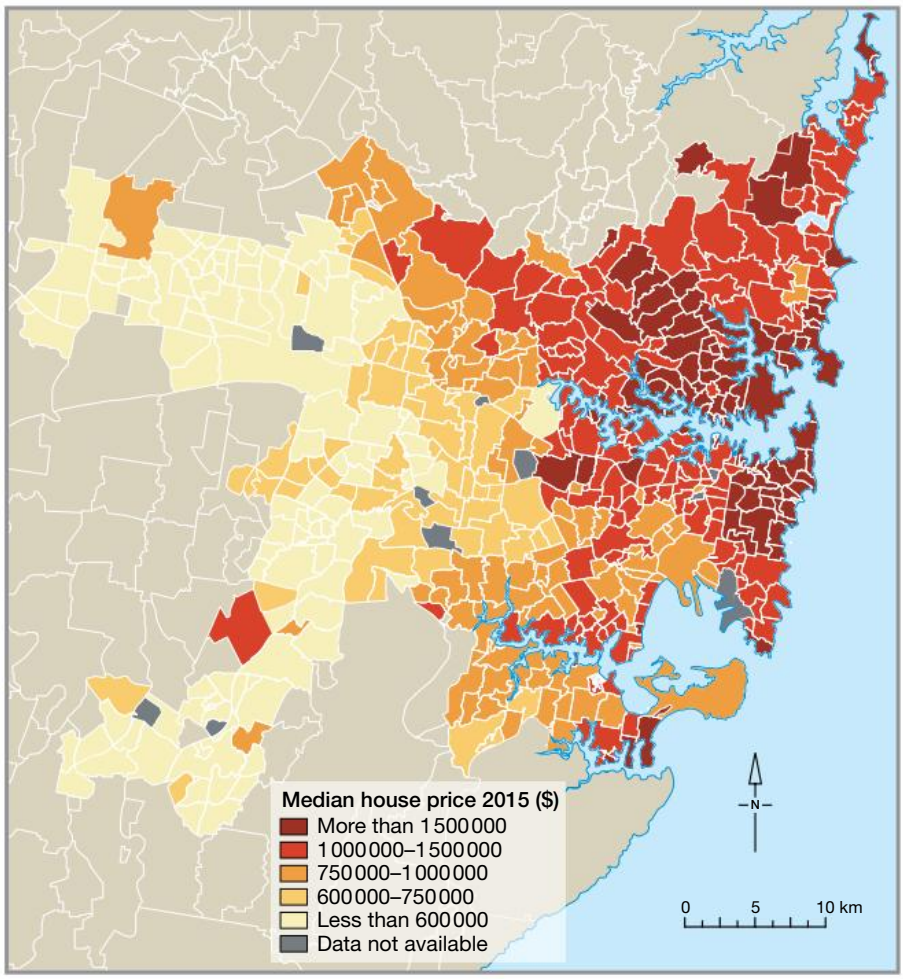
Changing nature and location of residential land

The nature and location of residential land in Sydney is largely determined by the operation of the city's residential housing market. This involves four processes:

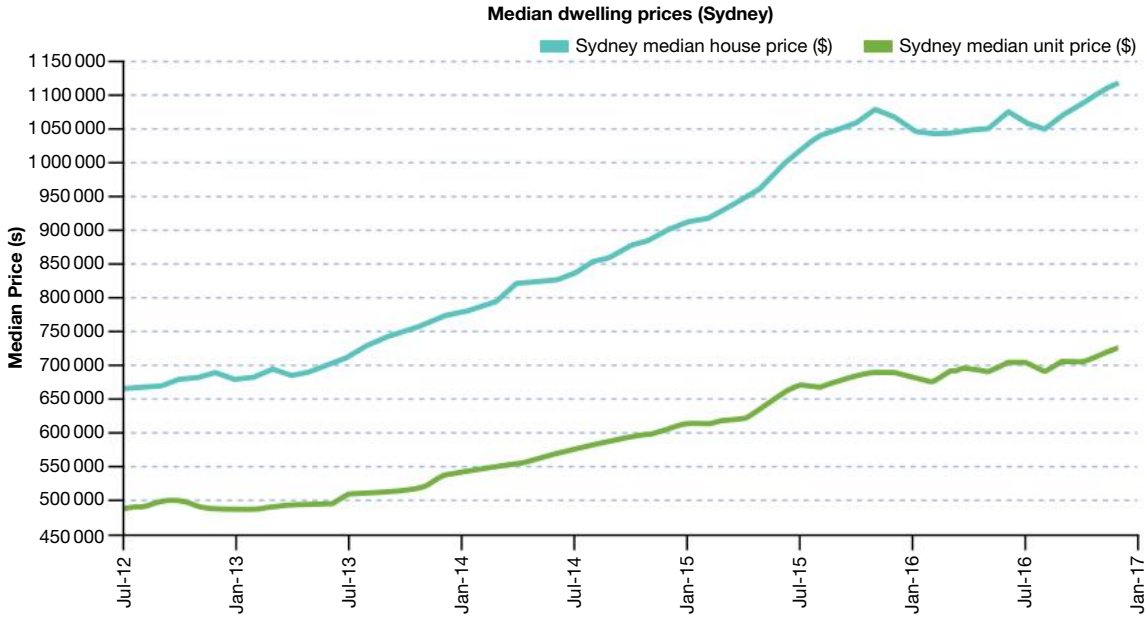
1 affordability
2 perceptions of 'liveability'
3 social and demographic trends
4 suitable housing stock.

Affordability

Where people live in Sydney ultimately depends on their ability to buy or rent a property in a particular area. Many people are locked out of more expensive (and desirable) areas of the city because they lack the financial resources required to access that particular section of the housing market. The result of this process is spatial inequality: patterns of advantage or disadvantage. It is also reflected in the median house prices in different parts of the metropolitan area. (See Figures 7.5.1 and 7.5.2.)



7.5.1 Sydney's median property prices, 2015

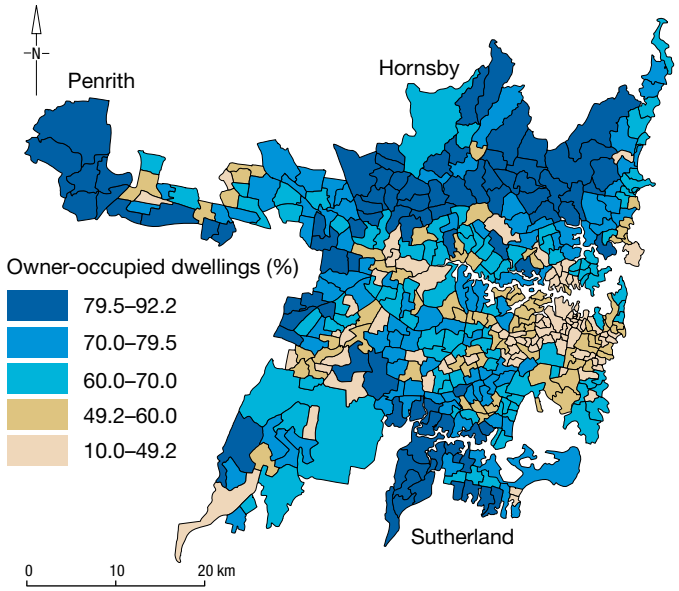


7.5.2 In December 2016 the Sydney median house price hit a new high of $1 117 500, putting home ownership out of the reach of many of those living in the city. The recent boom in medium-density and high-density housing is, in part, a response to the affordability gap. Apartments remain more affordable than detached homes.

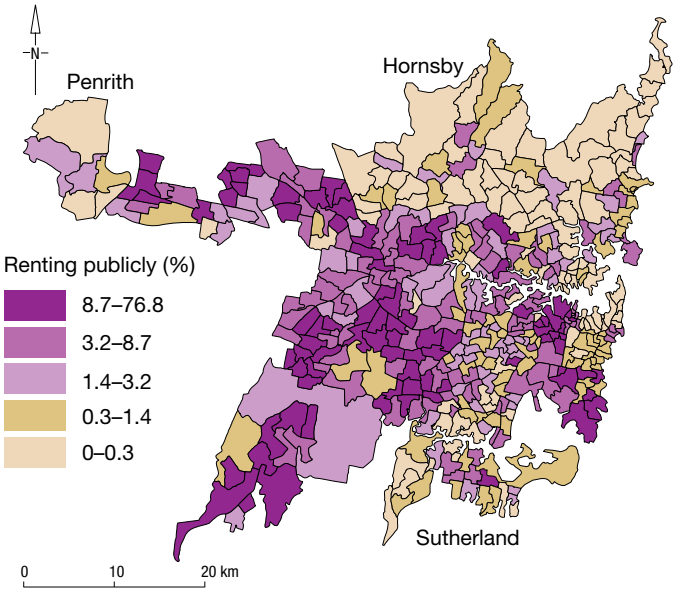
Owner-occupied and rented

Another way at looking at the nature of housing in Sydney is to distinguish between owner-occupied and rented accommodation. The latter can be divided into renters in the private rental market and those renting public housing. Each of these categories has its own unique spatial pattern. Owner-occupied dwellings are found throughout suburban Sydney and achieve their highest levels of concentration in the suburbs of the upper North Shore, the Penrith region and in the city's south, shown in Figure 7.5.3. Public housing renting its concentrated in the suburbs to the south of the CBD, the city's western suburbs and the suburbs of the south-west (see Figure 7.5.4).

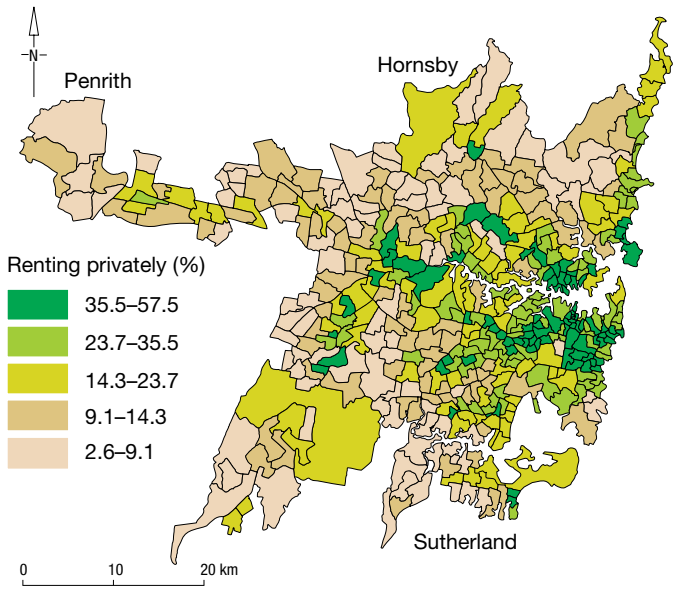
As shown in Figure 7.5.5, the greatest concentration of private rental accommodation is close to the city centre and in the suburbs of the inner west. The incidence of medium-density and high-density residential developments is linked to the number of private renters. Medium-density and high-density is preferred by property investor landlords.



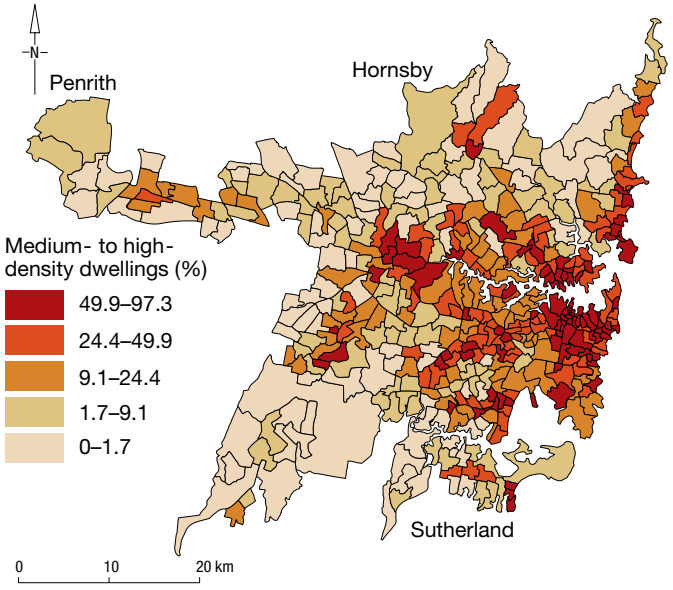
7.5.3 Distribution of owner-occupied housing; that is, housing owned outright or being purchased with a mortgage



7.5.4 Distribution of rented public housing



7.5.5 Distribution of privately owned property that is rented

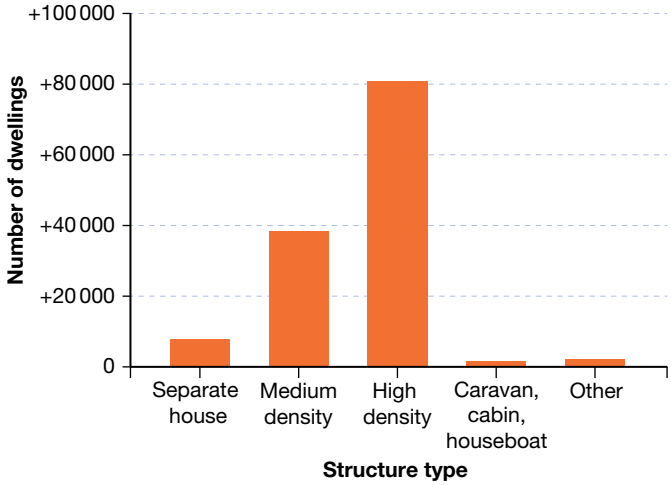


7.5.6 Distribution of Sydney's medium-density to high-density housing

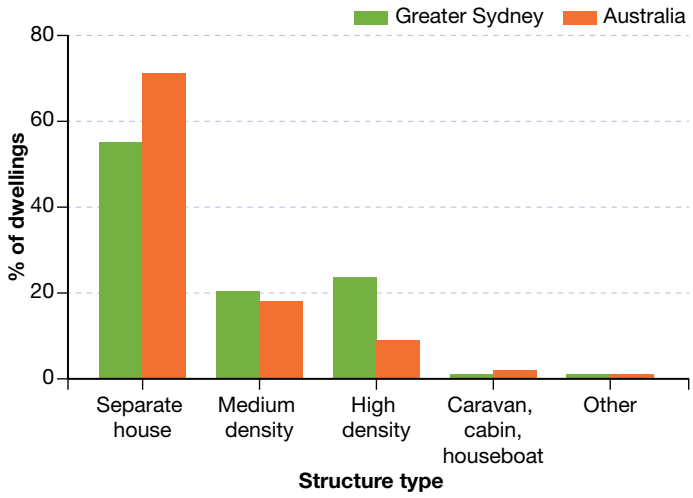
Type of housing

The character of Sydney's suburbs is largely determined by the nature of the housing stock found in the area. Some suburbs, especially those developed after World War II, are dominated by detached, low-density housing. Others are dominated by medium-density to high-density housing as shown in Figure 7.5.6. The suburbs of Olympic Park, Sydney CBD, Haymarket, Milsons Point, Wentworth Point, Elizabeth Bay, Rushcutters Bay, Wolli Creek, Meadowbank, Barangaroo, Rhodes, The Rocks, St Leonards, Pyrmont, Miller Point and Ultimo all have more than 90 per cent of their population living in apartments. In Greater Sydney, 43.8 per cent of dwellings are medium-density or high-density, compared to 27 per cent in Australia as a whole. The shift towards medium-density and high-density living is highlighted in Figures 7.5.7 and 7.5.8. This trend is more apparent in Sydney than the country as a whole.

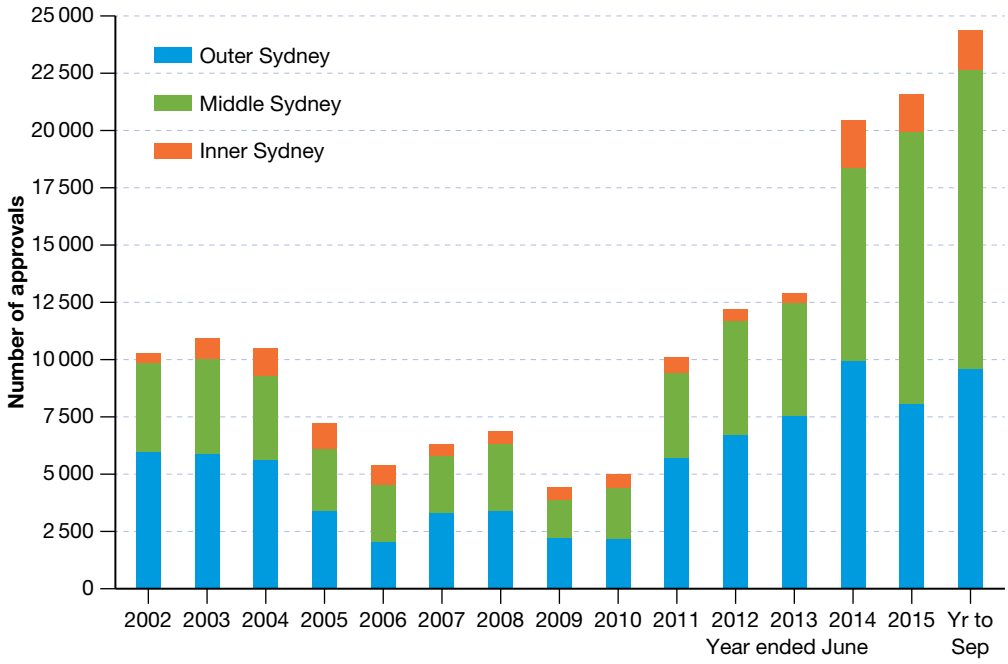
The trend towards medium-density and high-density living is also apparent in Sydney's western suburbs. About half the building approvals in 2014–15 were for apartments (see Figure 7.5.9).



7.5.7 Dwelling construction by type, 2011–2016



7.5.8 Dwelling type, Greater Sydney compared with Australia as a whole, 2016



7.5.9 Sydney apartment approvals by region, 2002–2016. The construction of apartments in 'middle Sydney' now exceeds those being built in inner-Sydney.

SPOTLIGHT

Sydney's population in numbers

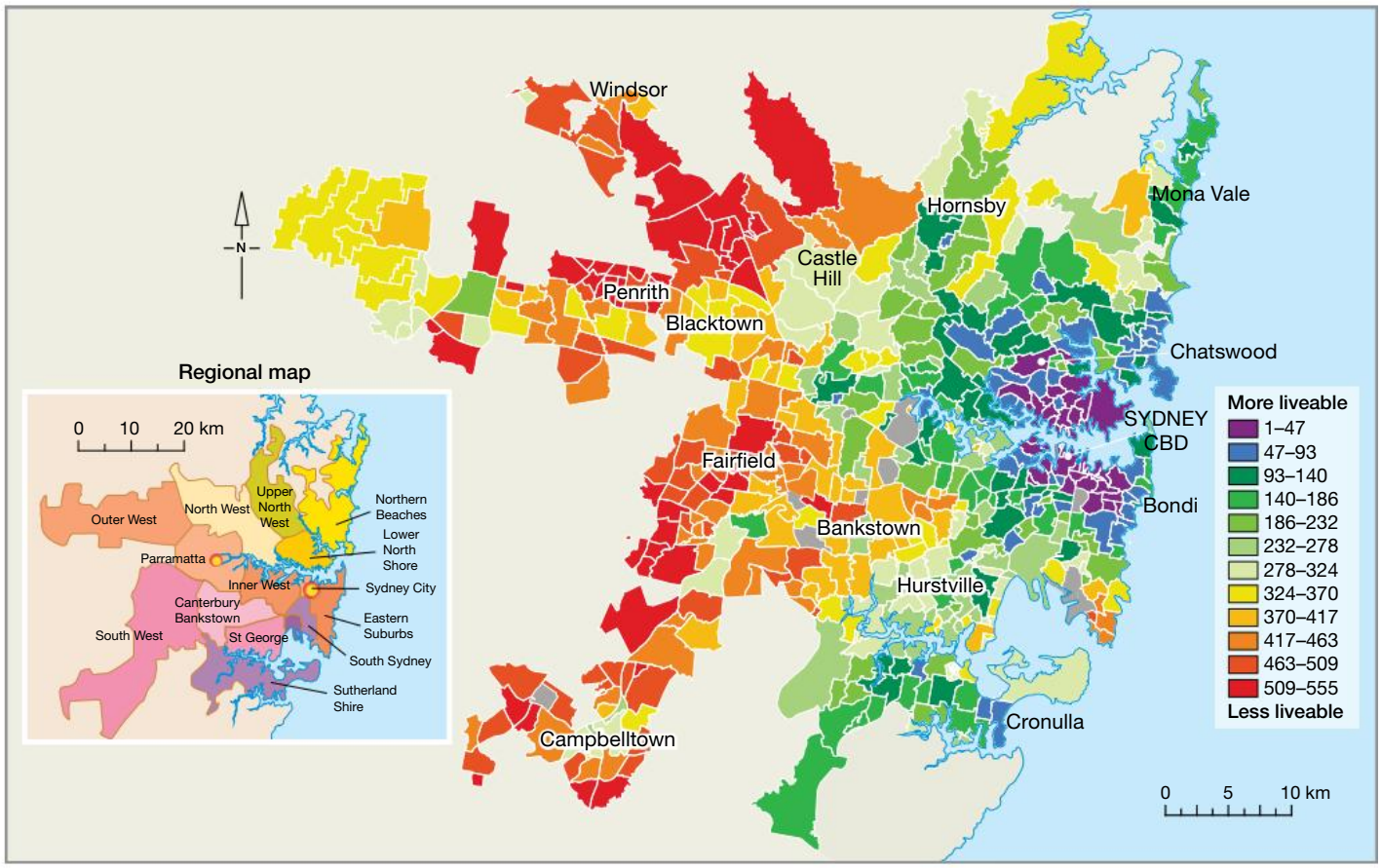
- The population of Greater Sydney is set to grow by more than 1.5 million people in just over 20 years, from 5.07 million in 2017 to 6.62 million people by 2040.
- Sydney's population density is 400 people per square kilometre.
- Fifty-five per cent of all dwellings in Sydney are separate houses; 20.3 per cent are medium density dwellings, and 23.5 per cent are high-density dwellings, compared with 71.1, 17.9 per cent, and 9.1 per cent in Australia respectively.
- The total number of dwellings in Greater Sydney increased by 135 546 between 2011 and 2016. The largest changes in the type of dwellings found in Greater Sydney between 2011 and 2016 were: high density (+80 585 dwellings); medium density (+38 066 dwellings); separate house (+7708 dwellings).
- In Greater Sydney, 35 per cent of households were made up of couples with children in 2016, compared with 30 per cent in Australia.

Liveability

In geography, the term 'liveability' refers to the characteristics of an urban place that contribute to the quality of life experienced by those who live in the place. Indicators of liveability include a range of factors but typically focus on political stability, availability of goods and services (including healthcare and education), low personal risk and efficient infrastructure.

In 2016, *The Sydney Morning Herald* commissioned a survey of liveability in Sydney (see Figure 7.5.10). The study used a range of indicators to identify the most (and least) liveable parts of the city. The indicators included: access to employment; proximity to train, bus, light rail or ferry services; whether there are cultural facilities nearby, such as libraries, museums and art galleries; the level of traffic congestion; and closeness to schools, shopping, cafes and restaurants. Other factors used were the amount of public open space, tree cover, topographic variations, crime levels, mobile and broadband coverage and harbour and ocean views.

In Sydney, the most 'liveable' suburbs were found to be lining the harbour and the coast. Some of the most liveable suburbs are also the most densely populated parts of the city. An increasing number of people are embracing high-density, inner-city housing and many apartment-dominated suburbs rated well. The high-rise, inner-city neighbourhoods of Elizabeth Bay, Potts Point, Pyrmont and Darlinghurst were all ranked in the top 50 for liveability.



7.5.10 Map of liveability in Sydney, 2016

Elsewhere in the city, areas once dominated by industry (known as brownfield sites) have been transformed into high-quality, high-density residential areas. The suburb of Rhodes occupies a site once dominated by a Union Carbide factory. The factory's toxic legacy had to be remediated before construction could commence. The suburb now ranks in the top 100 (out of a total of 555).

The transformation of other accessible brownfield sites into thriving medium-density and high-density residential areas will continue to play an important role in accommodating the city's rapidly growing population. The string of suburbs stretching from Central Station to Sydney's main airport is currently being transformed into vibrant new urban precincts.

Suburbs at the bottom of the liveability ranking are the newly developed neighbourhoods on the edge of the metropolitan area. The liveability rankings of these suburbs will increase as transport services and other urban amenities improve.

There is also evidence of a 'multi-centre' pattern of liveability developing in Sydney. Suburban precincts, located adjacent to commercial and employment hubs such as Parramatta, Penrith, Macquarie Park, Hornsby and Liverpool, now score well in terms of liveability. While such precincts have the advantages associated with access to employment, transport and services, they also benefit from more open space and less congestion than suburbs closer to the city centre.

Social and demographic trends

Lifestyle factors (for example, households that are non-family or family oriented) and family composition (for example, parents with preschoolers, school-age or working-age children, families comprising older couples or the single elderly) also help to determine the housing market that people access. Singles, couples without children and older couples tend to favour medium-density to high-density housing: flats/apartments, townhouses and villas. People with children continue to have a preference for housing that is semi-detached or fully detached (that is, a house plus garden). But Sydney's population is changing and the stock of homes will need to adapt to suit.

The fastest growing households in Sydney are single person households. In 2016, only 35.3 per cent of households were couples with children. Households that are couples with children will grow at a slower rate than both couple (22.4 per cent of all households) and single person households (20.4 per cent of households) over the next 20 years. Despite these trends, 55 per cent of Sydney's housing stock is detached houses (down significantly from 58.9 per cent in 2011).

As the population ages, many people will choose to downsize their homes. Many people will prefer to remain in their communities—around 50 per cent of people looking to purchase a new house stay within their current Local Government Area. The demand for inner-city living is increasing and more apartments are being built closer to public transport and centres. This reflects consumer demand for housing to meet budget and lifestyle requirements.

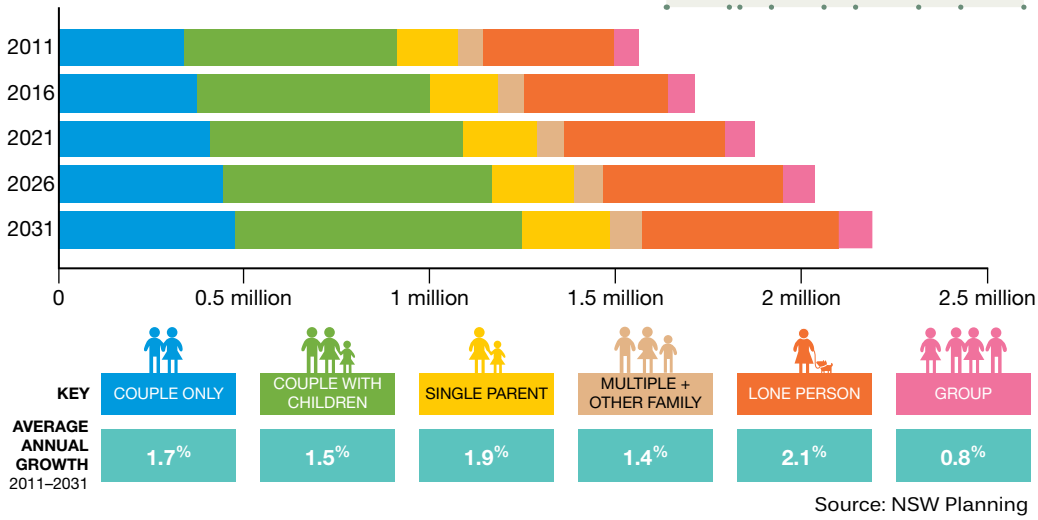
To respond to these shifts, the State Government has introduced planning controls that increase the number of homes in established urban areas to take advantage of public transport, jobs and services. It is also encouraging construction of well-designed, smaller homes to suit changing lifestyles and budgets. Sydney's household structure is shown in Figure 7.5.11.

SPOTLIGHT

The growth in high-density living

High-density housing, as a percentage of total housing units in Greater Sydney, increased from 20.7 per cent in 2011 to 23.5 per cent in 2016. Medium-density housings, as a percentage of total housing units in Greater Sydney, increased from 19.7 per cent in 2011 to 20.3 per cent in 2016. This suggests that there has been a greater focus on constructing high-density housing.

Just over 38 400 families with children were living in higher density (four or more storey) apartment blocks. This is an increase of 14 500 (60 per cent) from 2011. The overall supply of higher density housing grew by just over a third. In comparison, 74 100 families with children now live in semi-detached, terrace or townhouses, a 43 per cent increase from 2011. The supply of these types of homes increased by 33 per cent from 2011.



Source: NSW Planning

7.5.11 Greater Sydney household structure, 2011–2031 (actual and projected).

SPOTLIGHT

New strata rules to spark an urban consolidation boom

The 2016 revision to NSW's strata legislation included a clause that allows just 75 per cent of owners in a building—in place of the previous 100 per cent—to vote to sell the property to developers. Since it's rare that every owner will ever agree to anything, this amendment is seen as potentially revolutionising Sydney's apartment scene.

The new laws make it easier to redevelop older, crumbling apartment buildings throughout Sydney. More-relaxed height restrictions and floor space ratios, coupled with vastly improved building techniques, will allow more apartments to be built on the same footprint or on sites where higher, larger blocks were not previously allowed in what's now being seen as a redevelopment bonanza. Combined with the rezoning of land from low-density to medium-density and high-density housing, the new strata rules will increase the rate and extent of urban consolidation throughout the city.

Suitable housing stock

The fourth process shaping the Sydney residential housing market involves the type of housing stock available in an area. Former industrial sites close to the city centre and areas adjacent to railway stations are being redeveloped into medium-density and high-density housing precincts. The relatively cheaper expanse of outer suburbia remains dominated by low-density, owner-occupied housing. But even here there is a shift towards medium-density and high-density housing.

Location in relation to centres of employment and entertainment/recreation, accessibility and environmental amenity are important factors affecting land values. Land and dwelling values are highest close to the city centre; in the leafy, hilly areas to the north and south; in harbourside settings and in suburbs close to the city's many beaches. Suburban areas with harbour and ocean views are particularly sought after. Land prices are cheapest in the west and south-west. Within the broad sweep of economic and social processes, there are a wide variety of property submarkets. Some of these are identified with particular ethnic and/or social groups. For example, Sydney's gay community has a preference for the inner-city suburbs of Darlinghurst, Paddington, Woollahra, Newtown, Glebe and Leichhardt.

Spatial variations in housing stock across Sydney

There are very significant variations in dwelling type across Greater Sydney. The housing stock of the City of Sydney Local Government Area (LGA), is markedly different from Greater Sydney as a whole, as shown in Figure 7.5.12.

The housing stock of the City of Sydney LGA

Dwelling type	City of Sydney (%)	Sutherland Shire (%)	Campbelltown City (%)	Northern Beaches Council (%)	Greater Sydney (%)	Australia (%)
Separate (detached) house	1.9	62.2	77.2	55.7	55.0	71.1
Medium-density	21.8	18.9	19.8	17.2	20.3	17.9
High-density	74.6	18.0	2.6	25.9	23.5	9.1
Other (e.g. caravans, boats)	1.7	0.9	0.4	1.2	1.8	1.9

Source: Australian Bureau of Statistics, 2016 Census

7.5.12 Housing stock of the City of Sydney LGA compared with selected LGAs, Greater Sydney and Australia as a whole, 2016

Activities

Understanding the text

1 Identify the four factors that determine the operation of Sydney's residential housing market.

2 State what ultimately determines where someone lives in a city such as Sydney.

3 State what is meant by the term liveability.

4 List the demographic and social factors that impact on peoples' housing choices.

Working geographically

5 Outline how peoples' income and/or wealth affect the extent to which they can exercise choice when accessing the residential property market, either to buy or rent.

6 Study Figure 7.5.1. With the aid of a map of Sydney, describe the distribution of the city's highest and lowest median residential prices.

7 Study Figure 7.5.2. Using data from the graph describe the trend in median house and unit prices since 2012. What are the implications of these trends for those seeking to buy or rent in Sydney?

8 Study Figures 7.5.3–7.5.6.

- **a** Outline the spatial distribution of Sydney's owner-occupied housing, privately owned rental accommodation and public housing rentals.
- **b** State the percentage of Sydney residents living in medium-density and high-density housing. How does this compare with the Australian population as a whole?

9 Study Figure 7.5.7. Using data from the graph, describe the principal types of dwellings constructed in Sydney, 2001–2016.

10 Study Figure 7.5.8. Describe the trends in Greater Sydney dwelling construction in 2016 compared with Australia as a whole.

11 Study Figure 7.5.9. Using data from the graph, describe the distribution of apartment approvals across Greater Sydney. Describe the overall trend in apartment approvals since 2002.

12 Using information in the unit and Figure 7.5.10, describe and account for the pattern of liveability in Sydney. State the indicators used to assess the liveability of different parts of the city. Which parts were found to be the most, and least, liveable?

13
- **a** Identify the housing stock typically identified with inner-city 'brownfield' sites and those associated with 'greenfield' sites on the edge of the city.
- **b** Identify the factors that influence land values in Sydney.
- **c** State where land values are greatest and where they are lowest.

14 Write a report outlining the social processes affecting Sydney's housing market. Use data from Figure 7.5.11 to outline likely future trends in household structure.

15 Study Figure 7.5.12.

- **a** Compare the housing stock found in the selected areas of Sydney.
- **b** Using ABS data, describe the dwelling type data for the LGA in which you live.
- **c** Which of the LGA's shown in 7.5.12 does it most closely reflect? If none, speculate on the reasons why your LGA would be different from the ones included in the table.

16 Study the Spotlight box, 'New strata rules to spark an urban consolidation boom'. Explain how changes to the New South Wales strata rule have increased the rate of urban consolidation in Sydney's established suburbs.

UNIT 7.6

The morphology of Sydney's residential lands

Sydney's residential landscape is quite varied by international standards. From inner-city residential towers, to terrace housing in the older inner-city suburbs to the sprawling low-density detached housing estates stretching towards the periphery of the metropolitan area. It is useful to consider this morphology in terms of new suburban developments on the urban periphery and residential infilling and replacement.

New suburban developments on the urban periphery

New suburban developments on the urban periphery cater primarily for the needs of families. They reflect existing low-density suburban areas in terms of form and function; they are dominated by detached dwellings, seen in Figure 7.6.1.

Access to Sydney's radial system of freeways is an important locational factor. The construction of Sydney's M2 motorway (built to cater for the traffic generated by residential growth) has contributed to a further surge in residential development in Sydney's north-west. The M5 has helped to promote growth in the Liverpool–Campbelltown corridor. The M7 has opened up new areas for residential and commercial development in Sydney's west. Much of this development has occurred on land once occupied by remnant bushland or intensive forms of agriculture—market gardens, orchards, chicken farms and dairies.

Residential infilling and replacement

Residential infilling and replacement is now an important feature of Sydney's housing market and is closely linked to the process of economic restructuring. The decline and abandonment of the CIA has increased the availability of land close to the city centre. The types of residential units built vary, but usually involve a mix of both medium-density and high-density housing. The Central Park development (on a 5.8 hectare site once occupied by the former Carlton and United Brewery on Broadway), seen in Figure 7.6.2, is one such development. The $2 billion urban village includes up to 10 residential tower blocks, community facilities and parkland. A number of historic buildings on the site have been retained and incorporated into the development. The project also includes several commercial elements, including office space, retail outlets, restaurants, cafes and a supermarket.



7.6.1 Low-density residential development in Kellyville, Sydney's north-west



7.6.2 Central Park One, a landmark residential tower veiled in living green walls is the first of 10 towers to be built at Sydney's Central Park. The development is an example of residential infilling, a 'brownfield' development on a former industrial site close to Sydney's CBD.

The development of Sydney's airport railway initiated a large-scale residential and commercial redevelopment project around the new Green Square and Mascot stations and the Wolli Creek railway interchange.

The construction of the Metro Northwest and the City and Southwest Metro will intensify residential and commercial development in the areas surrounding new and existing stations. The CBD and South East Light Rail will have a similar impact. Again, accessibility is an important locational factor.

Specific housing submarkets include those described below.

Building conversions

Conversions are a significant trend in inner-city residential property markets, especially with gentrification. The cost of converting an existing building is often less than demolishing and rebuilding. It also has the advantage of retaining important elements of the city's architectural heritage and unique streetscapes. The conversion of the city's historic finger wharves and adjacent warehouses into residential apartments is seen as the only economically viable way of protecting these important elements of Sydney's architectural and maritime history. See Figures 7.6.3 and 7.6.4.



7.6.3 Walsh Bay, Sydney. The precinct's historic wharves and warehouses have been converted into apartments, theatres, restaurants, cafes and a hotel.



7.6.4 Sydney's historic Woolloomooloo Wharf has been transformed into a complex of luxury apartments, restaurants and a hotel.

Mixed residential developments with shared community facilities

In these 'new-age' planned developments, the individual blocks of land are relatively small but residents have access to common landscaped areas, sports facilities, playground equipment and commercial areas. Sydney's Newington and Liberty Grove are among the more established examples of this type of residential development. Newington occupies land once used by the Newington Armaments Depot while Liberty Grove occupies an abandoned industrial site.

One of the newest such communities is the Clemton Park Village in Sydney's inner-west. The village includes 750 apartments and is home to about 1500 people across 11 low-rise residential buildings. Other features of the village include: areas of parks and gardens; an open-air piazza and shopping village featuring a supermarket, specialty shops, alfresco cafes and restaurants; barbecue facilities and children's playgrounds; community centre and community garden; and an on-site childcare centre, see Figure 7.6.5.



7.6.5 Communal playground at the Clemton Park Village

Transport node developments

Public transport nodes (suburban railway stations and bus stations) have become an important locational focus for non-family oriented households due to their ready access to public transport. Properties have been consolidated, and the old houses demolished and replaced by apartments, townhouses and villas. The intensity of this process declines as the distance from the station increases, depending on demand and local town planning policies. Local government authorities, under State Government pressure, act to facilitate this process by rezoning land to accommodate such developments.

Demolition and rebuilding

The shortage of unoccupied residential land in areas close to the city centre has promoted a new type of urban replacement: the demolition and rebuilding of detached dwellings, as seen in Figure 7.6.6. This is most common in the middle ring of post–World War II suburbs. The high cost of land in these areas encourages this approach. Often the existing dwelling is worth much less than the land on which it stands, which makes demolition and rebuilding economically viable. Suburban areas with high levels of accessibility and/or environmental amenity are favoured by people who are attracted to this type of residential replacement.



7.6.6 The demolition and rebuilding of detached dwellings allows owners to live in a modern property in an established suburb.

Dual occupancy and duplex construction

The subdivision of a suburban block into two residential sites is another way of increasing residential densities. This may take the form of a new dwelling being constructed in the front or backyard of an existing dwelling. Originally, such developments were known as 'granny flats' because they were first restricted to family members. Corner blocks are especially favoured for this type of development because each dwelling can enjoy the advantage of a street frontage. Another increasingly popular type of development is the construction of duplexes (two attached dwellings with a street frontage).

High-density, inner-city residential development

The growing popularity of inner-city living and the high price that many people are prepared to pay for this lifestyle is reflected in the distribution of high-density residential developments. The height and scale of these projects reflect the ability to maximise the return on the capital invested. Land acquisition and building costs are very high. This accounts for the high price of these housing units.

The contemporary Australian family

In the past, an examination of the 'contemporary Australian family' could help explain the social processes impacting on Sydney's morphology, especially as it relates to the residential decision-making process. Two major components of modern family living can be distinguished:

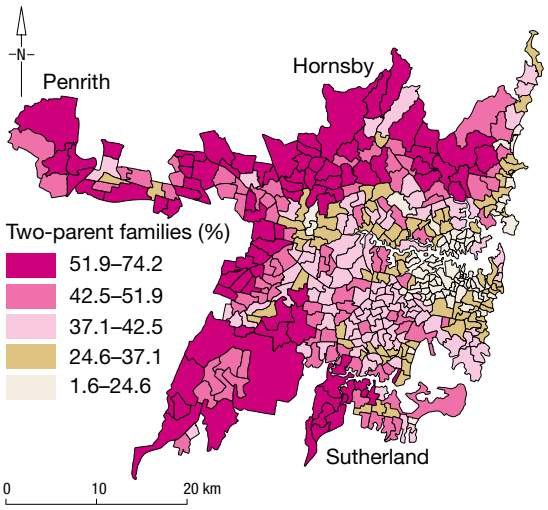
- **Lifestyle difference:** There is a difference between family (separate, commonly owner-occupied dwellings in suburbia) and non-family (commonly flat or apartment-based in the inner city) modes of living.
- **Life-cycle stage difference:** The larger, family orientated group can be subdivided into life-cycle stages: child-bearing, child-rearing, child-launching, post-child and widowhood.

However, this simple lifestyle/life-cycle stage approach is becoming increasingly irrelevant. Families are becoming more diverse as a result of the increasing instability of marriage and the proliferation of alternative living arrangements. Figures 7.6.7 and 7.6.8 illustrate the spatial distribution of family types in Sydney.

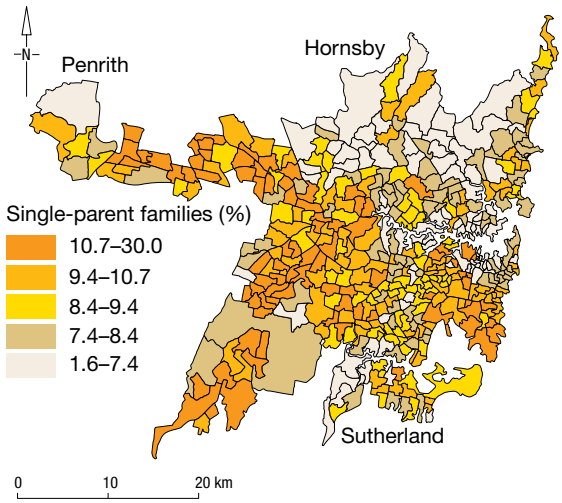
The increase in single-parent families largely centres on the female-headed family, which comprise seven out of every 10 such households. For these female-headed families, there is usually the need to adjust to a lower income. In many cases, it also involves a reliance on public housing. A number of commentators argue that this trend is contributing to the 'feminisation of poverty'.

An age-related lifestyle trend is the increasing popularity of higher-density living among retirees. A growing number are selling their detached suburban dwellings and moving into apartments, townhouses or villas. Many see these forms of housing as being more manageable (especially in terms of maintenance) and better suited to their preferred lifestyle as they age. The shift to planned retirement communities is another emerging trend.

Closely linked to family structure is the age profile of suburban Sydney. A study of this pattern provides additional insights into the city's housing market.



7.6.7 Distribution of two-parent families



7.6.8 Distribution of single-parent families

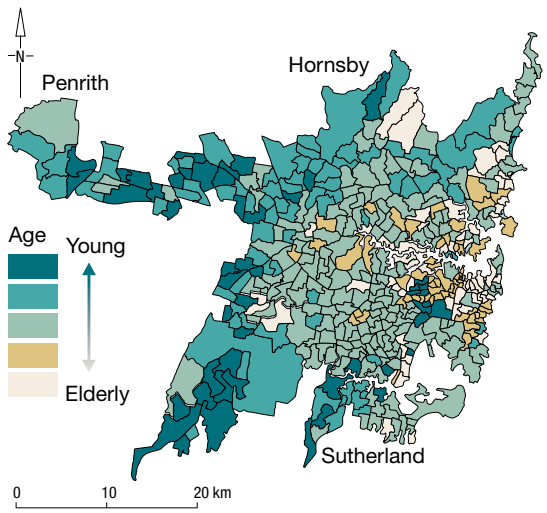
Sydney's age structure and its spatial outcomes

The map of Sydney's age structure (see Figure 7.6.9) is more complex than the family structure. The pattern is broadly concentric, but what is really shown is the distribution of different lifestyles and stages of the life cycle. Six age-structure types can be identified, each representing a distinctive profile:

- **'Young' areas:** These are made up of children mainly in the 0–14 years age range and parents in their 30s and 40s. They are generally in newly developed outer suburbs.
- **Areas characterised as 'young-mature':** These lack the pre-school element of the previous type, and instead are dominated by children in the 5–19 years age range and older parents in their 40s to 60s. They are generally found in outer suburban districts developed in the past decade or so. Examples are Liverpool in the south and the Hills District in the north-west: suburbs such as Castle Hill, Baulkham Hills and Winston Hills.
- **A 'mature-age' type:** These are characterised by a full range of age groups, present in proportions that are close to average for the city as a whole. This is middle suburbia in the Sydney context. Examples include Bankstown and the upper North Shore.
- **An 'old-age' type:** These are dominated by a markedly above-average presence of people in their 60s and older. This pattern is typical of older built-up areas of Sydney, the inner suburbs, the lower North Shore, Manly and pockets elsewhere in the city.

These first four types represent aspects of life-cycle stages within the family oriented lifestyle. The next two largely relate to non-family living:

- **'Old-to-youthful' type:** These represent three different sorts of households:
  - elderly people in late stages of the life cycle
  - younger, working-age adults without children, often from professional-managerial backgrounds in areas undergoing rejuvenation or gentrification
  - immigrant families with young children who commonly locate in inner-city areas on arrival from overseas.
- **'Young, working-age adult' type:** These are areas dominated by non-family orientated people in their 20s and 30s. They include flatting areas in the inner city and elsewhere close to major regional centres, such as Parramatta. They also include medium-density and high-density housing developments close to many railway stations, especially on Sydney's inner south side.



7.6.9 Sydney's age structure

Activities

Understanding the text

1 State for whom suburban developments on the urban periphery are best suited.

2 Outline the impact of Sydney's radial freeway system on the pattern of urban development in Sydney.

3 Explain what is meant by the term 'residential infilling and replacement'.

4 Explain the relationship between economic restructuring and residential development in Sydney.

5 Identify the benefits of warehouse conversions.

6 Outline the attractions of mixed residential developments with shared community facilities.

7 Explain why transport nodes have become the focus or urban consolidation.

8 Explain why demolition and rebuilding in established suburbs has become popular.

9 Explain what is meant by the term dual occupancy. Why is it encouraged?

10 Account for the high cost of inner-city residential developments.

Working geographically

11 a Distinguish between the two major components of modern family living.

b Explain why the lifestyle/life-cycle stage approach to the structure of the Australian family is becoming irrelevant.

c Outline the impact that the upsurge in single-parent households had on the housing demand.

d Explain what is meant by the expression 'feminisation of poverty'.

e Outline the impact that age-related lifestyle trends have had on housing demand.

12 Study Figures 7.6.7 and 7.6.8.

a Describe the distribution of two-parent and single-parent families in Sydney.

b As a class, discuss the social characteristics of each.

c Speculate on the reasons why each category tends to concentrate in particular parts of the city (and where that might be).

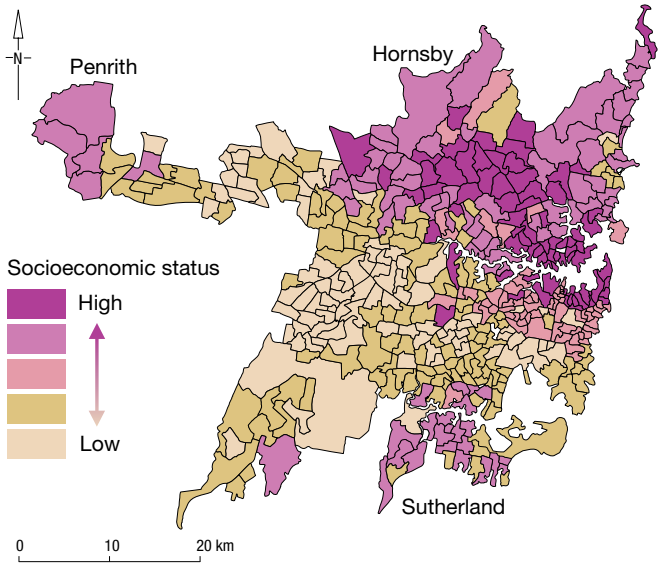
13 Prepare an oral report (or write an exposition). Topic: 'The traditional view of the typical Australian family has long been irrelevant. There is no typical family.'

14 Study Figure 7.6.9. Describe the age and lifestyle structure of Sydney.

UNIT 7.7

Processes shaping social geography

Sydney is Australia's largest metropolitan area. It is also a world city. Its social structure, and the dynamics that shape it, reflect both of these observations—its social structure reflects Australian society and social processes generally, while the city's contemporary social dynamics bring out all the advantages and disadvantages of global economic restructuring.



7.7.1 A socioeconomic map of Sydney

Socioeconomic status

Australians often describe their society as egalitarian and predominantly classless; however, like Australian urban society overall, Sydney has a well-defined class structure. This is inevitable in any advanced economy that is based mainly on private property ownership. Class is largely determined by a person's occupation in terms of prestige, financial reward and material lifestyle. A person's ability to access a particular level within the housing market (that is, ability to purchase or rent a property in a particular area) is a reflection of income (and/or wealth), occupation and education. This has a spatial outcome: the social ranking given to suburbs and neighbourhoods is based on their mix of occupations, education levels and incomes. Figure 7.7.1 illustrates a socioeconomic, or class, map of Sydney based on occupation mix.

Social effects of economic restructuring

A major feature of economic restructuring has been the growth in the service and finance sectors, accompanied by significant decline in other sectors, especially in manufacturing jobs. The dynamic, high-growth manufacturing sector had over time raised wages, reduced inequality and contributed to the growth of the middle class. However, it has given way to a new knowledge-based, service-dominated economy characterised by greater inequalities in income. Job shedding in the manufacturing sector has been widespread and almost half the jobs created in the services sector have been lower-income jobs.

As a result, the differences in living standards between more advantaged and less advantaged people are growing. Pockets, sometimes whole districts, of poverty, unemployment, violence, poor health and general social distress are now a feature of Sydney's social morphology. Once, these pockets were associated only with cities in the USA. At the other end of the social scale, Sydney has also developed areas of great wealth and privilege.

Australia's changing social structure

To fully understand the processes of social change occurring in Sydney, it is necessary to have some appreciation of the broader social context of that change. The image of Australia as an egalitarian and predominantly classless society bears little resemblance to the actual distribution of wealth, privilege or power in today's largely affluent, urban society. Distribution of income and wealth provides a good test of how egalitarian a community may be. On this basis, Australia is more egalitarian than most developed countries, including the UK and USA. However, it still shows extremes of wealth that account for the widely differing lifestyles and opportunities experienced by people at various levels of society, shown in Figure 7.7.2.



7.7.2 The different lifestyles experienced by various levels of society are often reflected in the home they occupy. **A** Affluent housing in Sydney's east. **B** Public housing in Western Sydney.

SPOTLIGHT

The richest seven

Australia's seven richest people have $56 billion in accumulated wealth, which is more wealth than 1.73 million Australian households. It is roughly equal to the amount of wealth held by the poorest 20 per cent of the population ($54 billion). See Figure 7.7.3.



7.7.3 Ron Tandberg's perspective on inequality in Australia

Wealth and poverty

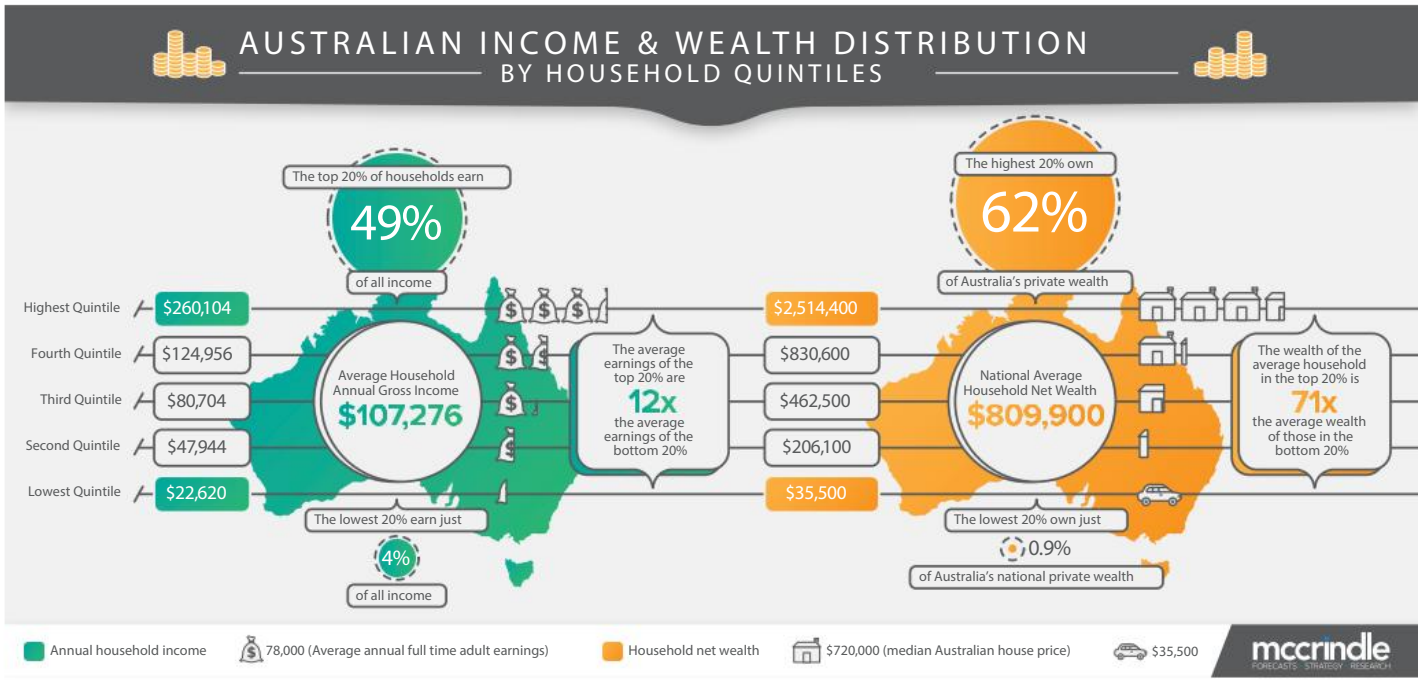
In 2016, the wealthiest 20 per cent of Australia's population controlled 62 per cent of the country's personal wealth (that is, assets). This was 71 times more wealth than that controlled by the poorest 20 per cent. The poorest 20 per cent held just 0.9 per cent of all private wealth. The average household wealth of the wealthiest 20 per cent of the population was $2.5 million while the accumulated wealth of the poorest 20 per cent of the population was just $35 000 (see Figure 7.7.4). The wealth of the top 1 per cent of Australians is even more pronounced; the top 1 per cent control 22 per cent of total Australian wealth.

Income distribution

The same pattern of inequality emerges when income distribution is examined. The top 20 per cent of households earn 49 per cent of all income while the bottom 20 per cent shares just 4 per cent of income. The average income of the top 20 per cent is $260 104 (12 times the average income of the bottom 20 per cent—$22 620).

Over the past 20 years the share of income and wealth of the top 20 per cent has risen while the share going to the lowest (and in the case of wealth also the middle) has decreased.

For middle-income and higher-income households (approximately 58 per cent of all households), wages and salaries remain the principal source of income. For low-income households (approximately 28 per cent of all households), government payments are the main source of income.



7.7.4 Infographic: Australia's income and wealth distribution, 2016

The poverty line

According to the Australian Council of Social Service (ACOSS), 2.99 million (or 13.3 per cent) of Australia's 24 million people are living at or below the poverty line, which is measured as 50 per cent of the average disposable income. People living at, or below, this level of income have difficulty meeting what most Australians would regard as an acceptable standard of living (see Figure 7.7.5). An estimated 20 per cent of Australia's children live in low-income households, where no-one has a job. Many of the poorest urban localities in Sydney contain high concentrations of children.

Increasing inequality

In Sydney, both wealth and inequality are growing. The city's average family income is approximately 10 per cent higher than the Australian average. The average value of family assets is 38 per cent greater than the Australian average. This is partly a result of higher property prices. Sydney also has a disproportionately high number of Australia's wealthiest people and a disproportionately large number of poor people. As a result it has the greatest level of inequality of any Australian city.

Australia's growing social and economic divisions have given rise to increasing spatial inequality; that is, distinct geographical divisions between poor and affluent populations. Throughout the 1980s and 1990s average household incomes in the 1000 poorest neighbourhoods declined while average household incomes in the richest neighbourhoods grew strongly. This trend has continued into the twenty-first century. The outcome of this process has been a significant increase in the geographical polarisation of household incomes across Sydney. The poor are becoming increasingly concentrated in one set of neighbourhoods and the rich in another.

The groups most at risk of poverty are listed in Figure 7.7.6. Figure 7.7.7 highlights the social distribution of Australia's poor.



7.7.5 One of Sydney's homeless

SPOTLIGHT

Poverty in numbers

- The poverty line (50 per cent of median income) for a single adult was $426.30 a week in 2014. For a couple with two children, it was $895.22 a week.
- In 2014, 2.99 million people (13.3 per cent of the population) were living below the poverty line, after taking account of their housing costs.
- An estimated 731 300 children under the age of 15 (17.4 per cent of all children) were living below the poverty line.
- Of those people who lived below the poverty line, 57.3 per cent relied upon social security as their main income while 32.1 per cent relied upon wages as their main income.

Groups at high risk of poverty

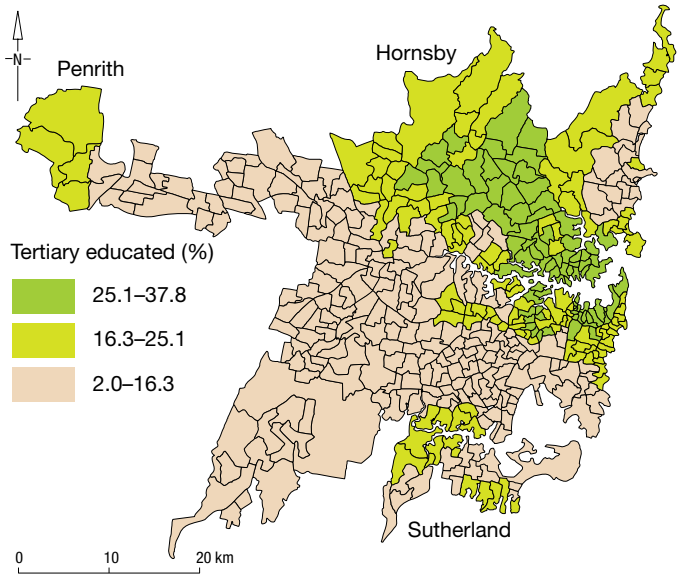
- Indigenous Australians
- People who are unemployed
- People dependent on government cash benefits
- Sole-parent families and their children
- Families who have three or more children
- People earning low wages
- People with disabilities or those experiencing a long-term illness
- Aged people, especially those renting privately
- Young people, especially in low-income households
- Single people on low incomes
- People who are homeless
- Migrants and refugees

7.7.6 Groups at high risk of poverty

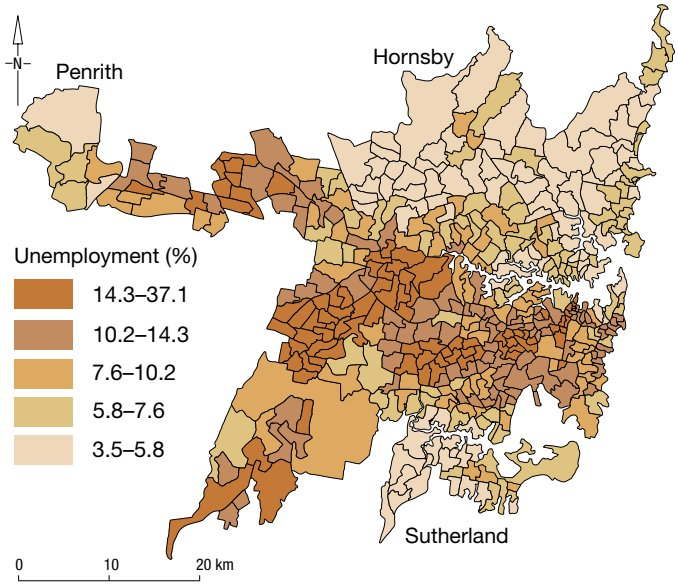
A Smith Family study estimated that of every 100 poor Australians:

- 24 live in working-poor (wage and salary) families
- 23 live in families with an unemployed head
- 15 live in other families dependent on social security
- 14 live in sole-parent families
- 9 live in self-employed families
- 6 live in families headed by an aged person
- 5 live in some other type of family
- 4 live in families reliant on superannuation and investment income

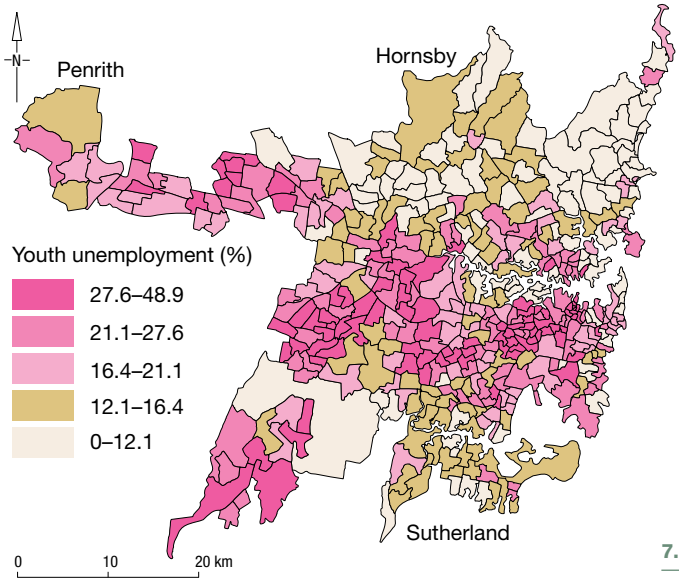
7.7.7 Who is poor in Australia



7.7.8 Levels of tertiary education



7.7.9 Pattern of unemployment



7.7.10 Youth unemployment

Spatial patterns of advantage and disadvantage

Two factors are seen as being important in shaping the spatial pattern of advantage and disadvantage in Sydney. These are the level of education a person attains and the extent to which people are engaged in work. Figure 7.7.8 shows the level of tertiary education achieved across metropolitan Sydney. Figure 7.7.9 shows the pattern of unemployment. Figure 7.7.10 shows the pattern of youth unemployment. The level of unemployment is greatest in those areas with the lowest level of tertiary education.

Locational disadvantage

Unemployment, the casualisation of the workforce, falling real wages, and cuts to welfare and public services have led to rising poverty and increased social disadvantage. Those affected tend to live in neighbourhoods with the least expensive housing. Often these are on the outer edges of our large cities. This further compounds their disadvantage because they are isolated from many of the services on which they depend, including healthcare, childcare, counselling, public transport and legal aid. This is sometimes referred to as locational disadvantage.

The concentration of the economically and socially disadvantaged into particular neighbourhoods often results in these areas becoming associated with high rates of crime, drug dependency, domestic violence, urban decay and vandalism. In extreme cases, the problem becomes so great that entire neighbourhoods move towards becoming 'no-go' areas. Class, or socioeconomic status, underpins questions of advantage and disadvantage.

A tale of two cities

By Brendan Gleeson

Chloe's story: a sad tale of urban disadvantage

One Saturday in early November 2003, the lifeless body of five-year-old Chloe Hoson was found discarded amidst refuse in the reserve opposite her home, Lansdowne Caravan Park, in south-western Sydney. Chloe had been raped, strangled and cast aside like rubbish by her killer. A young man resident in Lansdowne Park was later charged with her murder ...

[In her account of the tragedy] *The Australian's* Christine Jackman took readers beyond the monstrous crime that ended Chloe's life into the life-world that she had inhabited all too briefly ...

Jackman enters the Lansdowne netherworld to find and interview Chloe's playmates; just some of the many children who live with their parents in the tightly packed, poorly ventilated trailers and cabins that crowd the caravan park. The children knew well the tawdry reserve where Chloe was found because their parents had declared it off limits. It was a magnet for prostitution and drug dealing ...

Jackman speaks to 'Dave', a father of three children under the age of three. He fumes with helpless anger about the impossibility of keeping kids safe in a den of drugs, pollution and quietly smouldering rage. Jackman observes: '... beneath this father's fury is a deeper, brooding resentment at the powerlessness of life on the fringes of Australia's wealthiest city.' Dave speaks of entrapment, of not being able to access even the scruffier private rental market that thrives in parts of Sydney's middle west ...

Lansdowne, like many other urban welfare camps, is the last stop before outright homelessness. It provides none of the conditions for a healthy and happy life... The politics of choice seem to have sidestepped Lansdowne's 1000 residents ... Jackman writes: 'the only shopping centre within walking distance boasts a liquor store, a Chinese takeaway and a McDonald's—but the fruit and vegetable shop has closed down'. The problem of transport poverty is highlighted: 'Those without cars must rely on the local service stations for ready supplies—but often must dodge another sort of trade on their way to pick up milk.'...

We do not yet properly know the extent or precise character of these new urban netherworlds: our social scientific understanding of them is poor because such knowledge seems to attract little political or policy interest. It seems you can know too much in the Clever Country.

Brendan Gleeson, *Australian Heartlands: Making Space for Hope in the Suburbs*, Allen & Unwin, Sydney, 2006, pp. 116–17



7.7.11 A growing number of Sydney's affluent residents are choosing to live in planned estates consisting of enormous houses often referred to as McMansions.

Meanwhile, out in McMansion Land

[At the other end of the socioeconomic scale to Lansdowne Caravan Park are the new masterplanned estates—derisively called McMansion Land by some commentators] because their supersized contents seem steroid enhanced ... (see Figure 7.7.11).

[The journalist Janet Hawley] describes contemporary project homes on the newer Sydney masterplanned estates: '...four bedroom, spiral staircase, open-plan, kitchen-family-dining-lounge, multiple bathroom, rumpus room, big-screen media room, barbecue, spa, multi-garage bigger-is-beautiful-is-better houses.'...

The growth in dwelling size is an environmental concern—the suburban palazzos are energy guzzlers—and also, perhaps, a health concern... the national epidemic in childhood obesity points to a relationship between the expanding girth of dwellings and the growing waist-line of their inhabitants.

The contemporary suburban mega house internalises activity, allocating large amounts of space to passive recreation: home theatres, lounges, rumpus and computer rooms, courtyards and monster garages for the storage of the adults' toys... [People] 'love cocooning inside their McMansions, which are like castles, fun factories and mini resorts in one.'...

Recent survey evidence confirms the picture of sedentary children. A Newspoll study in early 2005 found that children were spending only about one-tenth of their time in outdoor play. Further, one in twenty admitted that they never left their homes to play ...

Journalist Jane Cadzow depicts the 'bubble-wrap generation': 'So reluctant are we to let our offspring out of our sight that we drive them to the playground and everywhere else rather than allow them to walk or ride their bikes. Strapped into the backseat of the family sedan, chauffeured to and from school, soccer practice and piano lessons, middle-class Australian boys and girls are like pampered prisoners—cosseted, constrained and constantly nagged.'

Brendan Gleeson, *Australian Heartlands: Making Space for Hope in the Suburbs*, Allen & Unwin, Sydney, 2006, pp. 117–19

Activities

Understanding the text

1 State the factors that determine a person's socioeconomic status in Australia.

2 Outline the impacts of economic restructuring on Sydney.

3 Comment on the proposition that Australia remains an 'egalitarian and largely classless society'.

4 Describe the distribution of wealth in Australia.

5 Outline the extent of poverty in Australia.

6 Outline the spatial implications of increasing social and economic inequality.

7 Explain what is meant by the term geographical polarisation.

8 Explain what determines the extent of choice a person has in the housing market, especially the decision of where to live.

9 Explain what is meant by the term locational disadvantage.

10 Explain why some areas move towards becoming 'no-go' areas.

11 List the social indicators that people use to construct the social ranking of suburbs.

12 Identify where Sydney's higher income earners live.

13 Explain what is meant by the term 'poverty trap'. Are some people more 'trapped' than others?

Working geographically

14 Study Figure 7.7.1. Describe Sydney's pattern of socioeconomic wellbeing based on income.

15 As a class, discuss the point Ron Tandberg is seeking to make in his cartoon (see Figure 7.7.3).

16 Study the infographic shown in Figure 7.7.4. Using data from the infographic describe the nature and extent of inequality in Australia.

17 Study Figures 7.7.6 and 7.7.7. Identify the groups at high risk of poverty and then construct a pie graph showing the relative size of each poverty group as identified by the Smith Family.

18 Study Figure 7.7.8. Describe the distribution of tertiary educated people in Sydney.

19 Study Figure 7.7.9. Describe the pattern of unemployment in Sydney. To what extent is unemployment concentrated among particular groups in certain parts of the city?

20 Write a paragraph commenting on the relationship between the patterns identified in activities 1, 5 and 6.

21 Study the extracts 'Chloe's story' and 'Meanwhile, out in McMansion Land'. As a class, discuss the following questions.

- **a** What does Chloe's story tell us about the nature of disadvantage in Australian society?
- **b** In what ways does the lifestyle of those living in McMansion Land differ from those living in Lansdowne Caravan Park? Should such inequities be tolerated in such an affluent country?
- **c** Debate the proposition that the conditions found in Lansdowne Caravan Park are more typical of megacities than large cities in the developed world.
- **d** Building on the points raised in your class discussion and debate, and the material included in this section of the text, write a discussion that highlights the spatial inequalities apparent in Sydney as an example of a large city in the developing world.

UNIT 7.8

Spatial patterns: advantage and disadvantage

Three of the most commonly used indicators of social advantage and disadvantage (or spatial inequality) are occupation, education and income. The social ranking that people assign to particular suburbs is based on perceptions shaped by a mix of all these variables.

Over time, the spatial concentration of disadvantaged groups may lead to residents being caught up in a cycle of poverty. This occurs when families experience a set of factors or events by which poverty, once experienced, is likely to continue for a number of generations. In the USA, intergenerational unemployment, especially among racial minorities, has led to the development of an underclass and a culture of poverty.

Although the unemployment-equals-inequality trend is increasing in Australia, there is no underclass. The reason is that Australia's welfare system provides a safety net. It includes income support, assistance for low-income families, Medicare, low-rental housing, training programs and counselling services. There are social problems associated with poverty (such as crime, truancy, dysfunctional families and drug abuse). However, as yet at least, there is no long-term, intergenerational transmission of unemployment that would act to produce an underclass and a whole culture of poverty.

Spatial patterns of advantage and disadvantage can be examined in terms of access to employment, housing, education and healthcare.

SPOTLIGHT

University graduates

According to the 2016 Census, university graduates make up 24.1 per cent of Sydney's workforce (compared with 18.8 per cent Australia-wide). Those with a Bachelor or higher degree tend to live in the upper North Shore, the western shores of Middle Harbour, and around the northern and eastern harbourside.

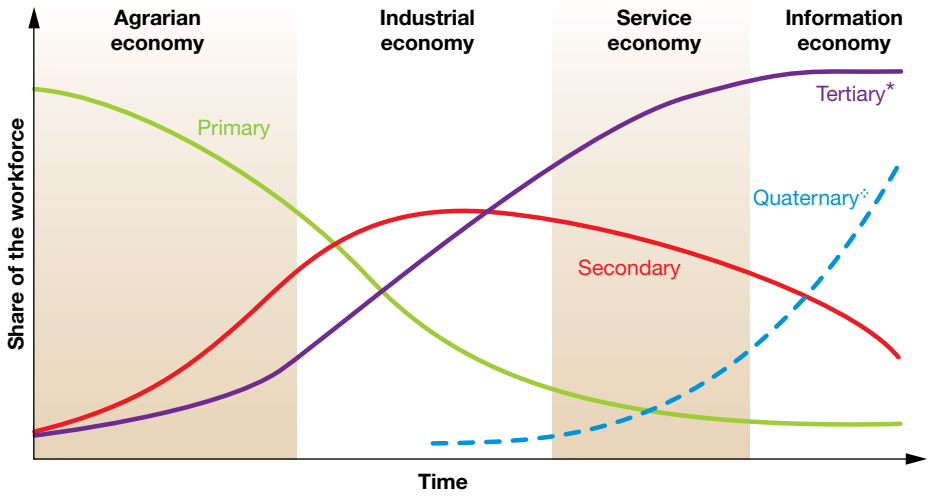
Professionals make up 25.5 per cent of Sydney's workforce. Clerical and administrative workers are the next largest group at 16.2 per cent, followed by managers at 13.3 per cent, technical and trades workers at 12.2 per cent, community and personal service workers at 8.8 per cent and labourers at 7.3 per cent.

Inequalities in access to occupation and income

Having a job enables people to enhance their material wellbeing and achieve a certain standard of living. In particular, employment governs access to the housing market. Access to employment can be examined in several ways.

Income is closely related to a person's range of work-related skills. Different skill levels (a product of education) are one of the factors generating inequalities.

Within production processes, a wide range of tasks are carried out. These require a variety of skills and expertise and are rewarded accordingly. Tasks requiring higher-order skills or longer periods of education or training are generally rewarded with higher incomes.

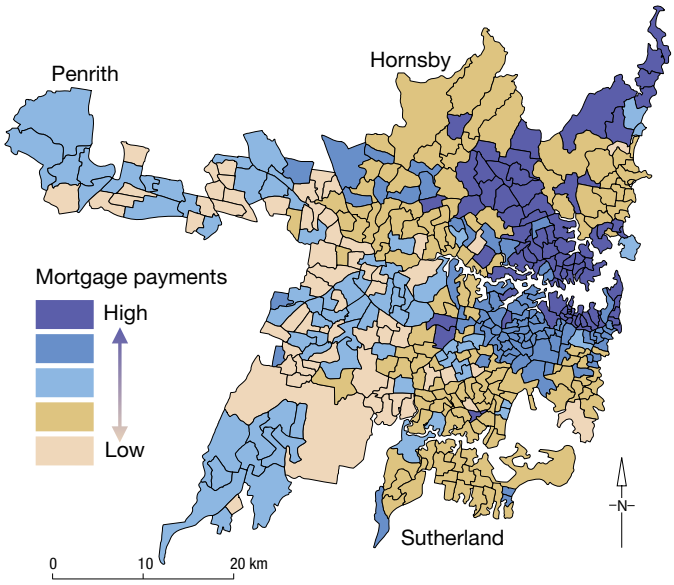


* Includes wholesaling and retailing, building and construction, transport and storage, and a range of personal services
⁘ Economic activities that involve the creation, processing and communicating of information

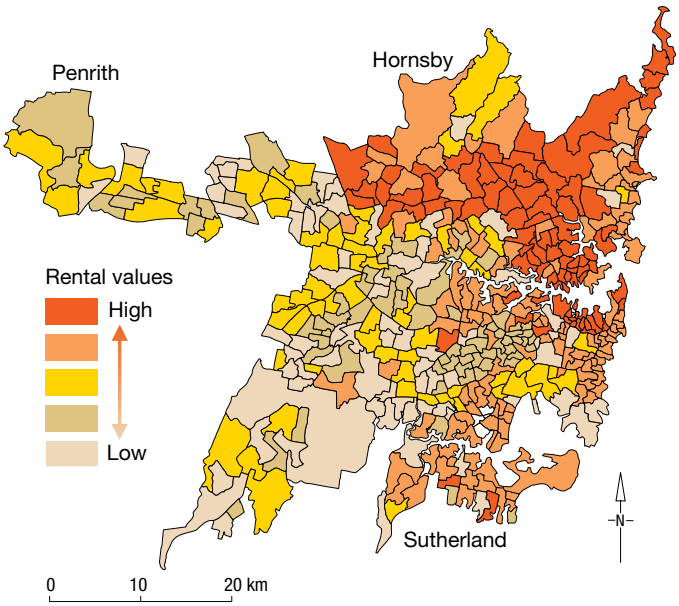
7.8.1 Structural change in the Australian workforce

Economic restructuring has seen a decline in lower-skilled occupations and a growth in the higher-skilled occupations. This process has tended to increase inequality since lack of education and skills prevents some workers moving from one sector to another.

The magnitude of employment shifts between sectors during the various stages of Australia's economic growth is illustrated in Figure 7.8.1.



7.8.2 Level of mortgage repayment



7.8.3 Rental values

The decline in manufacturing employment over the last 40 years is reflected in the relatively high levels of unemployment in Sydney's inner-western, western and south-western suburbs; that is, those areas traditionally associated with manufacturing employment. Over the same period, the proportion of the workforce employed in the information and service sectors has increased substantially.

Inequalities in access to housing

Social inequalities are increased when people are unable to secure adequate housing because they cannot afford it. An increase in social inequalities also occurs when people who are adequately housed have too little to live on after paying their mortgage or rent.

The two main ways of accessing housing—renting and purchasing—have different implications for equity. In the case of home purchase (usually with the assistance of a mortgage), the relationship between property value and mortgage repayments changes over time. This is because mortgage repayments relate to property values at the time of purchase. People's income tends to rise over time. As it does, the proportion of their income needed for mortgage repayments declines.

Equity in home ownership is, therefore, related to a family's age and wealth, and the time that has passed since the home was purchased. This can be seen in the pattern of mortgage repayments (see Figure 7.8.2). Obviously, those on higher incomes have the ability to support higher mortgage repayments. This gives them much greater choice in the housing market. Those on lower incomes have a restricted choice. This contributes to patterns of inequality within Sydney.

Renters are disadvantaged compared with those purchasing a home. This is because the equity built up in rising property value goes to the owner, while rising prices are passed on in the form of higher rents. While some people rent as a matter of choice (such as career-oriented, non-family groups), others, especially those on low incomes, are forced into renting.

In the main, house prices (and rents) in different parts of the city reflect a combination of the value of the home itself and the value of the land. The land value is itself a product of relative accessibility or location and environmental amenity. Figure 7.8.3 shows the value of rental accommodation in various parts of Sydney. High rents act to exclude low-income earners.

Activities

Understanding the text

1. Outline the impact of economic restructuring on employment opportunities in Sydney.
2. Explain the relationship between access to housing and increased levels of social inequality.
3. Compare the advantages and disadvantages between the two ways people can access the housing market: by purchasing or renting.
4. Explain the equity implications for each of the factors that determine the price of houses in different parts of the city.

Working geographically

5. Study Figure 7.8.1. Write a report describing the structural changes in the Australian workforce.
6. Using the 2016 Census data in the Spotlight box 'University graduates', write a brief report outlining the nature of employment in Sydney.
7. Study Figure 7.8.2. Describe the pattern of mortgage repayments in Sydney.
8. Study Figure 7.8.3. Describe the pattern of rental values in Sydney.
9. Write a report describing and accounting for the patterns identified in activities 2 and 3.

Inequalities in access to education

The relationship between socioeconomic status and the educational achievement of students is well known. Of particular interest to educators and human geographers is how this relationship becomes translated into the inequalities faced by students when they become adults.

The nature of the school attended, together with the student's home environment and the interpersonal relationships within it impact on educational achievement, as do factors such as a student's aspirations, peer group pressure, and the expectations of parents or guardians. These act, separately or together, to either foster or frustrate the learning process.

The effects of socioeconomic segregation within a city such as Sydney also have an impact on the school environment. Many believe that the level of student achievement is linked to the socioeconomic profile of the school itself, with students in high socioeconomic areas outperforming those from lower socioeconomic areas due to better resources and school services (see Figure 7.8.4).

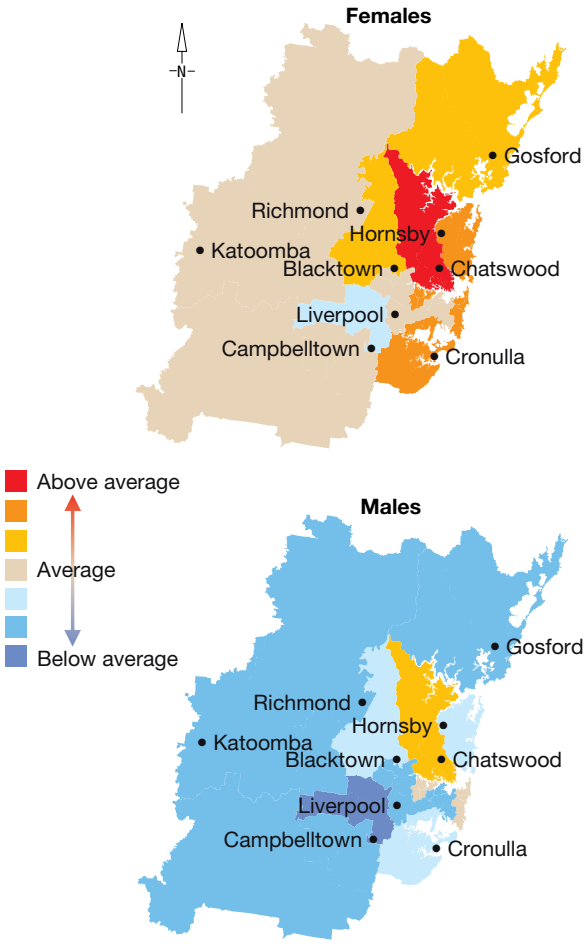
It is also possible that the school system reflects, and therefore tends to perpetuate, the existing social order through what it teaches, whom it teaches, and what pupils learn both in and out of the classroom.

These resulting spatial inequalities can be demonstrated in three ways:

- through high school retention rates, which is defined as the proportion of students entering Year 7 who remain to complete Year 12
- student performance in public examinations, such as the Higher School Certificate (see Figure 7.8.5)
- the distribution of those with tertiary qualifications.



7.8.4 Sydney Grammar School for Boys. Many believe that the level of student achievement is linked to the socioeconomic profile of the school itself.



7.8.5 Distribution of HSC English results, metropolitan Sydney

Activities

Understanding the text

1 Explain how education shapes a person's future.

2 Identify the aspects that must be taken into account when we investigate spatial variations in the level of educational achievement.

3 State the factors that are commonly used to investigate the geography of educational inequalities.

Working geographically

4 As a class, discuss:

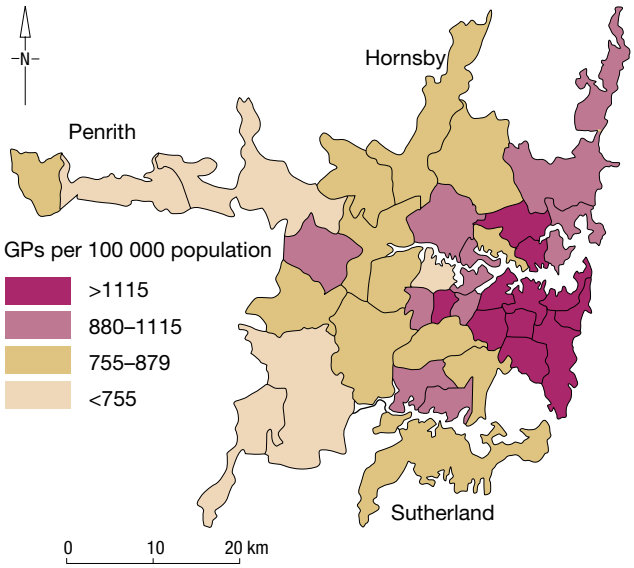
- **a** the role of home and neighbourhood in shaping attitudes to education and educational achievement
- **b** the extent to which the socioeconomic mix of pupils at a school affects student achievement.

5 Working in groups, discuss the view that what is taught at school, and what you learn, simply bolsters the existing social order—in other words, that it serves the needs of the more academically inclined, while failing to meet the needs of the less academically gifted or the more practically (jobs and skills) orientated. Share the points raised in your group's discussion with the rest of the class. Be prepared to justify your views.

6 Discuss the assertion that guardian/parental expectations and student aspirations play important roles in shaping educational outcomes. To what extent do you think these mirror the patterns of advantage and disadvantage noted in this study of Sydney?

7 Compare Figures 7.8.5 and 7.7.1. To what extent do you think that one reinforces the other; that is, bolsters the existing social order?

Inequalities in access to healthcare



7.8.6 Distribution of GPs

Concerns about inequities in urban services often focus on the provision of healthcare. Ideally, their provision should be on the basis of need. However, variations in access to medical services are apparent in Sydney. The outskirts of the metropolitan area and some poorer suburbs have been identified as lacking an equal share of healthcare resources.

The overriding issue in the provision of hospitals and community health services in Sydney is their distribution relative to the city's population. For the past decade or so, successive state governments have pursued policies of relocating hospital beds from the inner city to the west and south-west.

The reasons for present and remaining inequities in the provision of hospitals are largely rooted in the past. For example, it was often considered cheaper to expand existing inner-city facilities than build a completely new hospital complex in the suburbs. There is often considerable community resentment, and resistance to, the closure or relocation of hospital facilities away from communities in the eastern and northern suburbs.

The general issue of distribution according to need is important for several reasons. For example, variations in the supply of medical services can lead to differences of quality of treatment. People living in areas that are under-supplied may be treated with greater haste, or have to wait much longer, than those in areas of better supply. At the other end of the spectrum, overprovision raises the possibility of excessive treatment or over servicing.

The oversupply shows up in the spatial distribution of GPs (see Figure 7.8.6). The inner and northern suburbs have a heavy concentration of doctors, while in the outer western and south-western suburbs they are in a relative shortage. The choices made by doctors themselves about where they live and work may contribute to this spatial inequality. Those practicing in poorly served areas may be required to accept unreasonable workloads. The distribution of GPs also reflects the attraction of GPs to older, more established areas with a social standing consistent with the upper middle-class background of many doctors themselves.

Sydney: health outcomes by postcode

Sydney is a city of health inequity, with significant disparities in cancer death and diagnosis rates between the rich and the poor.

People living in some of Sydney's most disadvantaged postcodes die from potentially avoidable deaths due to cancers at significantly higher rates than their more affluent neighbours.

Figure 7.8.7 highlights the inequalities in avoidable mortality—defined as deaths that were potentially preventable in the Australian health system. Some of the most disadvantaged areas in greater Sydney had the highest rates of premature mortality linked to cancer, while some of the most affluent suburbs, including Double Bay and Mosman, had some of the lowest premature cancer death rates.

A range of social factors contribute to the inequitable health outcomes for those people living in Sydney's most disadvantaged communities, mostly located in Sydney's west. These include income, employment status, housing conditions, education, transport and obesity, as well as healthcare.

Overall, patients living in Sydney's most disadvantaged areas had significantly higher rates of cancer-related hospitalisations than the more advantaged suburbs. This can, at least in part, be explained by the higher rates of smoking and obesity among the disadvantaged.

Premature mortality	
Primary health area	**Premature deaths per 100 000 population**
Highest rates	
Mount Druitt—north-west	163.5
Ashcroft, Busby, Miller	148.4
Campbelltown	131.6
St Mary's, Colyton	128.5
Mount Druitt, Whalan	128.3
Kingswood, Werrington, Penrith	127.6
Claymore, Eagle Vale, Raby	127.4
Guildford West, Merrylands, Holroyd	119.5
Ingleburn, Denham Court, Minto	118.2
Bargo, Picton, Tahmoor, Buxton	117.9
Lowest rates	
Gordon, Killara/Pymble	56.1
Homebush Bay, Silverwater	58.9
Normanhurst, Thornleigh, Westleigh	61.8
Homebush	62.6
Avalon, Palm Beach/Newport, Bilgola	63.6
Double Bay area	63.0
South Hurstville, Blakehurst area	67.3
Cremorne, Cammeray/Neutral Bay, Kirribilli	67.2
Canada Bay—east	70.5
Willoughby, Castle Cove, Northbridge	70.4

7.8.7 Premature mortality, areas with the highest and lowest rates

Activities

Understanding the text

1. Explain why state governments have sought to reallocate health resources to western and south-western Sydney. What has made this such a difficult political exercise?
2. Explain the link between the supply of medical services and the quality of treatment.
3. Outline why there is an oversupply of medical practitioners in some parts of Sydney.
4. Study the section 'Sydney: Health outcomes by postcode' and Figure 7.8.7. What does the data provided tell us about the relationship between socioeconomic status and health outcomes? Map the suburbs listed. Use red for the highest rate of premature death and blue for those suburbs with the lowest rate.
5. Use the internet to investigate the spatial pattern of cardiac disease and obesity in Sydney. To what extent does the pattern of the these diseases reflect that of premature mortality shown in Figure 7.8.7?

UNIT 7.9

Spatial patterns: ethnicity, religion and identity

Sydney's social geography can be considered from the perspectives of gender and identity. Like all cities, it has a range of identity-related issues that impact on the city's urban morphology.

One of these issues is the need to integrate a gendered perspective into urban planning processes. This involves processes that acknowledge the equality of women and men, while also accepting their differences. In the planning of public spaces, for example, two important issues need to be considered: one related to the issue of safety which involves women, children, the disabled and the elderly, and the other one concerning the accessibility of all public spaces.

Like all cities, Sydney has identifiable spaces in which particular types of gender expression or sexual identity are considered welcome or appropriate, and other types are unwelcome or inappropriate. Different areas within cities can be more- or less-welcoming to people of particular sexualities or gender identities. In some areas, members of the lesbian, gay, bisexual, transgender, and queer (LGBTQ) community may be threatened physically if their sexuality becomes known. There are also spaces in which they feel comfortable.

The development of inclusive cities can only be achieved if the equality of all people is acknowledged and their sexuality, age, life situation, ethnic, cultural and social backgrounds, as well as their socioeconomic circumstances, are taken into account.

Gender-related social patterns

Any social geography of Sydney must include an examination of gender-related issues and the impact they have on urban morphology. An example illustrates this point.

Urban travel models focusing on the journey to work (traditionally dominated by males in full-time employment) overlook the complex patterns of women who are more likely to combine travel for (often part-time) employment with trips to meet household needs: shopping, and dropping off and picking up children at school and sporting activities. Explanations of these differences have traditionally focused on role differences: the work and homemaker role of the female, compared with the work role of the male. While obviously a generalisation, mothers and female spouses are often seen to be more closely 'tied to the home' or at least the home area than men. Their pattern of movement (and employment choices) is seen as being constrained by the need to combine the homemaker and work roles, with work being part time rather than full time. This is changing as an increasing proportion of women enter the workforce on a full-time basis. Yet, according to ABS data women still spend almost double the time doing housework compared to men.

SPOTLIGHT

Women in the workplace

- Women comprise 46.2 per cent of all employees in Australia.
- As a proportion of all employees, 24.8 per cent are women working full-time and 21.4 per cent are women working part-time.
- Women constitute 71.6 per cent of all part-time employees, 36.7 per cent of all full-time employees and 54.7 per cent of all casual employees.
- The workforce participation rate for women is 59.3 per cent, and for men is 70.4 per cent.
- The full-time average weekly ordinary earnings for women are 16.2 per cent less than for men.

Part-time versus full-time work

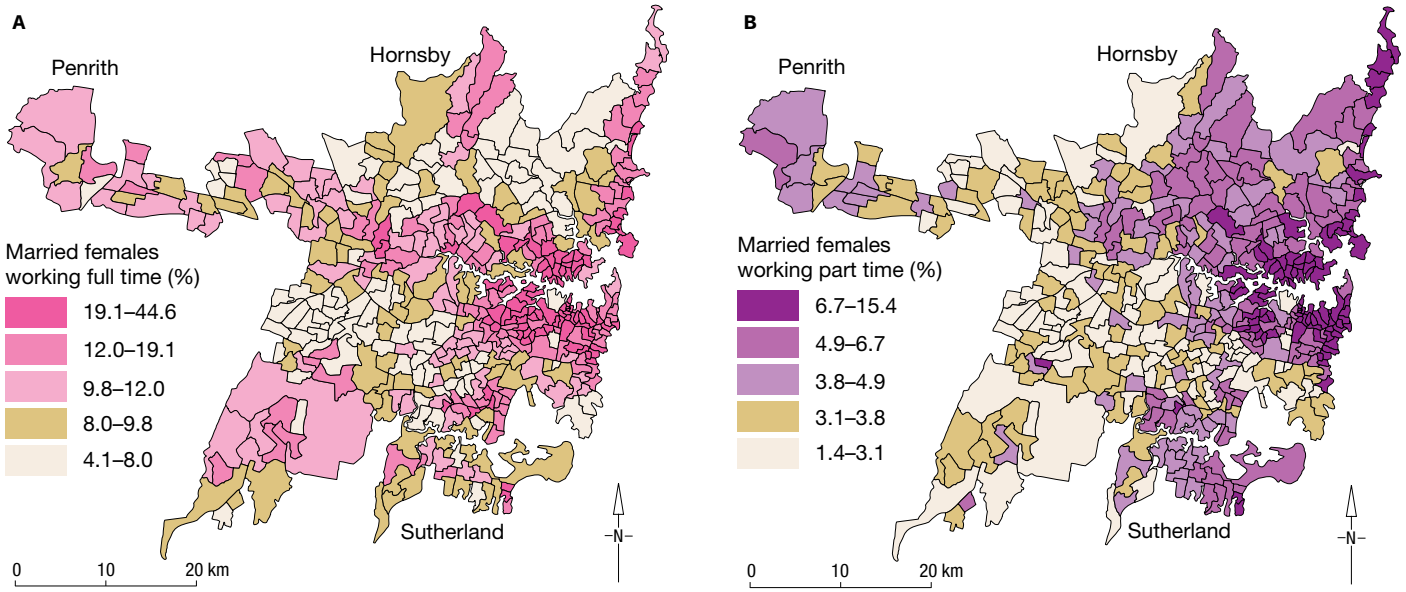
Part-time employment is still common among women. This is partly because it is preferred by employers in the traditionally female-dominated areas of the workforce (for example, banks and retailing) and partly because it suits the combined home duties and work role commonly performed by mothers and married women.

The spatial pattern of full-time and part-time female employment is shown in Figure 7.9.1.

The spatial outcomes that can be identified include:

- Mothers and married women who work full-time because of economic necessity are more often found where family incomes are lower; that is, in the western and south-western parts of Sydney. In suburban areas part-time work dominates, mainly where full-time work is not widely available.
- Non-family, career-orientated women are more likely to be found in inner-city locations.
- Part-time employment is much more common than full-time employment in middle-class and middle-income to higher-income areas. In these areas, employment for the mother and female spouse is more often a matter of choice. Part-time employment provides that choice and is carried out in combination with other responsibilities.

The division between the work role of the male spouse and the dual (work and home) roles of the female spouse remains largely intact. Working mothers are subjected to considerable strain where they retain almost sole responsibility for childcare and housework. One estimate has it that the dual role requires a woman with children to work a month a year more than her male spouse does.



7.9.1 Married females in the paid workforce: **A** full time, **B** part time.

Access to public transport

The provision of public transport is a good example of how urban services can disadvantage women. Public transport is geared to the movement of large numbers of people during peak hours, reflecting a bias towards those who work 9 a.m. to 5 p.m. This section of the workforce still tends to be male dominated (see Figure 7.9.2). Women are more likely to work the irregular hours associated with part-time and casual employment. They must make do with the irregular public transport services offered during off-peak periods. There is also the question of safety. Social problems such as violence and alcohol and drug use mean that suburban trains are often unsafe for women after dark. This adds a further gender-based disadvantage.



7.9.2 The morning commute: Sydney's suburban lifestyle illustrates the extent to which gender can influence human behaviour and spatial patterns.

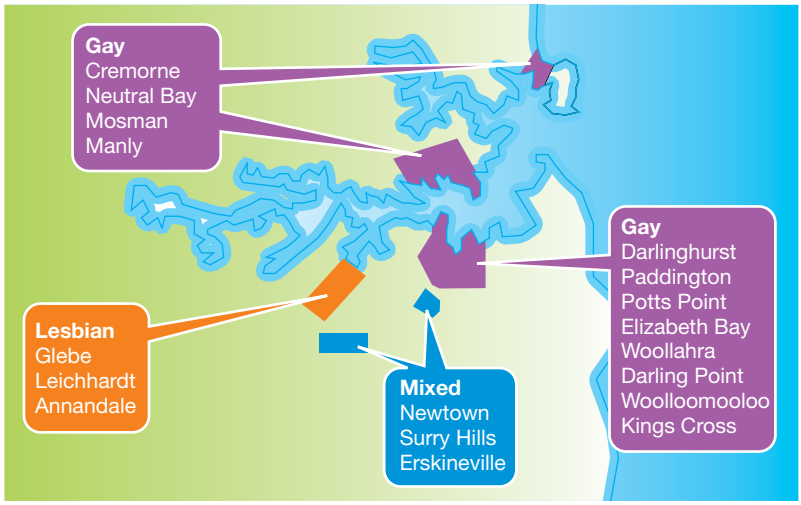


7.9.3 Sydney's Gay and Lesbian Mardi Gras highlights sexuality as a factor affecting the urban morphology of inner Sydney.

Sydney's geography of sexuality

As with many subgroups in society, Sydney's gay and lesbian communities have their own 'territorial basis', or geographical areas where a 'culture of place' has developed. An identifiable and lucrative real estate market has developed in Sydney's inner suburbs which caters to same-sex couples. Many are not constrained in their housing choices by the needs of children. A lack of dependents often means that a high proportion of their income is disposable (or uncommitted).

While the lifestyle focus of Sydney's gay and lesbian population remains near the inner city (see Figure 7.9.3), the gay and lesbian community is more widespread in terms of location of residence. Three categories of suburbs that are popular with gay and lesbian people have been identified and are shown on the map: areas where many gay men reside, areas where many lesbians reside, and areas popular with both gay and lesbian people (see Figure 7.9.4). Many in the real estate industry credit the gay and lesbian community with leading the gentrification of inner Sydney. The accompanying culture (including restaurants, entertainment venues and shops) is now part of the social mainstream. Darlinghurst is the centre of Sydney's gay community.



Although the emphasis here is on inner-city districts, suburbia is home to many gay and lesbian people. In working-class areas in particular, any non-traditional lifestyle is still sometimes frowned upon, to the point where sexuality is often concealed. 'Coming out' is more an option for members of the middle class, which is why we often gain the impression that gay and lesbian people are mostly found in inner-city, gentrified suburbs.

7.9.4 Sydney's main gay and lesbian communities

Activities

Understanding the text

1. Explain how gender and sexuality impact on the social geography and morphology of cities such as Sydney.
2. Outline how urban planners can address gender related issues when planning cities such as Sydney.

Working geographically

3. a Explain why the urban travel models focusing on the journey to work often overlook the transport needs of women.
   b Outline the generalisations that can be drawn from the pattern of part-time and full-time female employment.
   c Outline the causes and impacts of gender-based inequality.
   d Explain how the provision of public transport disadvantages women.
4. Study Figure 7.9.1. Describe the differences in the distribution of women engaged in full-time and part-time work. How do you account for these differences? Share your ideas with others in the class.
5. Working in groups, identify other ways in which women (together with the aged and immobile young) are disadvantaged within the urban setting. Share your group's findings with the rest of the class.
6. Study Figure 7.9.4.
   a Identify the suburban areas in which Sydney's gay and lesbian community is concentrated.
   b Identify the factors that have contributed to the growth of a lucrative real estate market catering to same-sex couples.
   c Explain why Sydney's gay and lesbian community has been credited with leading the process of gentrification.
   d Explain why we often gain the impression that gay and lesbian people are mostly found in the inner-city, rather than the suburbs.
7. Study Figure 7.9.4. Is there anything about the locations that suggest these communities are segregated from the rest of society? If so, why? Comment on any particular features of same sex couples' income that might make inner-city living attractive.

Sydney's geography of ethnicity

No social geography of Sydney would be complete without a consideration of its geography of ethnicity. Even though the ethnic groups in Australian cities are among the least segregated in the world, our ethnic communities still play an important role in shaping the functional form and character of the urban landscape, such as that seen in Figure 7.9.5.

Migrant streams

During the first half of the twentieth century, migration to Australia was dominated by people from Britain and Ireland. In the 1950s and 1960s, Sydney and Australia received considerable numbers of immigrants from continental Europe, most notably displaced persons from Eastern Europe (for example, Poland, the former Czechoslovakia and Hungary) and people from Southern Europe (for example, Italy, Malta and Greece) along with those from Germany and the Netherlands. This immigrant wave overlapped with people from the former Yugoslavia and the Middle East (Lebanon in particular) in the 1960s and 1970s.

The reasons why Europeans chose to migrate to Australia included:

- higher living standards in Australia
- widespread poverty, social dislocation and homelessness in post-war Europe
- political unrest in much of Central Europe
- rural poverty in Southern Europe.

In the 1980s and 1990s, immigration policy changed to favour two separate migrant streams: refugee migrants, notably from the Middle East, Indochina (Vietnam, Laos, Cambodia) and Latin America; and professional and business migrants, mainly from East and South-East Asian countries, such as Hong Kong, Singapore, Malaysia, South Korea and Taiwan.

The skilled stream of the migration program

In recent decades, there has been a further shift in the source of Australian settlers. India and China, followed by the UK, Philippines, Pakistan and Vietnam are now Australia's principal source of migrants and 68 per cent of those arriving did so under the skilled stream of the migration program.

The greater emphasis placed on the skilled stream of the migration program is designed to shift the balance away from independent skilled migrants, who do not have employment arranged in Australia prior to migrating here, towards sponsored skilled migrants, who have arranged employment prior to their arrival. This represents a shift in focus away from 'supply driven' independent skilled migration towards 'demand driven' outcomes, in the form of employer and government sponsored skilled migration. This approach targets the skills needed in the economy and ensures that skilled migrants are employed in industries with the highest need. The skilled stream is supplemented by a continuation of the family reunion and refugee programs.

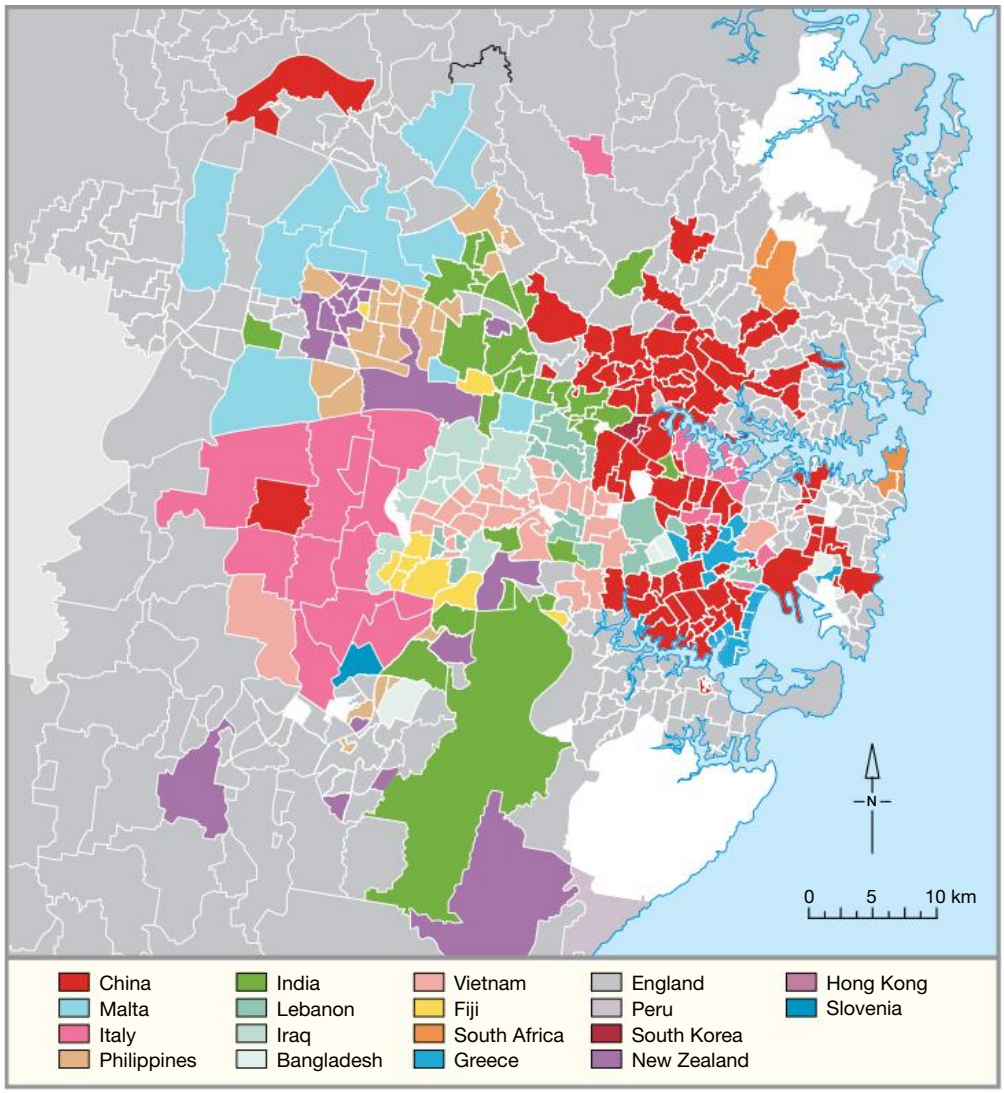


7.9.5 Vietnamese fruit shop in suburban Bankstown. Throughout Sydney, there is evidence of the city's ethnic diversity.

The ethnic dimension of Sydney's urban residential structure

In addition to its socioeconomic dimension, Sydney's urban residential structure has an ethnic and cultural dimension. Apart from those participating in the business and skilled migration programs, most migrants come to Australia to start their new life in a situation of relative disadvantage due to a lack of work skills, proficiency in English and financial resources. This disadvantage can be aggravated by prejudice against them in the host society, even from longer settled migrant groups. Such prejudice may stem from differences in religion, language, ethnicity or race.

At the 2016 Census, 57.1 per cent of Greater Sydney's population were born in Australia. The most common ancestries in Greater Sydney were English 19.4 per cent, Australian 18.1 per cent, Chinese 7.8 per cent, Irish 6.6 per cent and Scottish 4.9 per cent.



7.9.6 Largest foreign-born ethnic group found in each Sydney suburb

It is a feature of Australia's multicultural society that new settlers are not expected to abandon their cultural background but are encouraged to integrate into our communities and way of life. This process has enriched our communities through the introduction of new foods, sports, music and architecture, for example. Our communities are now much more culturally diverse.

The spatial outcome of immigration is a complex pattern of concentration (segregation) and dispersion (desegregation). The factors that contribute to ethnic segregation include socioeconomic status; prejudice based on cultural difference; and time of arrival. Figure 7.9.6 shows the pattern of ethnicity in Sydney based on the largest foreign-born ethnic group found in each suburb. Figure 7.9.7 shows the distribution of the Australian-born population.

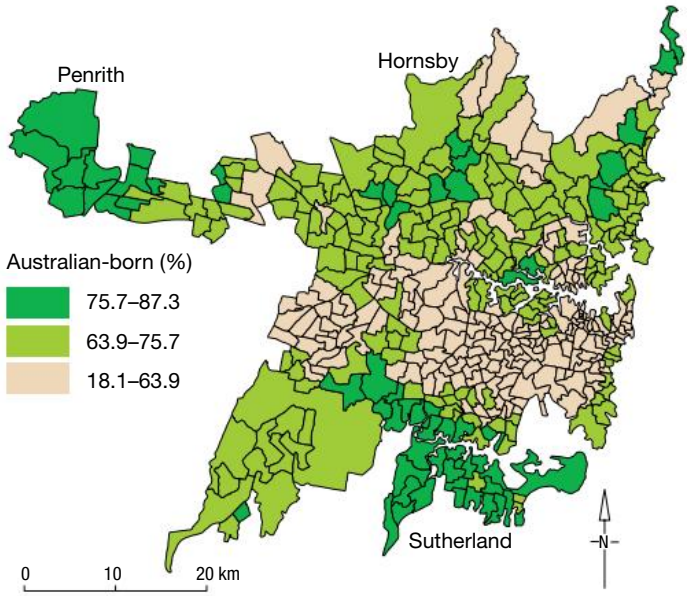
SPOTLIGHT

Multicultural Sydney

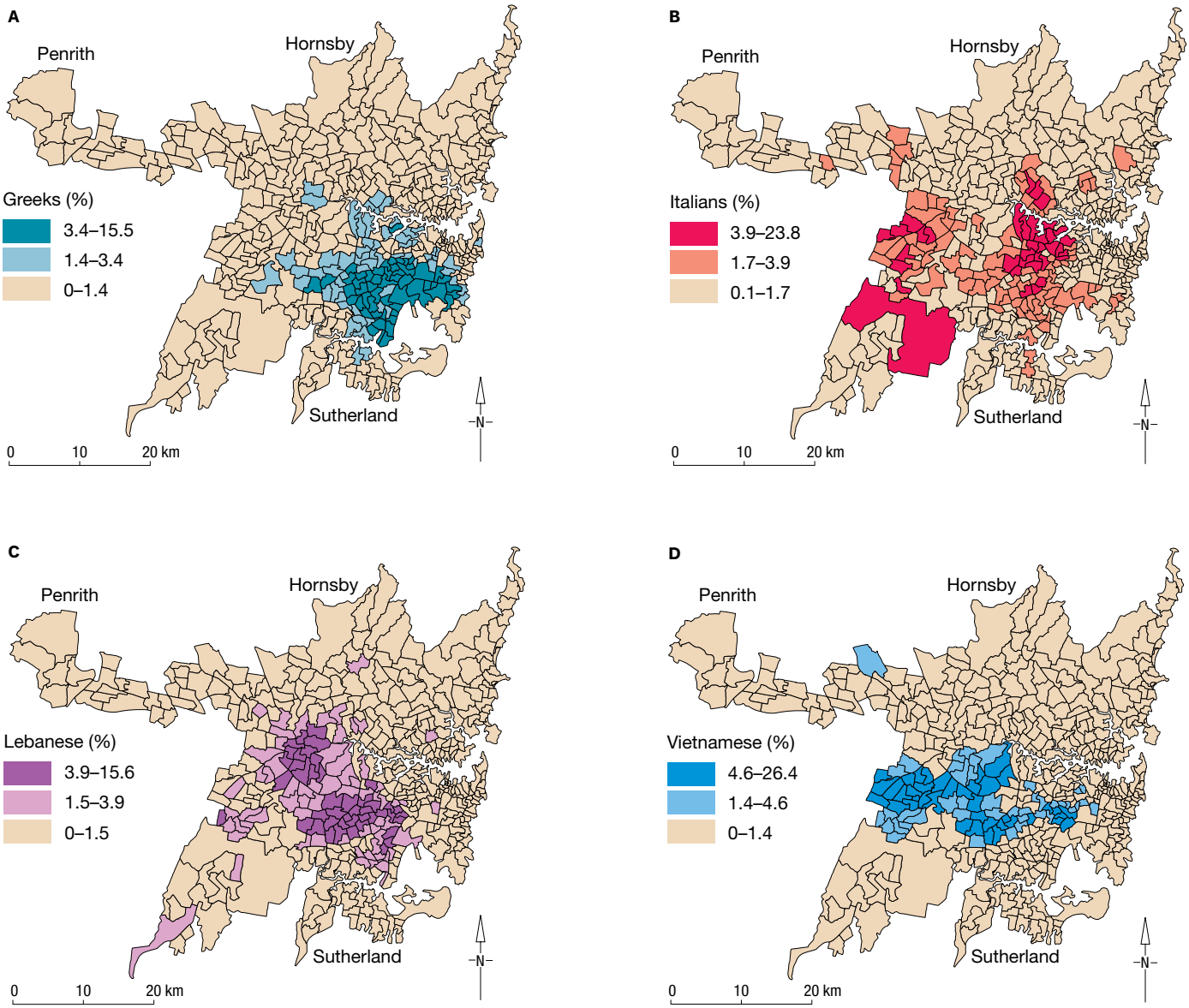
Of Sydney's 5.2 million people, 36.7 per cent were born overseas. Of these, China is the most common place of birth (4.7 per cent of the total population), followed by the UK (3.7 per cent) and India (2.7 per cent). New Zealand accounted for 1.8 per cent of Sydney's population. Southern Europeans, whose population is declining, tend to live in the inner west, south-west and around Liverpool.

In Greater Sydney, 36 per cent of residents speak a language other than English at home. People who speak a Chinese language (mainly Cantonese) tend to concentrate in Cabramatta, Auburn, Burwood and Ashfield in the west; Campsie in the south-west; Hurstville and Rockdale in the south; Eastwood, Carlingford and Epping in the north-west; and Chatswood and East Killara in the north. Arabic speakers tend to live in the Canterbury–Bankstown area and around Granville and Auburn.

Sydney's major languages are English, the Chinese languages (spoken at home by 7.6 per cent of people) and Arabic (spoken at home by 4.0 per cent).



7.9.7 Distribution of Australian-born residents



7.9.8 The spatial distribution of selected ethnic groups: **A** Greek-born residents, **B** Italian-born residents, **C** Lebanese-born residents, **D** Vietnamese-born residents

Spatial distribution of selected migrant groups

Figure 7.9.8 shows the spatial distribution of selected migrant groups. This analysis is based on the first generation of immigrants; that is, those born overseas. The pattern begins to change when the second and subsequent generations are taken into account. There is a movement away from the original areas of concentration to more dispersed suburban locations. There is, however, still some evidence of concentration but this tends to be much less pronounced. Overall, the level of concentration appears to diminish with successive generations.

Activities

Understanding the text

1 Explain how Australia's migrant stream has changed over time. What motivated people to migrate to Australia?

2 Outline the reasons why Europeans choose to migrate to Australia during the 1950s and 1960s.

3 Explain why new arrivals often find themselves in a position of relative disadvantage.

Working geographically

4 Study Figure 7.9.6. Describe the spatial distribution of residents born in China, India, Iraq, Lebanon and Fiji.

5 Compare the maps in Figure 7.9.8 with the earlier map of socioeconomic status in Sydney (Figure 7.7.1, p. 237). Comment on the relationship between birthplace and socioeconomic status.

6 Study Figure 7.9.7. Describe the spatial distribution of Australian-born residents.

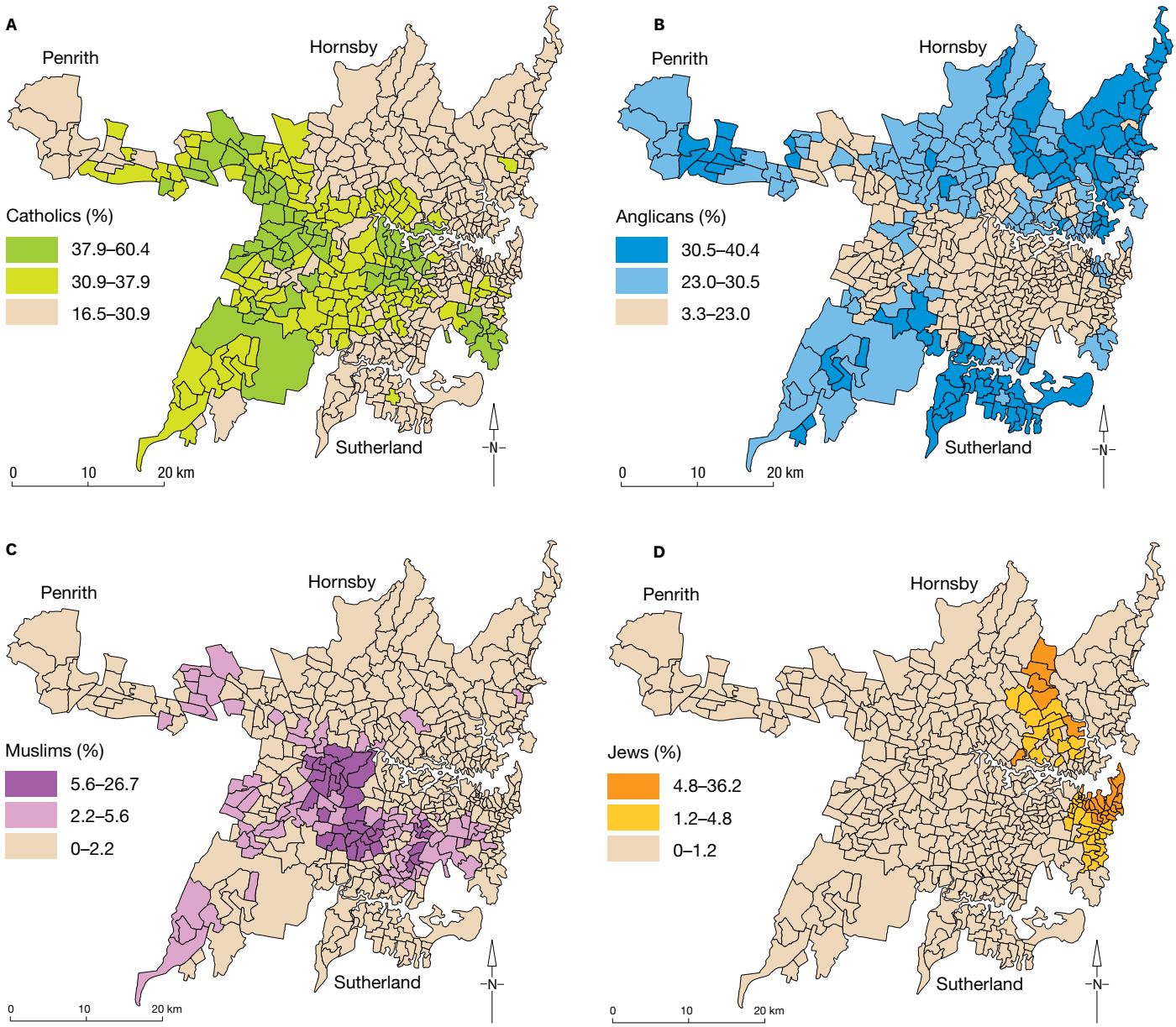
7 Study Figure 7.9.8. Write a report outlining any variations in the distribution of the various ethnic groups represented in the four maps. If you live in Sydney, identify the largest group of foreign-born residents living in your area.

Sydney's geography of religion

There is, perhaps not surprisingly, a close relationship between the spatial pattern of ethnicity and the spatial distribution of religious affiliations. The study of the latter helps us to better understand the former.

Maps of religious affiliation largely reflect the accumulated impact of different waves of immigration. The map showing the distribution of Catholics (see Figure 7.9.9A), for example, is closely associated with the distribution of immigrants from Southern Europe, but also reflects past waves of Irish immigrants. Because the Irish tended to concentrate in blue-collar (manual, process or goods-producing) jobs, their focus of concentration is in southern and western Sydney. This contrasts with the distribution of Anglicans (see Figure 7.9.9B), which is largely representative of middleclass-status (white-collar) Sydney.

The distribution of Muslims (see Figure 7.9.9C) reflects the presence of immigrants from countries of the eastern Mediterranean and Middle East. Consistent with their recent arrival, lower levels of educational attainment and lower levels of English proficiency in the first generation, their distribution is overrepresented in predominantly blue-collar (working class) areas of Sydney.



7.9.9 Distribution of selected religious groups: **A** Catholics, **B** Anglicans, **C** Muslims, **D** Jews

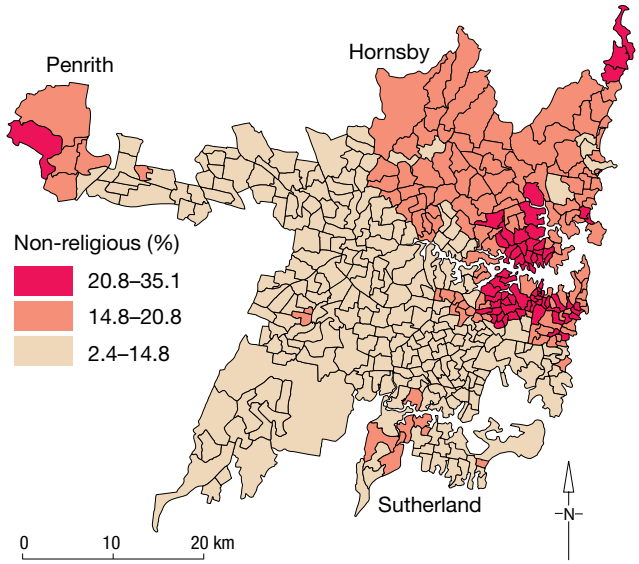
The same is largely true of other religions; though not for Jews, who tended to be more highly educated than the population as a whole—see Figure 7.9.9D. The overrepresentation of Jews in the Eastern Suburbs reflects this high socioeconomic status. The concentration of Jewish people in areas such as Woollahra, North Waverley and Ku-ring-gai results, in part, from a desire to live within a defined religious precinct.

Those professing 'no religion' are more concentrated in inner-city districts, shown in Figure 7.9.10.

Figure 7.9.11 shows some of the ways that religious groups shape the character of urban landscapes.



7.9.11 **A** Chinese temple at Summer Hill, **B** Lakemba Mosque, **C** St Mary's Cathedral, city



7.9.10 Distribution of the non-religious

DID YOU KNOW?

According to the 2016 Census, Sydney's principal religious affiliations were: Roman Catholic (24.2%), Anglican (12%), Islam (5.3%), Buddhism (3.9%), Hinduism (3.5%), Greek Orthodox (2.4%), Uniting (2.0%), Presbyterian (2.0%), and Baptist (1.2%). The proportion of the city's population with no religious affiliation was 24.9%.

Activities

Understanding the text

1 Account for the spatial distribution of Catholics and Anglicans in Sydney.

2 Explain why Muslims are concentrated in areas identified as predominantly blue collar (working class).

3 Outline where those professing no religion are concentrated.

Working geographically

4 Study Figures 7.9.9 and 7.9.10 and compare them with Figure 7.9.8. Which maps correspond, and why? Which maps do not correspond, and why?

5 As a class, identify the extent to which your local community reflects Australia's cultural diversity. Which elements relate to religion?

6 Study the 2016 Census data on religious affiliation in Sydney included in the 'Did you know?' box. Construct a pie graph showing 'Religions Affiliation, Sydney, 2016'. You will need to include an 'other' category.

UNIT 7.10

Culture of place



7.10.1 Paddington's culture of place: **A** Paddington terraces, **B** Paddington cafe, **C** Paddington hotel, **D** Paddington shops

Culture is a way of life. It is reflected in how we behave, how we look, our attitudes and perceptions, and the nature of our built environment. Like many geographical phenomena, 'culture of place' can be considered on a variety of scales. We can, for example, focus on defining Sydney's culture of place or focus on a particular urban precinct and examine the elements that contribute to its distinctive character. The culture of place of Paddington, for example, is defined by its Victorian architectural heritage and terrace-dominated streetscapes; the suburb's stylish retail outlets, restaurants and cafes; and the lifestyle of those who can afford to live there (see Figure 7.10.1). In this context the term 'culture of place' refers to distinctive cultural enclaves or identifiable groupings or clusters within a city.

Sydney's culture of place is defined by the nature of its biophysical environment (especially its climate, beaches and harbour setting); its multicultural character; the casual lifestyle of its population; its people's apparent preoccupation with sport and other outdoor pursuits; its streetscapes and architectural heritage (especially its iconic buildings: the Sydney Opera House and Harbour Bridge); its low-density urban sprawl and suburban lifestyle; and its increasingly international outlook, especially its status as a world city and popular tourist destination.

Urban villages

Urban villages are often differentiated on the basis of the distinctive culture of place that develops within a particular urban precinct. The factors contributing to this culture of place are outlined in Figure 7.10.2.

The culture of place is primarily about how we see ourselves, and how others see us. In the following section, we examine two examples that help to develop our understanding of this concept.

The first example is a subjective representation at odds with actual experience. In the second, we look at regional cultures of different parts of Sydney, or how others see us.



7.10.2 Factors contributing to a 'culture of place': **A** architecture, **B** colour, **C** street life, **D** noise, **E** streetscape, **F** biophysical environment, **G** heritage, **H** energy, **I** lifestyle environment

East versus west: how we see ourselves and others

Many social commentators represent Sydney's western suburbs as being negatively affected by an image problem. This image is based on a range of beliefs and attitudes formed both inside and outside the region from secondary sources, as opposed to direct experience. Some of these images may be quite false.

In *Out West: Perceptions of Sydney's Western Suburbs* (published in 1993), Dianne Powell speaks of a social consensus acting to 'move' Western Sydney, to the 'other side' of a major social divide. Perceptions of Sydney's built and physical environment east and west of Parramatta are characterised in Figure 7.10.3. Many elements of internal differentiation and diversity are ignored in these two representations and are very broad generalisations.

Three points are especially important in talking about place, culture and identity: ignorance, generalisation and insensitivity.

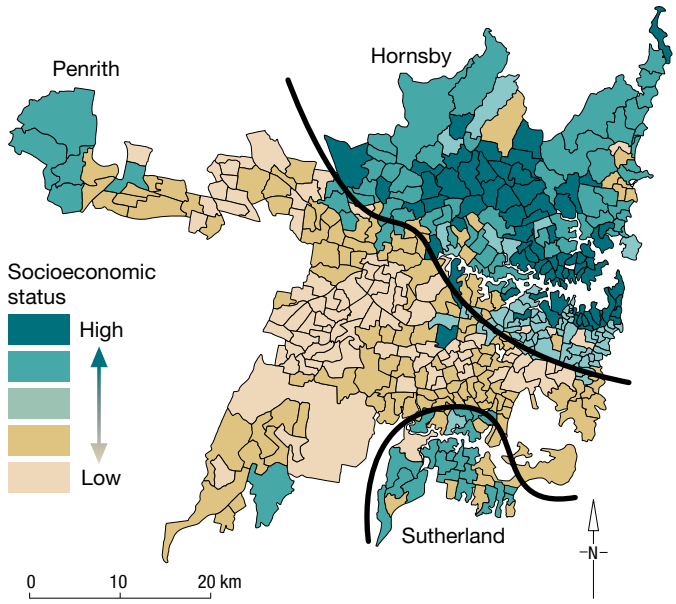
Areas or regions are often profiled from a 'culture of ignorance'; that is, images built up from indirect knowledge, especially when it is taken from the media. This applies as much to people who seek to portray northern Sydney as being uniformly 'silvertail' as it does to people who seek to portray Western Sydney as 'poor and disadvantaged'. Neither image is objectively correct of the whole, however true it may be in part. In fact, the real social divide is formed by a line running approximately north-west to south-east: from the Hills District to Kogarah but also taking in the Sutherland Shire, as seen in Figure 7.10.4.

Perceptions of Sydney's built and physical environment

Sydney east of Parramatta	Western Sydney
Heterogeneous	Homogeneous
Beautiful	Ugly
Hilly/rolling	Flat
Coastal/leafy	Dry/treeless
Compact	Sprawling
Mature	New

Source: Kathy Mee, in K. Gibson and S. Watson (eds), *Metropolis Now*, Pluto Press, 1994

7.10.3 Perceptions of Sydney's built and physical environment



7.10.4 Sydney's real social divide

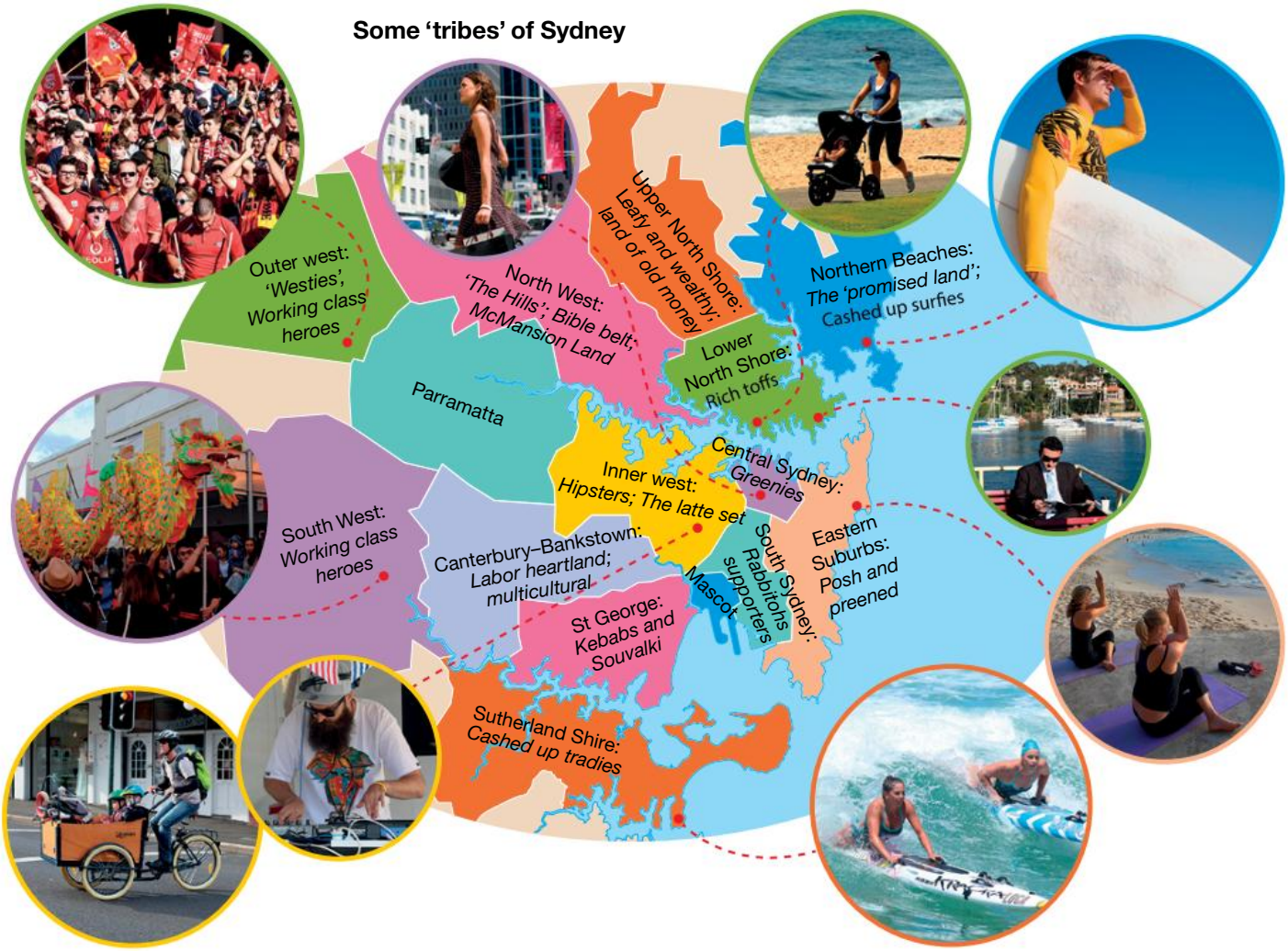
Perceptions and generalisations

Too often, perceptions are formed from generalisations or presentations constructed by middle-class media commentators, social commentators, planners and politicians who live in the east. For example, the characterisation of the east presented in Figure 7.10.3 is clearly representative of Sydney's North Shore, the eastern harbourside suburbs and parts of the Sutherland Shire. However, what of the middle-class to working-class southern municipalities, of Canterbury, Hurstville, Botany or Randwick, for instance? Or of the inner western suburbs: Burwood, Concord, Marrickville, even central and southern Ryde? The reverse is true in the west: the atypical Hills District suburbs; for example, Castle Hill, Baulkham Hills, Winston Hills and Kings Langley and the upmarket suburbs of Macquarie Links in Sydney's south-west.

Part of this 'culture of ignorance' includes insensitivity to internal differentiation and diversity, not only in Western Sydney, but in other parts of Sydney as well. This is certainly the case in respect to the 'atypical' suburbs in both east and west mentioned above. Not only are there differences among suburbs, there are also differences within suburbs. For example, differences in real estate values between Fairfield Heights and Fairfield in the south-west; differences between the 'home-unit' area north of Canterbury municipality and the red-brick, orange-tile roofscape of southern Canterbury. On the North Shore, there are major social and cultural differences between, Chatswood–Artarmon–Naremburn, parts of Willoughby municipality, and the adjoining harbourside suburbs of Castlecrag and Castle Cove.

The tribes of Sydney: how others see us

Sydney is a city of tribes, each with its own sub-culture. Figure 7.10.5 is one perspective on this tribalism. Yours might be quite different based on you own lived experience.



7.10.5 Contrasting perspectives on the tribes of Sydney

Activities

Understanding the text

1. Explain what is meant by the term 'culture of place'.
2. Outline the factors that contribute to Sydney's culture of place.
3. State what is meant by the term 'urban village'.

Working geographically

4. As a class, brainstorm the range of factors that contribute to your local area's 'culture of place'. Summarise your class's discussion in the form of a mind map.
5. Study Figure 7.10.2. List the factors that contribute to a city's or urban precinct's culture of place.
6. Use photography to develop a photographic collage of your community's culture of place. Use the outcome of the class brainstorming in Activity 4 to direct your fieldwork. Use Figure 7.10.2 as a model.
7. Study Figure 7.10.3. As a class consider whether the perspectives presented in the table provide an accurate portrayal of Sydney's east and west. What does it mean when it's claimed that such generalisations ignore the many elements of internal differentiation and diversity?
8. Study Figure 7.10.5. From your perspective, which of the characterisations do you agree with? Which do you disagree with? To what extent is the cartoon indicative of the tribes that inhabit the different parts of Sydney? Are there any characterisations that are at odds with the point of view or perspective you hold?

UNIT 7.11

Sydney's future growth and development

Like all large cities, Sydney faces a range of challenges in order to achieve ecological sustainability while also protecting and improving the quality of life of its people. The major issues confronting Sydney include:

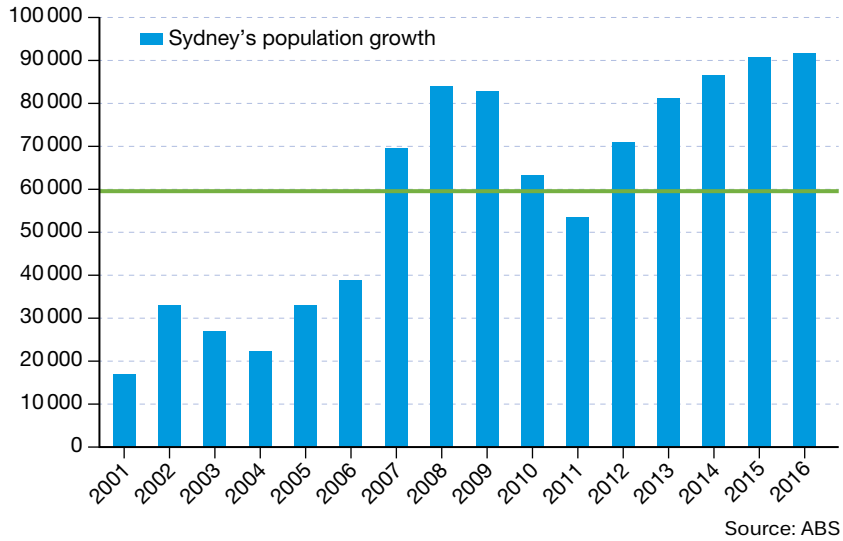
- accommodating future population growth
- enhancing liveability
- promoting employment opportunities close to places of residence
- addressing traffic congestion by providing transport infrastructure
- protecting the amenity of the biophysical and built environments
- securing Sydney's water supplies
- managing waste.

Accommodating future population growth

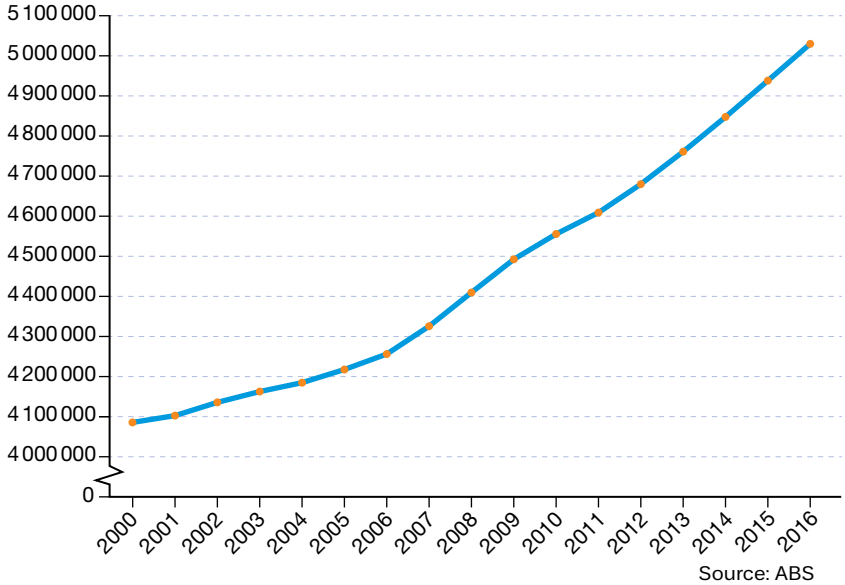
Sydney's population is anticipated to grow from 5.2 million (2018) to 7.6 million in 2050. Since 2000, the city has added more than a million people. Catering for this growth will be a major challenge for those responsible for Sydney's planning. It will, for example, generate demand for 664 000 new homes, new industrial estates, and additional commercial and retail space.

Figure 7.11.1 shows Sydney's annual population growth (2000–01 to 2015–16). Figure 7.11.2 shows the growth of Sydney's population, 2000 to 2016.

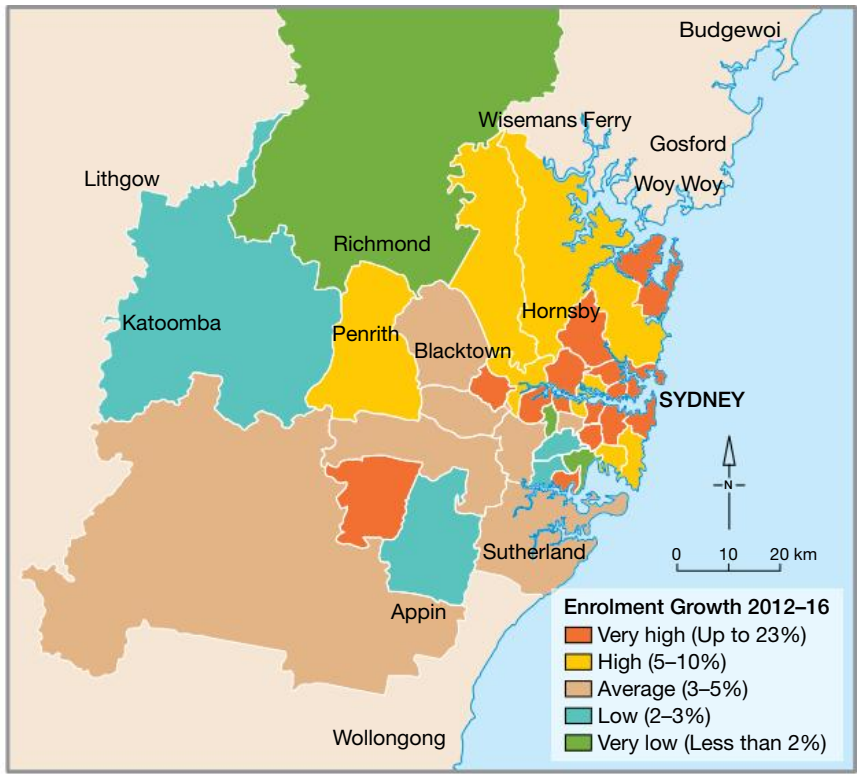
While much of the anticipated future population growth will be accommodated within the boundaries of the existing metropolitan area via the processes of urban consolidation (intensification) and infilling, some people will choose to settle in new suburban areas on the city's outskirts. To cope with this growth, urban planners at the NSW Government's Department of Planning and Environment have developed a *Plan For A Growing Sydney*.



7.11.1 Sydney's annual population growth, 2001–02 to 2015–16.



7.11.2 Sydney's population growth 2001–2016. Sydney's population has increased by a million people since 2001.



7.11.3 Change in enrolments, 2012–2016

Building new schools

Accompanying Sydney's rapidly growing population is an increase in the number of school age children. Figure 7.11.3 shows the pattern of this growth. The suburbs in Sydney's east and north (plus the Camden and Penrith regions) have the most rapid growth in enrolment for the period 2012–16.

To accommodate this growth, Sydney will soon have four new high-rise public schools accommodating more than 6000 students. The CBD and Parramatta will be the first to get the new schools, followed by Alexandria Park near Green Square and Ultimo.

Meeting peoples' housing needs

Sydney will grow much faster over the next twenty years than it has in the previous two decades. Planners will need to ensure that there is an adequate supply of housing on both greenfield sites and in established urban areas. There is also a need to keep housing affordable while aligning housing supply with the changing demographic profile of the city and the changing lifestyle choices of its inhabitants.

Strategies to achieve these objectives include the following:

- **Removing the barriers to increasing housing supply:** This involves eliminating or modifying planning controls that have, in the past, hindered the development of new housing stock.
- **Providing the infrastructure needed to support increasing populations in growth centres:** This includes transport infrastructure (roads and public transport), utilities and social infrastructure such as schools, childcare centres, health facilities, open space and recreation. This initiative is particularly relevant for the release of greenfield development sites on the periphery of the metropolitan area. Even in established areas such as the inner city there is a need to invest in new social infrastructure. The increasing number of families choosing to live in the suburbs surrounding the CBD has forced the NSW State Government to build new schools in areas where it once closed them due to declining enrolments.
- **Facilitating urban consolidation:** This is especially needed in transport corridors and locations that are close to jobs and will need to be serviced by transport services capable of moving large numbers of people. This can be done by re-zoning land in existing urban areas from low-density to medium-density and high-density housing, facilitating the redevelopment of existing medium-density and high-density housing through modifications to strata legislation, and identifying surplus government land that can be developed into mixed-use precincts (urban infill).
- **Creating priority transport corridors:** Priority transport corridors include the Parramatta Road corridor, the North West Rail Link corridor, the Anzac Parade corridor, and the Bankstown to Sydenham corridor. Potential corridors include Sutherland to Sydenham, East Hills to Sydenham, Hornsby to Strathfield via Gordon, Hornsby to North Sydney via Gordon and Kings Cross to Bondi Junction.
- **Initiating a Priority Precincts program:** This will deliver housing at a range of price points and incorporate best practice in urban design. A Priority Precinct program involves coordinating the planning and investment needed to revitalise local centres, services and infrastructure. The focus of the initiative is urban renewal.

- **Providing the infrastructure to expand the city's peri-metropolitan region:** The development of high-speed rail would, for example, allow affordable housing options to be developed well beyond the urban periphery.
- **Enhancing housing choice to suit different needs and lifestyles:** The fastest growing households in Sydney are single person households. In 2016 only 35 per cent of households were couples with children. Households that are couples with children will grow at a slower rate than both couple and single person households over the next 20 years. Despite these trends, 57.3 per cent of Sydney's housing stock is detached houses. Planners are keen to introduce planning controls that increase the number of homes in established urban areas close to public transport, jobs and services. Local governments will be required to give priority to well-designed, smaller homes to suit a range of lifestyles and budgets. Developers will be required to provide affordable housing options within their developments.



7.11.4 Google Earth image of the Oran Park 'greenfield' urban development in Sydney's south-west

- **Reducing the city's environmental 'footprint':** This can be done by enhanced urban consolidation, investments in public transport, and even attempts to alleviate traffic congestion via the construction of new motorways. Investments in public transport, combined with reductions in congestion, reduce emissions of nitrogen oxides, carbon monoxide, and other pollutants.

A greenfield urban development: Oran Park

Oran Park is a new town centre and a housing estate on the outskirts of Sydney not far from Camden, see Figures 7.11.4 and 7.11.5.

Before this development the land was used for agriculture and a car-racing track. Most of the new housing is two storey, detached homes with their own front and back yards but on smaller lots—the traditional suburban house. At the centre of the development is the town centre which will feature a range of retail, commercial and residential buildings.

Within the Oran Park town centre there will also be a number of apartment buildings, generally four to six storeys in height with a small number at eight storeys.

One housing type being developed at Oran Park is a new version of the traditional terrace house. These have become very popular as an alternative to the detached house.



7.11.5 Computer generated image of the completed Oran Park development

A brownfield urban development: South Village, Kirrawee

Built on the site of an old brick pit, South Village at Kirrawee is an example of urban infilling and urban consolidation on a former industrial site. The development, an integrated residential and retail complex, is located just minutes away from Kirrawee railway station. When complete, the development will feature 749 apartments and 10 000 square metres of retail space spread across seven buildings. The precinct has a dedicated 9000 square metre public park and podium-level private gardens for residents' use.

Enhancing liveability in existing urban centres

Activities

Understanding the text

1 Outline the projected future growth of Sydney and the demand for new housing. How will this demand be met?

2 Outline the strategies being used to meet the housing needs of a rapidly growing population.

3 Identify the initiatives designed to reduce Sydney's environmental 'footprint'.

4 State the lifestyle benefits flowing from the construction of new housing in established suburbs.

5 Identify the key elements of a well-designed urban space.

6 Outline the liveability strategies that can be implemented to enhance the quality of urban living.

Working geographically

7 Study Figure 7.11.1. Describe the trend in Sydney's annual population growth between 2001–02 and 2015–16. In how many years has the growth rate exceeded the 2001–02 to 2015–16 average? In what year did growth peak?

8 Study Figure 7.11.2. In which year did Greater Sydney's population exceed:

a 4.5 million?

b 5 million?

9 What does the need for new inner-city schools tell us about the distribution of Sydney's population growth?

10 Study Figures 7.11.4 and 7.11.5. In what ways does Oran Park qualify as a 'greenfield' development? What are the key elements of the new community? In what ways is it atypical of suburbs found on Sydney's urban periphery?

11 In what ways does South Village qualify as a 'brownfield' development, and an example of urban infilling and consolidation? What are the key elements of the project? Why has this site been selected for high-density housing?

12 Study Figure 7.11.6. Identify the cultural institutions in Sydney's cultural ribbon.

Encouraging the construction of new housing within Sydney's established suburbs (urban infilling or urban consolidation) brings real benefits to communities and makes good social and economic sense. It lowers infrastructure costs and reduces the time people spend commuting to work, which gives people more time with their families, relaxing or engaging in recreational activities. Directing new housing to existing urban areas also reduces the impact of population growth on the environment and protects productive rural land on the urban periphery. It also improves access to jobs, services and recreation, thereby enhancing the liveability of places.

The redevelopment of existing urban centres can make them more attractive to residents. A well-designed urban place should be easy to move around in and travel to and from surrounding areas; include a range of public and private spaces; be safe and welcoming; provide for a mix of goods and services, day and night; and respect the heritage and history of the place.

Cultural Ribbon

Sydney's 'Cultural Ribbon' is an area of inner-Sydney shown in Figure 7.11.6. Festivals such as Vivid (Figure 7.11.7), the Festival of Sydney and the Sydney Gay and Lesbian Mardi Gras, together with the city's world famous performing arts companies, are examples of cultural events and institutions that help to define the city's cultural identity and act as major tourist attractions.



7.11.6 Sydney's 'cultural ribbon'



7.11.7 Sydney's Vivid festival is a 23-day festival of light and music. In 2017 it attracted an estimated 2.33 million national and international visitors to the city centre.

Promoting employment opportunities close to places of residence

Efficient transport infrastructure is critical to economic growth and economic efficiency. Congestion adds to the cost of doing business. It reduces the number of deliveries that can be made and the number of jobs tradespeople can do in a day. It is also a matter of convenience and lifestyle quality for those living in Sydney. The time spent commuting detracts from people's quality of life and also has an environmental cost, especially in terms of air pollution from vehicles.

Strategies designed to disperse employment-generating economic activities have only had limited success. Sydney's CBD remains the employment-generating engine of Sydney's economy, a process reinforced by the shift towards a knowledge-based economy and the city's emergence as a centre of finance and related business service. Sydney's other employment intensive areas (Macquarie Park and other nodes within the global corridor) are some distance from the city's fastest growing residential areas.

The challenge for planners is to put in place a policy framework that facilitates economic growth and employment near places of residence. This will reduce the congestion associated with the long commute to work.

New edge cities

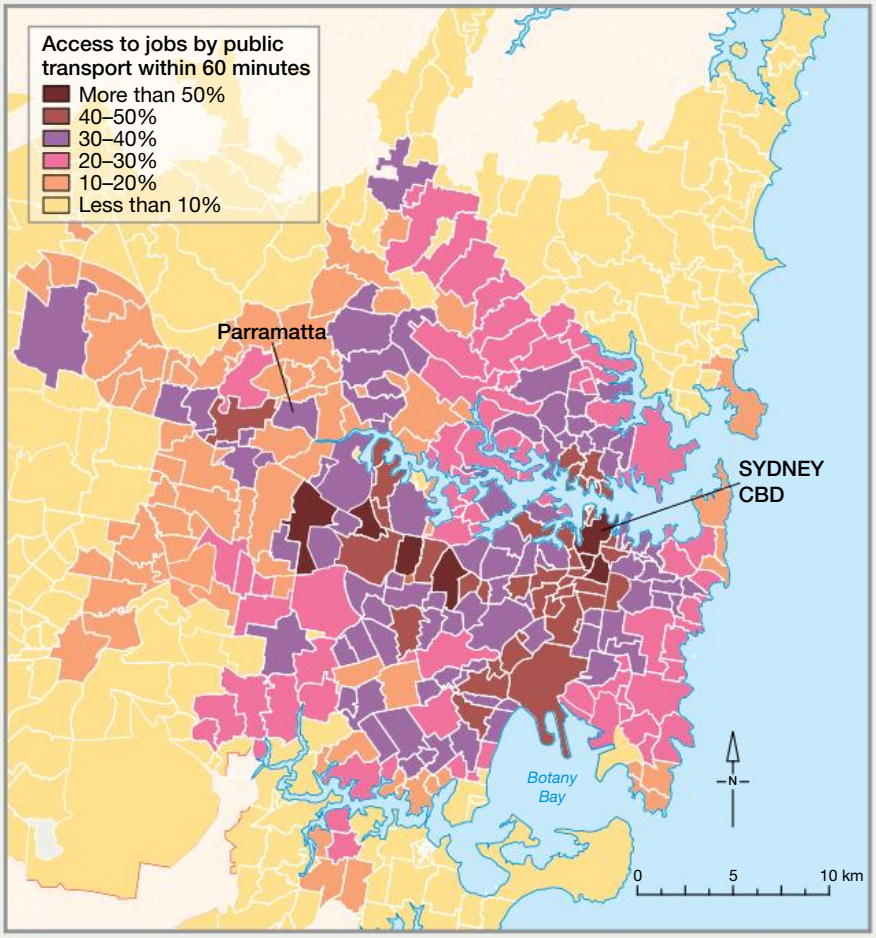
A key element of the State Government's strategy for a growing Sydney involves the promotion of Parramatta, Liverpool and Penrith as 'major' edge cities, while suburban centres (such as Bankstown, Blacktown, Bondi Junction, Brookvale/Dee Why, Burwood, Campbelltown, Castle Hill, Chatswood, Hornsby, Hurstville and Kogarah) will be developed as secondary edge cities. They will be the focus of retailing, healthcare provision, tertiary education and some medium-density and high-density housing.

Also planned are better-connected and stronger regional centres. Employment growth will be encouraged on the Central Coast and in the Illawarra and Lower Hunter. Improved transport links will reduce the costs of locating in the regions. Newcastle, Wollongong and Gosford will be promoted as centres of innovation.

SPOTLIGHT

Transport in numbers

- 35 per cent of households in Greater Sydney have access to one car; 46 per cent have access to two or more cars; 14.9 per cent have access to three or more cars.
- Only 10.7 per cent of households don't have access to a car.
- 13.8 per cent of employed persons travel to work by train; 5.8 per cent by bus (see Figure 7.11.8).
- 58.5 per cent travel to work by car either as a driver or passenger. Less than 1 per cent ride a bike to work and only 4.1 per cent walk.



Source: SGS Economics and Planning using Travel Model

7.11.8 Percentage of jobs that can be reached in 60 minutes by public transport in Sydney. The majority of jobs are located along the rail network.

SPOTLIGHT

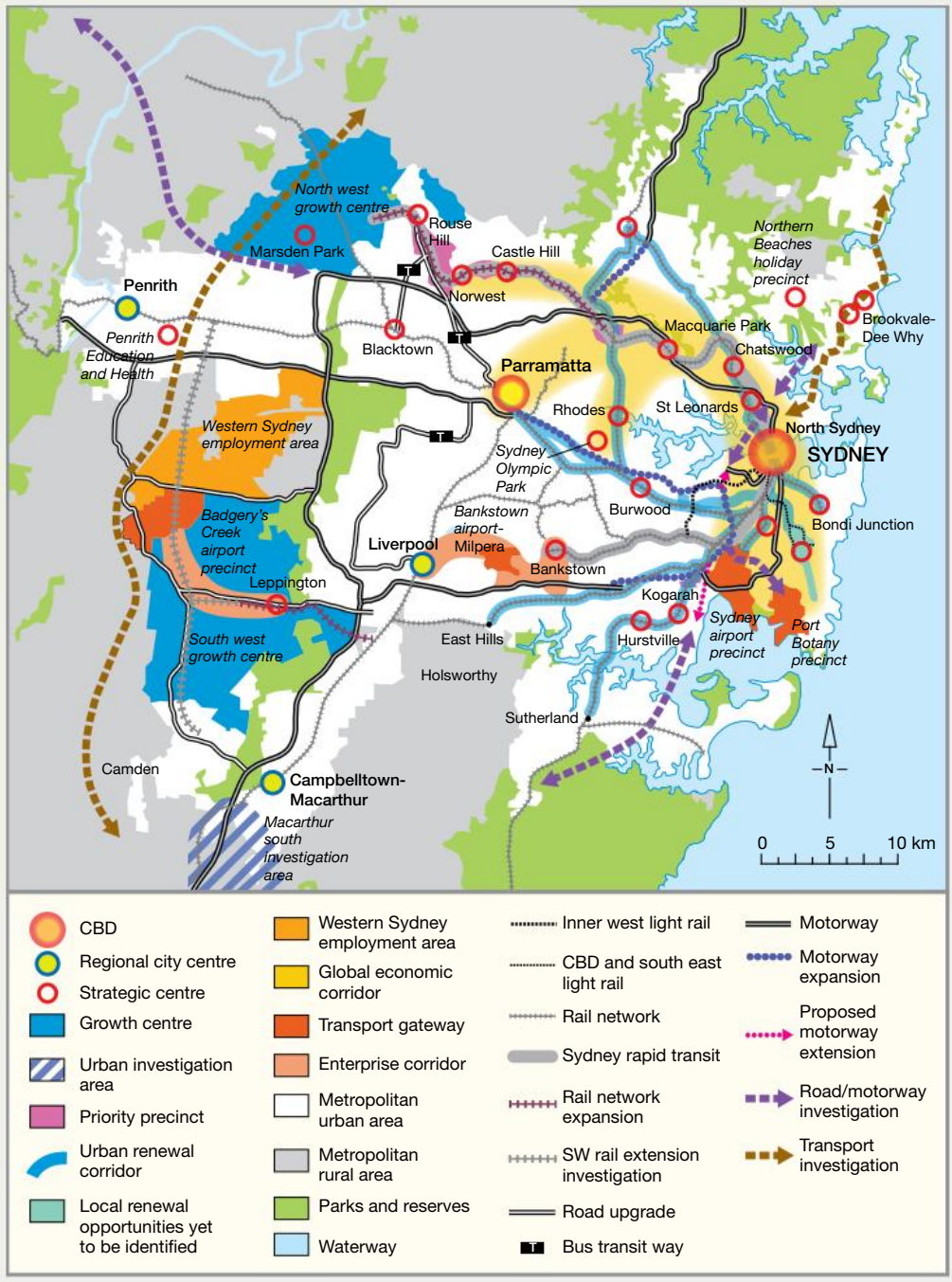
Public transport gains in popularity

Commuters travelling to Sydney's CBD (see Figure 7.11.9) are leaving their cars at home and are catching trains and buses instead. Traffic congestion, the cost of parking in the city centre and the growing popularity of social media are driving the shift.

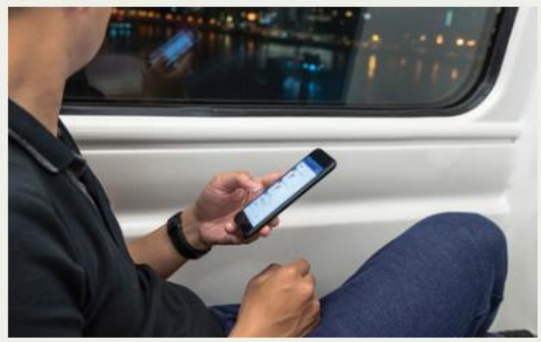
Between 2015 and 2017 there was an 11 per cent decrease in vehicles travelling to the CBD during the morning peak. In contrast, patronage on all modes of public transport in and out of the CBD between 5 a.m. and 10 a.m. rose by more than 10 per cent to 32.9 million trips in the first six months of 2017. The traditional rush hour (8 a.m. to 9 a.m.) is still, however, the busiest period.

Almost 15.5 million trips were made in that 60-minute period during the first half of 2017, a 7.3 per cent rise on the same period two years earlier.

One factor driving the shift is the growing popularity of social media and on-demand content online. Many commuters find the commute of public transport gives them time to communicate with friends, listen to the news or podcasts, and keep up to date on their social media, as seen in Figure 7.11.10.



7.11.9 Connecting jobs and homes: investments in transport infrastructure are designed to reduce congestion, thereby reducing commuting times.



7.11.10 Sydney's commuters use the time spent on public transport to go online.

Growing Sydney's CBD

As Sydney's CBD expands and its activities become denser, accessibility will assume greater importance (see Figure 7.11.11). The CBD and South East Light Rail will improve north-south connections as well as the movement of people throughout the CBD. The conversion of George Street into a pedestrian precinct will also improve the functioning and integration of the CBD, and enhance the CBD's liveability.

The Sydney Metro City and Southwest (with stations at Blues Point, Barangaroo, Martin Place, Pitt Street, Central and Waterloo) will greatly improve access to the CBD, as will the CBD and South East Light Rail Project. This new infrastructure increases the potential for economic activity within the Sydney CBD.

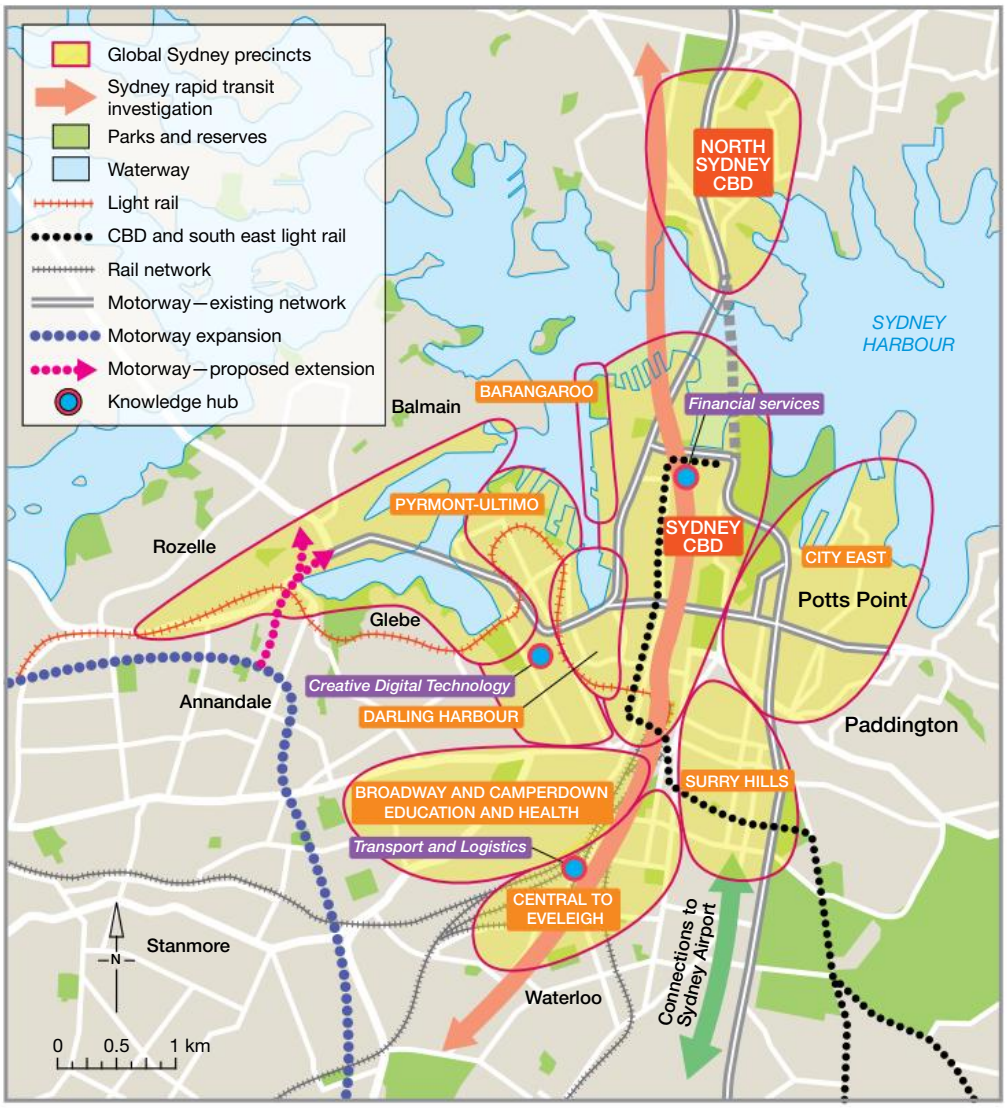
The massive Barangaroo development extends Sydney's CBD to the west and provides new commercial office space, retail and entertainments precincts, apartments, a hotel, new Headland Park and foreshore walks, and new transport infrastructure. The new Wynyard Walk connects the area to the CBD. The Darling Harbour Live development provides Sydney with world-class exhibition and convention facilities.

SPOTLIGHT

Reducing dependence on cars

Reducing car dependency addresses traffic congestion and improves air quality. Specific initiatives include:

- improving current bus and train services, which involves giving consideration to safety, reliability, value for money, flexibility of services and availability of accurate information about timetabling and transport arrangements
- building a more extensive, integrated public transport system
- encouraging walking and riding by constructing new walkways/cycleways and by reducing the amount of traffic in the CBD
- ensuring better land use and transport planning
- encouraging innovative transport and working arrangements.



7.11.11 Map of Global Sydney's functional precincts: accessibility is central to maintaining Sydney's liveability.

Source: NSW Department of Planning and Environment

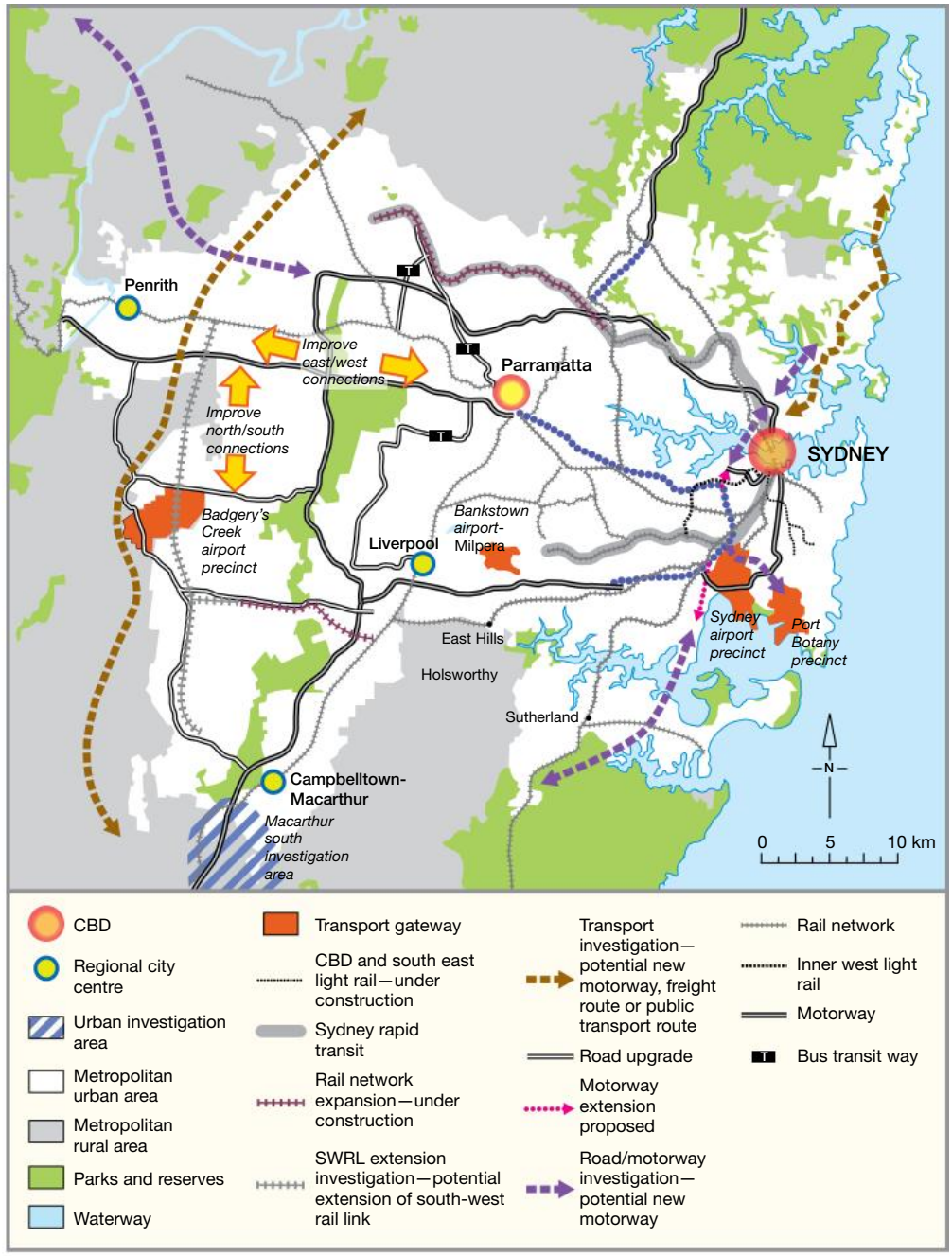
Addressing traffic congestion

Road projects

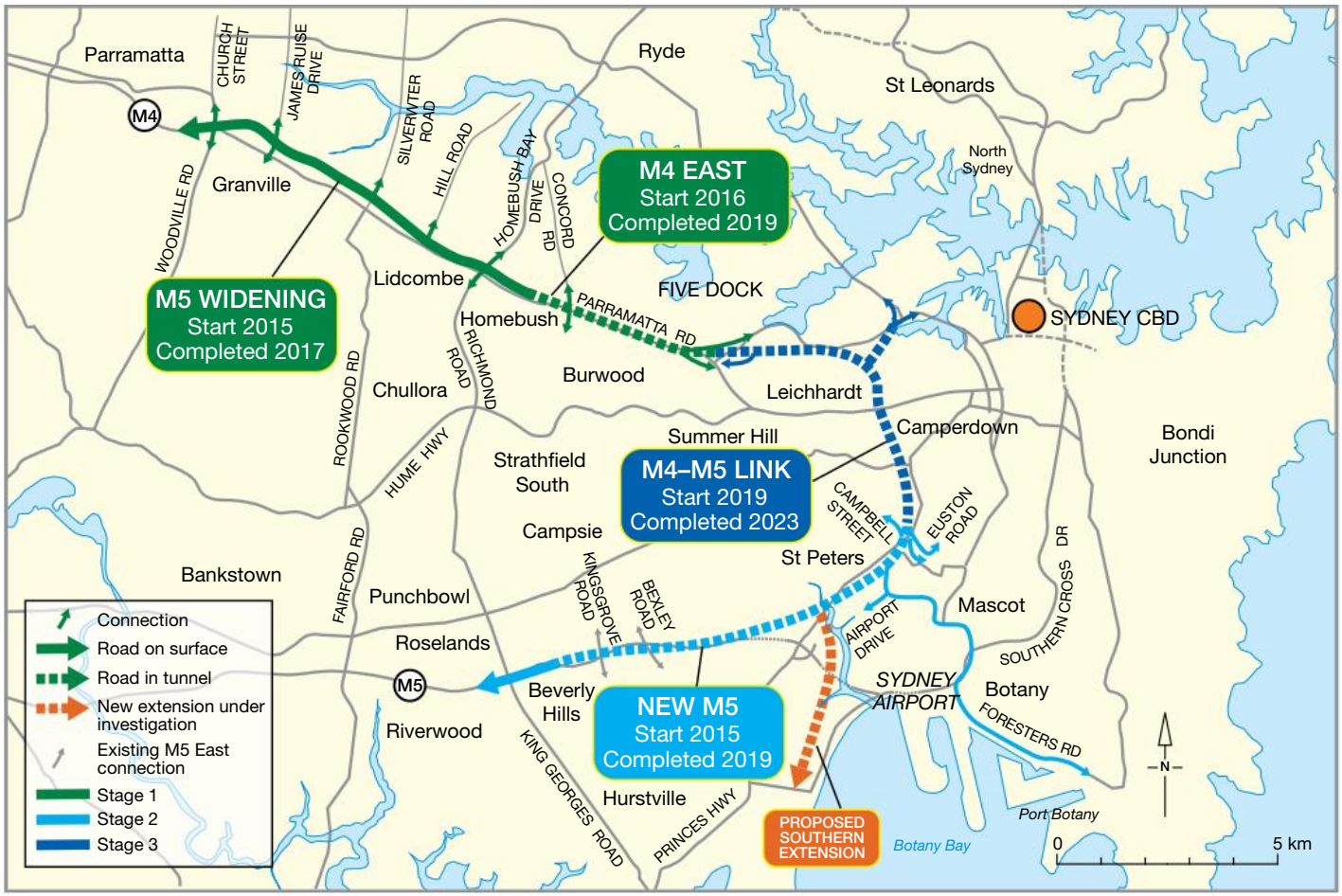
The construction of the $16.8 billion, 33-kilometre WestConnex motorway involves a number of elements: the widening of the M4 between Parramatta and Homebush; the duplication of the M5 East tunnels; the M4–M5 Link tunnel; and the Sydney Gateway Project (a link between the WestConnex St Peters Interchange, Sydney Airport and beyond towards Port Botany); see Figures 7.11.12 and 7.11.13.

Other projects include NorthConnex (a 9-kilometre tunnel connecting the M2 to the F3) and the Beaches Link Tunnel (a road link from Warringah Freeway in North Sydney to the city's Northern Beaches).

Future motorway projects include the M4–Western Harbour Link tunnel; the F6 extension from the M1 Princes Motorway at Waterfall to Sydney Airport; the M9 Outer Orbital; and the M12 (the link road between the M7 and Badgerys Creek Airport).



7.11.12 Sydney's major transport projects



7.11.13 The three elements of the WestConnex project

SPOTLIGHT

Trams making a comeback

Trams are not new to Sydney. From 1879 to 1961, trams served Sydney's inner suburbs (see Figure 7.11.14). At its peak, it was the largest tram network in Australia, the second largest in the British Empire (after London), and one of the largest in the world. More than 1600 trams were in service at any one time—more than three times the number of trams in Melbourne today. Patronage peaked in 1945 at 405 million passenger journeys. The network had a maximum street mileage of 291 kilometres in 1923.

Competition from the private car and private bus operators, combined with complaints about traffic congestion, led to the gradual closure of lines beginning in the late 1930s. The system was closed in stages with the last service, to La Perouse, in 1961.



7.11.14 Trams at Circular Quay in the early 1920s

Activities

Understanding the text

1 Explain the link between efficient transport infrastructure and the promotion of economic growth. How is it linked to peoples' quality of life and the quality of the environment? What needs to be done to address transport issues?

2 Identify the factors that have reinforced the CBD's dominance in job creation. What is being done to enhance the CBD's accessibility?

3 Outline the key elements of the plan to address Sydney's worsening traffic congestion. Outline the criticisms of the approach being adopted.

4 Study Figure 7.11.12. Locate the motorway, metro and light rail projects mentioned in the text.

5 As a class, discuss whether the decision to dismantle Sydney's tram network to make way for cars and buses was a wise one.

6 Write a paragraph or two outlining the strategies being used to reduce car dependency, and improve air quality.

7 Outline how authorities seek to minimise congestion on existing roads.

Working geographically

8 Study Figure 7.11.8. What does this map tell us about the time taken to get to work for those living in different parts of the city? Who are the most and least advantaged?

9 What are the factors encouraging people to leave the car behind and catch public transport?

10 Study Figure 7.11.11. Identify the principal functional precincts of Sydney's CBD. Where are the city's financial services, creative digital technologies and transport and logistics centres found? Research the intended uses of Sydney's Bays precinct and the types of land use activities found in Darling Harbour.

Metro projects

Three metro lines are planned for Sydney:

- **Sydney Metro Northwest:** This 36-kilometre, fully-automated metro rail will link Sydney's rapidly growing North West with Chatswood, where it will eventually link to the Sydney Metro City and Southwest line. Trains will run every four minutes during peak periods (15 trains an hour). Customers won't need a timetable; they will just turn up and go.
- **Sydney Metro City and 67 Southwest:** This 30-kilometre, fully automated line will link Chatswood with Bankstown via the CBD with new stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo along with new underground platforms at Central Station. The project includes the 13.5-kilometre upgrade and conversion of the T3 Bankstown line to metro standards.
- **Sydney Metro West:** This separate line will link the Sydney CBD with Parramatta and is expected to open in the second half of the 2020s. Stations will be located in Parramatta, Sydney Olympic Park, the Bays Precinct and the CBD.

Light rail projects

The CBD and South East Light Rail is Sydney's newest light rail network. The 12-kilometre route includes 19 stops, extending from Circular Quay along George Street to Central Station, through Surry Hills to Moore Park, then to Kensington and Kingsford via Anzac Parade and Randwick.

The new network adds to the Inner West Light Rail, which is now operating as the L1 Dulwich Hill Line. The 12.7-kilometre route connects Central Station and Dulwich Hill via 23 light rail stops. The link transports more than 9.7 million passengers each year.

The next planned light rail project is the Parramatta Light Rail. Stage 1 (Westmead to Carlingford via Parramatta CBD and Camellia) will be a 12-kilometre, 15-stop two-way track line.

Negative responses to transport planning

Critics of the NSW Government's approach to the provision of transport infrastructure argue that it does not do enough to reduce car dependency and increase the use of public transport. The critics present the following arguments:

- There is a 'political prejudice' against public transport, especially by conservative governments. This has resulted in a rail system that struggles to compete against the use of private cars. Sydney's rail network has remained largely unchanged since 1945, yet motorway construction continues to be given priority. The nature and scope of Sydney's current motorway building program is evidence of this bias.
- Heavy industrial traffic is incompatible with suburban street activities. Such traffic needs to be diverted elsewhere.
- Sydney does not provide adequate employment opportunities in the growing western suburbs. Incentives need to be provided so that firms locate closer to major population centres.

Minimising the impacts of transport infrastructure developments

In Sydney, detailed route-selection studies, environmental impact assessments and the use of modern design and construction techniques help minimise the environmental and visual impact of motorways. Nevertheless, motorway construction proposals are often meet with widespread community protest. The construction of the city's new WestConnex motorway has, for example, been accompanied by well-organised community-based opposition.

To minimise congestion on existing roads, authorities seek to make better use of the existing transport infrastructure, including computerised traffic control and electronic signage; greater use of transit and bus-only lanes; upgrading rolling stock (railway carriages) and ferries, and simplifying the rail network so that a breakdown on one part of the network does not disrupt services on other lines.

The cost of providing urban transport infrastructure is, of course, very high. Governments have many competing demands on their limited resources. Increasingly the private sector is being encouraged to build and operate tollways and rail links. This imposes cost-of-living pressures on Sydney households.

Securing Sydney's water supply

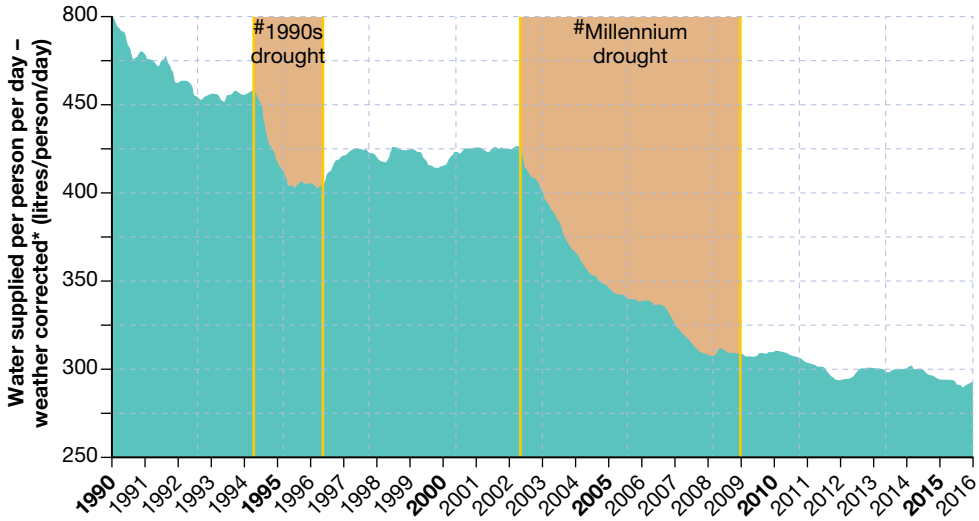
Sydney's water utility, Sydney Water, supplies 1.4 billion litres of drinking water to the city's 5.2 million people every day. Sydney Water removes and treats a similar amount of wastewater each day.

The city's principal source of water is Warragamba Dam. The dam supplies 80 per cent of the city's water. The city's desalination plant, built at a cost of $1.8 billion, is currently in a 'care and maintenance' mode and will resume production when dam levels fall below 60 per cent. When built, Sydney was experiencing its worst drought in 100 years, and Sydney's dam levels had fallen to just 30 per cent in early 2007. In mid-2017, Sydney's dam levels were at 90 per cent.

Current total water consumption levels are about the same as those experienced in the 1970s, despite an almost three-fold increase in the city's population. The introduction of our water efficiency programs, together with price rises, has resulted in significant reductions in water demand (see Figure 7.11.15). Water saving fittings and appliances, and the growing popularity of medium-density and high-density housing (with no gardens), have also contributed to the decrease.

Sewage treatment is critical in terms of ecological sustainability, and the protection of Sydney's coastal waters is of particular importance. As recently as 25 years ago, Sydney's iconic beaches were often closed due to pollution. To address the issue of water quality Sydney Water invested over $3 billion in deep ocean outfalls and a wastewater treatment.

Treated wastewater is also released into the city's creeks and rivers. These important ecosystems are very sensitive to changes in water quality. Sydney Water uses special treatment processes to remove nutrients and fine particles from the wastewater entering such waterways.



*Shows underlying demand trend removing impact of wet and dry years.
#Water restrictions and water conservation programs in place.

Source: Sydney Water

7.11.15 Water use in Sydney, 1990–2016

SPOTLIGHT

2017 Metropolitan Water Plan

Sydney's 2017 Metropolitan Water Plan outlines a range of strategies to better manage Sydney's demand for water. These strategies include the following:

- By ensuring an adequate environment flow from Warragamba Dam (see Figure 7.11.16) the health of the Hawkesbury-Nepean River is expected to improve.
- Initiatives are planned to increase water recycling. The recycled water will be used for watering golf courses and playing fields, irrigating crops and industry based processes. It will also be used for domestic purposes: thousands of new homes in Sydney's west will be fitted with duel reticulation so that recycled water can be used for watering gardens and flushing toilets. Recycled water will also be used to mimic natural river flows downstream of dams.
- By accessing deep water in the city's dams, supply will increase. The available supply can also be more effectively managed by building pipelines that enable water to be transferred between storages. The proposal to transfer water from the Shoalhaven River on the south coast could increase Sydney's water supply by 30 billion litres a year.
- Promotion of the WaterSmart Cities Program will encourage water saving by households, businesses, councils and government. Initiatives include the installation of water-saving devices.
- Water restrictions will reduce water consumption in times of drought.
- Lost water from leaking pipes will be reduced. Repairing leaks in the city's 21 000 kilometres of water mains is an ongoing process. Sydney Water aims to reduce leaks by 25 per cent through more regular maintenance.



7.11.16 Warragamba Dam supplies 80 per cent of Sydney's water needs. Constructed between 1948 and 1960, the dam is one of the largest domestic water supply dams in the world. Lake Burragorang, the water body formed by the dam, has a capacity of 2 031 000 megalitres (ML), which is four times the capacity of Sydney Harbour, and an area of 75 square kilometres.

Managing waste

While the recycling of glass, plastics, metals, paper and cardboard has significantly reduced the amount of waste going to landfill, Sydney still buries half the waste generated by households—about 2230 kilograms per person per year.

The success of recycling is attributed to a number of factors including the provision of kerbside collection services, community education programs, higher landfill levies and the development of markets for recycled materials.

Despite the success of recycling campaigns, the amount of waste sent to landfill remains a major environmental issue. When waste or garbage is buried it decomposes. In doing so, it emits greenhouse gases, principally methane. Methane is 25 times more powerful as a greenhouse gas than carbon dioxide and emission levels from landfill and other forms of waste are increasing. Landfill methane emissions currently contribute about 3–5 per cent of Sydney's total greenhouse gas emissions.

The technology now exists to collect the methane (sometimes referred to as biogas) from landfill and use it to generate electricity. The biogas collected at Sydney's Lucas Heights Waste Recovery Centre (a large landfill and recycling facility) is diverted to two adjacent Green Power accredited plants where it is used to generate enough electricity to power 47 000 homes. Lucas Heights is Australia's largest producer of biogas for the production of renewable energy.

DID YOU KNOW?

Sydney's dams are capable of storing 2600 billion litres of drinking water when full, and the desalination plant is capable of producing 250 million litres of drinking water a day.

In 2016, Greater Sydney used 530 billion litres of water—around 100 billion litres less than 25 years ago.

Activities

Understanding the text

1 Identify the reasons why Sydney's water consumption has been declining despite the city's growing population.

2 Outline the strategies being used to manage Sydney's waste. Evaluate their effectiveness.

Working geographically

3 Study Figure 7.11.15. By how much has water use in Sydney declined since 1990? How significant has drought been in changing patterns of water consumption?

4 Outline the strategies being used to better manage Sydney's demand for water.

5 Visit Sydney's CBD and observe how unique features of Sydney's built environment have been adapted to new uses. Record your observations. As a class, discuss the advantages and disadvantages of this approach to preservation.

6 Collect media reports regarding planning issues in Sydney. To what extent does a proposed development impact on the city's biophysical or built environment? As a class, discuss whether the advantages of the proposal outweigh any disadvantages.

7 As a class, discuss the proposition that the development of public transport, rather than the expansion of Sydney's motorway network, is the only way of achieving a sustainable city. Identify the factors that make people reluctant to use public transport. How could the concerns be addressed?

8 Collect media reports dealing with the redevelopment of former industrial sites. What type of industry occupied each site? Why did the industry decide to close or relocate? What type of development is proposed for each site?

9 Visit Sydney's CIA. What evidence is there to support the observations made in this unit? Which types of land use activities appear to be in decline? What types of activities are taking place? Use photography to record your observations. Mount a wall display and document the results of your fieldwork.

10 If there are any industrial areas in your local area, see if you can explain what is happening in terms of employment or activity. Is there growth, decline or no change?

11 Visit a CBD fringe suburb. Observe the types of residential developments occurring in the area. Use a camera to record your observations. Mount a wall display highlighting the various changes in the nature and location of residential land.

12 Visit a large, integrated residential/commercial development on a former industrial site. What are the locational advantages of the site? What is the mix of housing units being developed? What commercial elements have been included in the development? Which demographic group is being targeted by those promoting the development? Use a camera and field notes to record your observations. Add these to your wall display.

13 Visit a mixed residential development with shared community facilities. List the types of facilities available to residents of the development. Describe the mix of housing units available in the development. Consider the advantages and disadvantages of this type of development. Use a camera to record your observations. Add these to the wall display.

14 Use a camera to record examples of medium-density residential developments in your local area. Classify the types of residential units, such as townhouses, villas, duplexes, three-storey walk-up apartments and dual occupancy. Add these examples to your wall display.

CASE STUDY

Western Sydney

Promoting economic activity in Western Sydney is a particular challenge. With a population approaching 2.2 million and a workforce of 857 000, the region's economic potential is yet to be fully realised. Many residents are forced to commute long distances on inadequate infrastructure to the city's employment hubs in the east and north.

This was not always the case. In the period from 1950 to the 1970s manufacturing, having relocated from the Central Industrial Area, thrived throughout the region. However, the impacts of economic restructuring have taken a heavy toll. Job shedding in manufacturing has been widespread, a process borne most heavily by older males, the overseas-born and by unskilled youth.

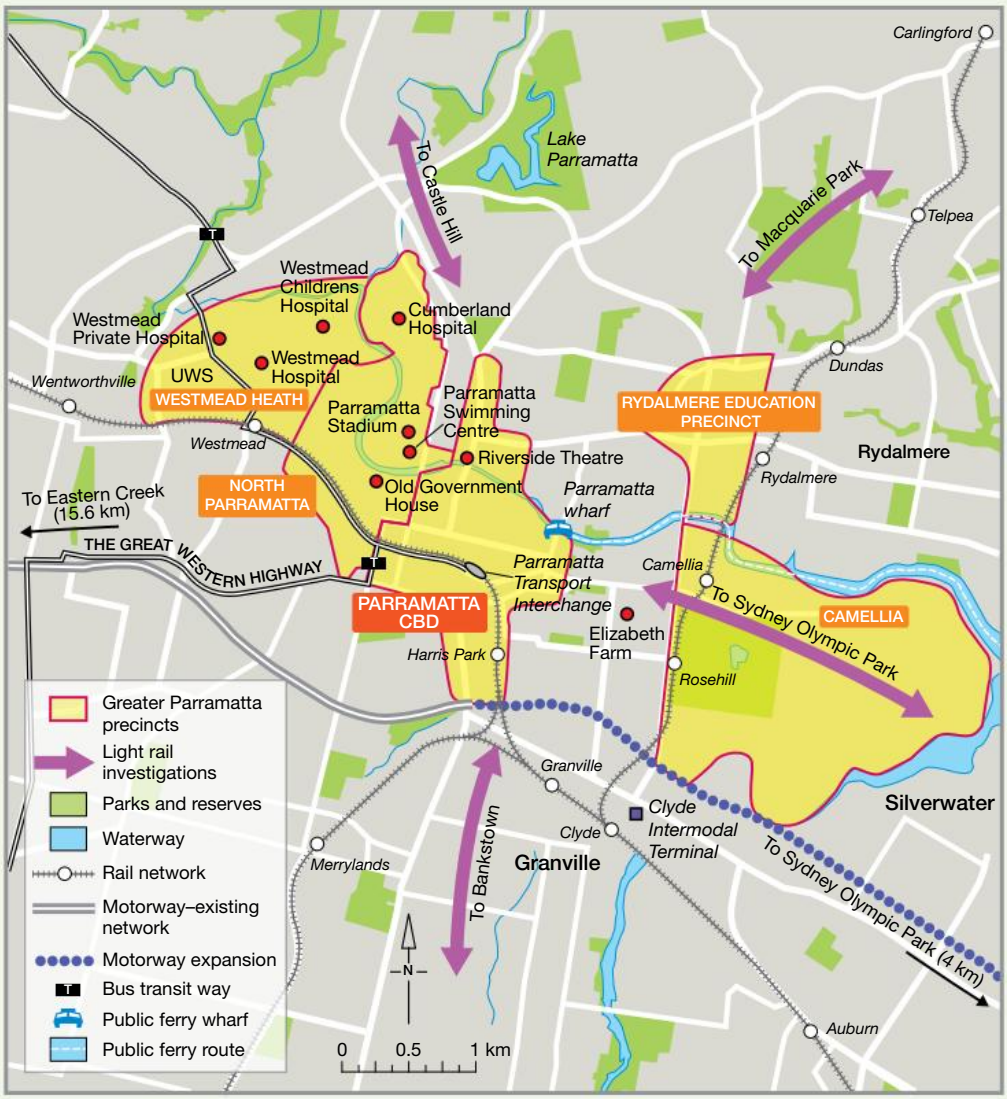
Today, the region needs thousands of new jobs every year to keep pace with population growth. To achieve this there is a need for long-term support for the clustering of economic activity in key locations serviced by well-functioning social and transport infrastructure. Also needed is investment in the region's human capital through appropriate social and community services (especially education) that directly support and promote employment participation. Finally, the region's advantages arising from cultural diversity need to be embraced, and businesses run by overseas-born operators encouraged.

The development of Sydney's second airport at Badgerys Creek holds the promise of improved transport links and the creation of new service centres and industrial precincts.

The Greater Parramatta to the Olympic Peninsula Priority Growth Area

A key element of the NSW Government's planning strategy for Sydney's future involves the designation of Priority Growth Areas (PGAs). By designating such areas, the Government aims to make better use of the existing urban infrastructure and provide a context in which it can plan and build additional infrastructure. In the case of the Greater Parramatta to the Olympic Peninsula Priority Growth Area shown in Figure 7.11.17, the creation of the PGA provides an opportunity to enhance Parramatta's status as the city's second CBD.

The Greater Parramatta to the Olympic Peninsula PGA incorporates areas that are now, or will be in the future, experiencing significant change as they transition from their current land uses and undergo redevelopment. The area includes Rhodes, Wentworth Point and



7.11.17 Greater Parramatta Priority Growth Area



7.11.18 Computer generated image of the redeveloped Carter Street redevelopment precinct

Sydney Olympic Park in the east; the industrial suburbs of Silverwater and Rosehill; Parramatta's CBD; the Westmead Health precinct; and the Rydalmere Education Precinct. The M4 (WestConnex) motorway; the North Shore, Northern & Western Line (T1); and the Cumberland Line (T5) currently serve the area. There are also links to the T2, T3, T6 lines and the area is well serviced by Sydney's Metro Bus network. In the future, the building of the Parramatta–Sydney CBD metro line and the Carlingford to Westmead light rail project will further enhance the PGA's interconnectivity.

Planned transport infrastructure is needed to unlock the development potential of the area and to support population and employment growth. Improvements to the public transport system will enable residents to travel to jobs in Greater Parramatta, Sydney's CBD, the Global Economic Corridor and other centres. Also needed will be the social infrastructure (schools, health services, childcare centres and recreation facilities) required to support a growing population.

Much of the current population growth is occurring at the eastern end of the PGA (Sydney Olympic Park, Wentworth Point and Rhodes). In the medium term, the Carter Street industrial precinct, shown in Figure 7.11.18 and wedged between Sydney Olympic Park and the M4, will be transformed into a new community with 5500 homes.

The PGA will also be promoted as a major employment node. Parramatta CBD, Sydney Olympic Park and Rhodes area are already three of Sydney's top 10 office markets.

Arts centre

The plans to develop Parramatta into a major arts precinct represents an effort to cater for the cultural aspirations of Western Sydney. The development of a new theatre complex on the banks of the Parramatta River and the controversial relocation of the Powerhouse Museum from Ultimo to Parramatta are examples of this initiative.

Western Sydney energy-from-waste incinerator

Australia's biggest rubbish landfill is located at Sydney's Eastern Creek. The former quarry is the largest integrated landfill/recycling facility in the Southern Hemisphere. The site is so vast that it will take twenty years to fill. A computerised recycling system involving a huge network of conveyer belts, crushers, magnets and sorting systems is used to separate waste.

Potentially, the landfill will make an important contribution to reducing the city's carbon footprint. The owners of the landfill, Dial-a-Dump, have applied to build a $700 million 'waste-to-energy' incinerator on the site. The facility, the largest of its type in the world, will process residue from building, commercial and demolition waste that is currently being buried as landfill, to generate electricity for 200 000 homes across Sydney. Community-based objections to the project, relating to concerns about air quality and human health impacts, have delayed its approval.

Activities

Understanding the text

1 Explain why the promotion of economic growth in Western Sydney is such a challenge. How can the issue be addressed?

Working geographically

2 Study Figure 7.11.17. Locate Western Sydney's North West and South West Growth Centre, the Western Sydney Employment Area and the planned enterprise corridors. Identify the region's transport infrastructure (existing and planned).

3 What is a PGA? Why has the Parramatta to Olympic Peninsula been designated as PGA? What will be done to enhance the area's potential as a new residential and employment precinct?

CASE STUDY

Protecting the biophysical and built environments

Sydney's biophysical environment

The protection of Sydney's biophysical environment goes well beyond the management of air and water quality. It includes the protection of Sydney's remnant bushland and its parklands, harbour foreshores, beaches and other places of scenic beauty. It means that development must be carefully planned and managed. Environmental impact assessments are one of the tools used by planners to assess potential impacts. The legislated planning powers, which are exercised by government authorities, are another mechanism for controlling environmentally sensitive developments. Agencies, such as the Environment Protection Authority (EPA), monitor existing land uses to ensure their impact on the environment is minimised.

Protecting Sydney's biophysical environment involves the containment of Sydney's urban footprint. Valued rural and timbered lands extending to the Nepean–Hawkesbury catchment and the foothills of the Southern Highlands are to be protected through land zoning mechanisms. This will allow Western Sydney's vulnerable animal and plant habitats to be protected and provide a valuable recreation resource for Sydney's growing population.

Specific strategies to minimise Sydney's urban footprint include:

- establishing environmental targets and then integrating them into decision-making processes
- improving the health of waterways, coasts and estuaries
- improving Sydney's air quality
- protecting sites that are of cultural significance for Indigenous Australians
- promoting energy efficiency and reduction of greenhouse gas emissions
- implementing policies that promote the sustainable use of water
- minimising waste and promote recycling
- providing access to open space in Western Sydney.

Sydney's built environment

The protection of Sydney's unique built environment is also important. Aspects worth preserving include:

- buildings that have some historical, architectural or cultural significance, such as the Sydney Opera House, General Post Office (GPO), Customs House and Capitol Theatre
- distinctive streets, such as Sydney's Bridge, Macquarie and Oxford Streets, and those in the suburb of Haberfield
- public parks and gardens, such as Centennial Park, the Royal Botanic Gardens and Hyde Park
- important features of Sydney's industrial and transport heritage, such as the Eveleigh Railway Workshops and Pyrmont Bridge
- places associated with historic events and people, such as the Woolloomooloo Finger Wharves (the embarkation point for Australian troops in both World Wars) and buildings by significant architects, including Francis Greenway and Walter Burley Griffin.

Sometimes it is not economically viable to retain buildings in their original condition. As a result many buildings have been redeveloped in ways that protect their historical, architectural or cultural significance, while allowing them to carry out modern functions. Sydney's historic Treasury Building, the GPO and Fairfax Building, for example, have been transformed into international hotels, and the Queen Victoria Building (once the city's markets) is now a fashionable shopping arcade. Elsewhere, unused but architecturally significant finger wharves, bond stores and factory buildings have been transformed into apartments, hotels, cultural facilities and office space. Harold Park's historic tramsheds shown in Figure 7.11.19 are another example.



7.11.19 Harold Park's historic tramsheds have been creatively adapted into a one of Sydney's most dynamic restaurant destinations.

Activities

Understanding the text

1 Outline the ways in which Sydney's biophysical and built environment is being protected. What strategies are being used to minimise Sydney's urban footprint? What aspects of Sydney's built environment are considered worth preserving?

Exam-style questions

Extended responses

- Explain the relationships between the urban dynamics and the changing economic character of a large city in the developed world.
- Analyse the changing nature of the economic character of a large city selected from the developed world.
- Explain the spatial pattern of advantage and disadvantage in a large city of the developed world.
- With reference to a large city in the developed world, analyse the factors that have contributed to the development of a culture of place.
- Account for the changing nature and location of residential land in a large city of the developed world.
- Explain the changing nature and location of commercial and industrial development in a large city in the developed world.
- With reference to a large city in the developed world, explain how lifestyle, architecture, streetscape and heritage can contribute to the development of a culture of place.
- Account for the spatial pattern of poverty and wealth in a large city in the developed world.
- Analyse the ways in which the growth and development of a large city in the developed world can be managed in an ecologically sustainable way.

Glossary

brownfield site land previously used—the term may be applied to vacant or derelict land; landfill site; land occupied by redundant or unused buildings; and developed land within the settlement boundary where further intensification of use is considered acceptable

Corridors Area area designed to attract investment and stimulate employment-generating development, aligned with transport infrastructure

economic restructuring significant and enduring changes to the nature and structure of an economy; it involves exposing an economy to international competition via tariff reduction, financial deregulation and company reorganisation (downsizing and outsourcing)

franchising a commercial relationship in which the franchisor provides a licensed privilege to the franchisee to do business and offers assistance in organising, training, merchandising, marketing and managing in return for a fee or share of any profit; franchising is a form of business by which the owner (franchisor) of a product, service or method obtains distribution through affiliated dealers (franchisees)

gentrification the rehabilitation or renewal of a deteriorated neighbourhood by new residents who are generally wealthier than the long-time residents; this often results in an increase in housing prices and leads to the displacement of long-time residents

greenfield development development in an area previously used for non-urban purposes

growth centre large area identified for future urban development; currently there are two growth centres in Sydney—the North West Growth Centre and the South West Growth Centre

infill development new development in areas already used for urban purposes; infill development can range from dual occupancy developments to large scale, major mixed-use developments

locational disadvantage due to a person's economic circumstances they are forced to live in parts of the city where the services on which they depend are not readily available

new economy the high-tech, information-based economy arising largely from new developments in the internet, telecommunications and computer sectors

old economy an economy in which labour-intensive manufacturing activities play an important role

public realm publicly owned streets, sidewalks, rights of way, parks and other publicly accessible open spaces, and public and civic buildings and facilities; it also includes the provision of services, such as public education and healthcare, and spaces that are privately owned but where there is a culturally embedded social expectation of right of entry, such as shopping malls

retail image the particular image the retailer seeks to associate with their retail business

SECTION

3 People and economic activity



The economic activities and related enterprises presented in this section demonstrate the rapidly changing nature of production. They also highlight the importance of consumer preference in determining the spatial distribution and future prospects of economic activities.

The first case study investigates global tourism and Perisher Ski Resort as an example of an economic activity drawn from the service-based sector of the economy. The second case study examines the global grape growing and winemaking industry and First Creek Wines as an example of an economic activity drawn from the secondary (processing) sector of the economy.

Both activities are important to the future economic wellbeing of the Australian people. They generate substantial export income and provide employment. Both are consumer-driven industries that must continually respond to shifts in consumer preference. The industries are also capital-intensive activities that require expensive infrastructure. Each demonstrates the emergence and growth of the global economy.

Outcomes

Students:

H1 explain the changing nature, spatial patterns and interaction of ecosystems, urban places and economic activity

H4 analyse the changing spatial and ecological dimensions of an economic activity

H5 evaluate environmental management strategies in terms of ecological sustainability

H6 evaluate the impacts of, and responses of people to, environmental change

H7 justify geographical methods applicable and useful in the workplace and relevant to a changing world

H8 plan geographical inquiries to analyse and synthesise information from a variety of sources

H9 evaluate geographical information and sources for usefulness, validity and reliability

H10 apply maps, graphs and statistics, photographs and fieldwork to analyse and integrate data in geographical contexts

H11 apply mathematical ideas and techniques to analyse geographical data

H12 explain geographical patterns, processes and future trends through appropriate case studies and illustrative examples

H13 communicate complex geographical information, ideas and issues effectively, using appropriate written and/or oral, cartographic and graphic forms

Overview

In Section 3, the focus is a geographical investigation of economic activity integrating the global and local contexts.

Chapter 8 Global tourism

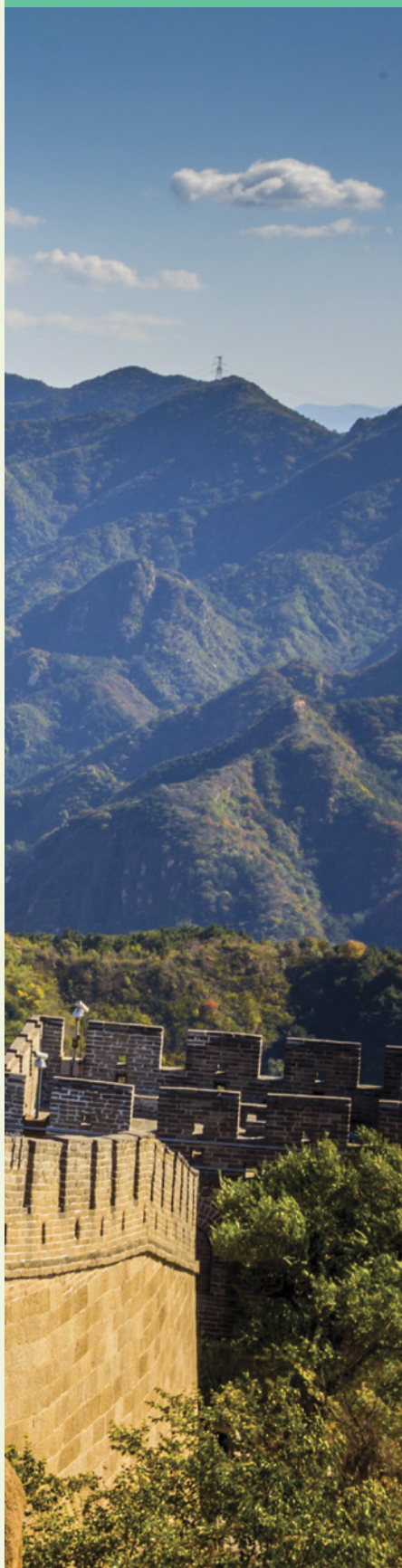
Chapter 9 Local tourism: Perisher Ski Resort

Chapter 10 The global viticulture and winemaking industry

Chapter 11 The local winemaking industry: First Creek Wines

Note: HSC candidates are required to study one economic activity integrating the global and local context.

8.0.0 The Great Wall of China



CHAPTER

8 Global tourism

For thousands of years humans have been drawn to discover the unknown, explore new and strange places and undergo new experiences. Travel to achieve these ends is not new, but tourism today is distinguishable from travel in the past due to its mass nature.

Tourism is a luxury. Until recently, participation was restricted to the few who could afford both the time and money to travel. Today most people in the developed world and increasing numbers of people living in the developing countries engage in tourism at some time in their lives. Tourism is an accepted and accustomed, even expected, part of the lifestyle of a large and growing number of people. It has become an indicator of socioeconomic status and is considered necessary for good health and personal wellbeing. The diversity of tourist experiences is also increasing as people seek out new destinations, create their own adventures and immerse themselves in the local culture. Technological advancements in the digital age have enabled people to become more independent when planning their travel.

> **Travel makes one modest. You see what a tiny place you occupy in the world.**
>
> **Gustave Flaubert, French novelist**

8.0.1 Porto, Portugal


DISTINTO

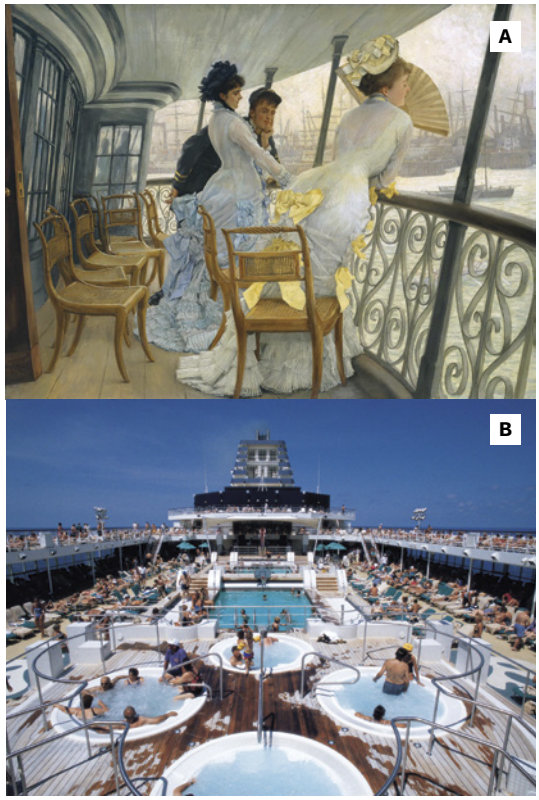
UNIT 8.1

The nature of tourism

Tourism research

Access the most recent data and resources relating to issues in tourism at the following organisations' websites:

- Australian Bureau of Statistics
- Tourism Research Australia
- Bureau of Infrastructure, Transport and Regional Economics
- Department of Industry, Tourism and Resources
- Tourism Australia (see the Corporate website section)
- Trekksoft (especially the Travel Trend Report under 'Resources')
- World Tourism Organization.



8.1.1 **A** In the nineteenth century, only the wealthy could afford lavish travel. **B** Taking a cruise is now affordable for the masses.

Tourism is a highly complex form of economic activity. It involves the economic interests and investments of large transport undertakings, owners of tourist sites and attractions, various services at the destination, and all levels of government. Each of these serves both the resident population and visitors, and their management must reconcile the needs of tourists with the resident population.

Travel and tourism (domestic and international) is the largest industry in the world. The number of people travelling internationally increased from 25 million in 1950, to 278 million in 1960, 674 million in 2000 to 1.24 billion people in 2016. The World Tourism Organization (WTO) forecasts that this will rise to 1.8 billion by 2030.

Tourism makes a significant contribution to the gross domestic product (GDP), employment, investment and foreign exchange earnings of many countries. It is a major catalyst for economic growth and structural change. Being more decentralised than other industries, tourism helps to diversify employment prospects in regional areas and provides opportunities for small business development and community involvement.

Tourism: benefits and costs

The growth of global tourism (see Figure 8.1.1) has had pronounced social, environmental and economic effects. Until recently, attention has concentrated on the economic impacts of tourism. This is a reflection of the early optimism with which tourism was generally viewed. Tourism was widely acclaimed as bringing a multitude of economic benefits—generating wealth and employment.

At the same time, the growth of tourism has prompted more perceptive observers to raise questions concerning the social and environmental desirability of further expansion, especially on the massive scale of contemporary tourism development. Any growth in tourism will place increased demand on the biophysical and built environments and requires a large investment in tourism-related infrastructure. The impacts of such expansion must be taken into account or the very attractiveness that drew tourists to a destination in the first place may be lost.

Defining tourism

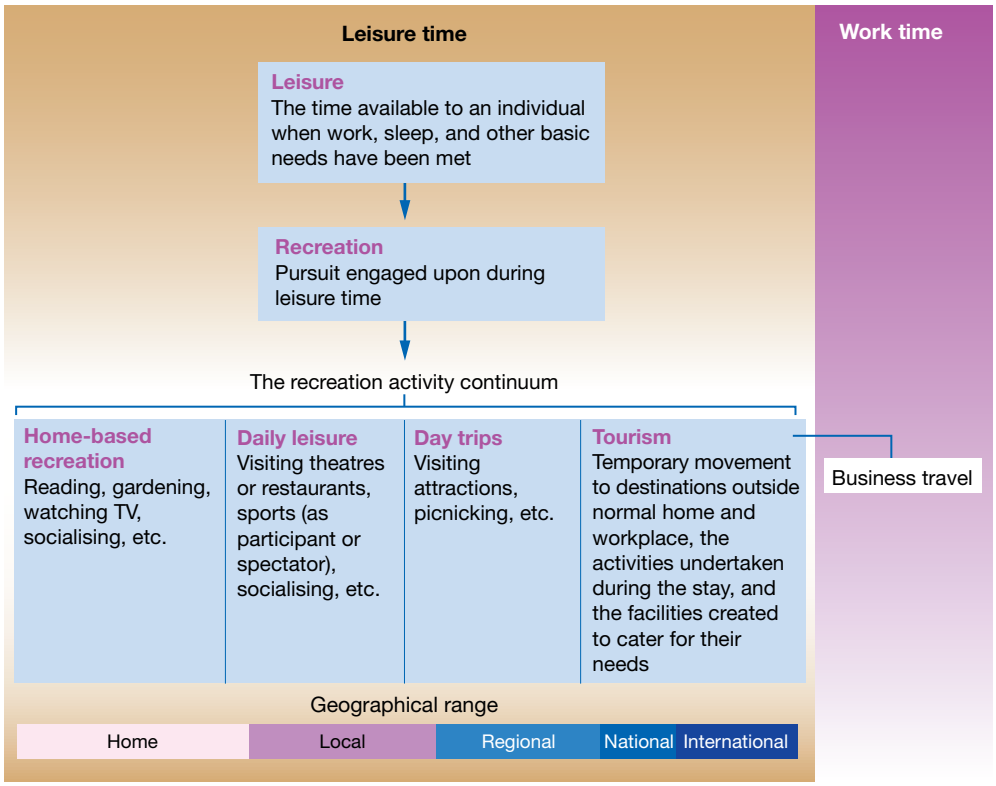
Tourism is a productive activity that encompasses human behaviour, use of resources, and interaction with other people, economies and environments. It involves the physical movement of tourists to locations other than their normal place of living.

Most tourism is a form of recreation, undertaken during an individual's discretionary time. However, some tourism is linked with obligations (such as business) or to access medical services.

One of the difficulties in arriving at an adequate definition of tourism as an economic activity is determining how to differentiate between leisure, recreation and tourism. Leisure can be defined as the time not spent working, and recreation as the activities undertaken in discretionary time. Separating recreation and tourism is more problematic. It is useful to consider a continuum with, at one end, recreation based either at home or close to home and, at the opposite extreme, travel for tourism, where some distance is involved and overnight accommodation is required.

This continuum is based on the time needed for the activity and the distance travelled. It places tourism at one extreme of the recreational activity spectrum as illustrated in Figure 8.1.2.

Tourism has traditionally been defined as the temporary movement of people to destinations outside their normal place of work and residence, together with the activities undertaken during their stay at those destinations and the facilities created to cater for visiting tourists. A new trend in the twenty-first century is digital nomadism where people work remotely and combine it with long-term travel. For increasing numbers of people, travel and tourism is a means of broadening their world and life experiences.



8.1.2 The definition of leisure, recreation and tourism

Tourism encompasses all the activities that contribute to a tourist's movements from origin to destination. It involves the consumption of a wide range of goods and services provided by transport (see Figure 8.1.3), tour operators, accommodation establishments, theme parks and attractions, entertainment and arts venues, museums and historical sites, travel agents, souvenir retailers and restaurants. Tourism generates a mass of productive activity, employment and income.



8.1.3 Travel and tourism is the world's largest industry

Tourism: economic inputs

Tourism depends on a large number of economic activities that cater directly to tourists and produce consumer durables used for tourist activity, such as motor vehicles and recreational equipment. Services provided without direct charge to tourists are also relevant. These include information offices; the maintenance of roads, airports, harbours, railways, national parks; tourist promotion; immigration and customs services; and the large number of amenities provided and maintained by local authorities.

Other characteristics of tourism include the following:

- The tourism industry operates 24 hours a day, seven days a week; although it is subject to seasonal fluctuations.
- It is a labour-intensive industry with employment opportunities at all skill levels.
- In most countries there are few, if any, barriers to entry into the tourism industry.
- Small businesses predominate, despite the growing investment by large companies.
- International tourism is an important medium for educational and cultural exchange and for promoting international understanding and goodwill.
- The impacts of tourism are broad ranging, involving economic, social and environmental considerations.

The language of global tourism	
Term	**Definition**
American plan	A payment plan in which the room rate includes breakfast, lunch and dinner
Bed and breakfast	A type of accommodation in which rooms in private homes are made available to tourists; breakfast is also provided
Charter flight	A flight booked for the exclusive use of a group of travellers
Ecotourism	A tourist activity designed to allow visitors to experience natural settings with minimal damage to the ecosystem
European plan	A payment plan in which the room rate includes lodging but no meals
High season	The time of the year when the greatest number of tourists travel to a particular location
Inclusive tour	A travel plan that includes the cost of land, air or sea travel as well as accommodation and meals
Jet lag	The fatigue that occurs after a long flight in an aircraft, especially when a number of time zones have been crossed
Load factor	The measure of the percentage of all seats that an airline offers that are sold to paying passengers; an indication of the efficiency of the operation of the airline
Passport	A document that is issued by a national government and certifies that an individual is a citizen of that country
Shoulder season	The time period that signifies the off-peak times of the tourist season; next to the high season
Theme park	An amusement facility that features a particular theme
Tour operator	A company that specialises in the packaging of vacations; the packages are usually sold to the public through travel agents
Tourist profile	A document that provides basic information about a country that a tourist would need to know, such as climate, food and customs
Travel agent	A company that sells travel-related services to the general public
Visa	An official document affixed to a passport; it allows the passport holder to visit the issuing country

8.1.4 The language of global tourism

Characteristics of mass tourism

Figure 8.1.4 outlines common tourism terms, while the main characteristics of mass tourism are outlined below:

- The sheer numbers involved mean that the tourism product has to be offered under conditions of mass production.
- There is a growing level of expenditure on consumer goods associated with tourism, such as surfboards for the beach holiday and skis and skiing accessories for the winter holiday.
- A few producers dominate particular markets: Disney in the world of theme parks; and Carnival Cruise Line among travel companies.
- Producers take the lead in developing new tourism attractions, whether opening up new mass destinations (such as Vietnam, Peru and Spain) or designing new theme parks, such as Universal's Volcano Bay™ Water Theme Park (see Figure 8.1.5).
- There is little differentiation between mass tourism products: the Mediterranean beach holiday, for example, offers much the same mix of architecture, facilities, food and drink, and entertainment whether it is located in Turkey, Greece or Spain.



8.1.5 Universal's Volcano Bay Water Theme Park opened in Orlando, Florida, in 2017.

Forms of tourism

Important distinctions can be made between international and domestic tourism.

International tourism

International tourism involves travel to a country other than the one in which the tourist normally lives. This is the most important market sector of tourism economically, as international tourists tend to stay longer at the destination and spend more to cover associated transport and accommodation. They also bring with them foreign currency which provides revenue to the economy.

Domestic tourism

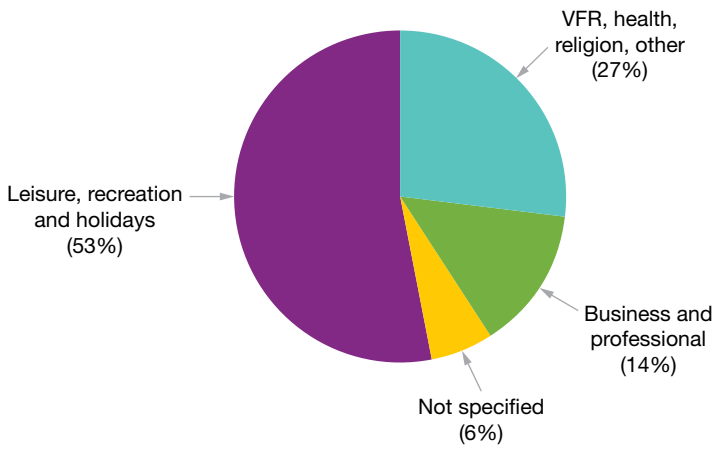
Domestic tourism is travel within the tourist's own country. Estimates of the size of this sector vary because domestic tourism is not adequately measured in many countries. In the United States, domestic tourism dominates the overall tourism market accounting for 96.7 per cent of the 2.1 billion total trips taken in 2013. This number of is projected to reach 2.2 billion by 2018. In the United Kingdom, the figure for domestic tourism is 86 per cent, reflecting the shorter distance needed to be travelled to reach the rest of Europe.

Evidence from surveys taken of the vacation market in Europe and North America indicate that, in most countries, between half and three-quarters of the adult population took holidays in any 12-month period. This proportion covers international and domestic holidays, although the latter is the larger category. Increasing numbers of people take more than one vacation trip a year, which is a factor of great importance for marketing managers involved in tourism.

Reasons for travelling

In 2015, the majority (53 per cent) of international tourist arrivals globally corresponded with trips for the purpose of leisure, recreation and holidays. These arrivals totalled 632 million. Business travel accounted for some 14 per cent (166 million) of the total and another 27 per cent (321 million) covered travel for other motives, such as visiting friends and relatives (VFR), for a religious purpose/pilgrimage or for medical treatment. For the remaining 6 per cent of arrivals the purpose of visit was not supplied; see Figure 8.1.6.

Inbound tourism by purpose of visit, 2015* (share)



Source: WTO

8.1.6 Inbound tourism by purpose of visit

SPOTLIGHT

Travel goes high tech

Don't forget the gadgets the next time you pack your bag.

A century ago, high-tech travel meant a horseless carriage or steamship and a postcard that arrived home long after the traveller did. By 2020, supersonic jet flights and regularly scheduled tourist rocket flights into space are anticipated to begin. Travel today is already a high-tech business.

With an internet-connected laptop or phone you can find a hotel or the closest cafe, assess their quality with the use of ratings and recommendations, and then make reservations. Digital photos can be stored, or shared on blogs and social media.

A host of travel gadgets, systems and tech toys are available. These include the global positioning satellite (GPS) handheld receiver: a must-have for serious hikers, sailors and the just plain directionally challenged. The GPS locks onto satellites quickly, provides turn-by-turn directions and precise elevations, and shows accurate compass readings and orientations. Other gadgets include the inbuilt battery in your baggage so you can recharge your phone and any other device via numerous USB ports. Such luggage also has a GPS to locate it if lost. Robotic suitcases are now available and these simply follow you through the airport. Noise-cancelling acoustic headphones are a key carry-on item for many travellers, who can now choose to allow important public announcements through while blocking out other unwanted noise.

Activities

Understanding the text

1 Distinguish between tourism and travel.
2 Describe how attitudes to tourism have changed.
3 Explain why tourism is described as a 'highly complex' productive activity.
4 Outline the global importance of tourism as a productive activity.
5 Explain why it has been difficult to arrive at an adequate definition of tourism.
6 Define tourism.
7 List the characteristics of tourism.
8 Distinguish between international and domestic tourism.

Working geographically

9 List the main characteristics of mass tourism and then write a short-answer response outlining the ways in which modern mass tourism differs from travel undertaken in the past.
10 Study Figure 8.1.2 and then write a short-answer response distinguishing between leisure, recreation and tourism.
11 Collect extracts from newspapers, magazines and the internet that address tourism-related issues. Write a 100-word synopsis of each extract. Share your extracts with others your class.

UNIT 8.2

The global pattern of tourism



2016 proved to be another excellent year for international tourism despite many challenges. International tourist arrivals grew for the seventh consecutive year to reach 1.2 billion, a sequence of uninterrupted growth not recorded since the 1960s. The strongest growth was recorded in the Africa and Asia and the Pacific regions.

International tourist arrivals reached 1235 million in 2016.

2016 saw growth in international arrivals of some 46 million, or 4%, over 2015.

Tourism has grown above average, at around 4% per year, for seven straight years.

300 million more people travelled internationally for tourism between 2008 and 2016.

Growth in advanced economy destinations (+5%) exceeded that of emerging economies (+2%) in 2016.

8.2.1 Tourism in numbers, 2016

All over the world people are travelling more, both within their own countries and abroad. Travel and tourism (domestic and international) is now the world's largest industry. As Figures 8.2.1 and 8.2.2 show, tourism has continued to grow internationally. Tourist data shows domestic tourist numbers are consistently around 11 times those for inbound tourist numbers.

Western Europe and North America dominate global tourist flow as shown in Figures 8.2.3 and 8.2.4. There was a strong flow of tourists from the United States to Europe throughout the twentieth century, and the level of transatlantic movement in both directions soared in the 1970s as keen competition reduced the real price of travel. Total world tourism (by numbers) grew throughout the 1980s, 1990s and 2000s, at around 4 per cent per annum.

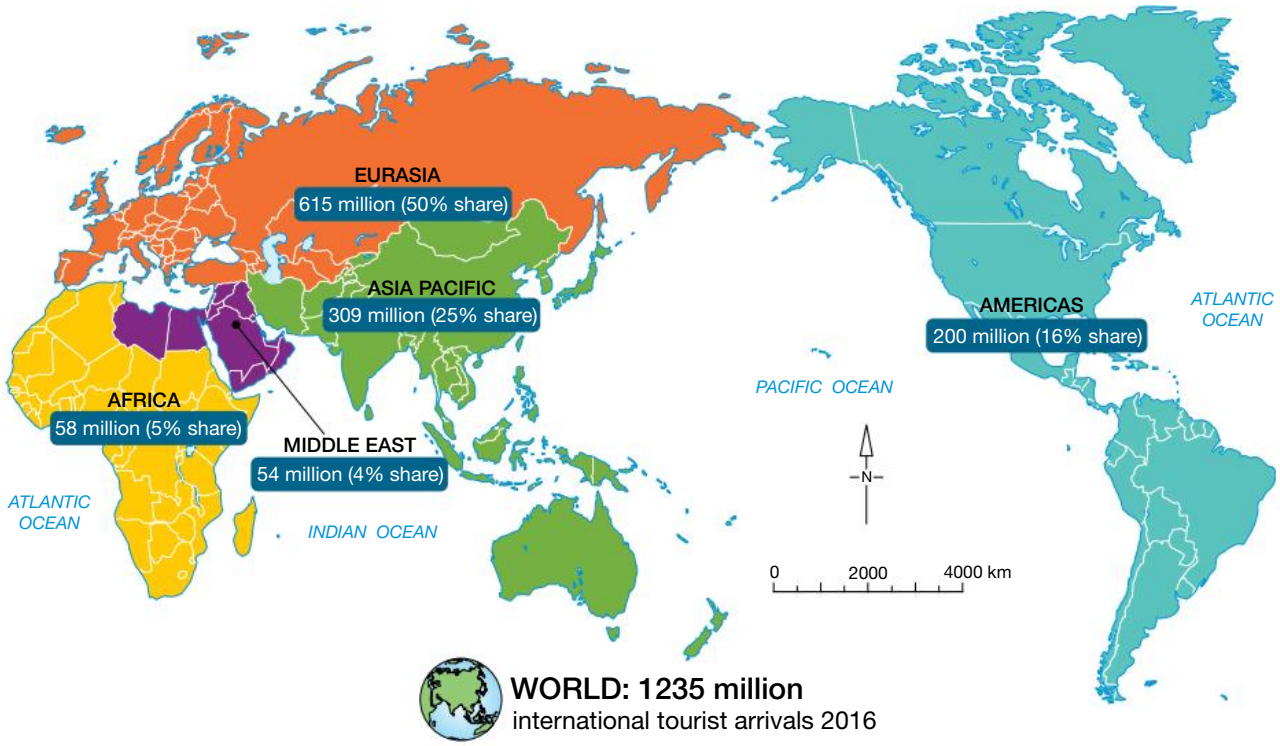
Simultaneously, there has been genuine globalisation as more and more countries became destinations for international travel, and the relative importance of the various segments has changed (see Figures 8.2.5 and 8.2.6). The range of destinations now encompasses virtually all countries in the developed world and many of those in the developing world.

There has been spectacular growth in the Asia–Pacific region: Oceania and Asia have had far higher growth rates than other world regions. In part this reflects the 'discovery' of these regions by the tour companies and tourists of developed countries. It also reflects the rising real incomes in countries such as China where an emerging middle class is keen to travel.

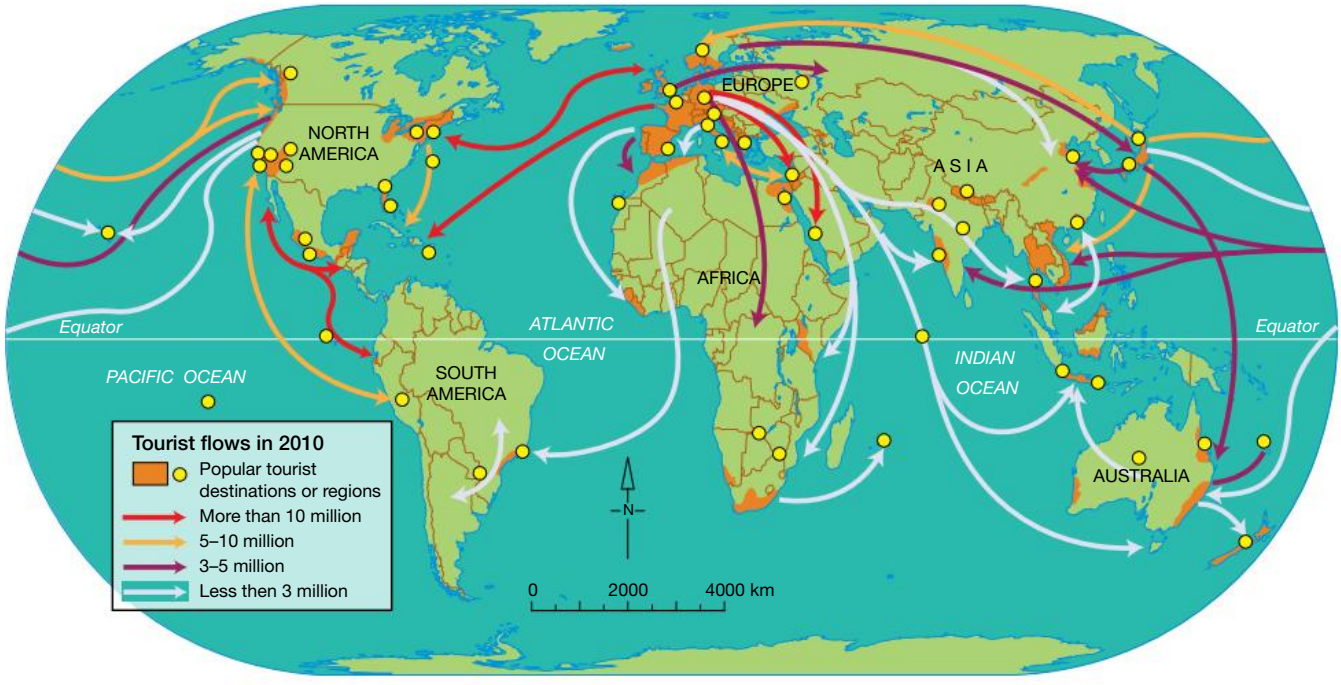


8.2.2 Growth in world tourism, 1995–2015

Source: UNWTO Tourism Highlights, 2016

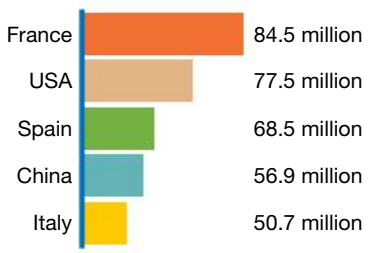


8.2.3 International tourist arrivals in 2016



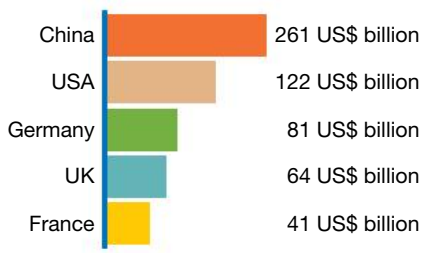
8.2.4 International tourism flows in 2011

World's top tourist destinations
International tourist arrivals, 2015



8.2.5 World's top tourist destinations

World's top tourism spenders
International tourism expenditure, 2016



8.2.6 World's top tourism spenders

SPOTLIGHT

Australian tourism

International visitors help Australian tourism hit the mark

Strong gains in international tourism will help Australia continue to move towards attaining the lower bound of its Tourism 2020 growth target ($115 billion per year) for overnight visitor expenditure by the end of the decade, according to Tourism Research Australia's (TRA) Tourism Forecasts 2016.

However, more work will need to be done if Australia is to reach the upper bound of its tourism industry potential ($140 billion per year) by 2020.

With international visitors set to increase their share of spend from 31 per cent of total spend in 2014–15 to 41 per cent in 2024–25, and domestic overnight visitor spend continuing to grow, but at a moderate pace, total overnight expenditure is forecast to reach $127 billion in nominal terms by 2019–20.

According to the Forecasts, our largest inbound source market is set to change, with strong visitor growth seeing China overtake New Zealand in 2017–18—two years earlier than previously forecast. China is expected to contribute 43 per cent of total growth in visitor numbers from 2014–15 to 2024–25 and 60 per cent of growth in expenditure.

Other markets expected to experience solid growth over the next few years are Indonesia, Malaysia, Hong Kong, Japan and South Korea, along with our traditional markets of New Zealand and the USA. Sporting events scheduled in 2017–18 will also see an increase in arrivals from the UK, Australia's third-largest inbound market.

Strong growth in holiday travel—largely due to the lower value of the Australian dollar—is forecast to drive growth in domestic tourism in 2017–18, with many Australians continuing to choose to holiday at home rather than travel abroad.

Source: AusTrade

The economics of tourism

- In 2015–16, tourism directly accounted for 3.2 per cent of Australia's GDP.
- Export earnings from tourism increased to $39 billion in 2015–16. This represents 12.5 per cent of Australia's total export earnings.
- Australia's international tourism receipts are the 11th largest in the world.
- Tourism is the largest component of Australia's services exports. In 2015–16 it accounted for around 62 per cent of services exports.
- In 2015–16, tourism employed 929 000 people or 8 per cent of the Australian workforce.
- Australia now makes more money selling tourism services to foreigners than it makes from exporting coal. Annualised tourism exports of $47 billion, based on September quarter figures, were greater than the two stalwarts, rural exports at $42 billion and coal at $41 billion.
- Iron ore is still our biggest export.

Modern mass tourism

Tourism has developed in many different contexts. Modern mass tourism has its origins in the affluence of the industrialised countries of Western Europe, North America and, more recently, China. Tourism has also expanded significantly in Eastern Europe and is becoming an important sector in many developing countries in Asia, Africa, Latin America, the South Pacific and the Caribbean. Tourism has developed both in the liberal Western societies and under centrally planned socialist regimes and has become an important economic sector in many developing countries. Likewise, tourism has developed in a wide variety of physical environments: on low islands of the Indian Ocean, at great heights in the Himalayas, in the countryside of Tuscany in Italy, on the savanna plains of Africa and along the Australian coastline.

Countries that offer attractive tourist destinations, have sufficient environmental safeguards, as well as a trained workforce and the support of governments are expected to be more sustainable moving into the future.

Tourism: a historical perspective

Tourism as a major global economic activity is relatively recent. Even travel for business-related purposes is comparatively recent. The word 'tourism' did not appear in the English language until early in the nineteenth century, and the word 'tour' was more closely associated with the idea of a voyage or a viewing of the arts than with any idea of being away from home for pleasure, which is a significant feature of tourism today.

Transport is the necessary precondition of tourism because tourism is a matter of being elsewhere. Much of the historical study of tourism parallels developments in transport technology. Mass transit has increased the number of people who travel.

The motivations for travel have also changed over time. Prior to the eighteenth century, most travel was for trade, pilgrimages or other religious purposes, or education. Any recreational travel was mostly confined to day excursions—over short distances—and to activities such as fairs, festivals, sporting events or other forms of entertainment.

The 'Grand Tour'

Even as the European 'Grand Tour' became a fashionable educational and recreational activity for upper-class young people, most travel continued to be for trade or commerce, including the voyages of exploration to Africa, the Americas and Australasia. Travel for pleasure was undertaken by a small, wealthy and mostly land-owning elite. The vast majority of the population hardly moved beyond their village and the nearest market town.

Industrial Revolution

The Industrial Revolution initiated dramatic social and economic changes that laid the foundations of modern tourism. The most dramatic feature was the increase in the size of the population and its subsequent urbanisation in the newly emerging industrial towns. People had higher incomes and were no longer tied to the land. Eventually they acquired statutory holiday rights, and often sought to escape from their urban surroundings.

This desire to travel felt by the new middle class was satisfied by the development of transport at a speed and level of comfort never before experienced. Travel in the nineteenth century was dominated by the railway on land and by the steamship internationally. Accompanying this was the emergence of the hotel industry (see Figure 8.2.7). Seaside resorts and spas were favoured destinations as it was believed they had curative effects.



8.2.7 The Banff Springs Hotel is a luxury hotel that was built during the nineteenth century as one of Canada's grand railway hotels. It is located in Banff National Park, Alberta.

The jumbo jet

The most spectacular growth of travel for tourism occurred in the latter half of the twentieth century. During this time the moral and legal right to leisure became established. Aircraft took over from the steam train or steamship as the prime mode of transport for large groups of travellers and from private road vehicles for small groups.

Global tourism is big business

- International tourism receipts earned by destinations worldwide have surged from US$2 billion in 1950 to US$104 billion in 1980, US$495 billion in 2000, and US$1.5 trillion in 2016.
- Tourism is a major category of international trade in services. In addition to receipts earned in destinations, international tourism also generated US$211 billion in exports through international passenger transport services provided to non-residents in 2015, bringing the total value of tourism exports up to US$4 billion a day on average.
- International tourism now represents 7 per cent of the world's exports in goods and services, up from 6 per cent in 2014, as tourism has grown faster than world trade over the past four years.
- As a worldwide export category, tourism ranks third after fuels and chemicals and ahead of food and automotive products. In many developing countries, tourism ranks as the first export sector.

Activities

Understanding the text

1 Explain how the motivation to travel has changed over time.

2 Explain why the twentieth century saw an explosion in tourism.

3 Explain why the Industrial Revolution was so important in the development of modern tourism.

4 Describe the global pattern of tourism. How is this pattern changing?

Working geographically

5 Study Figure 8.2.1.
   - a How many international tourist arrivals were there in 2016? Where was the strongest growth recorded?
   - b Describe the growth in tourism over the last seven years.
   - c Is the growth of emerging economy destinations exceeding that of advanced economic destinations?

6 Study Figure 8.2.2. Calculate the percentage increase in international tourism arrivals between 1995 and 2015.

7 Study Figure 8.2.3. With the aid of an atlas, name some of the countries on continents with the largest and smallest shares of international tourism arrivals.

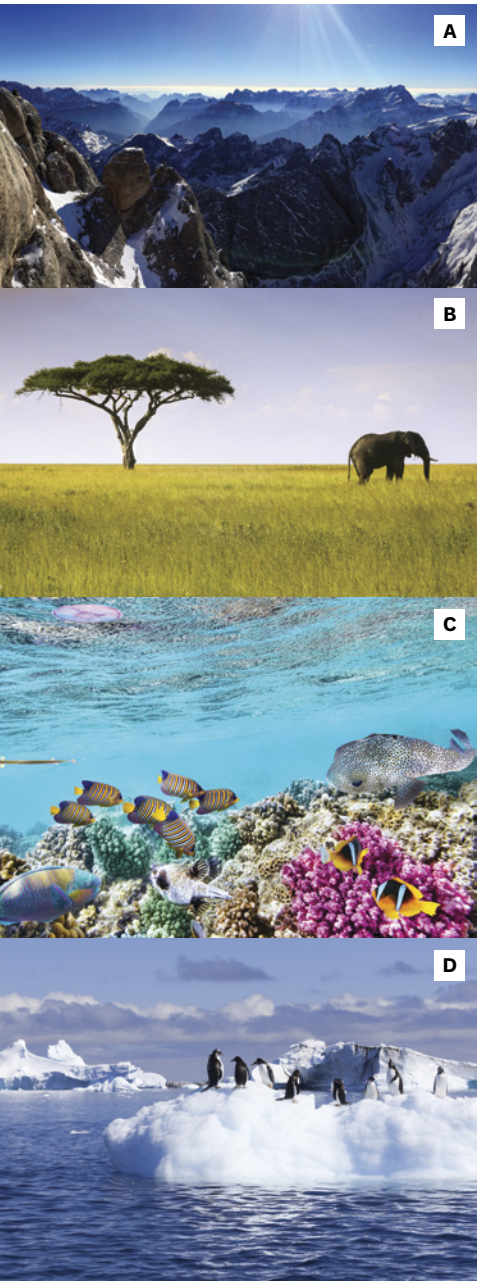
8 Study Figure 8.2.4. With the aid of an atlas, write a paragraph outlining the international flow of tourists.

9 Study Figure 8.2.5.
   - a Indicate the number of tourists who visited France in 2015.
   - b Of the world's top five tourist destinations what percentage visited France in 2015?
   - c Indicate the number of tourists who visited Italy in 2015.

10 Study Figure 8.2.6.
   - a Which country had the biggest tourism spenders in 2016?
   - b How much did they spend?

UNIT 8.3

Factors affecting tourism



8.3.1 The biophysical environment: **A** the Dolomites in Italy, **B** Serengeti National Park in Tanzania, **C** the Great Barrier Reef in Australia, **D** Antarctica

The tourism industry is a multifaceted economic activity and a geographically complex one. There is no single tourist product, no one commodity or service by which the output of tourism may be measured. Rather, tourists demand different services at different stages from their origin to their destination. Many components of tourism are inextricably bound to other economic sectors, such as airlines to transportation, souvenir shops and restaurants to retail or service, and hotels and other forms of accommodation to commercial development.

The spatial interaction that arises out of a tourist's movement from origin to destination, and the factors affecting it, lend themselves readily to geographical analysis.

The biophysical and built environment

A country's unique biophysical environment, cultural heritage and artistic life frequently represent integral components of its tourism industry. Scenic sites, comfortable climates and unique landscape features such as those shown in Figure 8.3.1 have an important impact on the patronage of specific localities, regions or countries.

Various types of tourism have differing requirements for favourable development, and certain sites, regions or countries will be more favourable for development than others. Different types of tourists place different demands on resources at, and on their way to, a destination. Figure 8.3.2 demonstrates the different resource requirements.

The tourism industry is located according to the spatial distribution of attractions and access to them, which is largely determined by environmental factors. The environment of a host region offers things that the tourist is seeking and needs, and which are unavailable at home.

Environmental conditions

The importance of environmental factors can be seen at all points in the tourism process. Tourist behaviour patterns are not necessarily motivated only by environmental conditions, but are clearly influenced by them through choice of destination and length of stay. Environmental conditions may influence tourists' loyalty to or substitution of tourist destinations.

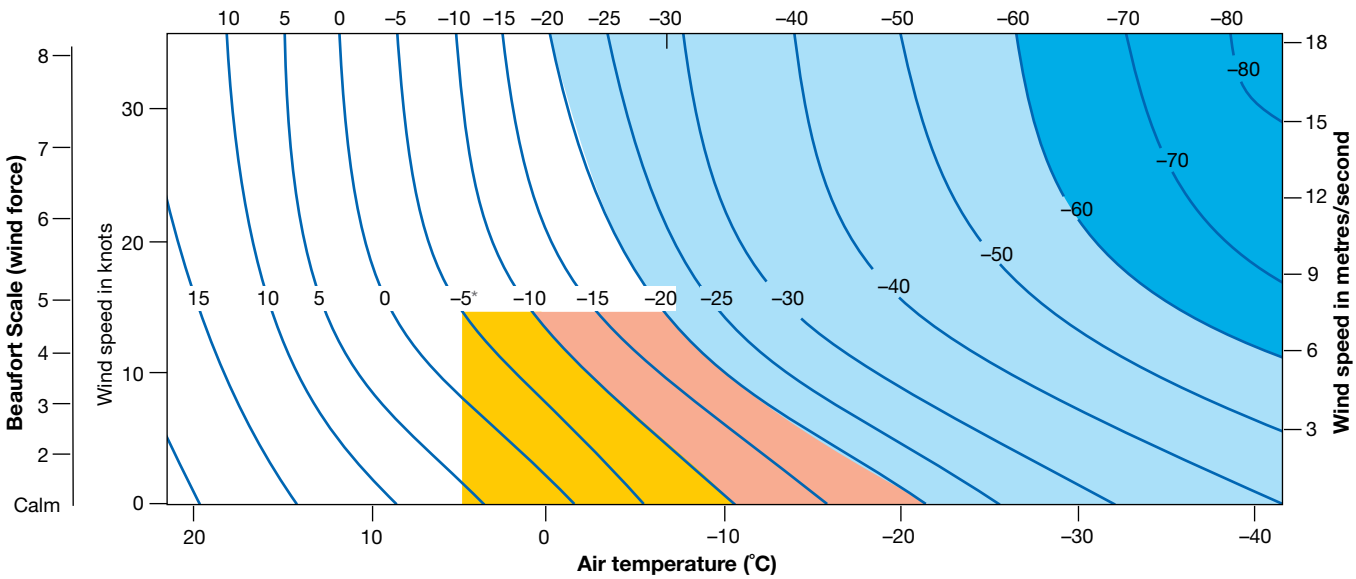
Environmental conditions may also place constraints on types of developments. Destinations lacking suitable climatic, geological, floral or faunal attributes are seldom chosen for tourist development. Some complementary natural characteristics are highly desirable, even if a place has a rich history or is unique historically or archaeologically. The construction of amenities and infrastructure alone is usually insufficient for the development of tourism.

Climate conditions

Most outdoor recreational pursuits depend on favourable weather conditions. Air travellers need accurate information on weather conditions, as only a limited range of clothing can normally be taken. A knowledge of the land and sea breezes of coastal areas is essential for the sailor, while a hang-glider is interested in the forecast of mountain winds. An appreciation of potential environmental hazards is basic to the safety of many recreational pursuits, especially in extreme conditions. Figure 8.3.3 shows that strong winds combined with relatively mild air temperatures can be more dangerous for walkers than temperatures well below 0°C under calm conditions.

Resource requirements of tourists by type						
Tourist type	**Climate**	**Natural resources**	**Amenities**	**Cultural facilities**	**Culture and customs**	**Access**
Explorer	Any	Bush Desert Mountains Jungle Polar	None	None	Any	Very remote
Wilderness lover/ anthropologist	Often extreme	Bush Desert Mountains Jungle Polar	None/basic	Only if appropriate to culture	Specifically remote	Remote
Experiential	Any	Any	Good Individual	Museums Festivals Theatre Architecture Sightseeing	Observe and interact	Any
Individual inclusive tourists	Appropriate season	Usually picturesque	Good Individual	Sightseeing	Any	Not too difficult but off the beaten track
Group tourist/ conventioneers	Appropriate season	Any appropriate	Conference centres Group accommodation Attractions	As a 'sideshow'	Most home comforts	Good Reliable
Mass charter	Sun/warmth	Sea and sand	Highly organised	None	As at home	Mass transit
Psychocentric	As at home	None	Clubs Local entertainment	Local	As at home	Local

8.3.2 Resource requirements of tourists by type



*Port Stanley, Falkland Islands in July: Average daytime temperature 4°C. Wind speed 16.5 knots. Equivalent temperature = –7°C

Comfortable for skiing on sunny days—bright sunshine reduces the windchill

Comfortable for skiing on overcast days

Risk of frostbite

Great danger of frostbite (exposed flesh freezes in less than 1 minute)

8.3.3 Windchill chart showing equivalent temperatures

For each tourist activity there is an optimal climate that allows comfortable participation for a maximum number of days each year. This depends on a combination of temperature, humidity, solar radiation, windspeed and visibility. Figure 8.3.4 summarises the characteristics of the major world climatic regions and their significance for tourism. The Mediterranean climate is probably the most agreeable. The tropical zone has great potential, although health hazards pose a major constraint in those regions where living conditions are substandard.

Climate often determines the length and profitability of the holiday season at a resort. For example, in the popular ski resorts of the Australian Alps, the amount of adequate snow cover strictly limits the peak tourist season (although these particular resorts cater for bushwalkers in the off-peak season).

Coasts, mountains and inland waterways are the most popular physical features for tourist development.

World climatic regions and tourism

Climate region	Physical characteristics	Significance for tourism	Examples of areas
Tropical trade wind and equatorial climates	■ Moderately high temperatures and high humidity year round ■ No real 'dry season' ■ Onshore winds have some cooling effect on island and windward coasts ■ Lush vegetation, including rainforest	■ High effective temperatures discourage strenuous activity ■ Warm water temperatures year-round encourage beach tourism	Islands of the Caribbean, South Pacific and Indian Ocean, and the Amazon Basin
Tropical wet–dry climate	■ Much greater seasonal differences, especially in rainfall ■ A long dry season often divided into the 'cool dry' (warm days and cool nights) and the 'hot dry', where the heat is usually associated with low humidity ■ The rainy season typically lasts from June to November in the Northern Hemisphere and from December to May in the Southern Hemisphere ■ Savanna grassland typical of many areas	■ Dry seasons may be suitable for sightseeing, safaris and beach tourism ■ In rainy season, high effective temperatures deter tourists and storms may disrupt communications	India, Gambia, Zambia, central–west Brazil, and northern Australia
Dry climate	■ Little or no rainfall ■ High daytime summer temperatures, but low humidity except in some coastal areas, such as the Persian Gulf ■ Intense solar radiation ■ Nights are much cooler and can be very cold in winter in mid-latitude interior locations, such as central Asia	■ Abundant sunshine favours outdoor recreation most of the year ■ Major problems include water supply, dust storms and extreme summer heat	Egypt, south-west United States, Central Australia and Namibia
Mediterranean climate	■ Warm–hot dry summers, cool winters with moderate rainfall ■ Abundant sunshine	■ Particularly favourable, permitting beach tourism for most of the year	Majorca, Southern California, Cape Town and Central Chile
Warm temperate humid climate	■ Warm–hot humid summers. Abundant rainfall, especially in summer ■ Cool winters, subject to occasional cold spells in some areas	■ High effective temperatures in summer may deter active recreation ■ Suitable for watersports most of the year	Georgia (United States), Republic of Georgia, South China, New South Wales and Uruguay
Cool temperate climate	■ Rather cool summers ■ Abundant rainfall year round ■ Weather highly variable ■ Mild–raw winters, windy on exposed coasts and uplands	■ Beach activities comfortable only during the summer months ■ Favours the more strenuous types of outdoor recreation ■ All-weather indoor facilities desirable	British Isles, Vancouver Island, South Island of New Zealand and Southern Chile

8.3.4 World climatic regions and tourism

Technological change

One of the most important variables affecting tourism is technological change. In the nineteenth century, industrial technology was the prerequisite for tourism, providing steam power for mass transport by road and sea. In the twentieth century, transport technology for air, road and off-road vehicles allowed the spread of mass tourism to destinations more widespread than those that could be reached by rail or ship.

From private vehicles, through to cruise ships and aircraft, competition among manufacturers is constantly developing the capabilities of vehicles in terms of their size, seat capacity, speed, range, fuel efficiency, noise level and passenger comfort. Such developments affect the profitability of operations, and can also influence consumer choice. Developments in transport will continue to determine which destinations can be reached within acceptable time and cost constraints.

DID YOU KNOW?

It is estimated that world traffic volume will increase from its current 25 trillion km annually to exceed 100 trillion km by 2050.

Climate region	Physical characteristics	Significance for tourism	Examples of areas
Mid-latitude continental climates	■ Pronounced seasonal changes ■ Warm humid summers with moderate rainfall ■ Cold winters with snow cover for several months, but weather is usually calm and settled ■ Large areas of coniferous forest in the north	■ Summers suitable for outdoor recreation ■ Winters suitable for skiing and other snow-based activities	Sweden, Ontario and Hokkaido
Cold marine climate	■ Cold and damp, no real summer, raw winters ■ Overcast skies and strong winds prevalent year round	■ Generally unfavourable for recreation, but rich bird and marine animal life attracts naturalists	Aleutian Islands and South Georgia
Subarctic and polar climates	■ Cold and dry ■ Period of summer warmth brief or absent, despite long hours of daylight ■ Very cold winters with excessive windchill and long hours of darkness ■ Low precipitation ■ Tundra with much surface water in summer due to poor drainage ■ Mountainous areas, as in Greenland and Antarctica, are permanently ice-covered	■ Permafrost inhibits construction of tourist facilities, while frequent blizzards and 'white-outs' result in high transport costs ■ Scope for adventure holidays involving a high degree of preparation: dog sledging, skiing and hunting in late winter and spring ■ Canoeing and fishing possible in more favoured areas in summer	Baffin Island, Spitzbergen and Northern Alaska
Highland climates (mountains and plateaus above 1500 m)	■ Altitude main factor, but great differences in temperature between sunlit and shaded locations ■ Intense ultraviolet radiation, low humidity and absence of dust and pollen at high altitudes ■ Interesting plant and animal life	■ Attracts a wide spectrum of recreationists, including trekkers, climbers and naturalists ■ Above 4000 m the thin air may restrict strenuous activities ■ In tropical countries mountains give relief from the heat of the lowlands (for example, the health resorts of India and Malaysia) ■ In middle latitudes a reliable snow cover at altitudes of 1500–3000 m encourages development of ski resorts	Bolivia, Ethiopia, Tibet, Colorado and the Alps

Source: B.G. Boniface and C.P. Cooper, *The Geography of Travel and Tourism*, Heinemann, 1999

What is the aim of travelling?

By H. Apter

What is the aim of all this travelling? Each nationality has its own different one. The Americans want to take photographs of themselves in: (a) Trafalgar Square with the pigeons, (b) in St Mark's Square, Venice with the pigeons and (c) in front of the Arc de Triomphe, without the pigeons. The idea is simply to collect documentary proof that they have been there ... If you meet your next door neighbour in the High Street [that is, at home in your local main street] or at your front door you pretend not to see him, or at least, nod coolly; but if you meet him in Capri or Granada, you embrace him fondly and stand him a drink or two; you might even discover that he is quite a nice chap after all and both of you might just as well have stayed at home.

H. Apter, 'Counting the social cost of tourism, part 1', The Travel Agent, 16 December 1974

The development of wide-bodied, long-haul jets was a major impetus to the growth of tourism. When the first generation of Boeing 747s appeared in the early 1970s, they made a significant difference to cost of travel, opening up the market for long-haul leisure travel. It made possible the rapid expansion of tourism into the Pacific region and other parts of the world that were previously too far removed from the wealthy tourist-generating countries of the developed world. The next generation of super large planes such as the Airbus 380 proved uneconomic if they were not full and long-haul flights have since favoured smaller, more efficient planes such as the Boeing 777 and Boeing 787 Dreamliner.

The next major technological advance in air travel will be the introduction of new supersonic jet aircrafts.

Social influences

Leisure and tourism are important elements when considering quality of life. Tourists typically assert that they want peace, change and something totally different from everyday life. Tourism for many people is a 'pressure valve' for modern life—used simply to restore physical and mental powers and overall wellbeing. For other travellers, replacing the known with the unknown and seeing different places, people and cultures may be a means of self-realisation.

Participation in tourism, for whatever reason, is affected by a number of demographic and social factors, such as age distribution, family life cycle, level of education, occupation structure and population concentration. While these characteristics have changed only gradually in the past, demographic and social changes should profoundly affect the propensity of populations to indulge in tourism in the future.

An important reason for the explosion in global tourism is the world's changing demographics. Increasing life expectancy means that there is a growing proportion of the population over the retirement age. The baby boomers are travelling now more than ever and are most active in spring and summer when it is warmer. They seek easily accessible destinations and hassle-free experiences, especially those that they can tick off their bucket list.

Millennials have become the largest generation to date and are now one of the most important demographics in tourism. By 2017, they were the largest market in global travel. Having grown up in the Digital Age they are tech savvy and are used to accessing all available options and apps on an electronic device. They use online reviews and social media to research destinations and subsequently book their trips and tours online. Having settled on a destination, millennials seek a full cultural immersion by visiting local hotspots, pursuing action and adventure activities and sampling the local cuisine. Millennials also seek to combine travel with remote working.

SPOTLIGHT

Remote working and digital nomadism

'Remote working' (see Figure 8.3.5) is the new millennial dream and many are embracing digital nomadism to fuel long-term travel. Twenty-first century workers celebrate flexibility, with many opting to go freelance, build an online business or work remotely for companies that allow it, giving them the freedom to become location-independent.



8.3.5 Tech savvy millennials seek the freedom to work remotely.

This urge to move, as often as once every three months, and not be rooted to a single location has also fuelled the growing trend of co-living and co-working spaces, where customers pay according to how much time they spend in these hybrid spaces. Digital nomads also tend to set up their base in cheaper destinations with a strong digital infrastructure like Bali and Ho Chi Minh City.

With digital nomadism comes the luxury of slow travel, where travellers get to explore a destination in-depth and build relationships with the local community. Digital nomads are mostly seasoned travellers and tend to stay away from the more popular tourist destinations.

Nicole Kow, Travel Trend Report, 2017. Trekksoft

Economic factors

For many countries, tourism is by far the biggest source of foreign exchange. It is among the strongest performing sectors of the global economy. In 2017, Australia was making more money selling tourism services to foreigners than from exporting coal. Annualised tourism exports of A$47 billion, based on September quarter figures, were greater than rural exports at A$42 billion and coal at A$41 billion, with iron ore still being the biggest export. By 1991, travel and tourism surpassed agriculture for the first time in the United States as the country's major export industry, and in 2016 its direct contribution to GDP was US$503.7 billion.



8.3.6 Tourists relax on the beach in Phuket, Thailand. Tourism is seen by many developing countries as a means of promoting economic development.

Tourism is a major source of employment, with large numbers of people working in the provision of accommodation, catering, transport, entertainment, other service industries and the souvenir trade. There is also an enormous amount of productive activity generated indirectly by tourism. Tourism is now seen as an important instrument for facilitating economic growth because of the wider multiplier effects it has throughout the rest of the economy (see Figure 8.3.6).

The changing economic circumstances of countries largely determine the size of the tourist industry. Figure 8.3.7 summarises how the stages of economic development impact on tourism.

The more developed an economy, the greater the levels of tourist demand. The rise in incomes in both developed and developing countries has brought travel within the reach of an increasing number of people. The Chinese lead an influx of tourists from the emerging economies of Asia, and Australia is a popular destination. Foreign travel especially has a relatively high-income elasticity of demand, where increases in national income result in more than proportionate increases in the demand for international travel.

Economic development and tourism

Economic stage	Some characteristics	Examples
Traditional society ■ Long-established land-owning aristocracy, traditional customs, majority employed in agriculture ■ Very low output per capita, impossible to improve without changing system ■ Poor health levels, high poverty levels	**The undeveloped world** ■ Economic and social conditions deny most forms of tourism	Much of Africa and southern Asia
Preconditions for take-off ■ Innovation of ideas from outside the system ■ Leaders recognise the desirability of change **Take-off** ■ Leaders in favour of change gain power and alter production methods and economic structure ■ Manufacturing and services expand	**The developing world** ■ From the take-off stage, economic and social conditions allow increasing amounts of domestic tourism (mainly visiting friends and relatives) ■ International tourism is also possible during the drive to maturity	South and Central America*; and parts of the Middle East* and Asia
Drive to maturity ■ Industrialisation continues in all economic sectors with a switch from heavy manufacturing to sophisticated and diversified products		Iberian Peninsula; Mexico; and parts of South America
High mass consumption ■ Economy now at full potential, producing large numbers of consumer goods and services ■ New emphasis on satisfying cultural needs	**The developed world** ■ Major generators of international and domestic tourism	North America; western Europe; Japan; Australia; and New Zealand

* Countries that are members of the Organisation of Petroleum Exporting Countries (OPEC) are a notable exception in these regions. Examples include Algeria, Libya, Nigeria, Iran, Iraq, Kuwait, Saudia Arabia, Ecuador and Venezuela.

Source: B.G. Boniface and C.P. Cooper, *The Geography of Travel and Tourism*, Heinemann, 1999

8.3.7 Economic development and tourism

Activities

Understanding the text

1 Explain how environmental conditions influence the spatial pattern of tourism.

2 Outline how the developments in transport technology have shaped the growth of tourism.

3 Outline how demographic factors have affected tourism.

4 Outline the economic importance of tourism.

5 Explain how the changing economic circumstances of countries influence tourism.

6 Explain the role of culture as a motivation for travel.

7 List the three forms of culture that attract tourists.

8 Outline the ways in which governments influence tourism.

Working geographically

9 Study Figure 8.3.1 and list the features of the biophysical environment that tourists may find attractive in each.

10 Select one of the types of tourists shown in Figure 8.3.2 and list what their requirements might be at a specific tourist destination in Australia.

11 Study Figure 8.3.3.

- a Describe the climatic conditions that are regarded as comfortable for skiing on overcast or on sunny days.
- b Under what climatic conditions is there a great risk of frostbite?

12 Study Figure 8.3.4. Identify the climatic region most suited for:

- a winter snow-based activities
- b trekking and climbing
- c watersports throughout the year
- d beach tourism for most of the year
- e safaris and beach tourism during the dry season
- f year-round beach tourism.

13 Study Figure 8.3.7 and write a short-answer response outlining the relationship between economic development and the growth of tourism.

Cultural influences

Features of historical or cultural interest exert a powerful attraction for many tourists. For example, the drawing power of Stratford-on-Avon because of its association with Shakespeare, or of Petra with its magnificent rock cut temples, or the incomparable pyramids of Egypt. Antiquities, famous ruins, castles and cathedrals, temples and stately homes, art galleries and music festivals all claim their pilgrims. Relics of the past, whether glorious or inglorious, exert a strong fascination.

Many Americans, Canadians and Australians visit Europe because of its historical heritage, and of course many perceive Europe as their ancestral homeland and harbour a sentimental attachment to it. Visitors to Paris, London and Rome are drawn by the historical associations and traditions, the pageantry and entertainment and many cultural attractions.

Three major forms of culture have been identified as attracting visitors:

- **Forms of culture that are inanimate or do not directly involve human input:** These include unique architecturally significant and historical buildings and monuments.
- **Forms of culture that are reflected in the normal daily life of a destination:** This involves visiting other people to observe their social, economic and leisure activities in an attempt to understand their religion, ideologies, customs and lifestyle.
- **Forms of culture that are especially animated and may involve particular events or depict historic or famous occurrences:** Examples include music festivals, festivals reflecting old traditions and behaviour, and re-enactments of old battles.

Contacts of this kind can have beneficial effects, but they may also have negative impacts on locals and their culture. Native cultures and traditional ways of life may be weakened or even destroyed by the impact of tourism. As some tourist destinations develop, the host community may come to resent tourists as outsiders. Crime, gambling and prostitution may emerge as social problems. Even the commercialisation of cultural artefacts, identity and performance may result in undesirable cultural change.

Political influences

Governments at all levels and of all political persuasions have recognised that while tourism is basically a private sector activity, its impact on local communities, regional and national economies and international relationships requires government involvement. It can be a lucrative source of revenue.

The extent to which a government becomes involved in tourism depends on its philosophical approach, the role of planning in the economy, and the breadth of its economy and dependence on certain industries. It also depends on the accumulated impact of development on the physical and cultural environment.

Whatever the extent of their involvement, governments profoundly influence the economic climate in which tourism operates. Governments largely determine expenditure on the infrastructure that travellers utilise, such as roads, railways and airports. Political factors directly affect the business side of tourism. Generally this occurs through labour regulation, taxation policies, foreign investment policy, visitor entry requirements, land zoning and consumer protection. Increasingly, governments are formulating national strategies for tourist development or incorporating tourism into broader development policies.

In Western democracies, the government's principal role in tourism is to foster the development of an environment in which the industry can prosper, consistent with its broad economic, social and environmental considerations. This involves promoting the development of a dynamic and competitive industry that contributes to economic wellbeing, an enhanced quality of life and a sustainable natural and cultural heritage.

SPOTLIGHT

The Silk Road heritage

The Western Silk Road Tourism Development Initiative involves collaboration between the United Nations World Tourism Organization (UNWTO) and the European Union. It is designed to revitalise the Silk Road heritage from the Caspian and Black seas to the Western Mediterranean basin. (See Figures 8.3.8 and 8.3.9.)

The Silk Road is an extensive network of trade routes extending over 12 000 kilometres and dating from 200 BCE to the fourteenth century. It was used for trade between the ancient empires of China, India, Persia and Rome and derived its name from the lucrative trade in silk and horses which were the main commodities exchanged. The Silk Road became the first bridge between East and West and was central to cultural interaction as philosophies, ideas, religion and technologies were shared.

The Western Silk Road Tourism Development Initiative aims to maximise the benefits of tourism development for local Silk Road communities, while stimulating investment and promoting the conservation of the route's natural and cultural heritage. Additionally, it is working to foster greater co-operation between Silk Road countries and regions, with the established aim of creating a seamless and memorable Silk Road travel experience in a unique set of destinations. Visitors are able to follow in the footsteps of some of the world's most renowned explorers such as Marco Polo and Alexander the Great.

As expressed by UNWTO Secretary-General, Taleb Rifai, 'in present times, and building upon a natural and cultural wealth spanning thousands of years, we are in a position to reject harmful global tendencies and revive a route capable of transforming the way we think about and relate to travel'.

Source: World Tourism Organization (UNWTO)



8.3.8
A wide range of the handmade carpets, traditional knotted Uzbek silk rugs, embroidered tablecloths and bed linen in a small bazaar, Khiva, Uzbekistan, Central Asia



8.3.9
The ancient Silk Road with modern cities and countries

UNIT 8.4

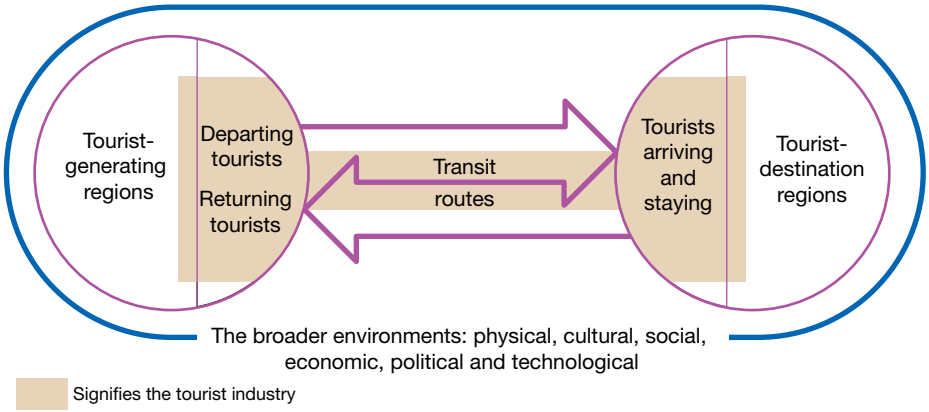
Tourism: production and consumption

Tourism as a productive activity consists of three major components: the country of origin of the tourists, the tourist destinations themselves, and the routes travelled between these locations. Figure 8.4.1 illustrates the place of tourists in the broader environment and Figure 8.4.2 expands on the types of activities involved in tourism.

Tourism-destination areas attract tourists by offering what isn't available at home. The activities found in these areas include accommodation, retailing and service functions, entertainment and recreation.

Transit routes link these two areas of economic activity and are a key element in that their efficiency and characteristics shape the size and direction of tourist flows. Transit routes represent the main transport component of productive activity.

As tourists travel, they acquire an experience made up of many different parts. Some of these are tangible, such as accommodation and souvenirs purchased. Some are intangible, such as the thrill of white-water rafting, the tranquillity of a rainforest and the appreciation of fine works of art. These many activities are, however, extremely interdependent. One cannot have the experience of white-water rafting without having travelled to an appropriate river, or having somewhere to eat and stay.



8.4.1 The place of tourism as a productive activity in the broader environment

The types of activity involved in tourism
Tourism resources
■ Natural resources
■ Human resources
General and tourism infrastructure
■ Means of communication and travel
■ Social installations
■ Basic installations
■ Telecommunications
Receptive facilities
■ Hotels, guesthouses, towns and villages
■ Condominiums
■ Complementary residences
■ Residences for receptive personnel
■ Food and beverage installations
Entertainment and sports facilities
■ Recreational and cultural facilities
■ Sports facilities
Tourism reception services
■ Travel agencies
■ Hotel and local promotional offices
■ Information offices
■ Car hire
■ Guides and interpreters

8.4.2 The types of activity involved in tourism

A complex set of industries is involved in the supply of goods and services to tourists. A large number of small, independent firms tend to operate alongside a few large, multinational corporations.

The nature of production is distinctive in that the quality of labour at the point of service is vital. Tourism is distinguished from other economic activities, such as agriculture and manufacturing, by the degree to which consumption occurs at the point of production. Tourism services are delivered directly to the consumers while on holiday. While souvenirs and other goods may be bought to take home, most of the goods and services demanded by the tourists are consumed in situ, in the places where they are offered or produced. Accommodation, food consumption and entertainment clearly illustrate this. A lot of the consumption also takes place en route to the destination area.

Activities

Understanding the text

1 Outline the nature of the three components of tourism.

2 Describe the nature of the firms involved in tourism.

3 State what distinguishes tourism from other forms of productive activity.

Working geographically

4 Study Figure 8.4.2. Working in groups, identify the range of occupations associated with each type of tourist-related activity.

UNIT 8.5

Tourism: changing production processes

The growth of tourism throughout the twentieth century was closely associated with rising living standards in the developed world. In the first half of the twentieth century the opportunity to travel remained largely the privilege of the wealthier groups in society. It was the period of rapid economic growth that followed World War II and the introduction of paid holidays that enabled lower income groups to travel more extensively. The motorcar and the aircraft superseded the railway and the steamship as the main means of transport soon after the middle of this century. New forms of accommodation, the emergence of tour operators, the marketing efforts of tourist organisations and the growth of associated businesses that provide tourist services were a response to this rapid growth of the tourist market.

A number of important changes are associated with the development of this industry. They are discussed in the following sections.

Internationalisation of tourism

As with other forms of economic activity, tourism has become globalised. Technological advances, particularly the increasing ease of international communications, have made travel safer, more comfortable and more accessible. The global transportation infrastructure is rapidly becoming 'a seamless, interconnected pathway' to all parts of the world. As air travel becomes more affordable and more accessible, travellers are no longer limited to the shorter distances that can be covered on land.

The level of globalisation has increased as more and more countries participate in international travel: tourists from Japan, Europe, North America, China, Australia and New Zealand have become increasingly internationalised. At the same time, the range of destinations of mass tourism has increased and now encompasses almost all countries in the developed world and many in the developing world. The collapse of communism in the late 1980s also made the borders of nation-states more porous.

The most significant development in the internationalisation of tourism in the last decade has been the emergence of China as the number one source market for outbound tourists since 2012. With the increasing prosperity of the Chinese middle class, the growth of outbound travel from China has benefitted several countries in the Asia Pacific region as well as long-haul destinations such as Europe and North America.

DID YOU KNOW?

It is estimated that in 2016, Chinese travel agencies organised more than 50 million tourists to travel overseas, many of whom joined a group. Among the 122 million outbound tourists, group travellers accounted for 40%, and individual travellers accounted for 60%.

Organisational developments

Organisation is the framework within which tourism operates. It is concerned with the structures, issues and approaches that relate to this type of productive activity. The organisation of tourism comes from two sources: the government or 'official' organisation, and the private sector.

Government

Governments at all levels and of all political persuasions have recognised that while tourism is fundamentally a private-sector activity, its impact on local communities, regional and national economies and international relations requires government involvement. Recognising the contribution tourism makes toward a country's economic and social wellbeing, nearly all governments have established national tourism organisations to promote tourism within their countries. The extent of their responsibilities vary, with some geared only towards international promotion and marketing, while others become involved in regulation and promotion of the industry domestically.

DID YOU KNOW?

Airbnb is an online marketplace and hospitality service where a person can make available a room, an apartment or a house to guests for short-term rental. Airbnb receives a commission from both the guests and the hosts for each booking. In 2017, three million lodgings were listed in 65 000 cities across 191 countries.

Private sector

Tourism in the private sector is characterised not only by a wide variety of economic activities supplying passenger carriage (or travel), accommodation, amenities and attractions, but also a range of different types of enterprises. The opportunities that exist in tourism give rise to a mix of large-scale and small-scale operations. These range from individuals renting out their lodgings to guests through Airbnb and sole proprietorships selling souvenirs or handicrafts to tourists, to large multinational corporations catering for all tourist needs from origin to destination. There has also been a significant growth of corporate involvement in tourism.

Types of activity that are less demanding in terms of capital, know-how and entrepreneurial skill can be handled by a small business. Capital-intensive, large-scale operations have a relatively long 'pay-back' period (a return for the capital invested) and require high levels of technical and managerial expertise. In the accommodation sector, camping grounds, bed-and-breakfast establishments and motels lend themselves readily to individual owner operation, while large hotel groups usually involve corporate ownership. Airline operations are usually the preserve of major companies, while transportation at destinations is often handled by small-scale owner drivers. In developed countries, domestic tourist travel is overwhelmingly by private car. In the attractions sector, perhaps the most varied of all, niches exist for a wide range of entrepreneurs, from the local hirer of motor scooters to major island resorts and theme-park operators.

While the range of opportunities has fostered the participation of small-scale operators, profit motives have encouraged moves towards large-scale operations and corporate control. Some of this has followed technological advances. The transition from DC3 aircraft to the aviation giants, Boeing 747-8 and the Airbus A380, not only reduced the relative cost of travel, but also contributed to the emergence of large-scale tour operators who could afford, and were able to exploit, these changes. Much of the growth in large tourism companies arises from the very competitive nature of many tourist markets and destinations and a drive for a greater market share and economies of scale.

Changing consumer products and markets

The past few decades have seen a marked shift towards active holidays. An increasing ease of international communication has played a part in generating consumer tastes in world travel. Changing social patterns have prompted new tastes in holidays to cater for those whose sedentary occupations encourage more energetic experiences. There is a trend towards 'experience-orientated' holidays with an emphasis on action, adventure, fantasy, nostalgia and exotic experiences (see Figure 8.5.1).



8.5.1 Swimming with whale sharks in Mexico: Many tourists are opting for 'experience-oriented' holidays.

Activities

Understanding the text

1. Name the three major factors responsible for the emergence of tourism as a major productive activity.
2. Outline the developments in the post–World War II period that contributed to the growth in global tourism.
3. Identify the factors that have contributed to the internationalisation of tourism.
4. Outline the ways in which governments influence tourism.
5. Describe the relationship between the type of tourist activity and the scale of the tourist operator.
6. Explain how consumer tastes in holidays have changed in recent times.

Working geographically

7. Visit a local travel agent. Examine the range of technologies used to support the agency's activities. Ask the agent to comment on any changes in consumer behaviour regarding the type of tour packages purchased, the frequency and duration of travel, and the sensitivity of consumers to things such as the level of domestic economic activity and the perceived threat posed by different destinations.
8. Investigate a selected tourist destination. Check what bookings can be made using the internet. Compile a list of the types of information you can access.
9. Investigate an adventure tourism experience. Check what bookings can be made using Airbnb.

CASE STUDY

Surge in Chinese tourism

Chinese tourists are becoming increasingly interested in overseas travel. Their rising incomes have funded this and it has also become much easier for Chinese passport holders to travel abroad. By 2017, China had signed visa exemption and visa-on-arrival agreements with 61 countries.

China has maintained its position as the source of the world's largest number of outbound tourists since 2012. This continued growth is evident in Figure 8.5.2. In 2016 the number of outbound tourism in China reached 122 million people, and Chinese visitors spent US$109.8 billion in overseas destinations. The top destinations visited by Chinese tourists is shown in Figure 8.5.3.

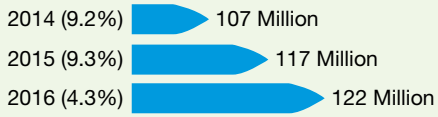
As the air pollution problem in China has been serious, clean air and a natural environment have become important considerations in choosing destinations (see Figure 8.5.4). Sunny beaches with fresh air have attracted increasing numbers of Chinese visitors. Island travel accounted for 30 per cent of the total outbound travellers in 2016; see Figure 8.5.5.

Family tours are very popular with Chinese travellers. In 2016, Universal Studios in Singapore, The London Eye, and Universal Studios in Los Angles were among the top 10 most popular family attractions (see Figure 8.5.6). The Metropolitan Museum of Art in New York, Musée du Louvre in Paris, Vatican Museum, and the British Museum were listed as the top 10 most popular foreign museums by Chinese tourists in 2016 (see Figure 8.5.7). Nowadays, medical tourism has become more popular among Chinese tourists. Wealthy Chinese people spend huge money on medical tourism (see Figure 8.5.8).

China's outbound tourists are still less than 10 per cent of the country's total population, and only 10 per cent of the population hold passports, which suggests huge potential in China's outbound travel market.

Source: World Travel Online

Number of Chinese outbound tourists



8.5.2 The number of Chinese outbound tourists

The most popular destinations of Chinese tourists, 2016

1	Thailand
2	South Korea
3	Japan
4	Indonesia
5	Singapore
6	United States
7	Malaysia
8	Maldives
9	Vietnam
10	Sri Lanka

8.5.3 The most popular tourist destinations of Chinese tourists



8.5.4 The natural attractions of Australia draw Chinese tourists.

Island destinations popular with Chinese tourists

1	Phuket
2	Bali
3	Jeju
4	Okinawa
5	Boracay
6	Maldives
7	Sabah
8	Nha Trang
9	Saipan
10	Sri Lanka

8.5.5 Island destinations popular with Chinese tourists

Family attractions that draw Chinese tourists

1	Disneyland®, Hong Kong
2	Ocean Park®, Hong Kong
3	Universal Studios Singapore™
4	Universal Studios Hollywood™
5	The London Eye
6	Universal Studios Japan™
7	Disneyland, Tokyo
8	Taipei 101
9	Lotte World
10	Burj Khalifa Tower

8.5.6 Family attractions that draw Chinese tourists

Foreign museums popular with Chinese tourists

1	Metropolitan Museum of Art
2	Musée du Louvre
3	Vatican Museum
4	The British Museum
5	The Uffizi Gallery
6	National Museum of Marine Biology and Aquarium in Kenting, Taiwan
7	Dubai Museum
8	Teddy Bear Museum, Jeju
9	Play Kpop Museum, Jeju
10	National Air and Space Museum, Washington DC

8.5.7 Foreign museums popular with Chinese tourists

Countries chosen by Chinese tourists as medical tourism destinations

1	Japan
2	South Korea
3	United States
4	Taiwan
5	Germany
6	Singapore
7	Malaysia
8	Switzerland
9	Thailand
10	India

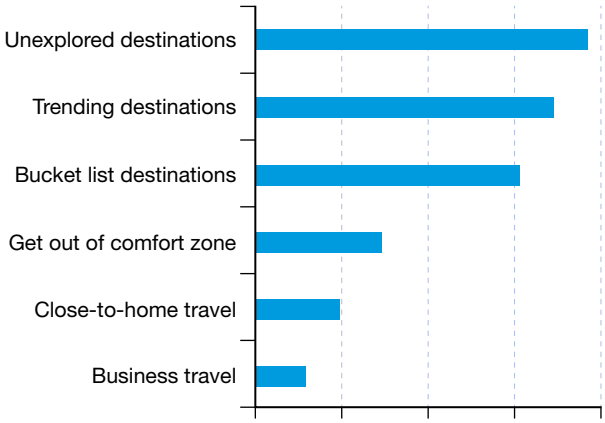
8.5.8 Countries chosen by Chinese tourists as medical tourism destinations

UNIT 8.6

Tourism: changing consumption patterns

Perhaps more than any other economic activity, tourism is driven by individual consumer decisions (see Figure 8.6.1). The more competitive the industry becomes, the more influence individual consumers wield each time they celebrate their experiences or air their frustrations on social media.

As more people are exposed through the media to other cultures, languages and environments, the desire to see them first-hand increases. Over time, the manner in which they do this has changed, with a dramatic impact on the nature of the industry.



8.6.1 Reasons for travel

The evolving tourism product

Package tours

The concept of buying transport, accommodation and ancillary services, such as entertainment or attractions, as a 'package' became established in Western Europe in the 1960s. The original demand came from the convenience of buying a single travel product. When airlines recognised that tour operators could fill empty seats, they introduced special fares for operators to incorporate into an all-inclusive tour. As a result, international travel became much more affordable. By the 1970s, the package tour had become a fully-fledged part of global tourism. Its growth led to a 'travel revolution' by lowering the real price of travel, especially when combined with the development of the large long-haul planes that needed to be filled.

Package tours retain their mass appeal with millions of individual consumers, most of whom come from developed countries. Another appeal is that consumers are able to choose a tour group with others their age. Contiki Concept tours, for example, cater for 18- to 35-year-olds worldwide.

The package tour is sold for an all-inclusive price, usually significantly lower than could be obtained by booking the transport and accommodation components separately. This brings holidays abroad within the reach of a much larger section of the market. Those travelling overseas, especially for the first time, welcome the security of the tour organiser being responsible for all the arrangements.

Small group tours

For the increasing number of tourists who reject the regimentation of mass-produced package tours, small group tours provide a popular alternative. On most trips the average group size is 16 people, keeping the experience and enjoyment as personal as possible. It is argued that small groups are more environmentally friendly (their effect is less disruptive) and that they promote a better understanding among people of different cultural lifestyles and backgrounds. They achieve this by utilising local resources and services wherever possible.

Individual travel

Many consumers are becoming more selective and are actively planning their own travel experience. Rather than being locked into a group tour, they prefer to individualise their itinerary. The individual's choice will depend on their experience and resources, and the nature of the experience sought.

Today's tourist

Many of today's tourists have travelled before and are therefore deliberate and sophisticated consumers. They know where they want to go, how they will get there and what they want to do once they arrive. Travel agents can no longer herd eager masses of tourists into a chartered air carrier, bus them from one site to another, and determine what restaurants they patronise. Experienced travellers seek to fulfil specific desires rather than absorbing as much as possible in the available time.

In the last 10 years, tourists to Europe have been less inclined to engage in a 'whirlwind' tour of as many countries as possible on a single, extended holiday. Instead they are opting for shorter holidays in individual regions or countries, giving more time to experience their destination. These changes reflect the travellers' increasing desire for new and different experiences. The specialised demands of the experienced traveller have created an enormous demand for specialty trips. Tourism as an economic activity has responded.

Adventure travel

Once the domain of the hard-core athlete, adventure travel has emerged as a popular reason to travel. Authentic adventure experiences, often with elements of real or apparent danger, are becoming increasingly popular, especially with millennials. Adventure travel experiences range from trekking (shown in Figure 8.6.2), scuba diving, white-water rafting and jet boating to paragliding, parachuting, bungee jumping from bridges or helicopters, and swimming with sharks.

There are a variety of possible explanations for the growing popularity of adventure tourism, including the idea that many people just want to have fun.



8.6.2 Trekking in remote and difficult terrain appeals to millennials seeking adventure.

Cultural and environmental travel

An increasing number of tourists choose to stay longer in a destination and immerse themselves in local customs and routines. They then take away with them memories of a shared experience, not just photographs. Cultural tourism includes educational tours, performing arts events, festivals, pilgrimages, visits to monuments, and the study of nature, folklore and art. The cultural tourist is likely to be someone who enjoys meeting local people and learning about their lifestyle, seeks educational experiences and uses travel for personal growth and a genuine appreciation of others.

Developing culturally geared tourism programs encourages destinations to celebrate and promote the elements that distinguish their communities. In doing so, they provide opportunities for authentic cultural exchange between locals and visitors. An increasing number of countries are recognising that the global appetite for experiencing different environments represents a major economic opportunity. The Brazilian government and American Express Brazil, for example, have spent millions to convince Americans that Brazil is a 'haven for ecotourists' and continue to build their nature-based tourism industry. Similarly, in response to the growing demands by tourists to experience Asian history and culture, Singapore has spent more than US$1 billion to preserve the city's remaining architectural and cultural heritage.

DID YOU KNOW?

Cultural tourism accounts for 37% of global tourism, and is expected to grow 15% each year. With so much interest, more and more destinations are leveraging the uniqueness of their society and investing in cultural tourism programs.

Food tourism

Food tourism is a growing trend. Food has always been closely tied to the culture of a place, but it has become much more than simply dining out when on holidays. Food experiences have evolved into authentic cultural experiences and are even the motivator to visit a particular place. Cooking classes and visits to local markets and farms to source ingredients are being sought by tourists as a way of immersing themselves in the local way of life. Food tourism, shown in Figure 8.6.3, is closely bound to the growing trend of experiential travel.



8.6.3 Participating in cooking classes in an exotic destination to sample and learn how to cook the local food is becoming increasingly popular.

Rural tourism

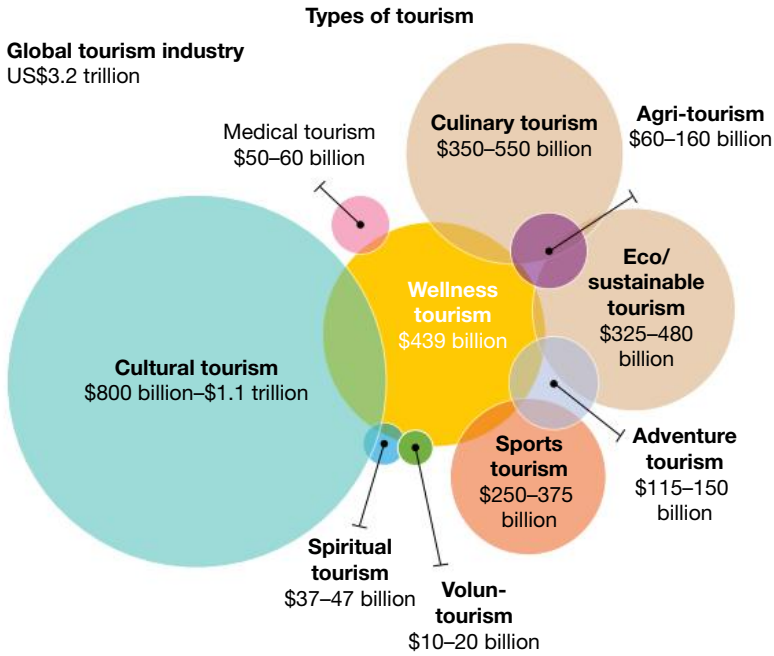
Increasing numbers of domestic and international travellers are showing an interest in holiday destinations outside urban areas. Tourists spending their holidays in the countryside often see it as a retreat from the pressures of urban living and a chance to take advantage of the peace and relaxation that country living can offer. Rural tourism tends to be informal and unstructured; travel agents and tour operators play little if any role and transport is mainly by private car.

In Europe, tourists can seek bed-and-breakfast accommodation, rent a cottage or camp on the farmer's land. In the United States, farm tourism takes the form of dude ranches, concentrated in the west, and vacation farms, found mainly in the east. Such tourist developments are characterised by small-scale, independent operators. The attraction for the farmer is that it offsets falling income from agriculture and makes use of underutilised resources, and they often enjoy the visitors' company.

While farm tourism depends largely on individual initiatives, in many countries farmers are supported by their governments. France, for example, has a well-instituted national federation of *gîtes*, which not only provides advice and assistance to the farmer, but also operates a national register of approved properties and a centralised booking system.

Growing market diversity

As the world economy integrates and the global society becomes more homogeneous, people are more likely to travel to express their individuality. Some will continue to follow the high-volume, large-scale tourism paths, but others will increasingly seek individualised experiences. Consumer tastes and preferences will profoundly influence the evolving tourist product and the directions this global productive activity will take. Figure 8.6.4 demonstrates the diversity of the global tourism industry.



8.6.4 The global tourism industry (in $US)

Activities

Understanding the text

1 Explain why the individual consumer has become so important within the tourism industry.

2 Explain what a 'package tour' is. Why have they become so popular?

3 Outline the impact that package tours have had on international travel.

4 Explain why small group tours and individual travel have become more popular.

5 Outline the ways in which today's tourists are becoming more sophisticated. How has this impacted on tourism?

6 Define adventure travel. What type of activities does it include?

7 Outline the cultural motivations for travel.

8 Explain why there is a growing interest in rural tourism. What types of experiences are available?

Working geographically

9 Study Figure 8.6.4 and answer the following questions.

- a Rank the order of the types of tourism from largest to smallest.
- b Calculate the percentage of global tourism undertaken for cultural reasons.
- c By how much do receipts from eco/sustainable tourism exceed that of adventure tourism?

10 Study Figure 8.6.4. Prepare a report describing each of type of tourism shown in the diagram, indicating the people who are inclined to undertake it and the destinations that are popular.

11 Using travel brochures or advertisements from newspapers and the internet, collect examples of package tours, small group tours, adventure travel, cultural and environmental travel, food tourism and rural tourism.

UNIT 8.7

Tourism: ownership, decision-making and control

While the diversity of opportunity in the tourism industry has encouraged the participation of small-scale operators, the profit motive has encouraged development of large-scale operations and an increase in the size of the companies involved. Much of the growth in large companies arises out of the competitive nature of many tourist markets, the drive for a larger market share, and the advantages of economies of scale.

Increasing the scale of production

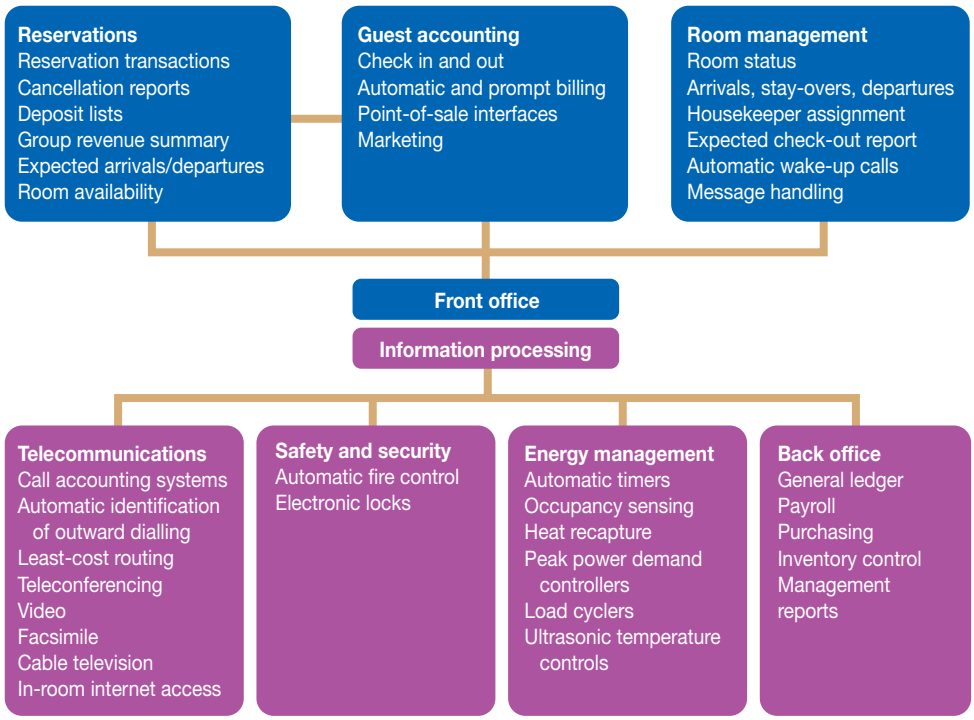
Increasing scale is especially evident in the accommodation sector. Marriott International of the United States secured its position as the world's largest hotelier in 2015 when it bought rival hotel chain Starwood for US$13 billion. With the phase of consolidation continuing, a handful of companies hold the keys to millions of hotel rooms throughout the world. In 2006, seven corporate groups owned or operated more than 1000 hotels each and by 2017, five of these controlled over 4000 hotels each. Most groups are United States-based, but InterContinental Hotels Group and Accor are controlled by European investors. This concentration of ownership is illustrated in Figure 8.7.1, and is evidence of the increasing trans-nationalisation of tourism.

8.7.1 Global hotel corporations

Global hotel corporations				
Group	**Marriott International**	**InterContinental Hotels Group**	**Hilton Worldwide**	**Accor**
Corporate HQ	Bethesda, Maryland, USA	Denham, Buckinghamshire, UK	McLean, Virginia, USA	Paris, France
Number of properties	5974	5070	4727	4200
Number of rooms	1 170 367	749 721	775 866	524 955
Luxury brands	■ Ritz-Carlton ■ Bulgari Hotels ■ JW Marriott ■ St Regis ■ Luxury Collection	■ InterContinental Hotels	■ Waldorf Astoria ■ Conrad Hotels	■ Sofitel Legend ■ Sofitel ■ Fairmont ■ Raffles
Up-market brands	■ Renaissance ■ Marriott ■ Delta ■ W Hotels ■ Gaylord Hotels ■ Design Hotels ■ Westin Hotels & Resorts ■ Le Méridien ■ Sheraton ■ Courtyard by Marriott ■ Residence Inn by Marriott ■ Four Points by Sheraton ■ Aloft Hotels	■ Crowne Plaza ■ Kimpton Hotels ■ Hotel Indigo ■ EVEN Hotels ■ Staybridge Suites ■ Holiday Inn Select	■ Hilton ■ DoubleTree ■ Curio Collection	■ Pullman ■ Swissôtel ■ MGallery ■ The Sebel ■ Adagio Premium ■ Grand Mercure
Mid-market brands	■ Fairfield Inn by Marriott ■ Protea Hotels ■ TownePlace Suites	■ Holiday Inn ■ Holiday Inn Express ■ Candlewood Suites	■ Embassy Suites by Hilton ■ Hilton Garden Inn ■ Homewood Suites by Hilton Tru by Hilton ■ Hampton by Hilton	■ Novotel ■ Adagio ■ Mercure
Budget brands				■ ibis Formula 1 ■ Adagio Access ■ Coralia

The scale of operations in the hotel sector continues to expand. The largest groups grew by adding new properties to their portfolio or through the takeover of smaller groups. This does not signal the imminent demise of the small hotel. While the large hotel groups can exploit economies of scale, the small independents can compete on the basis of cost (utilising low-wage family or other labour), individuality or personalised service.

Individuality and personalised service are commodities that can command a premium and allow small establishments to survive in even the most competitive situations. The economies of scale available to companies in tourism are similar to those in other forms of productive activity in terms of the purchase of inputs, the internal division and specialisation of labour, and the utilisation of capital. The latter is illustrated by the application of information technology systems that offer cost reductions and more effective management. Figure 8.7.2 illustrates how information processing is utilised in total hotel management. Information technology is also used where computer reservation systems involve a large capital cost. This means that only the largest chains can participate.

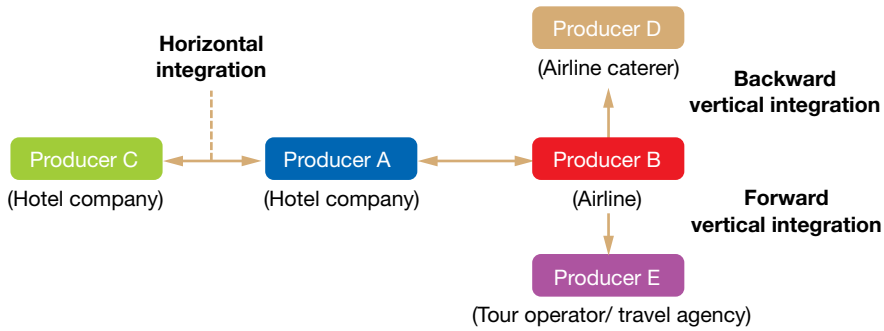


8.7.2 The total hotel management system

There are minimum capital requirements for successful operation in some sectors of the tourism industry. Airline operators, for example, require considerable initial capital outlay to hire or purchase aircraft and supporting infrastructure. Furthermore, to compete in the global market, major investments are required to keep updating the fleet. Smaller companies are incapable of competing, especially if large investments in research and development are required. Against this is the relative ease of entry into areas such as souvenir retailing or the provision of bed-and-breakfast and Airbnb accommodation.

Horizontal and vertical integration

Growth in the scale of operation and increases in the concentration of ownership and control have generally come about through horizontal and vertical integration. Decision-making by a producer, particularly one that is a profit or growth maximiser, would tend to concentrate on three important areas:



8.7.3 Main types of integration in the travel and tourism industry

- the scope for greater economies by increasing the scale of operation
- the ability to control and develop inputs and markets more thoroughly
- the opportunity to operate profitably in related fields.

A business may expand or develop by itself or seek to combine with other businesses. Figure 8.7.3 shows the main types of integration that occur in the travel and tourism industry.

Horizontal integration

Horizontal integration involves expansion within a given sector of the economic activity. For instance, in Figure 8.7.3 producers A and C (probably both hotel-owning enterprises) join, thereby removing competition between each other. They are able to take advantage of economies of scale with centralised management, finance acquisition and purchasing. The greatest value of horizontal integration is in marketing. Consumers can be referred to other hotels within the chain, rather than turning to a competitor. The existence of a familiar, reputable brand hotel in an exotic destination offers customers security—a base from which the unknown can be confidently explored.

Vertical integration

Vertical integration, on the other hand, brings together different sectors of the economic activity within one organisation. In Figure 8.7.3, Producer B (an airline, for example) may wish to secure its inputs, such as catering or airline services, and acquire Producer D. This is known as backward vertical integration. Similarly, to increase its control it may acquire tour operators and travel agencies or hotels, which is forward vertical integration.

Major package tour operators have been especially attracted to the corporate practice of vertical integration. In seeking to gain a competitive advantage and keep prices down, they have become progressively involved in all sectors of tourism, from the market (retail outlets), through the transport sector (control of an airline), to the destination (acquiring hotels and tour bus operators).

Transnational operations

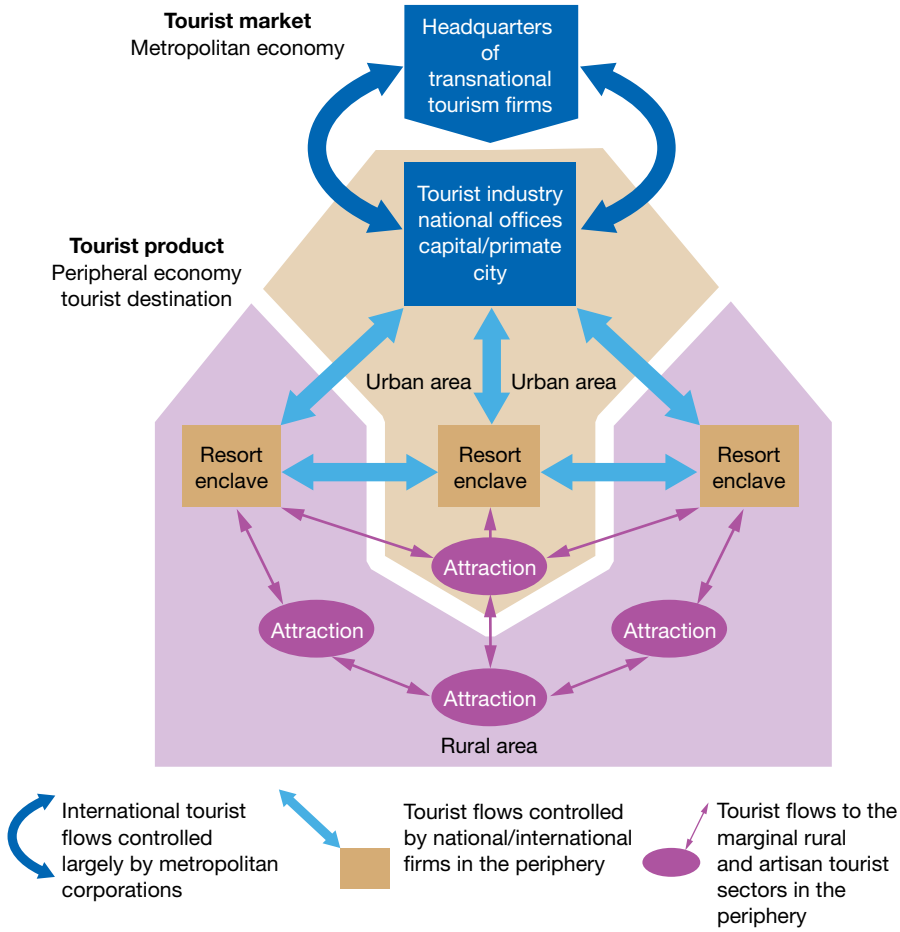
Integration in tourism has continued to the point where operations become multinational or transnational in nature. Marriott International of the United States is the world's largest hotel group. It was founded by J. Willard and Alice Marriott in 1927 when they opened a root beer stand that grew into the Hot Shoppes Restaurant chain. This family run business evolved into today's Marriott International with headquarters in Bethesda, Maryland. It now owns 5974 properties with 1.2 million rooms in more than 122 countries and territories. The group has a portfolio of 30 well-recognised and respected hotel brands—see Figure 8.7.4. It also manages a loyalty program with 100 million members worldwide rewarding customers for staying at a Marriott hotel. In 2016, Marriott International had revenue of US$17 billion.

The pattern of multinational development varies. UK corporations have been most active in Europe, Africa and the Caribbean, while US-based corporations tend to be most active in Asia and Latin America. Japanese corporations are most evident in the Pacific Rim region.



8.7.4 The St Regis is one of the luxury brands of the Marriott International group.

There are a number of reasons for the growth of transnational operations in tourism. Clearly a global market provides greater market potential and opportunities to secure a competitive advantage. Corporations wishing to diversify their portfolio of holiday products, or secure a larger share of the international market, must expand their activities overseas. Figure 8.7.5 shows the spread of corporate control into transnational activities.



8.7.5 The operation of transnational corporations in tourism

SPOTLIGHT

Concentration of ownership and control

The level of concentration achieved in the tourism industry in the future will depend on the relative strength of two opposing forces.

First, the demands of increasingly sophisticated travellers for new experiences and travel products provide opportunities for innovative operators to enter the industry. This could lead to a reduction in the concentration of ownership.

Second, there is the market strength of the big operators. They have the capital to invest in the latest technology and the market share to guarantee its efficient use. Their control of the market is especially evident with supply-led tourism. Increasingly, producers can generate a market by introducing and promoting a specific tourist product. It is common practice for large airlines to advertise a 'lead-in special', offering cheap air fares to a specific location with accompanying savings on accommodation. The touring arm of the corporation is giving special rates to its own accommodation wholesaler, effectively creating its own market. Such practices will undoubtedly lead to more concentration in ownership, control and decision-making in tourism.

Data gathering and industry support

The Brussels-based World Travel and Tourism Council (WTTC) is a coalition of interests from all sectors of tourism. Its stated goal is to convince governments of the enormous contribution of travel and tourism to national and world economic development, to promote expansion of travel and tourism markets in harmony with the environment, and to eliminate barriers to growth of the industry.

The largest tourism-orientated intergovernmental organisation is the World Tourism Organization (UNWTO). It is an agency of the United Nations Development Program. It's membership comprises 157 governments and over 500 affiliate members representing other related organisations. Its role is to promote and develop tourism as a means of stimulating business and economic development, and fostering peace and understanding between countries.

The UNWTO publishes annual tourism statistics. Compilation and analysis of the statistics is complemented by an active research and technical assistance program. The findings are presented at seminars and conferences and through an extensive range of publications that aim to raise the level of technical input into tourism and influence attitudes toward tourism.

SPOTLIGHT

The World Tourism Organization

The World Tourism Organization is the United Nations agency responsible for the promotion of responsible, sustainable and universally accessible tourism. As the leading international organization in the field of tourism, the UNWTO promotes tourism as a driver of economic growth, inclusive development and environmental sustainability and offers leadership and support to the sector in advancing knowledge and tourism policies worldwide.

The UNWTO encourages the implementation of the Global Code of Ethics for Tourism, to maximize tourism's socio-economic contribution while minimizing its possible negative impacts, and is committed to promoting tourism as an instrument in achieving the Sustainable Development Goals, geared towards reducing poverty and fostering sustainable development worldwide.

UNWTO generates market knowledge, promotes competitive and sustainable tourism policies and instruments, fosters tourism education and training, and works to make tourism an effective tool for development through technical assistance projects in over 100 countries around the world.

Activities

Understanding the text

1 Outline the trends apparent in the nature of the firms engaged in tourism. Why have they occurred?

2 Give examples of increasing scale within the accommodation sector.

3 Explain how firms achieve economies of scale in tourism.

4 Explain why it is difficult for smaller companies to compete in some sectors of tourism.

5 Identify the sectors of the industry that will continue to be dominated by small firms. Explain why.

6 Differentiate between horizontal and vertical integration.

7 Identify the factors that have encouraged the development of transnational corporations within the tourism industry.

8 Outline the forces that determine the level of concentration within the tourism industry.

9 Identify the nongovernmental and intergovernmental organisations involved in international tourism. Describe their function.

Working geographically

10 Study Figure 8.7.2 and write a one-page report outlining how information technology is used in the management of a hotel.

11 Study Figure 8.7.3 and write a short-answer response outlining the processes of vertical and horizontal integration.

12 Study Figure 8.7.5 and describe the role played by transnational corporations in the flow of tourists as illustrated by the model.

13 Undertake research to identify examples of vertical and horizontal integration within the tourism industry.

14 Select one of the hotel groups listed below:

- Marriott International
- Hilton Worldwide
- InterContinental Hotels Group
- Accor

Access the group's website. Write a brief report outlining the group's history, size and geographical spread, the market sector that the group targets, and the number and location of hotels that the group operates in Australia.

15 Use the websites of the hotel groups listed above to update the information presented in Figure 8.7.1. Allocate a different hotel group to each member of the class. Share the results of your research.

16 List the hotel groups that operate hotels in Sydney. For those hotels not listed in Figure 8.7.1, use the internet to find out more about the hotel group's ownership and country of origin. Describe the geographical distribution of any additional hotel groups.

UNIT 8.8

Tourism: technological change

Tourism is by far the world's largest commercial service sector of the global economy and among its fastest growing sectors. It is therefore not surprising that it receives substantial research funds to facilitate the development of new technologies. Technological innovations are changing every area of this economic activity.

Consumer choice

Tourist motivation and decision-making are increasingly being shaped by changing technology. In some ways this has made planning a trip even more complicated as increasingly people opt to plan their own trip online, rather than with a travel agent. With so much choice available some people research carefully, with the aim to get the best prices for fares and accommodation. The use of travel apps is also expected to rise and according to Booking.com, 44 per cent of travellers expect to plan their holiday using their smart phone.

While planning a trip, tourists can examine alternative destinations using interactive internet-based technologies. They can view a hotel's facilities, make a reservation and access the websites of the attractions (such as museums, galleries, theatres and theme parks) they may choose to visit.

Similarly, technology is transforming the way people record their experiences. Robust, compact cameras in mobile phones can record and instantly make travel experiences available on social media.

Transport technologies

Technology is advancing faster than ever before, and this is changing both the expectations of tourists as well as the way in which the tourism industry conducts its business. Some of the trends are leading to improvements in the ease of travel while others are changing how businesses are structured and developed as well the infrastructure put in place to service the industry.



8.8.1 The Boeing 777 is the most popular long haul aircraft in the world.

Aircraft

Mass transit by air involves two main types of aircraft: medium range, and long range.

Medium range aircraft

Medium range aircraft service destinations within a continent with a range of around 5000 kilometres. From Sydney, most of South-east Asia can be serviced by aircrafts such as the Airbus A320 and Boeing equivalent the B737. They are workhorses used by low cost carriers of those regional services in high demand. North America, East Asia, the European continent, South Africa and Africa are also serviced by these aircraft.

Long range aircraft

Long range aircraft link together the continents by crossing the oceans. The Airbus A380 and the Boeing 747-8 were released in 2005, and could carry 555 passengers in a three-class configuration. However, these super large planes were not efficient unless they were full and this was not sustainable.

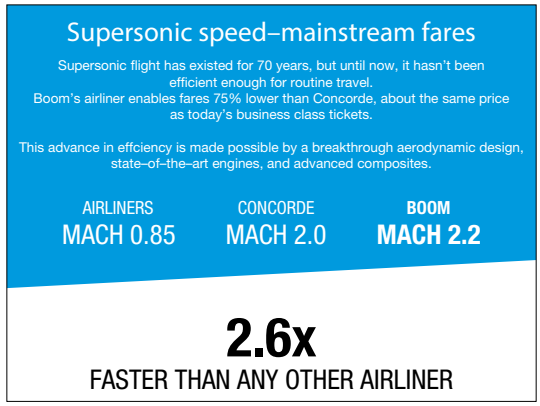
The last decade has seen a drastic shift to a new generation of smaller and more efficient planes. Boeing and Airbus manufacture some of the world's longest-range aircrafts in the skies. The Boeing 777X series has a range of 16 110 kilometres, similar to the A350-800 series with a range of 16 300 kilometres. (see Figure 8.8.1.)

The most popular and efficient plane for long haul travel is the Boeing 777 a family of long-range wide-body twin-engine jet airliners with a typical seating capacity of 314 to 396 passengers. The three Middle Eastern carriers favour it: Emirates, Etihad and Qatar and they are thriving in this market.

Fuel efficiency is becoming increasingly important in the design of long-range aircraft to help reduce the real cost of international travel.

SUPERSONIC PASSENGER JETS

The ability to fly faster than the speed of sound and thus greatly reduce travel times has long been seen as the future of long haul travel. First available for passenger service in 1976, the Concorde was one of the first supersonic passenger flights. Exorbitant operating costs due to fuel consumption and exceptionally high fares both limited its commercial success. Even though it flew until 2003, it never proved to be profitable enough to prompt construction of more than the original 16 aircraft. For decades developments in aircraft technology have favoured larger capacity aircraft, but still at subsonic speed.



8.8.2 Supersonic jetliners will offer faster travel than any other airliners, including the Concorde.

Efficient, economical and safe supersonic flight for routine travel is expected to soon become a reality. Breakthrough aerodynamic design, light-weight materials that can withstand supersonic flight and an efficient super-cruise propulsion system have all contributed to greater efficiencies (see Figure 8.8.2). The first flight is planned for 2018 and the manufacturer, Boom has orders of 76 aircrafts across five airline customers. Boom supersonic jets should enter service by 2023.

Long flights are a barrier to travel for many business travellers due to the time it takes. The appeal of supersonic flight is reduced flight time on popular intercontinental business routes at a price that will match current business class fares. A supersonic jet flight could turn an exhausting 16-hour journey into an easy overnight trip. One could also leave Sydney and arrive in Los Angeles seven hours later, half the time it currently takes. Supersonic aircraft fly higher that other aircraft, cruising at 18.288 kilometres. This altitude is above most of the turbulence, providing a smoother ride than on a subsonic aircraft. The view from the window includes the darkness of space above and the curvature of the Earth below.

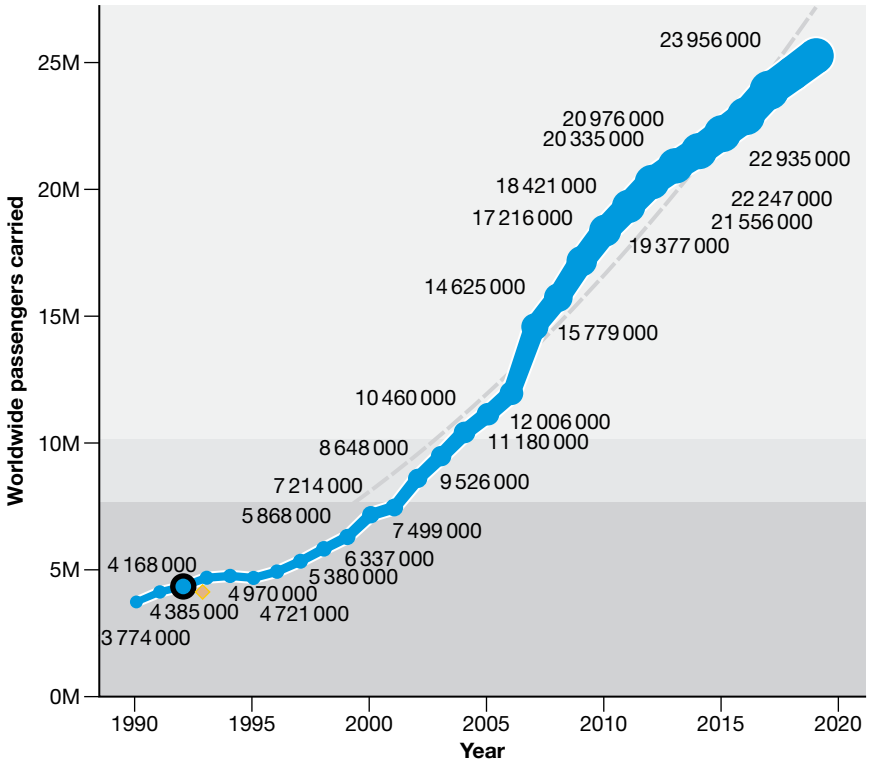
Land transport

Governments that recognise the enormous economic potential of tourism are spending billions of dollars on transport development projects. Considerable investment in infrastructure has made surface transport faster and more competitive over longer trips.

High-speed rail uses an integrated system of dedicated track and specially designed trains that travel considerably faster than traditional rolling stock. The Shinkansen bullet train in Japan can reach speeds of 320 kilometres per hour. Japan continues to upgrade and expand its high-speed rail network to more corners of the country frequented by tourists. Japan drew 20 million foreign tourists in 2015. The main cities on the islands of Honshu, Kyushu and Hokkaido are linked to Tokyo by a network of high-speed train lines. The first bullet train service to the northern island of Hokkaido was opened in 2016 at a cost of US$6.6 billion to connect Tokyo with ski areas and regions famed for their cherry blossoms on Hokkaido. Trains on this line travel through the Seikan Tunnel, which is one of the longest tunnels in the world. An extension of the line to Sapporo, the biggest city in Hokkaido, is expected to be completed by 2030.



8.8.3 The Öresund Bridge is the longest motorway and rail bridge in Europe. It runs from the Swedish coast to an artificial island in the middle of the Öresund Strait where it transitions into tunnel to complete the crossing.



Source region of passengers carried				
Year	North America	Europe	Other	Worldwide
2005	13 037 000	5 762 000	3 448 000	22 247 000
2016	13 211 000	5 894 000	3 830 000	22 935 000
2017	13 655 000	6 109 000	4 192 000	23 956 000
2018	13 890 000	6 231 000	4 507 000	24 627 000
2019	14 127 000	6 354 000	4 835 000	25 316 000

8.8.4 Growth of passengers carried on cruise ships worldwide

DID YOU KNOW?

The Seikan Tunnel is a 53.85 km dual gauge railway tunnel in Japan. One portion is 23.3 km long and sits 100 m below the seabed and 240 m below sea level.

Major European cities are also now linked by a network of high-speed trains. Ground transportation in Europe, for example, has been revolutionised by structures such as the Channel Tunnel between Britain and France, and bridges and tunnels that link Scandinavia to the rest of Europe. The Öresund Bridge is the longest motorway and rail bridge in Europe connecting the road and rail networks of the Scandinavian Peninsula with those of Central and Western Europe. It runs across the Öresund Strait from the Danish capital of Copenhagen to the Swedish city of Malmö. The cable-stayed bridge runs nearly 8 kilometres from the Swedish coast to an artificial island in the middle of the strait where it transitions into a 4-kilometre tunnel to complete the crossing to Denmark (see Figure 8.8.3). It carries with it a data cable network which handles internet transmission between Sweden/Finland and Central Europe.

Sea transport

By 2017 the cruise industry had become the most important growth sector in the global tourism market. According to research conducted by Cruise Market Watch, 23.96 million people holidayed on cruise ships in 2017 and this is projected to increase to over 25 million by 2020 (see Figure 8.8.4). Much of this can be attributed to the convenience of cruising and consumers' strong attachment to value for money. Globally, the cruise industry has grown by more than 65 per cent in the last 10 years. The building of larger capacity ships has driven this, with the world's cruise fleet now exceeding more than 300 vessels. Such growth has been supported by more destinations opening up with the accessing of new ports. Similarly, new on-board/on-shore activities have matched the demands of consumers. Sydney is emerging as an important cruise ship destination.

SPOTLIGHT

Millions hooked on cruising

Before the dominance of air travel, passenger liners were the preferred, and often the only available, mode of overseas travel. During the first half of the twentieth century, ships changed very little and grand ships such as the Lusitania, Ocean Monarch and Queen Mary were making the transatlantic crossings between London and New York. Those travelling first-class enjoyed opulent staterooms in stark contrast to second-class and third-class passengers. The real blow to the cruise industry came with advancements in air transport.

The cruise industry has been revitalised for travellers of all social classes. The appeal is the convenience of only unpacking once and the perceived value of the all-inclusive price covering fares, accommodation, meals and entertainment. The only additional costs are for alcohol and shore excursions. Larger and larger vessels continue to be constructed (see Figure 8.8.5), offering ocean views, pools and casinos. The pampering shipboard experience is marketed rather than the destinations. The rallying cry of the modern cruise industry to vacationers has been 'luxury for the masses'.

Worldwide, the cruise industry has an expected annual passenger growth rate of 6.55 per cent from 1990–2019. North America has been the primary market for cruise activities, with the United States accounting for the majority of all cruise passengers. The European cruise sector is ranked second and it has emerged as the fastest growing market. Cruise lines are also looking to the largely untapped market potential of China, where the number of cruise travellers could grow to tens of millions. Chinese travellers are very family oriented and cruises make a multigenerational holiday possible.

Some of the most popular cruising regions in the world include the Caribbean, the Mediterranean Sea and Alaska. River cruising has also attracted many travellers. In Europe many have taken in the countryside along the Danube, Rhone and Seine rivers, whilst the Mekong and Irrawaddy rivers are favoured in Asia.



8.8.5 The *Harmony of the Seas* of the Royal Caribbean's cruise line was the largest cruise ship in the world in 2017. On board is a 10-storey-high waterslide and seven iconic neighbourhoods including a tree-lined Central Park.

Keeping track of people and possessions

Modern technology enables passenger transport operators to deal more efficiently with the increasing volume of reservations, cancellations, ticketing, invoicing, and options on routes and fares. Simultaneously it generates a wealth of data that can be used for planning marketing programs. Global computer networks linked by satellite have provided powerful new marketing tools; for example, in hotel reservations. This was first exploited by Holiday Inn in the late 1970s and is now utilised by large hotel groups internationally.

Information technology has transformed the distribution process, with interactive online computer networks linking, for example, the reservation systems of airlines, hotels and car rental organisations. Tech-savvy travellers routinely research airlines, cruise lines, hotel chains and restaurants before and during their trip. GPS-enabled smartphones and free or affordably priced apps also empower independent travellers. Innovative smartphone data and location technology can also connect travellers with family and friends who can track them and alert public safety organisations if they get into trouble.

Qantas was one of the earliest airlines to embrace radio-frequency identification technology with its innovative Q Bag Tag. It is a permanent electronic bag tag designed to facilitate faster and easier baggage check-ins at airports. If a passenger checks in using their mobile phone before they arrive, they can go directly to the Bag Drop, as the details on their boarding pass or Qantas card is syncronised with their luggage.

Hotel guests expect instant connection for their devices when they check in. Previously, hotels operated on a 'user pay' system, sometimes at excessive rates, but are moving away from this model. Instead, high-density wireless infrastructure allows hotels to meet guest expectations. Major airlines also offer business travellers state-of-the-art facilities so that they can continue conducting business en route. Passengers can log on to the internet using a wireless in-flight communications system.

DID YOU KNOW?

In 2015, 26 cruise brands were active in Asia, with 52 ships on the water. Some 981 cruises carried 2.17 million passengers in Asia.

In an effort to maintain a competitive edge, many large hotels now offer the latest entertainment systems, such as movie streaming options and the latest sound systems. The latest 'must-have' inclusion is the SPD-Smart Window. These windows allow guests to control the amount of light, glare and heat entering through the windows in their room.

Enhancing the tourist's experience

Suppliers of tourist attractions have quickly adopted technical advances in lighting, sound, film, lasers, IMAX (very widescreen effects for film displays) and new materials, such as plastic and carbon fibre. New technologies provide theme parks with innovative ways to tell their stories and offer new thrills on high tech rides. Even conventional roller-coasters are giving way to new corkscrew and looping tracks, employing the flexibility of tubular steel. Computer-operated simulators create realistic sensations of movement and provide visual and aural effects, allowing Disney to send people on tours of the Star Wars universe. Theme-park rides, exhibits and synthetic tourist experiences can provide thrills and excitement and simulate wilderness or subaquatic environments.

Virtual reality animation has recently enabled theme parks to upcharge their visitors' experience on roller coaster rides. In the future this may embrace augmented reality, a new technology that superimposes a computer-generated image on a user's view of the real world using sensory input such as sound, video and graphics. This would enable visitors to move around the park and enhance their experience of all of the attractions available.

DID YOU KNOW?

Virtual reality replaces the real world with a simulated one, whereas augmented reality enhances one's current perception of the world.

Activities

Understanding the text

1 Explain why so much new technology is available to tourism.

2 Explain how consumer choice is being shaped by technology.

3 Describe the ways that long-range aircrafts have changed in the last decade.

4 Outline the likely future developments in air transport.

5 Explain why millions of people have become hooked on cruising.

6 Outline how technology is helping to keep track of people and possessions.

7 Explain how tourist expectations have influenced the provision of new technologies in hotels.

8 Describe ways that new technologies are enhancing the tourist's experience in theme parks.

Working geographically

9 Study Figure 8.8.4 showing the growth of worldwide passengers carried and answer the following questions.

- a How many passengers were carried in 2000?
- b In what year did the number of passengers reach 20 million?

10 Study Figure 8.8.4 showing the data on source regions of passengers carried on cruise ships and answer the following questions.

- a What percentage of worldwide passengers carried in 2017 were from North America?
- b What was the percentage increase of passengers carried from Europe between 2015 and 2019?
- c Which region has experienced the greatest growth from 1915 to 2019?

11 Investigate one of the latest cruise ships and provide an inventory of the facilities and on-board experiences available.

12 Investigate the cruise lines that operate out of either Sydney or Melbourne and provide an itinerary for one cruise that might be undertaken.

13 Investigate a river cruise in either Europe or Asia and write a report on why it would appeal to tourists.

14 Investigate a theme park and assess how it is utilising technology to enliven the visitor experience.

UNIT 8.9

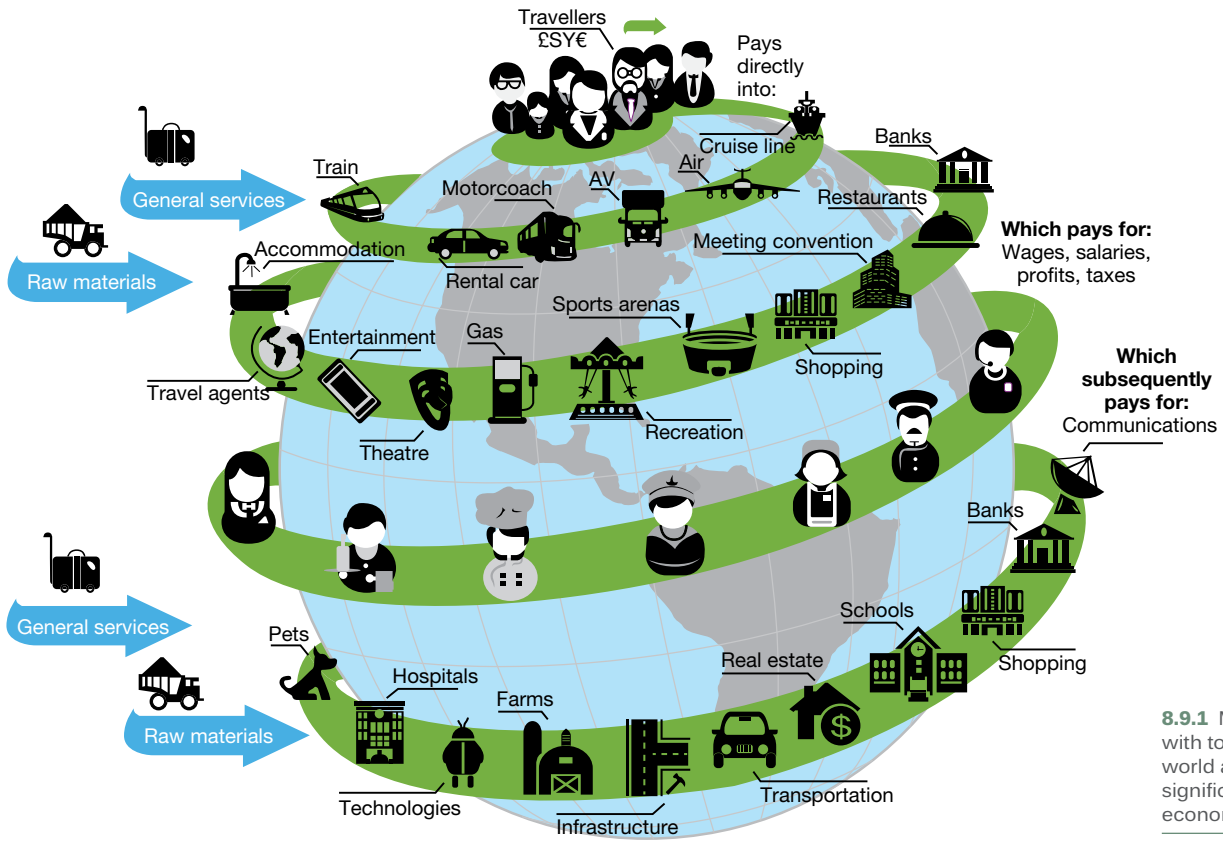
Tourism: political and economic factors

Tourism is recognised as one of the strongest drivers of world trade and acts as an engine for economic growth and development. It creates employment and increases foreign exchange earnings, which improves a country's prosperity. Most governments now actively seek to promote tourism to and within their countries and take steps to coordinate both public and private tourism-related activities and foster the industry's growth.

Some countries have a long history of active intervention in tourism. This has certainly been the case in France. The French Government has, for example, made a large investment in the development of the coast of Languedoc-Roussillon, which is one of the largest tourism projects in the world.

Government support has been less forthcoming in other parts of the developed world. Agriculture and manufacturing have often received a level of government support not available to the service-related industries such as tourism, because those employed in tourism lacked political muscle. This was certainly evident in the United States, where successive governments have been preoccupied with protecting its product-orientated industries. In 2017, the Trump administration announced plans to remove protection for some national parks and cuts to their size in order to allow resource extraction, such as mining and logging.

In developing countries, tourism is seen as the most viable and sustainable way of fostering economic development. Tourists bring with them a ready supply of much needed foreign currency (see Figure 8.9.1). As the popularity of a particular tourist destination grows, the country becomes increasingly attractive as an investment opportunity for the transnational developers of hotels and resorts. Jobs are also created, as it is a labour intensive industry. Many of the jobs available require relatively few skills and little investment, and therefore increase the employment prospects of the poor.



8.9.1 Money travels with tourists around the world and contributes significantly to the economy.

Resilience is key as impact of terrorism on tourism becomes clearer

The impacts of terrorism on tourism are becoming clearer, as demonstrated by a new report by the World Travel & Tourism Council (WTTC). At the macro level, terrorism has had little impact on global business and leisure travel in 2016.

The new data shows that in countries where attacks have happened, visitor exports, which is money spent by foreign visitors in a country, has suffered. The impacts of the initial attacks are compounded by inaccurate or extended travel advisories, and consumer reaction to seek perceived 'safer' places for their vacations.

In Europe, there were contractions in inbound tourism spending: Belgium (–4.4 per cent), France (–7.3 per cent) and Turkey (–22 per cent) following attacks in 2016. In North Africa, tourism visitor exports declined again in 2016 (–16 per cent). Egypt in particular is suffering from the impact of terrorism activity, followed by continued travel advisories. Inbound visitor spending continued to contract in the country, and the country's Travel & Tourism GDP is now 50 per cent below the 2008 peak level.

The research shows that overall Travel & Tourism remains resilient, as consumers continue to travel but they are switching to destinations which are perceived to be 'safer'. Within Europe, Bulgaria and Cyprus grew noticeably in 2016 (12.4 per cent and 17.1 per cent respectively), with Portugal and Spain showing robust growth (4.6 per cent and 5.2 per cent). Emerging destinations Slovakia, Poland and Hungary also showed strong performance (13.2 per cent, 8.6 per cent and 6.8 per cent respectively).

David Scowsill, President and CEO, WTTC, said: 'Travel & Tourism is a resilient sector. People will not stop travelling, despite the security threats in the world. Nevertheless, destinations must focus on security, as we operate in a new "normal" where the constant threat of terrorism exists'.

World Travel & Tourism Council (WTTC)
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DID YOU KNOW?

On average it takes 13 months for a place to recover from a terrorist attack and for tourists to return, according to research from the WTCC.

The changing political and economic environment

The collapse of the Soviet Union in the late 1980s and the opening up of Eastern Europe had an enormous impact on international travel. The old geopolitical issues that dominated world events for much of the twentieth century suddenly become irrelevant. Tens of thousands of Russians and Eastern Europeans were able to take vacations in Europe, North America and Asia.

Chinese tourism

The twenty-first century brought an even more monumental change with China opening up to the rest of the world as it switched from a centralised economy to a free market economy. Reforms undertaken by the Chinese government included easing restrictions on the movement of people to vigorously promote tourism as a means of earning foreign exchange. The social transformation of China resulted in an emerging newly rich middle class with the means to travel and explore. This has all resulted in China becoming one of the hottest inbound and outbound tourist markets in the world. As highlighted in Unit 8.5, China has now established its position as having the world's largest number of outbound tourists.

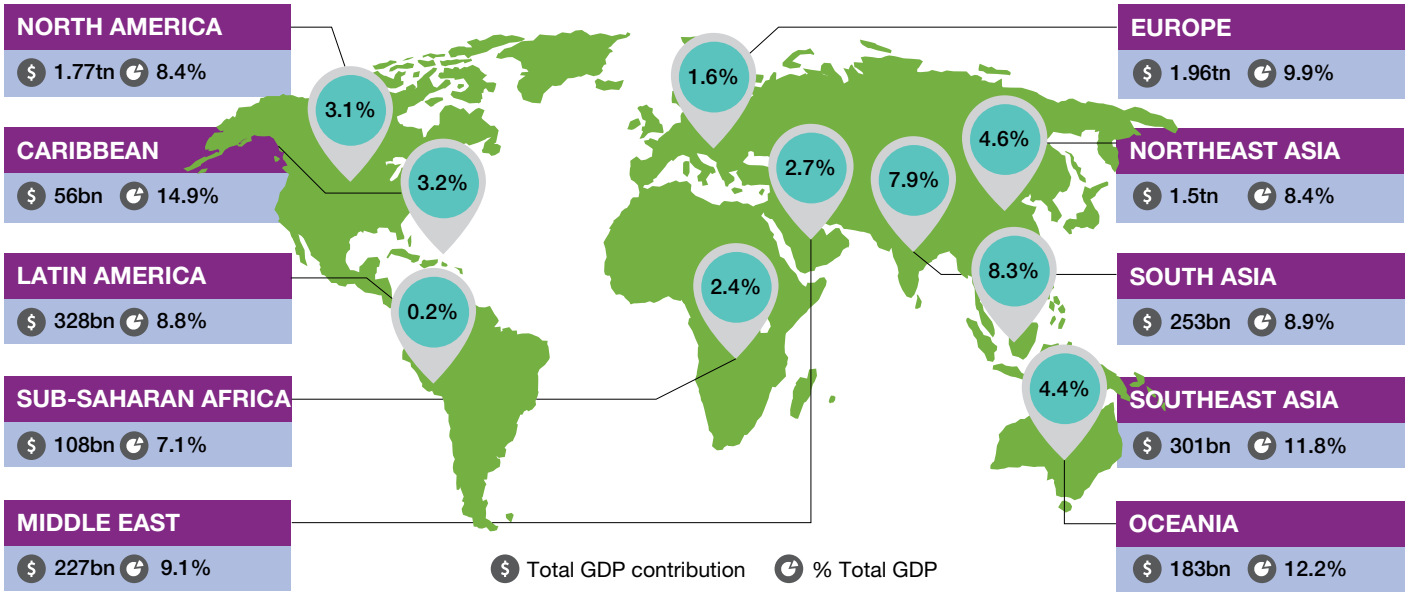
The Global Financial Crisis

According to the UNWTO 2016 Annual Report, the global economic crisis of 2008–09 had a significant impact on tourism, as international tourism receipts declined by 6 per cent. By 2010, tourism demand rebounded strongly, demonstrating the resilience of the industry. International tourist arrivals continued an upward trajectory for the next seven years with above-average growth despite many challenges, reaching 1.2 billion. A comparable sequence of such solid uninterrupted growth has not been recorded since the 1960s when mass tourism began.

Terrorism

According to the UNWTO 2016 Annual Report, the ongoing threat of terrorism and security in the twenty-first century continues to be a major concern of governments. Random terrorist violence is not anything new but sensitivity to it was heightened with the unprecedented scale of the 11 September attacks in the United States in 2001. The magnitude if this attack initially halted the growth of international tourism, with visitor numbers quickly dropping 1.3 per cent. Understandably, people abandoned their travel plans or substituted international trips for domestic travel. Holiday-makers also chose to travel by car and rail, rather than air. The slump had a major impact on the economies of major tourist destinations. Airlines were forced to slash services, hotel occupancy rates plummeted and unemployment in the tourism sector soared.

In recent years, ongoing terrorist attacks around the world have attracted harrowing media coverage. Tourists base their decisions on the perception of the safety of a destination, and the regions where the attacks have happened do suffer. This is a major concern to governments because the decline in tourism spending has repercussions in the wider national economy with a downturn in associated industries such as airlines, hotels, restaurants and retail sales. However, despite the ongoing incidence of terrorism, global tourism has continued to rise (see Figure 8.9.2).



8.9.2 The growth of tourism in 2016

The nature of government involvement

The role of government in tourism is diverse and can be both direct and indirect.

Tourism promotion

The primary contribution of governments to tourism is to promote tourism both to and within their country or territory. The most direct means is the establishment of national and regional tourism organisations designed to influence the path of tourism development. These organisations may focus on the regulation and promotion of tourism domestically or expand to international marketing and promotion as well.

Tourism Australia is the Australian Government statutory authority responsible for international and domestic tourism. Its mission is to make Australia the most desirable destination on Earth and it is active in seventeen international markets promoting the country's unique attributes to entice people to come here. It conducts research to target those people who are likely to travel widely across the country and who will spend more. Promotion is done through advertising, media hosting, trade shows and online communication. Tourism Australia also provides news and information for Australian tourism businesses and international media.

Facilitating visitor entry

Ease of access to a country or region is a key factor in attracting tourists. Governments are responsible for matters such as visa processing and customs clearance. If visitor entry formalities are unduly complicated and time consuming, tourism will suffer.

In an effort to encourage tourism, some countries have introduced visa-free entry or selective visa-free arrangements with other selected countries. The removal of border controls between the countries of the European Union is seen as a major stimulus to tourism in Europe.

DID YOU KNOW?

An airline alliance is an aviation industry agreement between two or more airlines to make it easier for passengers to travel between countries using inter-airline codeshare connection where different airlines share the same flight.

Transport policy

The availability, pricing and ease of transport dictates the flow of tourists both within and between countries. The distribution of transport capacity within a country also influences the level of dispersal of tourists and hence affects regional development. Governments are generally responsible for the provision of transportation infrastructure and equipment and the maintenance of safety standards, particularly airline security.

The rationale for government ownership of airlines is usually justified on the grounds of national prestige and the desire to provide competitive air services. Liberalisation, through deregulation and privatisation, has led to policy shifts by governments and partnerships between countries. The signing of a bilateral agreement by the United States and Germany facilitated an alliance between United Airlines and Lufthansa. Other airlines have also entered into alliances that enable them to reduce operating costs and increase passenger loads. Qantas and British Airways, for example, have formed an alliance and have joined with other airlines to form 'One World'. Star Alliance with 27 member airlines in 2017 is the world's largest airline alliance. It carries 637.6 million passengers a year with more than 18 000 departures each day.

Regulation and control

Government regulations are usually introduced for reasons of safety, zoning, consumer or environmental protection, and price or quality control or to ensure that services are available in remote locations. While such regulations are necessary, they incur costs. Too many regulations can cause conflict and become a deterrent to attracting investment.

General economic policy

Government economic policies have direct and indirect implications. For example, restrictive policies, imposed when governments are grappling with high rates of inflation or current account deficits, can reduce disposable incomes. This limits the amount available for discretionary spending on travel and tourism. High interest rates can mean lower investments in tourism infrastructure. This, in turn, limits the industry's capacity to provide services to potential visitors. Government taxes, charges and levies, for example, which increase costs to inbound tourists, can have an adverse impact on visitor numbers.

Activities

Understanding the text

1 Contrast how attitudes towards tourism differ between governments.

2 Explain why developing countries are interested in the development of tourism.

3 Describe the changes in the world's economic and political environment since the 1980s.

4 Outline how governments can promote tourism and facilitate visitor entry.

5 Explain why the transport policy of a government is important to tourism.

Working geographically

6 Study Figure 8.9.2 and answer the following questions.

- a By how much did the growth of tourism's contribution to GDP exceed that of the rest of the economy?
- b State the number of jobs supported by tourism in 2016.
- c In what region did tourism make the greatest contribution to total GDP?
- d Identify the three regions of the world where tourism earned the highest total GDP.
- e Identify the three regions of the world where tourism earned the lowest total GDP.
- f In what region was tourism's greatest contribution the highest percentage of total GDP?

7 Refer to Figure 8.9.2 and answer the following questions.

- a Predict what is likely to happen to inbound and outbound travel in both the United States and the United Kingdom in 2017. Justify your answer.
- b Describe and account for the winners and losers of 2016 visitor exports in Europe in 2016.

8 Investigate the three main airline alliances in the world: Star Alliance, Oneworld Alliance and SkyTeam Alliance to determine what airlines are involved, where they operate and what they offer to customers.

CASE STUDY

Ecotourism

The growing awareness of environmental issues and the environmental alienation of modern urban living have spawned a demand to experience a close interaction with nature (see Figure 8.9.3). Natural phenomena are now seen as an integral part of some tourism experiences. Increasingly, tourists are looking for the extraordinary, such as a hike in an Ecuadorian cloud forest, a walk among Kangaroo Island's sea lions, a glimpse of gorillas in the mist, or a dive with the green turtles on the Great Barrier Reef. Travel companies have recognised the potential of this marketing niche and are keen to develop ecotourism products.

> Ecotourism, the low-impact offshoot of the adventure travel industry, represents the best intentions of an educated and affluent middle class to travel without despoiling ... However, the very presence of tourists, regardless of their mission to only watch wild animals, can threaten the ecology of such areas as the Antarctic.
>
> H. Kurent, World Travel & Tourism Review, vol. 1, 1991

Origins of ecotourism

The term 'ecotourism' was introduced by a conservationist, Hector Ceballos-Lascurian, in 1983. While working for the Mexican Government, he noted that certain tourists travelled specifically to experience nature. He suggested that their visits to the wetlands in Yucatan, to see the flamingos, could finance protection of those wetlands.

Ecotourism was formally acknowledged as motivation for travel in the 1970s when the World Wildlife Fund recognised that conducting tours to unique natural areas could generate funds to ensure the preservation of those areas.

Ecotourism quickly became associated with any tourism related to nature-orientated outdoor activities. Tour operators were quick to use the latest jargon, and ecotourism increasingly became a marketing, rather than a conservation, tool. In fact, many current practices have continued to lead to negative environmental impacts, undermining the very foundations that the whole ecotourism industry is supposedly protecting.

Definition ecotourism

There is no generally accepted definition of ecotourism. The Audubon Society, in *Rebirth of Nature* (1993), defined ecotourism as 'purposeful travel to natural areas to understand the natural and cultural history of the environment while maintaining the integrity of the ecosystem and providing economic opportunities that make the conservation of natural resources financially beneficial to the inhabitants of the host region.'

The Australian Government's National Ecotourism Strategy defines ecotourism as 'nature based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable.'

Marguerite Young, former tourism adviser for the World Wide Fund for Nature, emphasises the complexity of the ecotourism concept. She contends that ecotourism encompasses not only conservation and development, but also business and community goals.

She argues that a one-sentence definition of ecotourism is inadequate and that it is better served if a set of criteria is established. Young, therefore, defines ecotourism as tourism to relatively undisturbed natural areas that promotes conservation by:

- minimising negative impacts on the environment
- impacting on tourists by heightening their awareness and appreciation of nature
- respecting and financially benefiting local communities.



8.9.3 Pre-Colombian archeological site, Ciudad Perdida, Sierra Nevada, Colombia

Benefits of ecotourism

John Naisbitt, in his book *Global Paradox* (Allen and Unwin, 1994), recognised some important advantages of ecotourism. These include the following.

- **Ecotourism saves habitat:** The Rwandan Government was under strong pressure to cut the forest habitat of the mountain gorillas to make way for crops and cattle. Instead, the Verunga Volcanoes were opened to ecotourists who were happy to pay US$170 an hour to see the gorillas. Before the recent Rwandan civil war this generated over US$1 million a year, becoming the primary source of income for the area and giving the local people strong incentives to protect the gorillas. Ecotourism is an incentive to expand protected areas.
- **Ecotourism saves rainforests:** The global onslaught on tropical rainforests has heightened the desire of tourists to see them. Sustainable ecotourism can provide an alternative to logging and unsustainable farming. Today in Costa Rica, tourism is more important than cattle as a source of income. Luis Manuel Chacon, the former head of Costa Rica's tourism board, emphasises that local people 'will be the worst enemy of the parks if they can't make a living off them'.
- **Ecotourism employs people:** World outrage at the bludgeoning to death of newborn seals in the Gulf of St Lawrence seal hunts of the late 1970s not only prompted the Canadian Government to ban the killing in 1987, it also spurred interest in the seals. Today, income from tourists coming to watch the seals is three times greater than the incomes the sealers earned by selling seal hides.
- **Ecotourism is a way to earn foreign exchange:** For many countries—including Costa Rica, Rwanda, Kenya, Ecuador and Nepal—ecotourism is the leading source of foreign exchange.

The need for responsible management of ecotourism

As with other forms of tourism, poorly managed ecotourism endangers the very sights and experiences that tourists covet. In Australia, one of the main criticisms of the ecotourism industry is that it has no standards—virtually anybody can claim to be an ecotour operator. Most states and territories have guidelines for tour operators, but they are not enforceable and many experts consider them inadequate.

Large-scale tourist developments in environmentally sensitive areas are increasingly common. In many cases these developments are commenced without adequate consideration of their potential environmental impact. Many developers are willing to meet only the minimum environmental standards required by law and consent-granting authorities. Some developers, however, have demonstrated a willingness to invest millions to protect environmentally sensitive areas.

In some areas the continued survival of the natural environment, which prompted the tourists' interest in the first place, is at stake. Survival can only be assured if all those involved—governments, tour operators and local people—are committed to maintaining environmental quality. Ecotourism must be ecologically sustainable: in its use of natural areas it must operate within an area's ecological carrying capacity so that future generations can also enjoy the resource. Scientists are already actively researching the environmental aspects of tourism that will, it is hoped, enable development of such resources to be ecologically sustainable.

Colombia's future involves fewer terrorists and more ecotourists

Colombia is to birds what Ascot is to hats; the number and variety are extraordinary, and many are photogenic. It has over 1900 different species, more than any other country. At least 270 are endemic or near-endemic. The Sierra Nevada de Santa Marta, an isolated, snow-capped massif rising sheer out of the Caribbean, is a particularly rich aviary. It is home to some 15 species, including a pygmy owl, a mountain tanager and a foliage gleaner, which are found nowhere else.

Few outsiders have enjoyed this avian paradise. Until recently, Colombia, geographically challenging and historically conflict-ridden, received little international tourism. This has started to change in the past decade. In 2016, 1.9 million tourists visited, double the number of 2005. Tourism has become the second-biggest source of foreign exchange (US$4.2 billion last year), trailing oil but ahead of coffee, bananas and flowers. Bird Tourism could generate create at least 7500 jobs.

Source: *The Economist*

Activities

Working geographically

1 Define ecotourism.

2 Investigate an ecotourism enterprise and discuss its advantages and disadvantages.

UNIT 8.10

Tourism: the issues

Two major issues threaten the long-term survival of tourism: environmental degradation, which may diminish the pleasure that visitors receive from the tourism experience; and undesirable social impacts, which often accompany the growth of tourism. The advantages and disadvantages of tourism are summarised in Figure 8.10.1.

Tourism and the environment

Tourism developments tend to be located near attractive or unique features of the biophysical environment. Unfortunately, however, tourism often places a heavy strain on such natural resources. The greatest threat exists to those environments considered to be the most fragile; that is, most vulnerable to natural or human-induced stress.

Without careful management, intensive tourism development can contribute to a deterioration of the environment, notably air and water quality. Hotspots for tourism put pressure on resources, especially water. Figure 8.10.2 illustrates water consumption in hotels in the Asia-Pacific region where tourism growth is a key driver of water demand. Over 75 per cent of the countries throughout the region are experiencing water stress and addressing such shortages is becoming increasingly important.

Advantages and disadvantages of tourism

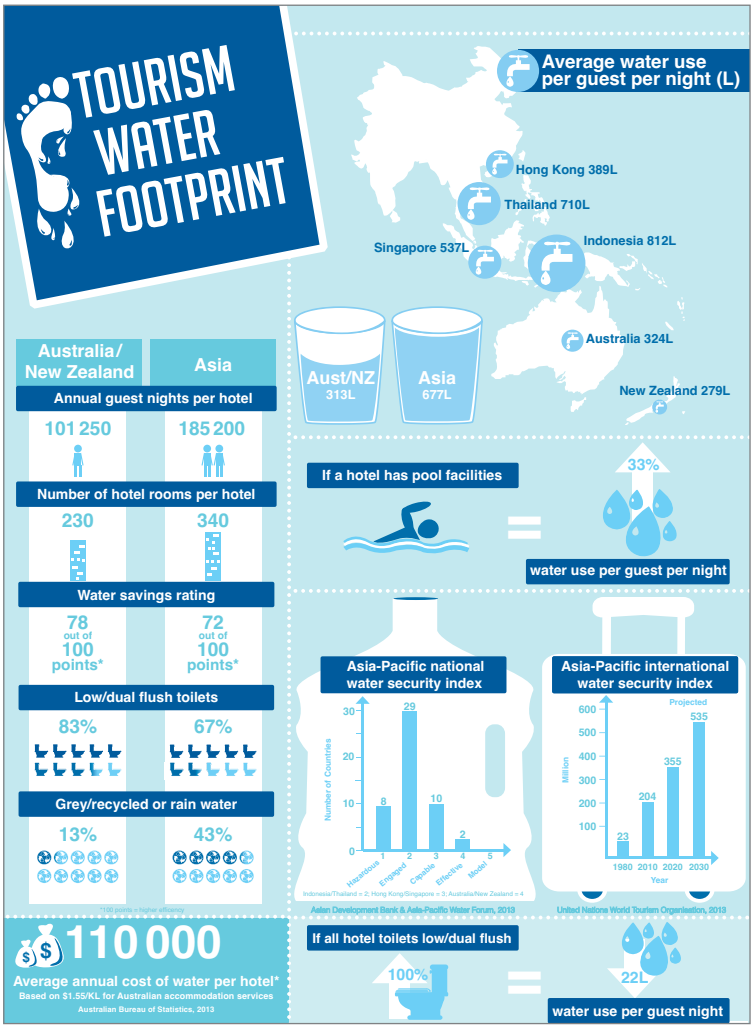
Advantages of tourism

- Tourism earns foreign income that can be used to pay for imported goods and services.
- Unique environments are often protected because of their appeal to tourists.
- Tourism creates jobs and is labour-intensive.
- Tourism provides opportunities for small operators to establish their own business.
- The production and selling of souvenirs creates work for craft-based industries.
- Local produce can be sold to hotels and restaurants.
- There is much-needed foreign investment in airports, roads, hotels and other tourism-related infrastructure.
- Profits can be used to improve housing, schools, hospitals, electricity and water supplies.
- Local customs and heritage are preserved because tourists want to experience it.
- Tourism promotes increased understanding between cultures.

Disadvantages of tourism

- Only 10 to 20 per cent of the income received stays in the country; most hotels are foreign-owned; profits go overseas.
- Lack of planning often results in hotels, airports, roads and golf courses being built in the wrong place, spoiling scenic sites and causing pollution.
- Much of the employment is seasonal and poorly paid; the better-paid jobs are often taken by foreigners.
- Traditional craft-based industries may be destroyed as people are encouraged to produce cheap, mass-produced souvenirs.
- The agricultural systems break down as land is sold off to developers; much of the food eaten by tourists is imported.
- Locals are often discouraged from using hotel facilities; few can afford the prices charged.
- Borrowed money can increase the country's debt. Repaying this debt can divert resources from the provision of much needed social infrastructure, such as schools and hospitals.
- Local traditions and customs are destroyed by contact; prostitution, crime, drugs and drunkenness often increase.
- Tourists may show lack of respect for local customs and religious beliefs.

8.10.1 Advantages and disadvantages of tourism



8.10.2 Tourism water footprint in the Asia-Pacific region



8.10.3 Tourists face a dilemma about the impact their presence has on the natural environment.

Tourism can also lead to destruction of the natural environment. Vegetation can be damaged by trampling, fire and the removal of species. Wildlife can be decimated by hunting and disruptions to feeding and breeding, as well as restrictions on movement and the loss of natural habitat.

Tourists may be unaware of the impact their presence has on the natural environment and others may start to question the wisdom of visiting in the first place when their very presence may damage what they have travelled to appreciate (see Figure 8.10.3).

A more detailed reference system from which potential tourism impacts can be identified and assessed is presented in Figure 8.10.4.

Environmental protection

The link between tourism development and environmental protection is critical for the future success of this economic activity. Uncontrolled development in environmentally fragile areas could well destroy the natural attraction that draws the visitors. With adequate planning by governments and adherence to environmental codes by tourism operators, the threat of environmental degradation posed by global tourism can be overcome.

The challenge is to develop procedures to assess the potential environmental impacts of tourism-related developments. Australia's Environmental Impact Assessment (EIA) process is designed to identify the likely consequences for the biophysical environment of a development at a stage when it can influence the decision of the officials responsible for sanctioning a proposal. Other mechanisms available for governments to address the impact of tourism are regulations, the establishment and management of national parks, the preservation of significant heritage sites, and the enactment of legislation that helps to conserve our scarce cultural and natural resources.

Potential impacts of tourism on the environment

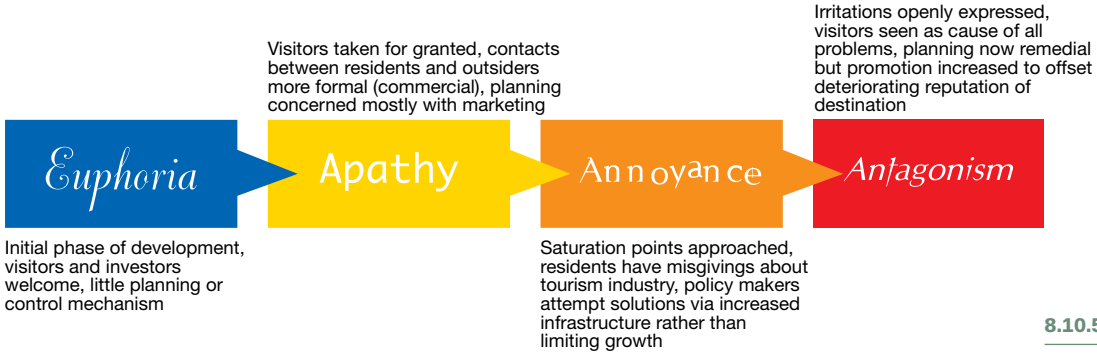
The natural environment	The built environment
Changes in floral and faunal species composition ■ Disruption of breeding habits ■ Killing of animals through hunting ■ Killing of animals in order to supply goods for the souvenir trade ■ Inward or outward migration of animals ■ Destruction of vegetation through the gathering of wood or plants ■ Change in extent and/or nature of vegetation cover through clearance or planting to accommodate tourist facilities ■ Creation of a wildlife reserve or sanctuary **Erosion** ■ Compaction of soils, causing increased surface run-off and erosion ■ Increased risk of occurrence of land slips or land slides ■ Increased risk of avalanche occurrence ■ Damage to geological features, such as tors and caves ■ Damage to riverbanks **Pollution** ■ Water pollution through discharges of sewage and spillages of oil or petrol ■ Air pollution from vehicle emissions ■ Noise pollution from tourist transportation and activities **Natural resources** ■ Depletion of ground and surface water supplies ■ Depletion of fossil fuels to generate energy for tourist activity ■ Increased risk of occurrence of fire **Visual impact** ■ Facilities, such as buildings, chairlifts and car parks ■ Litter	**Urban environment** ■ Land taken out of primary production ■ Change of hydrological patterns **Restoration** ■ Reuse of disused buildings **Infrastructure** ■ Overload of infrastructure, such as roads, railways, car parking, electricity grids, communications systems, waste disposal facilities and water supplies ■ Provision of new infrastructure ■ Environmental management to adapt areas for tourist use, such as sea walls and land reclamation **Urban form** ■ Changes in residential, retail or industrial land uses, such as the move from houses to hotels and boarding houses ■ Changes to the urban fabric, such as roads and pavements ■ Emergence of contrasts between urban areas developed for the tourist population and those for the host population **Visual impact** ■ Growth of the built-up area ■ New architectural styles ■ People and belongings ■ Tourism-related advertising

8.10.4 Potential impacts of tourism on the environment

Social impacts of tourism

Social contact between tourists and residents can be mutually beneficial. The resident population can gain a greater understanding of visitors' customs, values and culture, as well as enjoying an increased demand for traditional entertainments, crafts and music, thereby preserving parts of the national heritage. Tourists' patronage of museums, art galleries and theatres brings revenue and maintains these facilities for local use as well. The tourists themselves may go home with a better understanding of the host country and its culture and traditions.

Critics of the industry often suggest that the transient social relationships inherent in tourism are incapable of producing any meaningful contact between visitors and residents. Increasing numbers of tourists can mean a shift in attitude from initial euphoria by the resident population to growing hostility, as outlined in Figure 8.10.5.



8.10.5 Index of irritation

Tourism development may result in mutual misunderstanding, hostility and social tension as residents' lifestyles are affected by the demands of tourists. One of the most significant and least desirable impacts of tourism is the growth of prostitution, crime and gambling in the host population.

Such serious social impacts indicate that social policy and the provision of community services must become an integral part of tourism planning by both tourism operators and the host government. Where such planning is lacking and the problems are not addressed, resentment develops, especially if money is drained from the host country because of foreign ownership of tourist resorts. Outright hostility towards visitors may emerge, which could reduce tourist flows and threaten the viability of the operation.

SPOTLIGHT

The World Tourism Organization's sustainable tourism development guidelines

Sustainable tourism development guidelines and management practices are applicable to all forms of tourism in all types of destinations, including mass tourism and the various niche tourism segments. Sustainability principles refer to the environmental, economic and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability.

Thus, sustainable tourism should:

1. Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural resources and biodiversity.
2. Respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.
3. Ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.

Sustainable tourism development requires the informed participation of all relevant stakeholders, as well as strong political leadership to ensure wide participation and consensus building. Achieving sustainable tourism is a continuous process and it requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary.

Sustainable tourism should also maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists, raising their awareness about sustainability issues and promoting sustainable tourism practices amongst them.

Source: *Making Tourism More Sustainable, A Guide for Policy Makers*, World Tourism Organization

DID YOU KNOW?

In 2015, world leaders agreed upon 17 Sustainable Development goals to guide development. Tourism is committed to doing its part in this common endeavour under Goal 8, 'Decent Work and Economic Growth'. The UNWTO stated that by 2030 the goal is to devise and implement policies to promote sustainable tourism and promote local culture and products.

Activities

Understanding the text

1 Identify two major issues that threaten the long-term survival of tourism.

2 Describe how tourism can damage the biophysical environment.

3 Explain how governments and organisations manage the impacts that tourism has on the environment.

4 Outline how the social impacts of tourism can be both positive and negative.

Working geographically

5 Study Figure 8.10.1 and write a discussion outlining the advantages and disadvantages of tourism.

6 Study Figure 8.10.2 and write a report that discusses the potential impacts of tourism on the environment.

7 Study Figure 8.10.3. Working in groups, identify the issues addressed in the cartoon. Build on this discussion by identifying the advantages and disadvantages of tourism with regard to environmental quality. Have someone in the group record the points made during the discussion. A spokesperson from each group should orally summarise the discussion points to the rest of the class. Having heard the various reports, individual students should then write a one-page response describing the environmental advantages and disadvantages of tourism.

8 Study Figures 8.10.4 and 8.10.5. Address the following issues in a report.

- **a** Reasons why overcrowding is occurring in some parts of Europe.
- **b** How the attitudes of the host population often change with the influx of larger numbers of tourists over time.
- **c** How the resident population of tourist hotspots and authorities are responding.

9 Refer to Figure 8.10.2 and answer the following questions.

- **a** In what country is the average water use of guest per night the highest?
- **b** What are two reasons why Australia and New Zealand's hotel guests use less water each night?
- **c** If a hotel has pool facilities, what impact does this have on water use per guest night?
- **d** If all the hotel's toilets are low/dual flush, how does this impact on water use per guest night?

Heading to Venice? Don't forget to pack your pollution mask

by Axel Friedrich

If you're heading to Venice on holiday this summer, don't forget to pack your pollution mask. Worrying about toxic air might seem strange in a city with few roads and cars, but Venice's air carries hidden risks. Every day five or six of the world's largest cruise ships chug into the heart of the ancient city, which hosts the Mediterranean's largest cruise terminal. These ships advertise luxurious restaurants, vast swimming pools and exotic entertainment – but keep quiet about the hidden fumes they pump into the city's air.

Ship operators claim they use low-emission fuel when they are near big cities, but measurements tell a different story. The fuel they burn while at berth contains more than 100 times as much sulphur as truck diesel. These particles linger in the air long after the ships have passed, and are carried hundreds of kilometres inland by the winds. Particulate matter is linked to severe health problems such as cardiovascular and respiratory diseases, including strokes and cancer.



8.10.6 Venice hosts the Mediterranean's largest cruise terminal. Every day five or six of the world's largest cruise ships arrive.

The World Health Organization places diesel particles in the same carcinogenic category as smoking and asbestos. Diesel engines produce a range of other pollutants that damage human health, the environment and the climate, including carcinogenic soot and sulphur and nitrogen oxides. Figures by the European Commission estimate that about 50 000 people die prematurely every year in Europe because of pollution from the shipping sector.

Source: *The Guardian*

UNIT 8.11

The future of tourism

Since 1945 the growth of tourism has been explosive (see Figure 8.11.1). It has become the largest industry in the world. As a potential source of employment and income, governments at all levels embrace it. Tourism is one of the major players in international commerce, and at the same time represents one of the main income sources for many developing countries. They are especially keen to capture a larger share of the international tourist market as a means of accelerating their rate of economic development.

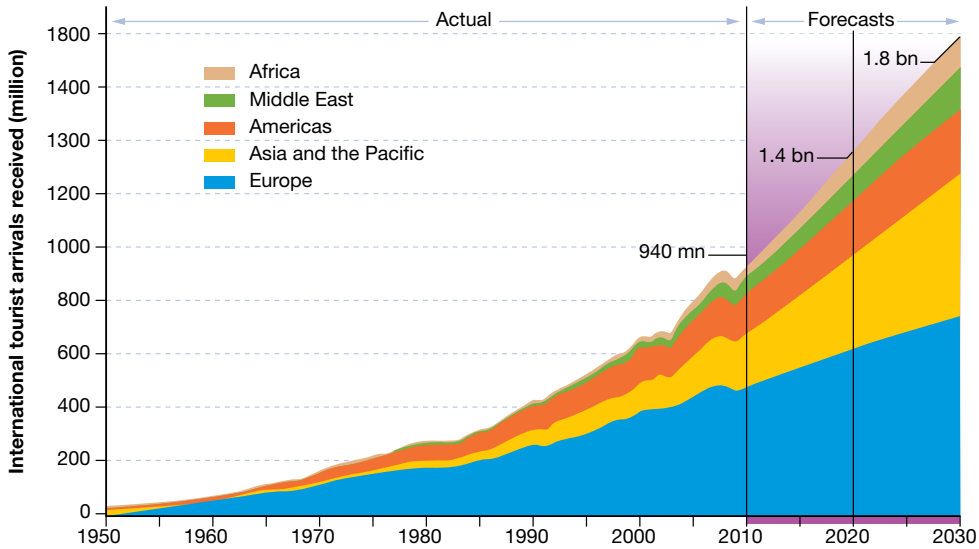
Tourism has proven to be a resilient industry, maintaining growth despite global financial shocks and growing concerns of security associated with terrorism and geopolitical friction. What the future holds for tourism is uncertain. There are some exciting and innovative developments ahead, but this is against the backdrop of a world where tomorrow may be very different to yesterday.

DID YOU KNOW?

In the next five to 10 years, millennials will become the industry's core customer base. Their spending on flights is expected to account for 50% of global travel by 2020 and to maintain that share for the subsequent 15 years.

Deepening diversification

The irresistible desire to travel, explore and especially to gain an authentic new experience underpins tourism motivation and decision-making. In the digital age people scour the internet for new destinations that will deliver thrills or unique experiences. Tech-savvy millennials are more connected that any previous generation and are changing the travel and tourism market as they seek out the unusual. There is a heightened awareness of the intricacies of the natural world and the cultural richness to be explored throughout the globe. Competition between desirable destinations is fierce with each one appealing to people's emotions that what is on offer is special. Modern tourism is closely linked to a growing number of destinations that are deeply diversified.



8.11.1 Trends in global tourism (actual and forecast), 1950–2030

Many different specialised corners or niches are emerging in the tourism market. They usually develop around a visitor's particular interests. Tourism in Northern Ireland was promoted by appealing to fans of the popular *Game of Thrones* series that was filmed there. In 2017, fans were given the opportunity to relive their favourite scenes from the show. A Tourism Ireland campaign featured a 77-metre tapestry telling the story thus far and new sections of the tapestry were revealed each week on social media. After a sales mission to China, a delegation of travel agents from Hong Kong arrived in Northern Ireland to view key locations from the show in order to promote the destination to Chinese travellers.



8.11.2 An expedition trekking across the steppes of Mongolia

Expedition tourism is becoming increasingly popular, appealing to those who see themselves as bold travellers with a thirst for exploration and ready to explore remote regions that would normally be visited only by scientists or hardened adventurers. Such tourists embark on expeditions, usually in the company of experts, willing to push themselves to achieve what are extraordinary feats for them. Such experiences range from swimming with salmon sharks in Alaska to wandering among king penguins and elephant seals on Macquarie Island in the Southern Ocean or trekking across the steppes of Mongolia (see Figure 8.11.2). Silversea Expeditions specialise in luxury cruises for the curious traveller offering an immersive experience to illuminate all that they see.

SPOTLIGHT

The Fourth Industrial Revolution

'The Fourth Industrial Revolution is characterised by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. The possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge, are unlimited. These possibilities will be multiplied by emerging technological breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.'

Source: World Economic Forum

Silversea expedition ships sail to all seven continents from the luxurious rainforests of the equatorial Pacific to the polar extremes in the Arctic and Antarctic.

With the demand for niche tourism rising, tourist operators are always looking for new experiences to challenge and entice travellers. The industry continues to diversify in the rush to take advantage of new opportunities.

Where will technology take tourism?

Given the revenue that tourism generates, it is not surprising that it receives substantial research funds to facilitate the development of new technology. Technological innovations are changing every area of this economic activity and they are most visible in transport. Technology has, and will, continue to transform the way people travel (see Figure 8.11.3). Indeed the world is on the cusp of a revolution in transport both on the land and in the air. Only a decade ago, any prospect of supersonic flight was discounted, but new technologies are making it a reality. The future now looks supersonic.

Shrinking distances and time could also revolutionise land transport. Sci-fi dreamers have long envisioned travelling at remarkable speeds through low-pressure tubes. The ultra-fast Hyperloop is a new technology first conceived by entrepreneur Elon Musk in 2015. It involves levitating pods travelling through a vacuum at 1200 kilometres per hour. Musk envisaged cutting the five-hour trip from New York to Washington down to just twenty-nine minutes. Hyperloop One is an American technology company working to make the Hyperloop a reality in moving passengers at airline speeds at a fraction of the cost. In 2017, Hyperloop One completed a successful maiden journey in Nevada with its pod travelling at 309 kilometres per hour. The company is moving forward aggressively towards the goal of having three production systems in service by 2021.

As with all economic activity, the tourism industry must embrace the Fourth Industrial Revolution in order to remain competitive. As high-tech applications such as intelligent automation are increasingly adopted, it is forecasted that while new employment opportunities will become available, other travel jobs could be lost. There are concerns that low-skilled workers and developing countries could be hardest hit.



8.11.3 From jetpacks to flying cars—how we'll travel in the future. **A** The Martin Jetpack can fly 1000 m above the ground and reach speeds of 120 km per hour. **B** This concept for personal travel in the future from Martin Gallo designers has adjustable propeller arms and propeller blades that let the vehicle switch between the road and skies. **C** The XCOR Lynx space plane can transport a pilot and one passenger four times higher than any commercial aeroplane to 103 km above the Earth's surface. **D** This magnetic levitation train in a vacuum tunnel is a concept of future travel. Passengers will be carried vast distances at high speeds.

Security concerns

Tourists have acquired more freedom to travel in recent decades, but how this may continue in the future is uncertain. Indeed, as the geopolitical landscape becomes more complicated it could be reversed. The new global landscape with rising tensions between some countries and the ongoing threat of terrorism has significant implications for tourism, notably the free movement of people across national borders. Thus far the industry has been remarkably resilient, and it is expected that it will continue to grow.

Air travel remains one of the safest ways to travel with stringent security checks in place. As the industry grapples with the possibility of new threats, additional layers of security procedures and regulations may be put in place to reassure the travelling public. Stakeholders in the travel industry are increasingly recognising the value of co-operation and data-sharing across international borders to improve the safety of travellers.

DID YOU KNOW?

'Tourism unites people and nations. It promotes stability, peace and growth. It builds bridges of cooperation and opens up roads to prosperity.'

Source: UNWTO

SPOTLIGHT

Europe, upgrading security

The tourism industry accounts for nearly 10 per cent of economic activity in Europe. Terrorism attacks across the region have become more frequent and widespread, not only in the major capital cities of London, Paris, Brussels and Stockholm, but also in other major cities, including Manchester, Nice, Munich and Barcelona. There is concern in Europe that the increased terrorist activity will drive not only tourists but also investors away. In response to the terror attacks, European governments are spending hundreds of billions of euros on improving domestic security and operations, see Figure 8.11.4. Across the continent, armed police and army troops patrol areas frequented by tourists. In France, the increased security costs €1 million euros, or US$1.1 million, a day.



8.11.4 Belgian soldiers patrolling the main square of Brussels after Islamic State killings of civilians.

Tourism on the move in a changing climate

Tourism not only contributes to climate change, but is affected by it as well. Climate change is likely to increase the severity and frequency of weather events, which can have disastrous effects on tourism in those regions. Climate change will also bring heat waves and extended droughts.

The Intergovernmental Panel on Climate Change reported that:

> … the tourism industry faces profound impacts from climate change – impacts that are already being felt. As temperatures rise, the attractiveness of many destinations will fade. Winter sports will become less viable in some destinations. Coastal tourism is highly vulnerable to rising sea levels. The natural phenomenon that millions of tourists travel to see – coral reefs, forest, fauna-rich savanna will be degraded or destroyed. The sector also faces impacts of a more general nature: more expensive insurance (from more extreme weather), reduced water availability, reduced food security and greater conflict affecting some communities in which it operates.

Source: UN

Activities

Understanding the text

1. Describe the deepening diversification of tourism.
2. Predict where technology might take tourism.
3. Define the Fourth Industrial Revolution.
4. Identify those types of tourism that are likely to be hardest hit by climate change.
5. Justify a basic strategy in tourism development that must be adopted if tourism is to remain viable in the future.

Working geographically

6. Investigate the Fourth Industrial Revolution to determine what technologies are likely to transform the tourism industry.
7. Study Figure 8.11.1 and answer the following questions.
   - a How many international tourist arrivals received are forecasted in 2030?
   - b Calculate the percentage change of international tourist arrivals received from 2010 to 2030.
   - c How many international tourist arrivals received are forecasted for the Americas in 2020?
   - d Identify the region expected to experience the greatest growth by 2030.

Impacts and responses to climate change throughout the world are detailed in Figure 8.11.5.

Tourism on the move in a changing climate

Rising temperatures, higher sea levels and degraded habitats will have serious impacts on the tourism industry. But options exist to help the industry adapt.

Mountain and snow tourism

Risk: Rising temperatures will mean less reliable snowfall.

Adaptation: Snow-making machines can help, although operators will face technological and economic limits.

Adaptation: Winter sport resorts can market themselves as year-round destinations.

Forest and lake tourism

Risk: Fire seasons will lengthen in some areas, with more high-fire-danger days.

Impacts: Severe droughts and pest infestation have led to wide scale forest die-back in North America.

Mitigation: Behavioural changes such as holidaying locally would reduce the impacts of tourism.

Beach and coastal tourism

Impact: Sea levels are estimated to rise by 0.45–0.82 m by the end of the century if emissions continue to rise at the current rate.

Risk: Degraded beaches are less desirable as destinations, this can reduce the prices that operators charge for accommodation.

Mitigation: New aircraft typically offer 20–30% improvement in efficiency. Shifting from kerosene to biofuels offers 30%+ cuts in direct greenhouse gas emissions.



Urban centre tourism

Risk: An estimated 150 million people currently live in cities with perennial water shortage, a figure that could rise to 1 billion by 2050.

Impact: Half to two-thirds of Asia's cities with 1 million or more inhabitants are exposed to one or more climate-related hazards, with floods and cyclones bringing the greatest risk.

Mitigation: The built environment accounts for 20% of the sector's climate impact. Retrofitting, and energy-efficient new builds would cut emissions.

Biodiversity and agricultural tourism

Risk: Rising temperatures are seeing species shift towards the poles and to higher elevations. Extinctions are increasingly likely.

Risk: In sub-Saharan Africa, up to 40% of species in national parks are likely to become endangered by 2080.

Risk: Most existing wine regions are expected to become less suitable for vine-growing.

Ocean and sea life tourism

Impact: Fish distributions are changing as the oceans warm, affecting recreational fishing and marine-animal watching.

Risks: By the second half of this century, 2°C of global warming and ocean acidification would see reef structures degrade. Mass coral bleaching and mortality will become an annual risk.

Adaptation: The decline in sea ice is expected to add to an already rapid increase in Arctic cruises.

8.11.5 Climate change and tourism

Activities

Working geographically

1. Refer to Figure 8.11.5 and write a report on the likely impacts of climate change on the tourism industry and how it might respond to the challenges ahead.
2. Investigate an expedition that you would be interested in embarking on. Provide details of what this expedition entails and why it appeals to you. Prepare an itinerary for your trip and how you anticipate sharing your experience on social media.

Greater responsibility

People will continue to be fascinated by unusual and scenic natural environments and the different lifestyles and cultures of those outside their own community. It is often these differences that motivate them to travel in the first place. A basic strategy in tourism development is to protect and retain those aspects that set a destination apart. Whether it be by establishing environmental codes of ethics and development guidelines, or by enforcing legislation, tourism development must be sustainable if it is to remain viable throughout the twenty-first century.

Exam-style questions

Extended responses

- Describe the nature, spatial patterns and the future directions of one economic activity in a global context.
- Analyse the factors that explain the nature and spatial patterns of one economic activity in a global context.
- Outline the factors that explain the nature and spatial patterns and predict the future directions of one economic activity in a global context. Justify your predictions.
- Assess the environmental, social and economic impact of one economic activity in a global context.

Glossary

accessibility a measure of the ease and efficiency with which a location can be reached

adventure travel travel that involves people interacting with a natural environment in a way that has elements of apparent danger; examples include white-water rafting, canyoning, paragliding, skiing, snowboarding, trekking and bungee jumping

cultural tourism involves travelling to a place in order to experience its unique culture

domestic tourism travel within the tourist's own country

ecotourism travel to natural areas in order to appreciate and learn the natural and cultural history of the environment while not disturbing it

EIA environmental impact assessment

international tourism travel to a country other than that in which the tourist normally lives

package tour a combination of travel, accommodation and perhaps some ancillary services, such as entertainment and attractions

rural tourism holidays spent in the countryside as a retreat from the pressures of urban living

small group tour a small number of people travelling together on an organised tour

tourism temporary movement of people outside their normal place of work and residence

tourism-destination area area that attracts tourists to stay temporarily by offering what isn't available at home

tourism-generating area the home base of tourists where the journey begins and ends

tourist industry the people and organisations that provide facilities and services for tourists

transnational operation the extension of a corporation's activities to a range of countries so it becomes multinational or transnational in nature

VFR visiting friends and relatives

CHAPTER

9 Local tourism: Perisher Ski Resort

Skiing and snowboarding is big business. Located in Australia's Snowy Mountains, Perisher Ski Resort is the largest and most visited snow sports destination in Australia and the Southern Hemisphere. This unit examines the nature of the enterprise; its locational factors and ecological dimensions; its linkages and flows of people, goods, services and ideas; and the effects on the enterprise of global changes within the industry. It is a geographical study of an economic enterprise operating at a local scale.

According to the report *The Economic Significance of the Australian Alpine Resorts Winter 2011* (published December 2012), snow sports activity attracted around 1.65 million annual visitor days in 2011 and contributed $881 million in total gross state product to the New South Wales economy. Total winter season employment generated (in full-time equivalent terms) was 9203. Importantly, job opportunities generated were almost 16 264. Alpine resorts are an important part of the economy and communities of south-east New South Wales.

> **Let us not forget the past while we look forward to the future. Past and present practices make us strong and we are committed to making this a better country for all.**
>
> **Kosciuszko Aboriginal Working Group**

9.0.1 Skiing at Perisher

Source: Perisher Media



UNIT 9.1

The nature of the economic enterprise

perisher

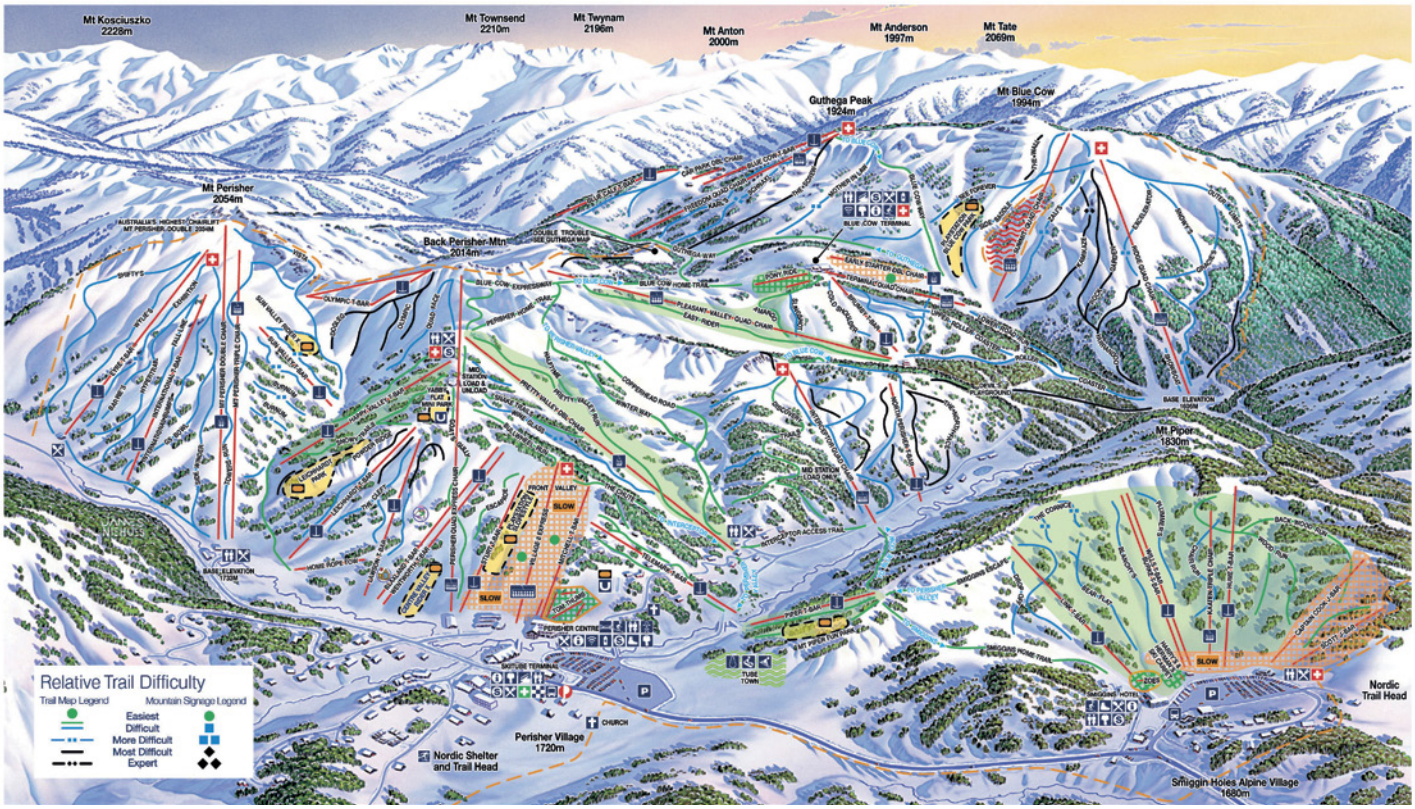
9.1.1 The logo of Perisher Ski Resort

Perisher Ski Resort is an alpine-based, leisure (recreation) and hospitality enterprise located within the boundaries of Kosciuszko National Park, in south-east New South Wales (see Figures 9.1.1 and 9.1.2). It was originally formed in 1995 by combining the resources and facilities of Perisher Valley, Smiggin Holes, Blue Cow, Guthega, The Station and Skitube. In 2015, Perisher was acquired by Vail Resorts, a US-based operator of world-class mountain resorts, becoming its first international mountain resort.



Perisher Ski Resort (see Figures 9.1.3 and 9.1.4) is a purpose-built alpine resort destination, the largest such facility in the Southern Hemisphere. It covers 1245 hectares (12.45 square kilometres) of skiable terrain, incorporating seven major peaks (the highest of which is Mt Perisher at 2054 metres), and 47 ski lifts with a total capacity of 53 990 people per hour. Perisher operates Skitube, a Swiss designed rack-rail train through a tunnel in the Ramshead Range to the Perisher Ski Resort. The first stop is the underground station at Perisher Valley; it then continues through another tunnel in the Perisher Range to Blue Cow.

9.1.2 Perisher is one of Australia's premier ski resorts.



9.1.3 Trail map of Perisher, the Southern Hemisphere's largest ski field.

As a business, Perisher is a multifaceted enterprise focusing on snow sports area operations (ski lifts, snow grooming and snowmaking, a snow-sports school and equipment hire), railway operations (the Skitube), lodgings and the supply of food and beverages. While principally a winter-based operation, the vision for future development of Perisher Range Resorts within Kosciuszko National Park is that: 'Perisher Range will be the pre-eminent all-year-round destination mountain resort in Australia providing international-class facilities based on ecological sustainable principles.'

Perisher Ski Resort is a subsidiary of Vail Resorts Inc., the parent company, which is traded on the New York Stock Exchange under the symbol MTN. Vail Resorts is a family of resorts and travel-centric companies based in the United States. The company has a lease on various buildings and ski lift operations until 2068. They also have exclusive rights within a defined area for ski lifts, instruction, and hire and sales.



9.1.4 Perisher is the largest winter sports destination in Australia.

The history of winter tourism

Winter tourism was made popular by the British leisured classes: 'the pioneers of organised sport'. In 1864, the Swiss villages of Zermatt and St Moritz became the world's first alpine tourist destinations. Zermatt was 'discovered' by British mountaineers, most notably Edward Whymper, whose conquest of the Matterhorn made the village famous worldwide. The village's notoriety attracted an ever-growing number of visitors keen to explore the region's notable physical attractions: its soaring pyramidal peaks, ice caves and glaciers. The first packaged winter sports vacation was to Adelboden, also in Switzerland, in 1903.

Skiing in Australia is said to have first taken place in 1861 at the gold-rush town of Kiandra, about 60 kilometres to the north of Perisher. After a demonstration by some Scandinavian miners, the locals took to sliding over the snow on old fence palings and planks. A sustained interest in winter sports, however, dates from the flood of European settlers following World War II. Many of those settling in the area came to work on the Snowy Mountains Hydro-electric Scheme. The presence of snow enabled these immigrants to pursue their interest in winter sports. One such immigrant, Tony Sponar—a Czechoslovakian hydrographer—identified the slopes of the present site of Thredbo as ideal for winters sports. Sponar had been a ski instructor at the St Anton Resort in Austria and longed to pursue his love of skiing. In 1955, the Kosciuszko Chairlift and Thredbo Hotel Syndicate was formed and in the summer of 1956–57, work started on a chairlift and basic accommodation.

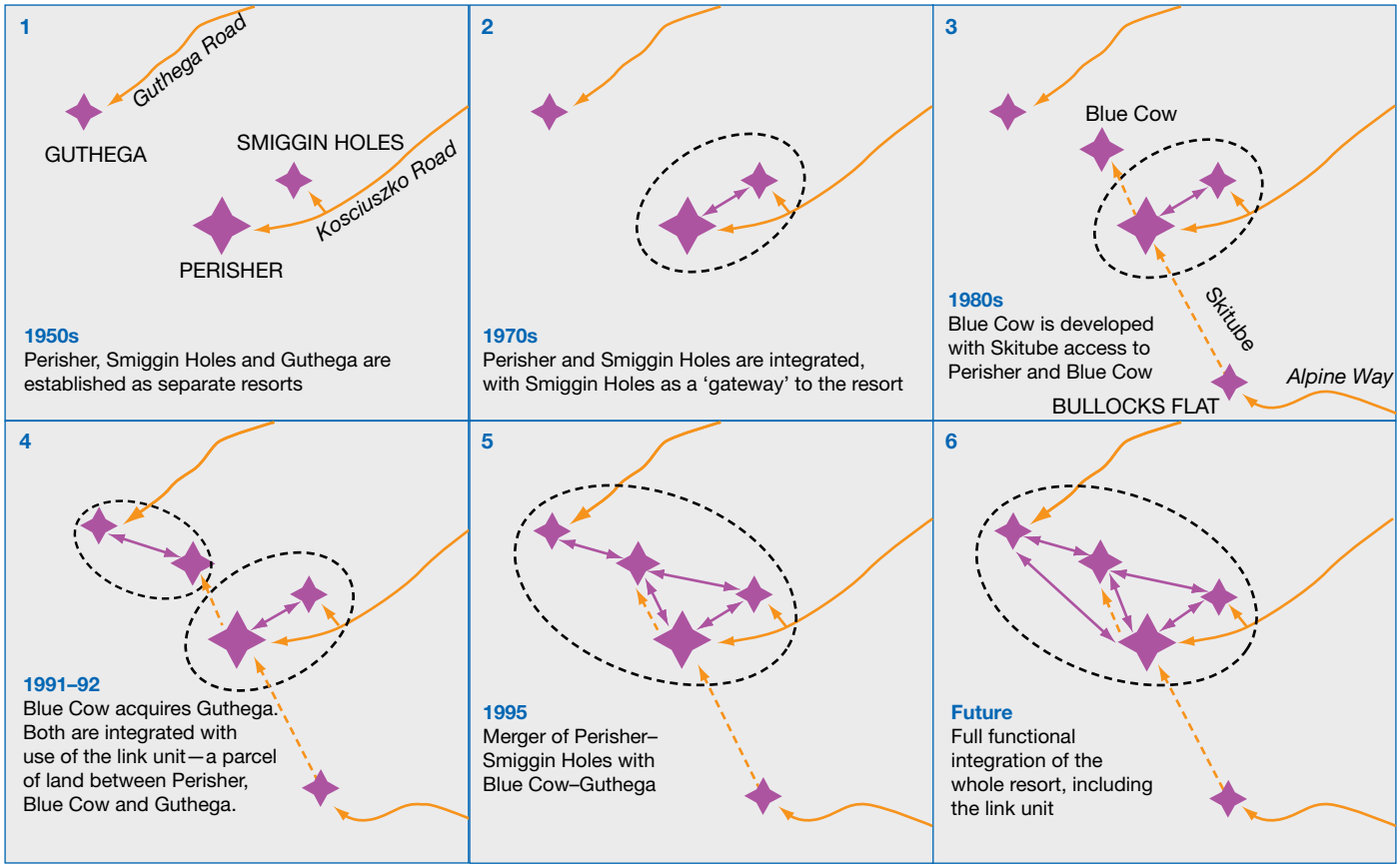
Other NSW alpine villages include Charlotte Pass (dating from 1930), Smiggin Holes (1939) and Guthega and Perisher (the 1950s). Charlotte's Pass is widely regarded as the birthplace of modern skiing in Australia. It is also Australia's oldest and highest alpine village.

The history of skiing in Perisher Valley

Skiing in Perisher Valley dates from 1939 when improved road access to the mountains and the influx of European migrants with skiing experience stimulated interest in snow-based sports in the high country of southern New South Wales.

To cater for the needs of skiers travelling to Charlotte Pass and Mt Kosciuszko, a cafe was established at Smiggin Holes in 1939. The principal mode of travel in those days was horse-drawn sleigh to Smiggins and then overland on skies to the historic Kosciuszko Chalet (first built in 1930) at Charlotte Pass.

As the number of skiers increased, services, facilities and the means of access were also improved. Perisher's first lodges (Telemark and the Snow Revellers Club) were completed in 1952 and in the winter of 1953 the first over-snow motorised transport operated to Perisher Valley.



9.1.5 The evolution of the integrated Perisher Ski Resort

In 1958, Svere Kaaten constructed a rope tow at North Perisher. Ken Murray (the initial major developer of Perisher) built a second rope tow and Perisher's first T-bar. Development continued and the Mt Perisher Double Chair was opened in 1962. With the opening of the first chairlift and the construction of further T-bars and rope tows, the Perisher area thrived. In 1972, Australian Consolidated Press took over Murray Publishers Pty Ltd, thus beginning an association between the Packer family's business interests and Perisher; see Figure 9.1.5.

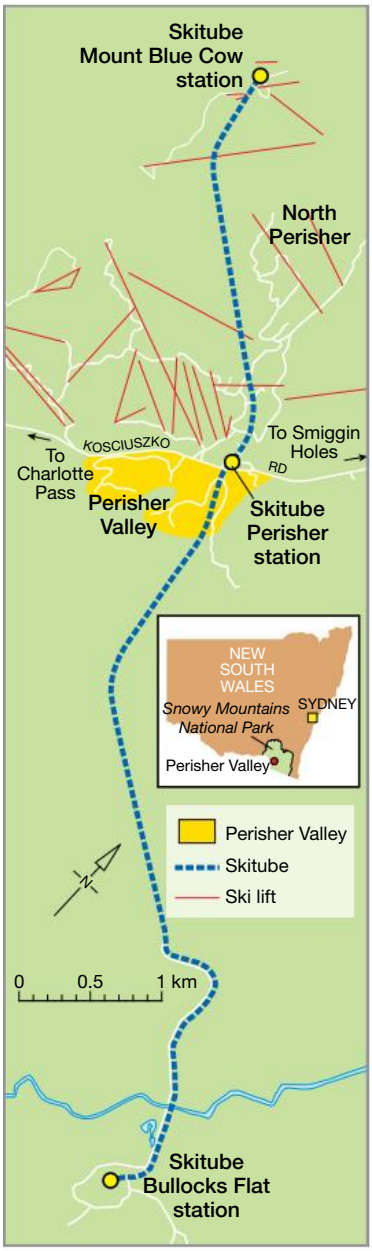
The Skitube

Initially, the Skitube alpine railway shown in Figures 9.1.6 and 9.1.7 was designed as a winter based access system to improve entry to the Perisher Range ski fields. Until then, these areas were served by a single road of limited capacity that was, and still often is, adversely affected by snow and ice during winter. The Skitube was deemed to be the most efficient and environmentally acceptable alternative available. When it was decided to go ahead with the development of Blue Cow in 1984, Skitube was the most practical option for providing access to the resort, and so Skitube was extended from Perisher to Blue Cow.

Skitube is a rack-rail train of Swiss design. The Skitube transports passengers from Bullocks Flat, on the Alpine Way and well below the snowline, through a tunnel in the Ramshead Range to the Perisher Ski Resort. It then continues on to the Blue Cow terminal via another tunnel passing through the Perisher Range. With a length of 6.3 kilometres, the rail tunnel is Australia's longest. At its deepest point it is 550 metres below the surface. Since it opened, the Skitube has carried over 4.5 million passengers.

The railway's 5 metres diameter tunnel was cut through the granite mountains on a 1:8 gradient using a tunnel-boring machine and a drill and blast method. More than 100 000 cubed metres of rock were excavated.

Because the Bullocks Flat Terminal is well below the normal snowline and only 20 kilometres from the town of Jindabyne it is normally a trouble-free journey. Frequent train services run to Perisher Valley and on to Blue Cow Mountain. A Skitube pass includes the Kosciuszko National Park entry fee, and savings can be made by purchasing a combined ticket and lift pass. The journey from Bullocks Flat to Perisher takes 10 minutes. It is then another 7 minutes to Blue Cow.



9.1.6 Skitube transports skiers and boarders from Bullocks Flat to Perisher and then on to Blue Cow.



9.1.7 The Skitube has greatly improved ease of access for skiers and boarders travelling to Perisher.

SPOTLIGHT

Snowboarding and skiing: sharing the mountain



9.1.8 The introduction of snowboarding proved to be a major boost to snow-based tourism.

Snowboarding has been vital to the economic viability and commercial success of the world's snow-based enterprises since the late 1980s. It has introduced a new generation to the challenges and thrills of snow-based sports (see Figure 9.1.8). Snowboarding now features its own distinctive sporting culture and heroes. It has its own fashion code and terminology.

Snowboarding developed in the United States in the 1960s. Over the next decade, different pioneers refined the design of boards and promoted interest in the sport. Surfers and skateboarders became involved and by the late 1980s snowboarding had become hugely popular. It has been critical to the growth and economic viability of many winter sports destinations.

International competitions began in the 1980s. The United States hosted the first World Championships in 1983, and a four-stop World Cup tour was established in 1987. Snowboarding first featured in Olympic competition in 1998. There are three snowboarding events: the halfpipe, the parallel giant slalom and the snowboard cross. In the first, using speed gained on the slope, snowboarders come up over the rim of the pipe and perform aerial manoeuvres. The second event features head-to-head matches on the mountain, where competitors battle it out on two side-by-side courses until there is a winner. In the third event, participants face a challenging route that includes jumps and obstacles. The heats consist of four competitors who start at the same time. The best two in each heat proceed to the next round.

Today snowboards are a mainstream winter sport activity. A recent survey conducted at Perisher Ski Resort indicates snowboarding comprises 38 per cent of the Perisher snow rider market, as shown in Figure 9.1.9.

Rider type survey	2016		2017	
Two-hour sample period 10 a.m. to 12 noon	**Tally**	**%**	**Tally**	**%**
Total skis	3832	56%	4682	62%
Total snowboards	2982	44%	2841	38%
Total numbers	6814	100%	7523	100%

Source: Rider Type Survey

9.1.9 Skiing and snowboarding statistics

Profiling Australia's snow sports enthusiasts

Despite living on the driest and flattest inhabited continent on Earth, Australians love snow sports. According to research published by the Alpine Resorts Co-ordinating Council in December 2012, visitors to the alpine resorts in winter 2011 comprised an estimated 2.91 million visitor days for New South Wales and Victorian alpine resorts (see Figure 9.1.10). Of these visitor days:

- there were 1.88 million skier days plus 1.03 million visitor days spent in non-lift snow sports and other activities which did not involve snow sports
- 57 per cent, or 1.65 million, visitor days were spent in New South Wales alpine resorts
- 43 per cent, or 1.25 million, visitor days were spent in Victorian alpine resorts
- in the New South Wales alpine resorts, visitors from outside the state made up 27.4 per cent of total visitors (this includes visitors from the Australian Capital Territory), representing 453 390 visitor days.

More males than females visited the alpine resorts in all age categories in 2011. The predominant age group in both Victoria and New South Wales was under 17. Visitation declined for those over the age of 40.

Age and gender of visitors to Australian ski resorts

State	Gender	0 to 17 (%)	18 to 24 (%)	25 to 29 (%)	30 to 39 (%)	40 to 49 (%)	50 to 59 (%)	60 to 69 (%)	70+ (%)	Total (%)
NSW	Female	16.20	4.87	5.63	5.84	5.16	3.11	1.40	0.46	42.67
	Male	21.34	6.90	7.41	8.32	5.64	4.38	2.59	0.75	57.33
Victoria	Female	14.61	7.93	6.78	6.25	4.85	1.97	1.02	0.25	43.65
	Male	16.63	10.83	10.56	7.95	6.04	2.80	1.22	0.32	56.35

Note: Age groups were changed to align with a recent government practice.

Source: Alpine Resorts Co-ordinating Council

9.1.10 Age and gender of visitors to Australian ski resorts

Activities

Understanding the text

1 Outline the nature of the Perisher Ski Resort as an economic enterprise.

2 Demonstrate how Perisher Ski Resort is a multifaceted business enterprise.

3 Describe the vision for the future development of the resort.

4 Outline the operation of the resort regarding the infrastructure in place (such as buildings and ski lifts).

5 Demonstrate the importance of snowboarding to snow-based enterprises since the 1980s.

Working geographically

6 Using the information in the unit and Figure 9.1.5, write a paragraph outlining the evolution of the Perisher Ski Resort.

7 Outline the importance of the Skitube to the commercial success of Perisher. Explain why the railway was considered the most efficient and environmentally acceptable alternative in this part of Australia.

8 Study the text and Figure 9.1.9 in the Spotlight box 'Snowboarding and skiing: sharing the mountain' and answer the following questions.

- a Calculate the percentage difference between total skis and total snowboards for 2016.
- b Calculate the percentage difference between total skis and total snowboards for 2017.
- c Describe the change between 2016 and 2017.

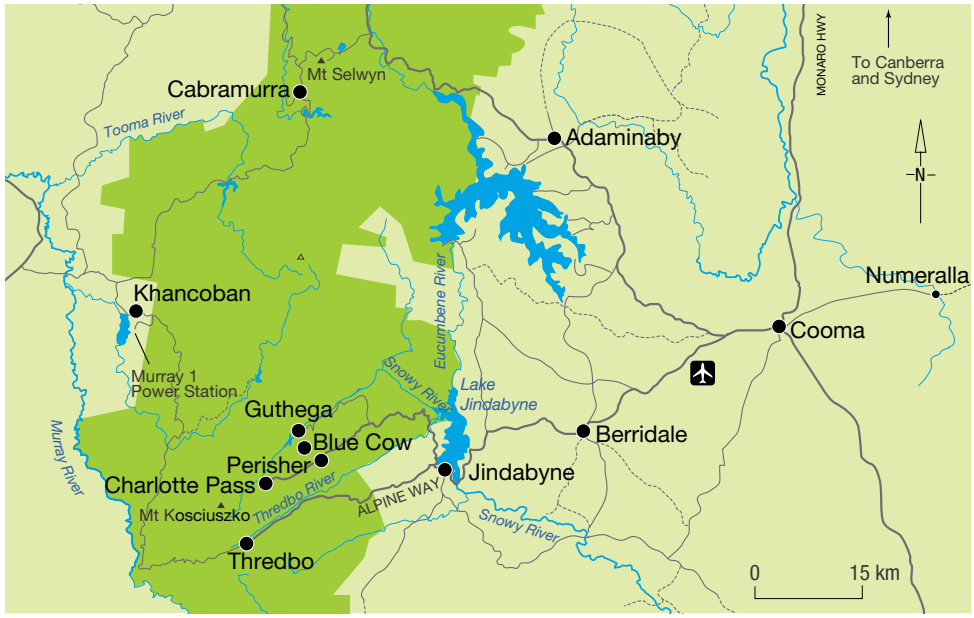
9 Study the text and Figure 9.1.10 and write a report on the 'typical' Australian snow sports enthusiast.

10 Familiarise yourself with the Perisher website. Use the information available to update the material presented in this case study of an economic enterprise.

UNIT 9.2

Locational factors

Perisher is located within the borders of the Kosciuszko National Park in the Snowy Mountains of south-east New South Wales. The resort is linked to Jindabyne (the nearest urban centre of any significant size) by Kosciuszko Road. The distance between the two centres is 30 kilometres as shown in Figure 9.2.1. Jindabyne provides accommodation for many of the skiers and boarders who utilise the facilities and services provided by Perisher and also the staff responsible for supplying and maintaining these services and facilities.



9.2.1 The location of Perisher

Sydney and Canberra represent the two most significant markets for Perisher. The NSW snowfields are a 5.5 to 6 hour drive from Sydney via Canberra or Cooma and a 2.5 hour drive from Canberra. More than half the distance travelled from Sydney is spent on a freeway or dual-carriage standard road.

Cold-destination tourism is restricted to those parts of the world that have the necessary geographical (climatic and topographical) features. The location of ski resorts is determined by elevation and latitude and the impact these have on climate.

The high seasonal variability of the enterprise

Visitation in winter is much greater than in other seasons. As a consequence, there is an incredible variability in visitor numbers throughout each year. These peaks and troughs make it a complicated industry to manage.

Perisher operates on a 17-week winter season, but the real business happens in just 12 to 14 weeks. In this short time, the resort needs a return on the hundreds of millions of dollars invested in facilities. Staffing increases from 140 to 1200 people.

Snow sports visitors

Most snow sports visitors are after the best guest experience possible. Seventy per cent of the market is aged below 35 years. They are often families and young professional people, with a high disposable income. They enjoy the 'creature comforts' and look for a range of après-ski (after-ski) activities in the village.

Elevation

There is a misconception that the ski resorts in the Australian mountains are not as high as those overseas. In fact, they are often at comparable altitudes, if not higher than many. The villages of Whistler in Canada (653 metres above sea level) and Zermatt in Switzerland (1608 metres above sea level) are both lower than Perisher's base elevation of 1720 metres. Perisher's highest lifted point is 2034 metres above sea level. Fernie in Canada's British Columbia is 1800 metres.

SPOTLIGHT

Much more than downhill skiing

The National Parks and Wildlife Service also provides over 100 kilometres of marked cross-country ski trails on the Perisher Range. Future plans include night skiing and snowmaking on the 2 kilometre cross-country loop, improving snow reliability and the experience of users. There are also new, dedicated snowshoe trails.

World-class competition facilities are planned with newer, bigger terrain parks, rail parks and facilities. Perisher Ski Resort is home to the Olympic Winter Institute of Australia's Freestyle Mogul Skiing and Snowboard programs. A World Cup Standard Freestyle Mogul Course is set up for major competitions.



9.2.2 Dumps of snow are usually associated with the passage of cold fronts sweeping across the region.



9.2.3 Cold temperatures prevail in winter, especially on clear mornings.

Likewise, the slopes of St Anton in Austria lie between 1600 and 2600 metres. Elevation, therefore, is not the principal locational determinant. At 1605 to 2034 metres, Perisher's elevation is well within the range of altitude occupied by other resorts.

Latitude

The key locational factor in Australia's case is latitude, not altitude. Australia's geographical location means that it misses out on the colder temperatures experienced at higher latitudes. It also misses out on many of the cold fronts and subpolar lows that sweep across the Southern Ocean to the south of Australia and have the potential to deliver bigger and more frequent dumps of snow. In years where these fronts slip below the Australian continent, natural snowfalls are poor. For this reason the 2006 ski season was described as being one of the worst on record, while New Zealand picked up the snow from these fronts and enjoyed the best conditions in more than a decade.

Climate

Perisher's total annual precipitation is 2000 millimetres, most of which falls in winter as snow, shown in Figures 9.2.2 and 9.2.3. The snow is 'dumped' by the passage of cold fronts sweeping across the south-east corner of the continent.

The alpine area generally provides snow cover for up to four months of the year at elevations above 1600 metres (the snowline). Cold temperatures are experienced, with the mean daily maximum temperature ranging from 18.2°C in January (summer) to 2.4°C in July (winter). The mean daily minimum temperature ranges from 5.7°C in January (summer) to –5.0°C in July (winter), as seen in Figure 9.2.4. In winter, strong winds generally accompany snowstorms and deep snow drifts form.

Climate data for Perisher Valley

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Mean daily max. temp. (°C)	18.2	18.3	15.3	11.3	7.8	3.9	2.4	3.3	5.7	9.3	13.3	15.1	8.5
Mean daily min. temp. (°C)	5.7	5.8	3.6	1.0	–1.3	–3.5	–5.0	–4.3	–2.1	0.2	2.1	4.2	–0.6
Precipitation (mm)	98.4	65.3	124.4	121.1	161.3	195.3	204.1	256.9	245.4	214.1	139.9	121.9	1947.9

9.2.4 Climate data for Perisher Valley

The evolving and dynamic nature of Perisher

The 1970s and 1980s

Murray Publishers Pty Ltd, the operators of Perisher's ski lifts, was taken over by Australian Consolidated Press in 1972 and Kosciuszko Alpine Resorts was formed. Murray Publishers traded under the name of Perisher Ski Resort, which incorporated the resorts of Perisher Valley and Smiggins Holes.

The 1990s

In 1995, Murray Publishers Pty Ltd and the Alpine Australia Group Pty Ltd (the operators of the Blue Cow and Guthega resorts) merged to form Perisher Blue Pty Ltd. Perisher has invested millions in new infrastructure since 1995. The integration of Perisher Valley, Smiggin Holes, Blue Cow and Guthega into one inter-connected resort, under the promotional umbrella of Perisher Ski Resort, has enabled a common ticketing and resort brand.

Present day

In 2015, Perisher was acquired by Vail Resorts, which is based in the United States. The company's subsidiaries operate eleven world-class mountain resorts and three urban ski areas, including Vail, Beaver Creek, Breckenridge and Keystone in Colorado. Vail Resorts is a publicly held company traded on the New York Stock Exchange.

The future

Perisher Range Master Plan involves converting it into an all-season alpine resort. The focus of the development is hospitality, passive recreation, non-passive recreation and tourism. The Master Plan also focuses on unifying the mountain system for skiing and other winter and summer activities. The investment of $500 million includes a further 1320 beds in the resort as well as upgrading the infrastructure to accommodate the needs of the increased number of tourists. The existing car park will be partially replaced by a village complex with accommodation, shops, restaurants, a community centre and perhaps even a year-round ice skating rink. The attraction of Perisher Range is that it will facilitate year-round usage of the resort, plus diversify the visitors' experience in winter.

SPOTLIGHT

Comparing NSW's premier ski resorts

As noted earlier, Perisher is the largest ski resort in the Southern Hemisphere. Figure 9.2.5 provides a comparison between Perisher and Thredbo, which is the other major alpine resort in New South Wales.

Compared with Thredbo, Perisher has more skiable terrain at a higher altitude so its snow conditions tend to stay better for longer. Having a larger area means that the skiers and boarders can spread out across the resort. This helps reduce queue times at ski lifts. It also enables skiers to take advantage of the different terrain, slope, snow and weather conditions. Both Perisher and Thredbo's snowmaking systems allow for good skiing when natural snowfalls are low.

Comparison of the Perisher and Thredbo Resorts	Perisher	Thredbo
	Popular with families and younger, budget-conscious skiers and boarders; limited village-based accommodation; many snow riders stay in Jindabyne and commute to the resort by road or via the Skitube	Fashionable, self-contained alpine village; popular with celebrities and wealthy Sydney-siders and Canberrans; extensive range of accommodation available; lively après-ski scene
Base elevation	1605 m	1365 m
Highest lifted point	2034 m	2037 m
Vertical drop	355 m	672 m
Snow sports area	1245 ha	480 ha
Snowmaking area	53.4 ha	75 ha
Longest run	3 km	5 runs all over 3 km
Number of lifts	47	14
Lift capacity	53 990 riders per hour	17 841 riders per hour
Average snowfall	190 cm	203 cm

9.2.5 Comparison of the Perisher and Thredbo Resorts

Accessibility

In addition to issues related to transport infrastructure, the location of winter sports destinations is influenced by factors such as market potential and the availability of a labour force. By their very nature, ski resorts tend to be found in remote mountain locations and can only be developed if the specific site is accessible by tourists and staff. In New South Wales, the alpine resorts developed as a consequence of another economic activity: the construction of the Snowy Mountains Scheme.

The Snowy Mountains Scheme is a hydroelectricity and irrigation complex in south-east Australia, which generates peak-load power for the Australian Capital Territory, New South Wales and Victoria. Construction began in 1949 with one hundred thousand workers until it was completed in 1974. Many were immigrants from Europe, including German, Greek, Irish, Italian, Norwegian, British, Polish and Yugoslav people.

It was this scheme that encouraged the development of the ski industry in New South Wales. These immigrants came to work on this great national infrastructure development and embraced skiing as a serious recreational pursuit. The Snowy Mountains Scheme also opened up the area through the construction of access roads. The growth of settlements such as Jindabyne ensured that there was a pool of labour on which the resorts could draw. There is, however, a major reliance on seasonal workers, many of which come to the district to mix work with snow-based recreation.

The market for the services provided by resorts such as Perisher is principally metropolitan based. Attracting winter sports enthusiasts from Sydney (and to a lesser extent Canberra) is the main objective of Perisher's marketing program. Given the distances involved, the cost of fuel, and competition from other Australian and international resorts, the challenges facing the resort's marketing department are considerable.

Perisher spends a large sum of money each year on advertising. This involves some traditional media like radio commercials, although Perisher does most of its sales campaigns and product promotion placement through digital media such as the internet, social media and email.

Improvements in transport infrastructure (the Sydney–Canberra dual-carriage motorway) have significantly decreased travel times to the snowfields. This, together with the opening of the Skitube, has reduced one of the barriers to consumption.

Activities

Understanding the text

1 Describe Perisher's location relative to its major markets.

2 Explain why the operation of snow sports-based resorts is described as being a 'complicated' industry.

3 Describe the nature of the experience sought by visitors to Perisher.

4 Explain why latitude rather than elevation is the most important locational factor in the Australian context.

5 Identify the non-climate factors that influence the location of ski resorts.

6 Identify the major infrastructure development that initiated the development of the winter sports industry in New South Wales.

Working geographically

7 Outline the future plans for Perisher. What is the rationale for this expansion of the resort's infrastructure?

8 Study the Spotlight box 'Much more than downhill skiing'. Outline the ways Perisher is seeking to cater for the increasingly sophisticated and diverse demands of the cold climate tourist.

9 Study Figure 9.2.1. Describe Perisher's location relative to Jindabyne and Thredbo.

10 Construct the climate graph for Perisher using the data supplied in Figure 9.2.4.

11 Using the internet, define the meaning of each of the following snow-sports related terms: cross-country skiing, snowshoeing, terrain park, rail park, halfpipe and mogul.

12 Undertake internet research to locate the climate data for a Northern Hemisphere resort, such as Whistler, Zermatt or Aspen. Compare this data with that provided for Perisher. What does this comparison suggest about Australia's suitability as a cold tourism destination?

13 Compare the information supplied for Thredbo and Perisher in Figure 9.2.5 with Vail ski resort, Colorado. Add an additional column to the table and add the information that is relevant to Vail.

14 Compare the information provided for Thredbo and Perisher with the Victorian resorts of Falls Creek, Mt Buller and Mt Hotham.

UNIT 9.3

Ecological dimensions

The very existence of Perisher Ski Resort depends on the appropriate mix of topographical and climatic features, especially elevation and the seasonal spread of snow. The combination of these elements, together with the historical development of skiing in the mountains, resulted in Perisher being located within a fragile alpine environment. This unique Australian ecosystem is protected as part of a national park. Established in 1944 the Kosciuszko National Park covers 673542 hectares. This makes it the largest national park in New South Wales and one of the largest conservation reserves in Australia. It has the added standing of being internationally recognised as a UNESCO Biosphere Reserve.

In an ideal world, local habitat and species would be free to thrive. However, Perisher, like many ski resorts, has habitat and threatened species that are at risk. In the last 20 years, there has been a rapid surge in the store of knowledge about the environment in which Perisher is located. This has occurred in response to increased concerns about the ecological implications of human activity in the region.

Ecological sensitivity and management responses

Snow-based tourism is not without its environmental impacts. These include:

- the construction of resort-related facilities (such as accommodation, lifts, maintenance facilities, access roads, car parks and commercial buildings)
- the clearing and preparation of ski runs
- effluent and solid waste disposal
- the compaction of snow by groomers and snow riders, which has impacts on vegetation such as alpine grasses and perennials.

The management of Perisher, working closely with the NSW National Parks and Wildlife Service (NSW NPWS), has set in train policies and practices designed to protect the area's endangered flora and fauna and generally minimise the environmental impact of snow-based tourism.

Threatened animal species

Three notable species that are native to the Perisher Ski Resort area are the mountain pygmy possum (see Figure 9.3.1), the broad-toothed rat and the alpine water skink. Perisher Valley and the Blue Cow Mountain area are prime habitats for these distinctive species.

Mountain pygmy possum

The mountain pygmy possum is listed as an endangered species under the Environmental Protection and Biodiversity Act, and is the only mammal in Australia that is confined to elevations above the winter snowline (1600 metres). It occupies the boulder fields that feature the mountain plum pine and the migratory bogong moth, which is the main food source of the pygmy possum. The bogong moth aestivates (undergoes a period of reduced activity) in rock crevices in the mountains during the summer.

The species was thought to have become extinct until one was discovered in the University Ski Club at Mt Higginbotham in Victoria, in 1996. Since then, Perisher and the NSW NPWS have implemented an intensive program of monitoring and protecting the pygmy possums. Monitoring at Blue Cow since the mid-1980s has shown that snow-based recreational activities have not had a detrimental impact on the mountain pygmy possums.



9.3.1 Mountain pygmy possum

An area of prime mountain pygmy possum habitat at Blue Cow, previously known as 'Rough Rider' has been closed to all ski and snowboard traffic and grooming vehicles since 2002. This is to minimise potential disturbance to hibernating possums during the winter months.

The mountain plum pine at Blue Cow is a staple food source for the mountain pygmy possum and was badly impacted by the bushfires in 2003. Following the bushfires, Perisher staff assisted the NPWS in the planting of mountain plum pine seedlings in the Blue Cow mountain pygmy possum habitat area. The plants are progressing well and more have been planted in recent summer months. Monitoring results from NPWS in 2013 saw the highest number of mountain pygmy possums since the 2003 bushfire, with 16 females and 12 males caught and tagged. This is attributed to the revegetation work and trapping of feral predators.

Climax vegetation communities

The area's most distinctive plant species are the highly specialised alpine and subalpine plant communities, such as the old growth snow gum. Overall, 178 plant species are found in the area. Eleven of these are listed as threatened. They include the anemone buttercup and shining cudweed. The NSW NPWS has recovery plans for both species.

The oldest tree in the area is estimated to be 2500 years old and grows at 1970 metres. Many of the trees are, in fact, thousands of years old. Such communities have reached their full potential in terms of the relationships developed between individual species and the environment in which they grow. Alpine communities only have short windows for growth and they take from 300 to 700 years to reach full maturity.

In terms of Perisher's mountain operations, the location of these plant communities affects what is done, and how it is done, because any rehabilitation is much slower in the cold. The areas of high ecological importance are generally left intact: protected by temporary signage and rope.

Significantly, the alpine and subalpine vegetation zone is protected by a layer of snow during the period in which tourists visit the area. Snow groomers are able to push snow over the heavy traffic areas if the snow is thinning. Snow grooming equipment (which is getting bigger, but lighter) is leaving a less significant 'footprint' than in the past. However, the process of snow grooming, then skiing and snowboarding does have an impact on the subnivean spaces (the pockets of air that exist between the base of the snow and the uneven ground surface created by boulders and vegetation).

Water supply: a critical resource



9.3.2 Water quality in Perisher Creek is affected by the concentration of human activity in the Perisher Valley.

It is perhaps a paradox that in an area that receives almost 2000 millimetres of precipitation a year (and most of it falling as snow in winter when it is needed) there can be a critical shortage of water. This is because Perisher is located on the headwaters of Perisher Creek (see Figure 9.3.2) so it has a relatively small catchment area. Even more significantly, most of the moisture is unavailable when it is needed in winter, as it is frozen as ice in the snowpack.

The water supply for domestic purposes and snowmaking is critical, as it places a limit on the development that can take place in the area covered by the resort. Snowmaking uses hundreds of megalitres of water per season. This water is drawn from the Snowy Hydro's aqueducts (pipes and channels that transport water, usually by gravity).

Water shortages can be overcome because of the existence of the Snowy Mountains Scheme. Perisher will be able to plug into an aqueduct and 'borrow' water, subsequently returning it to the same catchment. All this, of course, depends on the Snowy Mountains Scheme receiving adequate rainfall.

Pollution

The influx of large numbers of tourists in winter threatens environmental quality in two ways: sewage and cars.

Sewage

The NPWS is responsible for the care, control and management of the NSW alpine resort areas.

NPWS operates two sewage treatment plants, one at Perisher Valley and one at Sawpit Creek. The Perisher Valley plant treats sewage effluent collected from Perisher Valley, Smiggin Holes and Guthega. It has to switch from virtually no waste during the summer months to a massive input from the thousands of skiers and boarders who visit the resort during the winter season, all wanting a hot shower and the use of the toilet. Complicating the issue is the fact that when the treatment plant is operating at maximum capacity it is partially buried by snow. Furthermore, the waste contains a lot more liquid than normal domestic sewage, as day visitors tend only to urinate, resulting in high diurnal flows.

As part of the Perisher Range Master Plan, the sewage treatment plant (see Figure 9.3.3) was upgraded at a cost of $50 million. Treatment of water through a decanted aeration treatment process enables its full assimilation into the natural environment. Another precautionary measure has been to encase old pipes in protective sleeves, so that leakage does not occur.

The operation of the sewage system is vital to the commercial success of the enterprise. Any disruption to the treatment process would result in a temporary closure of the resort and the loss of millions of dollars in revenue.



9.3.3 Perisher sewage treatment works

Pollution from cars

Australians often choose cars as their method of travel and enjoy the convenience of being able to drive to their destination. Unfortunately, cars are a problem in the fragile alpine zone. Apart from the issue of exhaust fumes, the greatest problem is the spillage of polyaromatic hydrocarbons (PAHs) onto car park surfaces. Polluted car park run-off can impact on water quality in the nearby streams.

All Perisher staff are encouraged to use the Skitube to access the resort whenever possible, in order to limit the amount of cars travelling on Kosciuszko Road to Perisher Valley and Smiggin Holes. In 2003, Perisher introduced a requirement for all staff (except those with exceptional circumstances) to travel on Skitube during certain peak periods.

Climate constraints

The sustainability of Perisher depends on climate more than any other constraint. Global warming could result in the retreat of the snowline to higher elevations. It is also projected that climate change may result in reduced snowfall and a shorter snow season.

According to a report by the CSIRO and the Bureau of Meteorology released in 2015, CSIRO's climate change modelling predicts that the average snow season across Victoria and some of New South Wales will become 20 to 55 days shorter under a low-risk scenario and, under a worst-case scenario, 30 to 80 days shorter. The CSIRO has found significant decline over the past 60 years in snow depth and duration of snow cover in the southern slopes and Murray–Darling basin area, and current predictions are for continued decline.

Given the lack of scientific certainty, decision-makers at Perisher are applying the precautionary principle and take seriously the notion of intergenerational equity. According to these principles, the onus is on the current generation to ensure responsible management and protection of the environment for future generations.

SPOTLIGHT

Kosciuszko National Park: Perisher Range Resorts Master Plan

The vision for future development of Perisher Range resorts within Kosciuszko National Park [KNP] is that: 'Perisher Range will be the pre-eminent all-year-round destination mountain resort in Australia providing international-class facilities based on ecological sustainable principles.'

Kosciuszko National Park, and Perisher Range in particular, contains a great variety of outstanding scenery and natural features. The park is internationally recognised for its significant natural heritage, through the park's listing as a UNESCO Biosphere Reserve.

The Perisher Range Resorts Master Plan applies to the ski resort villages of Guthega, Smiggin Holes and Perisher Valley within the area known as Perisher Range Resorts. The role of Bullocks Flat and Blue Cow within the Perisher Range Resorts has also been considered.

An opportunity now exists to substantially improve the image and operations of each of these resorts by ensuring that future growth in bed numbers and infrastructure is managed within an appropriate planning and design framework that is based on the principles of ecologically sustainable development.

The Master Plan recognises that Perisher Range is both a summer and winter resort. It emphasises the need for a close integration of the village areas with adjacent ski slopes. The Master Plan assumes that visitors will continue to access Perisher Range by car, bus and Skitube.

The framework for future development seeks a balance between the demands of resort-based recreation and natural resource conservation in KNP. The aim is to provide opportunities for winter and summer visitors to use KNP in ways that are consistent with preserving the unique natural and cultural heritage of the park. The resort area plans contained in the Master Plan are separate from the Perisher Blue Ski Slope Plan which covers ski slope areas; however, the planning and staging of both areas will be closely integrated.

NSW NPWS, Department of Environment and Conservation NSW, Sydney, 2006

A number of measures have been implemented to assist the environment. These include harmonic filters installed on most chairlifts to save on energy consumption; a fuel management system to monitor fuel use; increasing energy efficiency by designing better equipment for lifting and snowmaking; improving water efficiency; replanting disturbed areas with native species; and a native revegetation program to rehabilitate areas of Blue Cow after the bushfires of 2003. Revegetation work is monitored for years afterwards to ensure it is successful. In partnership with NPWS, new techniques are being trialled and monitored. Over the last three summers over 7000 native shrubs, trees and grasses have been planted throughout the resort.

On 25 July 2017, Perisher's parent company, Vail Resorts, Inc. announced that the company will pursue a comprehensive sustainability commitment, called 'Epic Promise for a Zero Footprint'. This undertaking, commits to zero net emissions by 2030, zero waste to landfill by 2030 and zero operating impact to forests and habitat.

Zero net emissions by 2030

Vail Resorts aims to achieve net zero emissions in its operations by 2030 through the following initiatives:

- Reducing the company's electricity and natural gas use by another 15 per cent—in addition to the 19 per cent already achieved—by improving operating practices and investing $25 million in innovative, energy-saving projects, such as low-energy snowmaking equipment, green building design and construction, and more efficient grooming practices and equipment. Since 2008, Vail Resorts has implemented an aggressive plan to reduce its electricity and natural gas use and has already achieved a 19 per cent reduction, after adjusting for acquisitions and new business locations.
- Purchasing 100 per cent renewable energy equivalent to Vail Resorts' total electrical energy use and working with utilities and local, regional and national governments to bring more renewable energy to the grids where the company operates its resorts. The company is already a member of CERES Business for Innovative Climate and Energy Policy as well as RE100, a global collaborative initiative of influential companies committed to using 100 per cent renewable electricity.
- Investing in programs such as tree planting to offset the use of other types of energy (for example, gasoline and diesel).
- Engaging with the company's vendors and suppliers to identify and collaborate on opportunities for them to reduce their emissions and environmental impact.
- Providing resort guests with information and opportunities for them to reduce or offset their carbon footprint.
- Sharing the company's progress in achieving its 'Epic Promise for a Zero Footprint' goals in an annual sustainability report following the fiscal year ending July 2018, which will follow the Global Reporting Initiative's standard.

Vail Resorts intends to achieve a 50 per cent reduction in its net emissions by 2025, based on 2016 levels.

Zero waste to landfill by 2030

Vail Resorts plans to achieve its 2030 goal of 'zero waste to landfill' by diverting 100 per cent of the waste from its operations to more sustainable pathways. Currently at a 40 per cent waste diversion rate across its entire operations, the company has set its sights on an interim target of diverting 50 per cent of its waste by 2020. Vail Resorts plans to achieve this goal by:

- improving its recycling and composting program
- engaging with vendors to reduce packaging and to source recyclable and compostable products
- working with local resort communities to increase options for reuse and diversion
- increasing awareness and engagement with employees and guests through signage, labeling and training.

Zero operating impact to forests and wildlife habitat

To protect the spectacular mountain landscapes in which Vail Resorts operates, the company commits to the following initiatives:

- Minimising or eliminating the impact of any future resort development.
- Planting or restoring an acre of forest for every acre of forest displaced by the company's operations, with the goal of achieving improved species and age diversity, resulting in healthier, more resilient forests.
- Continuing and expanding Vail Resorts' existing commitments to partner with and fund local organisations focused on the health of forests, habitat and wildlife. In 2016, for example, the company contributed more than $1 million to 50 environmental stewardship projects through direct grants, the company's $1 guest donation initiative, and the '1% for the Forest' commitment, made in partnership with the National Forest Foundation and The Nature Conservancy.

SPOTLIGHT

Perisher's villages

Most ski resorts focus on the character and charm of 'their' resort village. Perisher Range consists of three discrete, unique villages. Boasting splendid vistas and a unique wilderness quality, Guthega Village (see Figure 9.3.4), tucked in below the Main Range, will continue to attract those seeking a quieter resort destination. Smiggin Holes will retain its character as the gateway to Perisher with a distinct family feel. It is known as a beginner area in the security of the natural bowl. Perisher Valley will be transformed by the emergence of a new Village Centre, which will act as the vibrant heart of the resort. The visitors' experience will be enhanced by all that is on offer. The rest of Perisher will continue to provide a combination of commercial and private lodging, offering a mix of lodging styles and character, all within an easy distance of the village centre and ski slopes.



9.3.4 Guthega is a small village nestled under the western rim of the Perisher Range.

Establishing the ecological dimensions of Perisher

Establishing the ecological dimensions of Perisher entails a consideration of the following factors:

- Perisher's very existence depends primarily on the appropriate topographical and climate features of elevation, and the spread and depth of snow.
- The development and operation of the resort has a substantial impact on the biophysical environment. These include the clearing of slopes for ski runs; construction of towers for chairlifts, T-bars and rope tows; and the building of roads and amenities.
- The NPWS, which manages the lease of Perisher, has conservation and sustainable use as the cornerstone of its management strategy. Balancing the commercial interest of Perisher and the ecological integrity of the area is central to the process of environmental management.
- No further spatial expansion can occur. Therefore, the Perisher Range Master Plan involves redeveloping within existing areas. New lifting equipment will generally be constructed in existing disturbed corridors. Site-specific environmental assessments and safeguards will be used to reduce any existing impacts. This ensures that any development will not compromise the ecological health and integrity of Kosciuszko National Park.
- The ultimate future of the resort may well be determined by an ecological constraint outside its control: global warming.

Future planning guided by the principles of ecologically sustainable development (ESD)

The development of the NSW NPWS's Perisher Range Resorts Master Plan has been guided by the principles of ecologically sustainable development (ESD). The central feature of the plan is the development of a substantial village centre in Perisher Valley with increased on-snow accommodation. The plan also foreshadows an improvement in the overall environmental performance of the existing ski resort and the provision of international class facilities. This, in turn, will combat the loss of skiers to competing interstate and overseas resorts: the lack of sufficient on-snow accommodation at Perisher being a reason cited by people for choosing other snow resort destinations.

Supporters of the Perisher Range Resorts Project maintain that it is planned for areas already disturbed by human activity and hence little, if any, environmental degradation is likely to occur. Any adverse impacts, they argue, should be addressed by monitoring and remedial action. Failure to implement the proposal will limit the potential for future growth in the industry with adverse impacts on both the regional and state economy.

One of the most fundamental issues arising from the Perisher Range Resorts Master Plan is the type and intensity of the resort development. Of concern is whether it is able to attract and retain the existing and projected level of tourism, while maintaining environmental sustainability. A related issue is the economic contribution the industry makes to the economy at the state and regional level.

Activities

Understanding the text

1 Outline the impacts on the environment of snow-based tourism developments.

2 Specify the strategies Perisher uses to protect the mountain pygmy possum.

3 Describe the plant communities of Perisher. What impact do these have on the operations of Perisher?

4 Explain why Perisher faces a 'critical' shortage of water.

5 Identify the source of water Perisher uses for snowmaking.

6 Specify the factors complicating the treatment of effluent at Perisher.

7 Outline the impacts of human activity at Perisher on its water quality.

8 Explain how cars have an adverse impact on water quality. Outline Perisher's response to the issue.

9 Outline the possible impacts of global climate change on Australia's alpine area.

10 Explain what is meant by the terms 'precautionary principle' and 'intergenerational equity'.

11 Outline how Perisher is responding to the threat of global climate change.

12 Specify the factors influencing future planning at Perisher.

Working geographically

13 Consider the initiatives undertaken by Vail Resorts to protect environmental quality. Identify those aspects of the biophysical environment that are involved and assess how these initiatives will make a difference.

14 Access the NSW NPWS website and locate the 2006 Plan of Management for the Kosciuszko National Park. Study the plan and identify those aspects that will impact on the commercial activities of Perisher Blue Pty Ltd. Working in groups, develop a mind map summarising the key impacts.

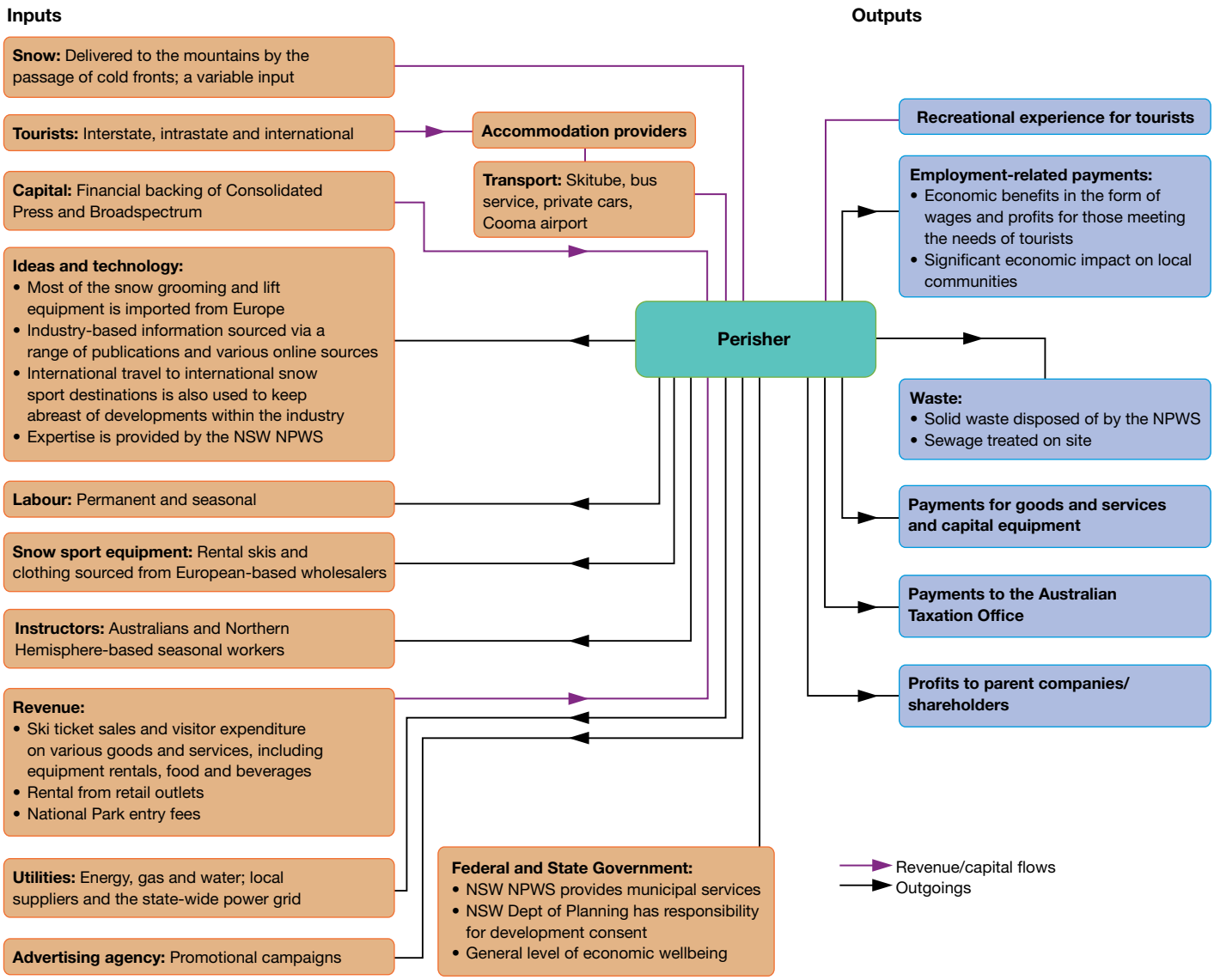
15 Study the Spotlight box, 'Kosciuszko National Park: Perisher Range Resorts Master Plan'. Outline the key features of the plan.

16 Access a copy of the Perisher Range Resorts Master Plan. After studying the report outline the key elements of the initiative and evaluate the claim that the plan is consistent with the principles of ecological sustainability.

UNIT 9.4

Internal and external linkages and flows

The significant flows of people, goods, services and ideas at Perisher are illustrated in Figure 9.4.1.



9.4.1 The flows of people, goods, services and ideas at Perisher

Market linkages

Perisher is a market leader at both local and national scales. Perisher has about twice the visitation of Thredbo and does more business than all the Victorian resorts combined. Perisher's lowest elevation is 1605 metres, which is 200 metres above the Victorian resorts. In terms of visitor numbers (see Figure 9.4.2), area and revenue, Perisher is the largest ski resort in the Southern Hemisphere. When taking into account the hectares of snow-riding terrain and the number of lifts, it is comparable to some of the large resorts of North America.



9.4.2 Visitors enjoying Perisher

Perisher is a significant local employer and major player in terms of the regional economy. Perisher recruits staff from the major capital cities of Sydney, Melbourne and Adelaide to work in hotels, food and beverage outlets, in its railway operations (the Skitube), as ski and snowboard instructors, in equipment rentals, as lift operators and in guest relations. Some of the more specialised ski instructors fly in from the Northern Hemisphere resorts to continue their perpetual winter. Young locals who have grown up in the mountains often seek this as a career as many have developed the necessary skills.

The impact of Perisher on the local economy is enormous. Fifty per cent of the entire operating cost of Perisher is spent on labour. Millions of dollars are paid out in wages in just four months to young people who, in general, don't save. A significant amount of the money is fed into the local economy in a very short period in return for accommodation, food, alcohol and clothing purchased from local shops, supermarkets, restaurants, hotels and nightclubs. This is quite apart from the money that flows into adjacent urban centres (Jindabyne, Berridale and Cooma) servicing the massive influx of tourists in the winter. The multiplier effect of dollars spent by tourists in the mountains is enormous.

The Station is located 5 kilometres from Jindabyne—owned and operated by Perisher— and caters for tourists and staff of the resort. Lodges, motels and hotels also accommodate tourists, with bookings handled by real estate agents and visitors' centres located in Jindabyne and Cooma.

Planning and development

The NSW State Government, through the NSW NPWS and the NSW Department of Planning, sets the parameters in which the resort operates. The NPWS was, until recently, responsible for the administration and planning within the ski resorts of the Snowy Mountains. However, following the Coroner's Report on the 1997 Thredbo Landslide, the consent authority for development in these resorts was transferred to the Minister for Planning. This ensures that all planning and development within the ski resorts follows the same rules and procedures as the rest of New South Wales. The NPWS remains responsible for managing development in the national park outside the dedicated resort areas.

The NSW National Parks and Wildlife Service

The alpine resorts of New South Wales are the most popular seasonal recreational destinations in the Kosciuszko National Park and the most developed parts of the national park. As with all resorts, Perisher operates under a lease, which contains rights and obligations. The NPWS is responsible for managing the resort leases, the natural and cultural values of the lease areas, public health and issues related to the impacts of the resorts on the adjacent parts of the park.

Such municipal utilities and infrastructure are normally the responsibility of local councils. However, this is not the case in Kosciuszko National Park.

It is a statutory requirement of the National Parks and Wildlife Act 1979 (NSW) that a plan of management establish the 'scheme of operations' for Kosciuszko National Park. In 2006 a new plan of management was adopted to provide a framework of objectives, principles and policies to guide the long-term management of the broad range of environmental and heritage values contained in the park. It contains a suite of actions to be undertaken to protect and conserve the values of the park. The plan takes into account the views and values of the wider community and acknowledges the significant challenges posed by the need to balance conservation of the natural environment and the expectations of the wider community in relation to resort-based recreation and leisure opportunities.

The NSW Department of Planning and Environment

The NSW Department of Planning and Environment has the role of providing the strategic and statutory planning framework to guide planning and development in the resorts and to administer development control. The NSW Department of Planning and Environment is responsible for the assessment of any development requiring consent under the Environment Protection and Assessment Act 1979 (NSW).

The Alpine Resorts Plan

The new planning processes include an Alpine Resorts Plan being prepared by the Department of Planning and Environment. The Alpine Resorts Plan and the 2006 Kosciuszko National Park Plan of Management will guide future planning and management of the alpine resorts and Kosciuszko National Park.

All the resort areas in the Kosciuszko National Park are valued as significant natural, cultural and commercial assets. The pressure for development and change within a highly recognised, fragile alpine environment presents a major challenge for planning and management. The NSW Government is responding to the challenge through the preparation of the Alpine Resorts Plan.

The Alpine Resorts Plan applies to the resort areas, which occupy an area of some 5000 hectares, or just 0.6 per cent of the total area of Kosciuszko National Park (695 000 hectares). However, their spatial extent greatly underestimates their importance and influence on the park and the wider region. The NSW resorts comprise four discrete areas: Perisher Range (Perisher Valley, Smiggin Holes, Blue Cow and Guthega), Thredbo, Charlotte Pass Village and Mt Selwyn. A detailed consultation program formed a key part of the development of the Alpine Resorts Plan. Government agencies, relevant councils, resort operators and environmental, community and user groups were consulted during the development of the plan.

Flow of people, goods and services at Perisher

The principal flows of people, goods and services generated by the activities of Perisher include the following:

- **Tourists:** Visitors to Perisher can be divided into day visitors (who tend to be locals or commute from Canberra) and those who stay for several days (mainly members of ski lodges, ski clubs or those on package deals offered by Perisher).
- **Lodge owners and managers:** The majority of hospitality operators tend to stay in Perisher during the winter months when they return to run the lodge and meet the needs of guests.
- **Ski and snowboard instructors:** Perisher's extensive ski and snowboard school attracts instructors from around the world. The resort employs about 400 instructors in a typical season (see Figure 9.4.3).



9.4.3 Perisher's instructors come from around the world. This highlights the increasingly globalised nature of the industry.

- **Food and beverages:** Vast amounts of food, especially fast food, restaurant/bistro meals, soft drinks, alcohol and hot chocolates are consumed daily at the resort. These inputs are supplied by wholesalers, who transport the products from nearby urban centres.
- **Retail activities:** These include ski and snowboard sales and hire; tuning and waxing; clothing; souvenirs; and general retail outlets, such as newsagents and chemists.
- **Service/utilities from nearby urban centres:** Examples of the enterprises and services with which Perisher and other alpine resorts have a relationship include Essential Energy; Elgas; Australia Post; various banks; insurance companies; the Roads and Maritime Services; motor vehicle and skidoo service centres; the Doppelmayr Group, which builds and services chairlifts; the State Emergency Service for rescues and disaster relief; schools; police; as well as the ambulance and fire brigade.
- **Medical facilities:** Snow riding can be a dangerous recreational activity. For example, on average, five cruciate ligament injuries are treated at the Perisher Medical Centre each day. Access to medical treatment is essential. Hospitals, doctors, ambulances, physiotherapists and an emergency rescue helicopter are examples of linkages related to the activities of Perisher.
- **Entertainment:** Linkages include nightclubs, hotels, bars and restaurants; clubs; a cinema; an indoor swimming pool; and gyms.
- **Administration:** The NSW NPWS headquarters is located in Jindabyne and the Snowy Monaro Regional Council in Berridale.
- **Transport:** Transport-related linkages include the Skitube, bus services to the resort, and the airport at Cooma with links to Canberra, Sydney and Melbourne.

Movement of tourists within Perisher

The whole concept of Perisher is one based on linkages. It is a single integrated resort incorporating four interlinked resort nodes: Perisher, Smiggin Holes, Guthega and Blue Cow. The integrated nature of the resort has proved very popular. Skiers and boarders circulate between the nodes taking advantage of what is referred to as an integrated ski circuit. They are able to select from a broad range of terrain and slope standards, snow conditions and weather conditions. The initiative has allowed Perisher to expand the size of its market.

The economic significance of the Australian alpine resorts

The alpine resorts industry is located in three adjacent Australian states: New South Wales, Victoria and Tasmania. It is an important part of the Australian tourism industry and provides significant economic benefits—not only in the resort areas themselves, but also in the surrounding towns. The industry provides substantial employment, especially for younger people who might otherwise be attracted out of the regions to the larger cities. The industry also supports many specialised businesses that provide clothing and equipment for the range of alpine activities. These businesses may also be located in the major cities as well as within the alpine regions.

In 2011, total gross direct visitor expenditure generated by the New South Wales alpine resorts was $881 million and $636 million for the Victorian alpine resorts. In 2005, total gross direct visitor expenditure generated in the New South Wales alpine resorts was $867 million and $497 million for the Victorian resorts (in 2011 prices). The combined total for the 2011 winter season was $1517 million compared to $1364 million for the winter season in 2005. These expenditures cover all items of visitor expenditures, including food, beverages, lift passes, entry fees and travel from place of residence to the resort.

Total winter season employment generated (in full-time equivalent terms) in 2011 was 9203 in New South Wales and 4870 in Victoria. Importantly, job opportunities generated were almost 16 264 in New South Wales and 9754 in Victoria. (Source: ASAA Economic Significance of Winter 2011.)

Visitors to alpine regions

It is estimated that there were 2.91 million visitor days for New South Wales and Victorian alpine resorts in the 2011 snow sports season. Of these visitor days:

- there were 1.88 million skier days plus 1.03 million visitor days spent in non-lift snow sports and other activities which did not involve snow sports
- 57 per cent of visitor days, or 1.65 million, were spent in New South Wales alpine resorts
- 43 per cent of visitor days, or 1.25 million, were spent in Victorian alpine resorts
- in the New South Wales alpine resorts, visitors from outside the state made up 27.4 per cent of total visitors (this includes visitors from the Australian Capital Territory), representing 453 390 visitor days
- in the Victorian alpine resorts, visitors from outside the state made up 29.0 per cent of total visitors or 363 634 visitor days
- an average 2.3 per cent of visitors at Australian alpine resorts were from overseas, representing around 68 070 visitor days.

Although the proportion of international tourism remains low, the Australian alpine resort industry is extremely important in retaining snow sports and recreational tourism and expenditures that would have gone overseas if the alpine resorts in Australia had not been developed to capture snow sports activity and expenditures in the local economy.

Ideas and technological inputs

The modern ski industry is heavily reliant on technological development. As cold-destination tourism is most sophisticated in the Northern Hemisphere, this is where most of the ideas and technology are sourced. Ideas and technological inputs include the following:

- **Snow groomers:** Grooming machines, shown in Figure 9.4.4 A, are an expensive although essential component of a resort's infrastructure. Perisher recently added two new snow cats to the fleet for the 2017 winter season. The Prinoth Bison snow cats (including one winch cat), arrived from Europe at a combined cost of $750 000 and ensure that Perisher's fleet of 17 snowcats continue to groom over 100 runs (see Figure 9.4.4 B) during winter throughout Perisher Valley, Blue Cow, Smiggin Holes, and Guthega areas. The ongoing purchase of the latest technology snow grooming equipment allows for increased production while also reducing overall emissions from the fleet.
- **Snowmaking equipment:** Perisher has invested heavily in snowmaking to ensure guests are provided with the best possible conditions all winter. Since 2007, Perisher has spent over $22 million on improving and expanding the resort's snowmaking system, including the installation of new automated, energy efficient snow-guns.



9.4.4 When the ski lifts close, snow groomers take to the slope and work through the night to prepare the snow for fresh tracks the next morning.



9.4.5 The quad chairlift at Perisher quickly moves people up the mountain.



9.4.6 The magic carpet conveyor belt at Smiggin Holes helps beginners gain confidence on their skis.

- **Lifting equipment:** Perisher's lifting equipment includes express eight-seater, quad (see Figure 9.4.5), triple and double chairlifts, T-bars and magic carpets (see Figure 9.4.6). For the most part, this equipment is supplied by the Doppelmayer Garaventa Group. With production facilities and sales and service locations in over 30 countries Doppelmayer Garaventa is the world's largest supplier of ropeway transport system.
- **Specialised ski and boarding equipment and cold climate clothing:** Nearly all the equipment required for snow sports (skis, snowboards, boots and bindings) is imported.
- **Over-snow transport:** This includes over-snow vehicles, such as skidoos.
- **Information technologies:** Internet websites, snowcams, computerised guest management systems and automated weather stations all play an important part in the commercial operations of Perisher.

New trends are influencing the alpine resorts. Changing technologies and the influence of social media are changing the way that visitors interact with the resorts and their businesses. The information society, the growth of social media and the internet means that snow sports enthusiasts obtain information about changing snow conditions in new ways. This means a stronger response to good and poor snow conditions and changing patterns of mountain use.

Online retail

In recent years, online retail activity has increased significantly and is changing the retail industry in Australia. Because of their specialised nature, alpine industry businesses selling snow sports equipment and clothing are likely to be subject to intensifying international competition.

Online shopping is growing and competition from overseas is intensifying as overseas retailers become more sophisticated in their marketing, selling and distribution strategies. It is likely that specialist retail will be particularly vulnerable to international competition, as many of the goods sold are manufactured offshore and price competition is fierce. As a broad estimate of international trends, multi-channel retailers currently expect the split between retail shop sales and online sales to be in the region of 80/20 per cent respectively with the online share continuing to increase.

Flow of capital

The capital required to construct the infrastructure needed for a ski resort is enormous. Most of the equipment (including chairlifts, slope groomers and snowmaking equipment) has to be imported at great cost. Likewise, the running costs are very high. Perisher's wages bill, for example, exceeds tens of millions a season. The eight-seater chairlift (the Village 8) constructed in Perisher's Front Valley in 2004 cost around $8 million. The Freedom Chair constructed in 2014 cost in excess of $4 million.

Such an economic enterprise is only possible with the backing of a large company; in this case, Perisher Ski Resort is a subsidiary of Vail Resorts, Inc. (the parent company). Vail Resorts is a family of ski resorts and travel-centric companies based in the United States.

Activities

Understanding the text

1. Outline the economic importance of Perisher to the local community.
2. List the range of people, goods and services needed to support the tourism-related activities of Perisher.
3. List the principal government agencies that regulate the activities of Perisher. Identify the role of each body.
4. Provide examples of the snow sports industry's reliance on technological developments.
5. Outline the capital demands of a snow-based enterprise such as Perisher. Why is it sometimes difficult to generate a return on the capital invested?

Working geographically

6. Study the section 'The economic significance of the Australian alpine resorts'. Construct a mind map highlighting the economic significance of the resorts.
7. Access the NSW Department of Planning and Environment website. Locate information about planning for alpine resorts and prepare a report on what alpine resort development assessments involve.

CASE STUDY

Snowmaking

The ability to make snow was discovered by accident. In the 1950s, a Californian citrus grower was spraying his crops with water to prevent frost damage. As the temperature dropped below zero the water spray turned to snow.

In Australia, the first snowmaking demonstration took place at Perisher in 1967. By the late 1990s most Australian ski resorts had installed equipment providing them with a significant snowmaking capacity.

Snowmaking is increasingly common at winter sports destinations. It is used to:

- enhance the on-slope experience of skiers and boarders
- improve and maintain the quality of the snow, especially in high traffic areas or when natural snowfalls prove inadequate
- extend the length of the season and maintain the viability of snow-based enterprises.



9.4.7 Snowmaking at Perisher

To make snow, water and compressed air must be transported to a network of snow guns through a duplicated system of steel pipes: one for the compressed air, the other for water. Each system is accompanied by a facility that produces compressed air and houses high-pressure pumps to supply the water.

Snowmaking requires a significant level of infrastructure including water storages, pump stations, compressors, pipes, electricity supply, hydrants and weather stations. Snowmaking machines (commonly referred to as 'snow guns'), make snow by breaking water into small particles, cooling the water by causing the particles to move through cold air, nucleating (the creation of small ice crystals) the particles and distributing the resulting snow on the ground, as seen in Figure 9.4.7.

The efficiency of snowmaking is largely driven by weather conditions. Low temperature and low humidity increase snowmaking efficiency, so in Australia, snowmaking is practicable mainly during the early to middle part of the season (typically May to mid-August).

Snowmaking consumes large amounts of water. While most of this water finds its way back into the supply from which it came, it is important that local environmental flows be maintained.

Snow quality

The operator determines the quality of the snow produced by snowmaking machines. Wet, medium or dry snow can be made depending on the condition of the ski slopes and the prevailing weather conditions.

Wet snow is produced to simulate the condition of three-day-old natural snow. (Natural snow becomes denser with age.) It lasts longer, copes with traffic better, resists wind scouring, grooms more easily and is more energy efficient to produce.

Medium-moisture snow is produced when ski runs have an adequate snow base. Fresh, medium-quality snow is easier to ski on than wet snow. It is usually added after a slope has been groomed.

Dry snow results in a lighter, powdery cover on the ski slope. It produces optimum riding conditions for skiers and boarders.

Meteorological conditions

The effectiveness of snowmaking depends on meteorological conditions. Low temperatures and low humidity are essential. Air temperature, humidity, wind speed and direction must be monitored closely and the guns adjusted regularly to ensure optimum snow production.

Good snowmaking conditions occur when temperatures fall to about –1˚C and relative humidity to about 30 per cent. If the temperature drops to –6.7˚C, snow can be made even if relative humidity is 100 per cent.

Temperatures below –10°C are ideal for snowmaking. Sometimes a natural protein called snowmax is added to increase the amount of snow produced.

Technological developments

Techno Alpin has supplied the latest in automated snowmaking technology that is up to nine times more energy efficient than previous systems, improving snow reliability and quality. The new snow guns are controlled by computer software and have their air/water mix constantly adjusted to maximise efficiency under the prevailing climate conditions. The computer controlled automation also allows significantly quicker start-up and shut down than manual operations, further increasing efficiency.

Snowmaking at Perisher

Perisher uses three types of snow guns: manual air-water guns, fan guns and new fully automatic computer controlled snowmaking technology.

Manual air-water guns use a jet of compressed air from a central compressor to break up a stream of water into fine particles and propel these into the atmosphere under conditions which causes them to freeze as particles of snow. A snowmaker adjusts the amount of water to the snow gun to obtain the optimum snow quality.

Fan guns achieve a similar effect by passing a stream of water into an airflow produced by a fan; similarly water is adjusted to obtain the optimum snow quality. While fans are slightly more energy-efficient than air-water guns, they produce snow in a broad dispersed band that's difficult to direct, especially in windy conditions.

Air-water guns produce a more concentrated stream of snow, which can be more effectively directed along confined trails or accumulated in a large pile for distribution by grooming machines. Both types of snow guns can be mounted on a tower to increase the amount of 'hang time' the water droplets are in the air, which increases the amount of snow that can be produced.

The new automated snow guns come in two types: Lances and Fans. Lances are similar to an air/water snow gun but are mounted on either a 6 metre or 9 metre tower and use 9 times less compressed air. Each gun is controlled by a computer system that constantly checks local weather information and adjusts the snow gun to produce the optimum snow quality. Automation also allows the snowmaking department to start and stop the snow guns quickly to take advantage of, sometimes, short snowmaking windows.

Snowmaking is normally undertaken at night in two shifts, the first beginning at 4.00 p.m. and ending at midnight, and the second from midnight to mid-morning. If conditions are cold enough snowmaking can continue all day. Perisher's record for continuous snowmaking is 223.5 hours (9 days). Perisher's snowmaking capacity covers 53.4 hectares.

Efficiency of snowmaking is enhanced by snowmaking additives, which are added to the stream of water to promote the nucleation of the snow. Scientific research both in Australia and overseas shows the additives cause no environmental concern. The National Parks and Wildlife authorise additive use; however, Perisher does not use any snowmaking additives.

Activities

Working geographically

1. Why do resorts such as Perisher invest in snowmaking technologies?
2. Describe the infrastructure required for snowmaking. Why might snowmaking be described as 'capital intensive'?
3. How is snow made?
4. Under what meteorological conditions can snow be made?
5. How are technological developments enhancing the efficiency of the snowmaking process?
6. As a class, discuss whether the use of resources for artificial snowmaking can be justified given the growing problem of global warming.

UNIT 9.5

Effects of global changes

Global climate change

More than any other constraint, the future of Perisher depends on climate. Global climate change could result in the disappearance of natural snow from all but the highest peaks of mainland Australia.

The alpine ecosystem is the most sensitive to climate change in Australia because of its limited areal and altitudinal extent. Reduction of the snowpack would disrupt the ecological processes and impact on the distribution of species, populations and communities. Climate change scenarios would adversely affect alpine fauna species, such as the mountain pygmy possum, broad-toothed rat and southern corroboree frog.

Given the lack of scientific certainty of exactly what will happen, Perisher's decision-makers have adopted the 'precautionary' approach and are planning for climate change. They are following the trend evident in alpine areas elsewhere in the world, and are seeking to transform their operations from a core winter business into an all-season resort.

The NSW NPWS and Perisher Resorts have responded to the challenge of managing high-impact recreational activities within a National Park by developing the Perisher Range Master Plan. The existing car park will be partially replaced by a village complex with a theatre, restaurants, community centre, gymnasium, pool, and indoor rock-climbing wall. The aim of the plan is to accommodate destination skiers and other visitors, providing a range of active and passive activities. This will facilitate year-round usage of the resort, and diversify the visitors' experiences in winter.

Perisher has a comparative advantage in terms of climate change. Snowmaking, with improvements in technology, will allow more artificial snow to be made at higher temperatures and humidity. Snowmaking, however, requires vast amounts of water and, globally, most resorts are in the headwater catchments of mountain streams. This means the shortage of water is a real restriction on any plans to expand snowmaking capacity. Perisher is in the unique position of having the Snowy Mountains Scheme as a water supply.

Increasing global competition

The market in cold-destination tourism is highly volatile. Meeting guests' expectations is how resorts differentiate themselves from their competitors. It is simply not good enough to replicate what is available elsewhere. To be successful, a resort must find a niche and then push it.

The snow sport customer base is strongly represented by young people. For example the age group 15 to 29 years (24.9 per cent) was the largest age group of visitors to the Snowy Mountains region in 2016, followed by 40 to 49 years (22.4 per cent) and 30 to 39 years (16.2 per cent). (Source: Destination NSW 2016.) In general, this customer base seeks out the best available experiences: the latest technology, creature comforts and a range of après-ski activities at the base. They expect snowmaking and slope grooming so that snow conditions don't disappoint.

Not only does Perisher have to compete with other NSW and Victorian resorts, and overseas cold-destination resorts, but also warm-destination resorts both here and overseas. It is a fiercely competitive economic activity.

Relatively cheap international airfares have enabled an increasing number of Australians to travel to winter sports destinations in North America, Europe, Japan and New Zealand. Many of these resorts market themselves heavily to Australian skiers and boarders. New Zealand, for example, looks to Australian skiers for growth potential in its ski industry and at this point in time they offer a much broader experience as there are more activities there apart from skiing and boarding. Activities such as bungee jumping and winery visits are available close to the ski resorts to broaden the tourism experience.



9.5.1 Bike riding, a summer activity at Perisher

The response of Perisher has been to draw up plans for improved mountain facilities, including lifting and snowmaking. The NSW Governments long-term strategy for Perisher is to transform it into an all-year-round resort to rival Thredbo, which has gradually established itself as a summer destination.

Apart from the obvious issues of snow reliability and climate change, the ability of the state's two largest snow-based resorts to more fully utilise the infrastructure they have developed at great expense represents the industry's greatest commercial challenge. Thredbo has successfully transformed itself into a year-round destination. Each summer, 300 000 people visit the village to walk the high country, play golf, bike ride (see Figure 9.5.1), attend weddings and conferences, participate in a series of music festivals or just relax in an alpine environment. The challenge for Perisher is to replicate Thredbo's success. Both Thredbo and Perisher are ideally placed to take advantage of the expected surge in domestic tourism. This is driven, at least in part, by the retirement of the baby boomers.

Globalisation and the emergence of international strategic alliances

As with other productive activities, the process of globalisation is helping to transform the winter sports industry. There is, for example, a trend towards the development of strategic marketing alliances that link ski resorts all over the world. This will eventually result in the emergence of a truly global holiday club where tourists can move freely between allied resorts in Australia, North America and Europe and be rewarded for their loyalty.

Perisher's season pass, called the Epic Australia Pass is a good example of this global tourism strategy. The Epic pass allows access to Perisher Ski Resort and to the 'Family' of ski resorts owned by Vail Resorts and located in the United States and Canada.

Activities

Understanding the text

1 Outline how global climate change might impact on the commercial viability of Perisher. How is the enterprise responding?

2 Explain why there is increasing global competition in the snow-based tourism industry. Outline Perisher's response to this competition.

Exam-style questions

Extended responses

- Analyse the factors affecting the nature and location of an economic enterprise operating at a local scale.
- Account for the location of an economic enterprise you have studied at a local scale, and describe the ecological dimensions related to this enterprise.
- Describe how environmental constraints and human impacts influence the nature of an economic enterprise you have studied at a local scale.
- Analyse the linkages and flows of people, goods, services and ideas related to an economic enterprise you have studied at a local scale.
- Explain how global changes in an economic activity have affected an enterprise you have studied at a local scale.

Glossary

alpine above the tree line (approximately 1800 metres in altitude)

alpine resort an area that has been developed for principally (but not exclusively) snow-based activities. Such resorts may include a diverse range of supporting infrastructure, including accommodation, ski lifts, ski hire, restaurants and other related businesses. Alternatively, an alpine resort may simply comprise snow sports areas with little or no supporting infrastructure. Many alpine resorts also cater for summer-based recreational activities, such as hiking and mountain bike riding

capacity the ability of an ecosystem to support a use within the limits of acceptable change

cold-destination tourism an economic activity that is found at ski resorts in the alpine regions of the world; it is an industry that is globally recognised as being separate from warm-destination tourism, which is characterised by beach and tropical island holidays

conservation all the processes and actions of looking after a place so as to retain its natural or cultural significance; it includes protection, maintenance and monitoring

ecological integrity the degree to which a natural system retains its condition and natural rate of change in terms of size, habitat, biodiversity and geodiversity (the number and variety of the non-living earth features found within a specified geographical region)

ecological processes all those processes that occur between organisms, and within and between populations and communities, including interactions with the non-living environment, that result in existing ecosystems and bring about changes in ecosystems over time

ecologically sustainable development (ESD) the effective integration of economic, social and environmental considerations in decision-making processes; ESD recognises development that improves the total quality of life, both now and in the future, and requires the maintenance of essential ecological processes

grooming the process of maintaining the operational quality of ski slopes; it includes terrain smoothing in summer and snow shaping in winter

non-passive recreation recreational activities that require considerable physical exertion on behalf of the participant; examples include skiing, snowboarding and cross-country skiing

passive recreation recreational activities that require limited physical exertion on behalf of the participant; examples include photography and observing wildlife

precautionary principle the principle that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

rehabilitate to restore disturbed natural or cultural features to near their original condition

slalom a downhill ski race over a winding course defined by upright poles

snow crystallised water vapour; snow forms when droplets of water vapour freeze at sub-zero temperatures in the atmosphere; the crystals typically feature six tiny arms (called dendrites); machine-produced snow forms a compact six-sided structure more like an ice cube

UNESCO United Nations Educational, Scientific and Cultural Organization

CHAPTER

10 The global viticulture and winemaking industry

Wine has been produced and consumed for thousands of years. Indeed, it has been linked with the development and spread of civilisation. In Europe, wine has long been a reflection of the land and culture, intrinsically woven into everyday life. As Europeans ventured into the New World on voyages of exploration and quests for colonisation they carried vines with them. Subsequently the tradition and culture of winemaking spread to the Americas, Australia, New Zealand and South Africa.

Today, the industry is truly global in its character and extent. More than ever, wine is consumed throughout the world as a celebratory drink and an accompaniment to food. Wine continues to fascinate as, unlike any other beverage, it is inextricably linked to the land, the people and the culture that crafted it. It has become an established part of global culture. Indeed with increased affluence in Asia and an increasing desire to access popular Western culture, the consumption of wine has risen markedly in that region.

Viticulture and winemaking is a lucrative economic activity and it has become a fiercely competitive one. The traditional dominance of the longer-established wine regions of Europe is being challenged by well-marketed, quality wines from New World countries such as Australia and Chile.

> **In victory, you deserve Champagne. In defeat you need it.**
>
> **Napoleon Bonaparte, French military leader**

10.0.1 Grapevines in the Chianti region, Tuscany, Italy



UNIT 10.1

Nature, spatial patterns and future directions

The global wine industry involves two distinct activities: viticulture (the cultivation and harvesting of grapes) and winemaking (the production of an alcoholic beverage by crushing and fermenting grapes).

The nature of the viticulture and winemaking industry

Grape growing is a highly specialised agricultural system as seen in Figure 10.1.1. People managing the system need to be skilled in all aspects of the process, including site selection and vineyard design, vine species selection, monitoring and control of pests and diseases, fertiliser application, irrigation, plant management, monitoring of fruit development, and deciding when to harvest. Viticulturalists (specialised grape growers) work closely with winemakers. This is necessary because vineyard management, and the resulting grape characteristics, provide the distinctive product with which the winemaker must work.



10.1.1 Viticulture is a highly specialised agricultural system

Of all factors affecting the quality of a wine, the quality of the grapes is arguably the most important. This is affected by factors such as the weather experienced throughout the growing season, the soil in which the vines are grown, the stage at which the grapes are harvested and the manner in which the vines are managed. The other key factor is the knowledge and skill of the winemaker.

Winemaking involves a number of distinct stages. After being harvested, the grapes are crushed and allowed to ferment. This initial or primary fermentation stage usually lasts about a week. During this stage, yeast converts most of the sugars in the grape juice into ethanol (alcohol). In the next stage of production, the liquid is transferred into vessels for the secondary fermentation. Here, the remaining sugars are slowly converted into alcohol and the wine becomes clear. Some wine is then allowed to age in oak barrels (which gives the wine a distinctive taste) before bottling, while others are bottled directly. The time from harvest to drinking can vary from a few months to many years. Most wine is now produced for consumption one to three years after the harvest.

This is not the end of the production chain. Just like any other product, wines must be marketed. It is often this final stage that determines the commercial success of the enterprise producing the wine.

A short history of wine

Wine has been produced and consumed for at least 5000 years. Exactly where the first wine was made and consumed is not known. It is, however, thought to have been in the region stretching from Spain to Central Asia, where wild grapes grow. The first large-scale production of wine must have been in the Middle East, the region where grapes were first domesticated. For this reason, winemaking is often associated with the development and spread of civilisation: a process linked with the beginnings of agriculture and the emergence of urban societies.

Egyptian records dating from 2500 BCE make reference to the use of grapes for winemaking. In Ancient Egypt, wine played an important role in ceremonial life. A thriving royal winemaking industry was established in the Nile Delta following the introduction of grape cultivation from Levant around 3000 BCE. There are numerous references to wine in the Bible's Old Testament.

The Greeks and Romans

The Greeks and Romans introduced grape growing and winemaking to Europe. Wine was an important part of the Roman diet and winemaking became a very precise business. As the Roman Empire expanded across Europe, so too did the growing of grapes and the production of wine. Virtually all the major wine-producing regions of western Europe, including the Moselle and Rhine valleys of France and Germany and the Danube River valley in Austria, were established by the Romans.

When the Roman Empire fell around 500 CE, Europe descended into a period of conflict and social turmoil known as the Dark Ages. Throughout this period, grape growing and winemaking expertise were preserved by the Catholic Church (see Figure 10.1.2).

The word 'wine' comes from the Old English word *win*, which derives from the German word *winam*. The word *winam* is itself an early borrowing from the Latin *vinum*, which can mean either wine or vine.



10.1.2 Wine became an important part of the Christian religion with European monasteries doing much to improve winemaking techniques in the cellar.

DID YOU KNOW?

In the nineteenth century, wine was often cleaner and safer to drink than water. Such was the case for hundreds of years and the renowned biologist of the nineteenth century Louis Pasteur asserted 'Wine is the most healthful and hygienic of beverages'.

The spread of wine

Grape cultivation was transported from the 'Old World' to Mexico, South America, South Africa, Australia and California. This commenced during the Age of Exploration (from the early fifteenth century to the early seventeenth century) and continued during the period of colonialism, which extended from the start of the Age of Exploration through to the first half of the twentieth century. Today, wine is produced on all the inhabited continents.



10.1.3 Grapevines attach themselves to a trellis in the vineyard by twisting their tendrils around the wire.

Viticulture: the growing of wine grapes

Vitis vinifera

Wine is produced from the juice of grapes, which grow on vines. The grape species *Vitis vinifera* (*vitis* meaning to twist, as the vines cling and climb with tendrils, and *vinifera* meaning wine-bearing) is most commonly used in winemaking, as shown in Figure 10.1.3. There are about 5000 varieties of grapes in the world and of those 1000 are suitable for making wine, with about two dozen that now dominate the global wine industry. They are distinguished by the colours of their skin which is determined by the composition of their pigments ranging from a very light green, through to yellow, russet, pink, violet and blue-black. These produce red and white wines and the dominant grape varieties used in the global wine industry are shown in Figure 10.1.4.

Dominant grape varieties used in the global wine industry

White wine varieties		Red wine varieties	
 A	Riesling Chardonnay Sauvignon blanc Semillon Pinot gris Gewurztraminer Trebbiano Muscato Palomino	 B	Cabernet sauvignon Pinot noir Merlot Shiraz Sangiovese Cabernet franc Tempranillo Grenache Zinfandel

10.1.4 Dominant grape varieties used in the global wine industry: **A** white wine grapes, **B** red wine grapes

The qualities in *Vitis vinifera* that make it suitable for winemaking are:

- acidity, which makes the juice clean and pleasing to taste
- a high natural sugar content—a grape can accumulate up to a third of its volume as sugar, which feeds the yeast in the fermentation process producing a wine with an alcohol content of at least 10 per cent alcohol; any lower and bacteria will spoil the wine.

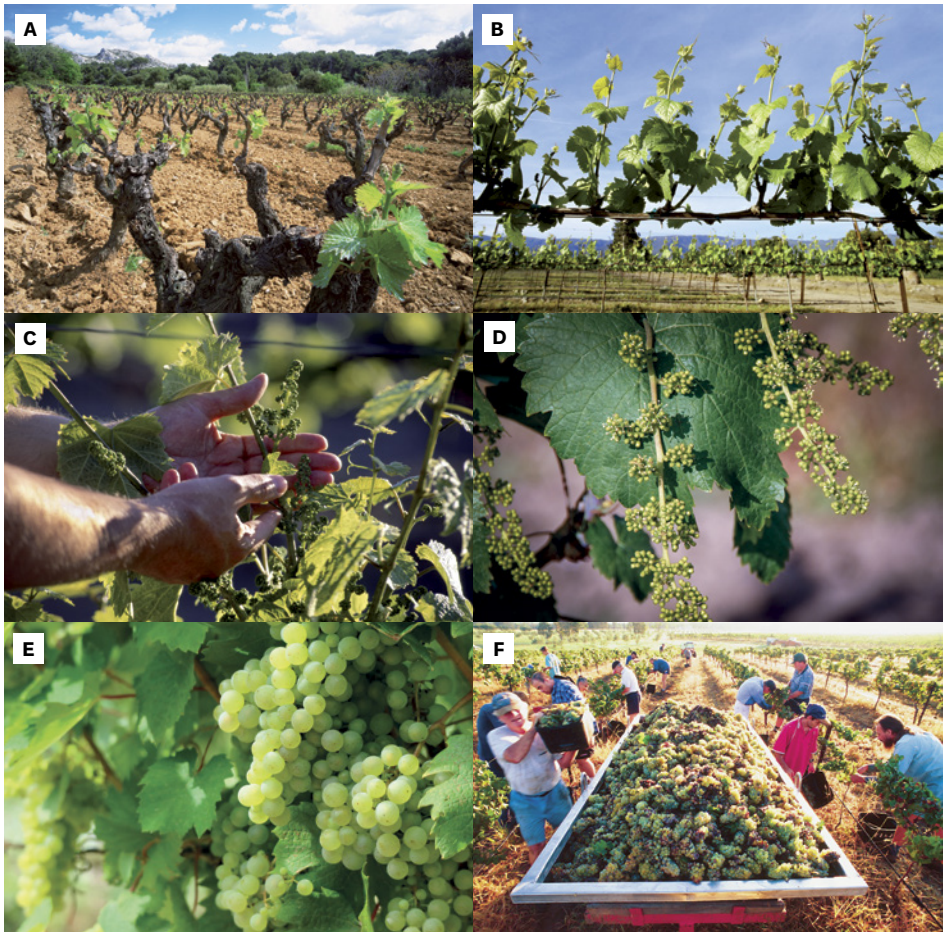
Growth of the grapevine

It can take up to five years for a grapevine to develop and produce its first crop. Grapes develop at the end of the vine's yearly life cycle, and each stage of the development is dependent on the previous stage. The vine draws its energy from the surrounding natural environment. The root system, for example, absorbs water and minerals from the soil.

Budburst is the first sign of the annual growth of the vine. The buds swell and open allowing the new green shoots to break through. The seasonal growth cycle of the grapevine is outlined in Figure 10.1.5. From flowering to harvest the growth cycle takes approximately 100 days.

The quality of the grape crop is determined by a number of factors. These include nutrient and water availability, the nature and extent of the plant's root system, and the amount of solar energy available to support the process of photosynthesis.

A series of actions must take place in the vineyard throughout the year. These are important to the development of the vines and are largely influenced by seasons and environmental circumstances.



10.1.5 Seasonal growth cycle of a grapevine.
A Early spring: the wood of the vine produces tender shoots.
B Spring: budding occurs and the stalks, leaves and tendrils become obvious.
C Late spring: the vines form flower buds, which appear like bunches of grapes.
D Early summer: vital flowering occurs.
E Summer: grapes set and change colour and begin to ripen.
F Mid to late summer: harvesting takes place.

Winemaking: from grapes to bottle

Winemaking is the second stage in the wine-production process. Today the process combines traditional knowledge with the latest technological and scientific advances. The products created are, for the most part, of a consistently high standard.

Wineries are traditionally adjacent to vineyards where the grapes are grown, or they may be sourced from another region or even a different country. New World producers often blend grapes from a number of different regions to create varietal wines that have distinctive characteristics and provide a consistent flavour from vintage to vintage, which meets consumer expectations and builds customer loyalty. A bottle of chardonnay made in Australia may be a blend of grapes from Coonawarra in South Australia and the Yarra Valley in Victoria. The transportation of grapes needs to be managed carefully with the grapes being crushed near the vineyard and transported in bulk to the winery for blending.

To make good wine, good grapes are needed. However, it is the winemaking process that largely determines the nature and characteristics of the wine produced. The process varies between the Old and New World producers as technology has advanced and the demand has grown for consistent quality wine.

Winemaking varies depending on the style and flavour of the wine. For example, the process is different for white, red, sparkling or fortified wines. Despite these differences the basic process remains the same.

The winemaking process

The main stages of winemaking are described in the following sections. A simplified winemaking process is shown in Figure 10.1.6.

1 Juice extraction

Mechanical wine presses are used to crush the grapes. For red wines, the broken skins are retained with the juice and then sent to fermentation tanks. For white wines, the pulp is pressed so that the juice can be extracted before fermentation without the skins.

2 Primary fermentation

Primary fermentation requires yeast. Natural yeast is often already present on the grapes, as a powdery substance on the skin of the grapes. The fermentation process can be initiated using this natural yeast, but often cultured yeast is added to ensure a more predictable result. During this primary fermentation stage, the yeast cells feed on the sugars and multiply, producing carbon dioxide and alcohol.

The temperature during the primary fermentation stage affects the taste of the finished product. For red wines, the temperature at this stage is typically 22–25°C, and for white wines 15–18 °C. If the sugar content of the grapes is too low to obtain the desired alcohol percentage (approximately 12 per cent), sugar is added at this stage. For red wines, the grape skins are removed after primary fermentation.

In the case of sparkling wines, bottling takes place immediately before fermentation is completed. The final stage of fermentation takes place in the bottle.

3 Secondary fermentation

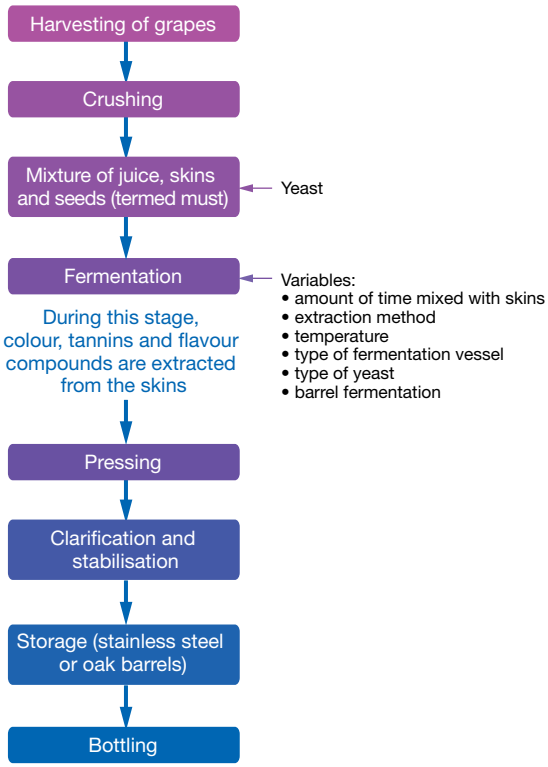
The secondary fermentation stage usually takes place in large steel tanks and lasts for three to six months. During this stage, protein in the grape juice is broken down and the remaining yeast cells and other fine particles are allowed to settle. As a result of this process the originally cloudy wine becomes clear.

4 Ageing and blending

Quality red and white wines are stored in barrels made of oak for a period of time ranging from just a few months to a number of years. While ageing, the wine absorbs the aromas and tannins (astringent compounds found in oaks) from the wood (see Figure 10.1.7). Prior to bottling, the winemaker will often mix or blend wines from different casks. This helps to give the vintage and label a uniform taste.

5 Bottling

Before bottling, any remaining traces of yeast are destroyed by the addition of sulphite. This prevents the continuation of the fermentation process within the bottle. While wine bottles are traditionally sealed with a cork, synthetic corks and especially screw caps are now widely used.



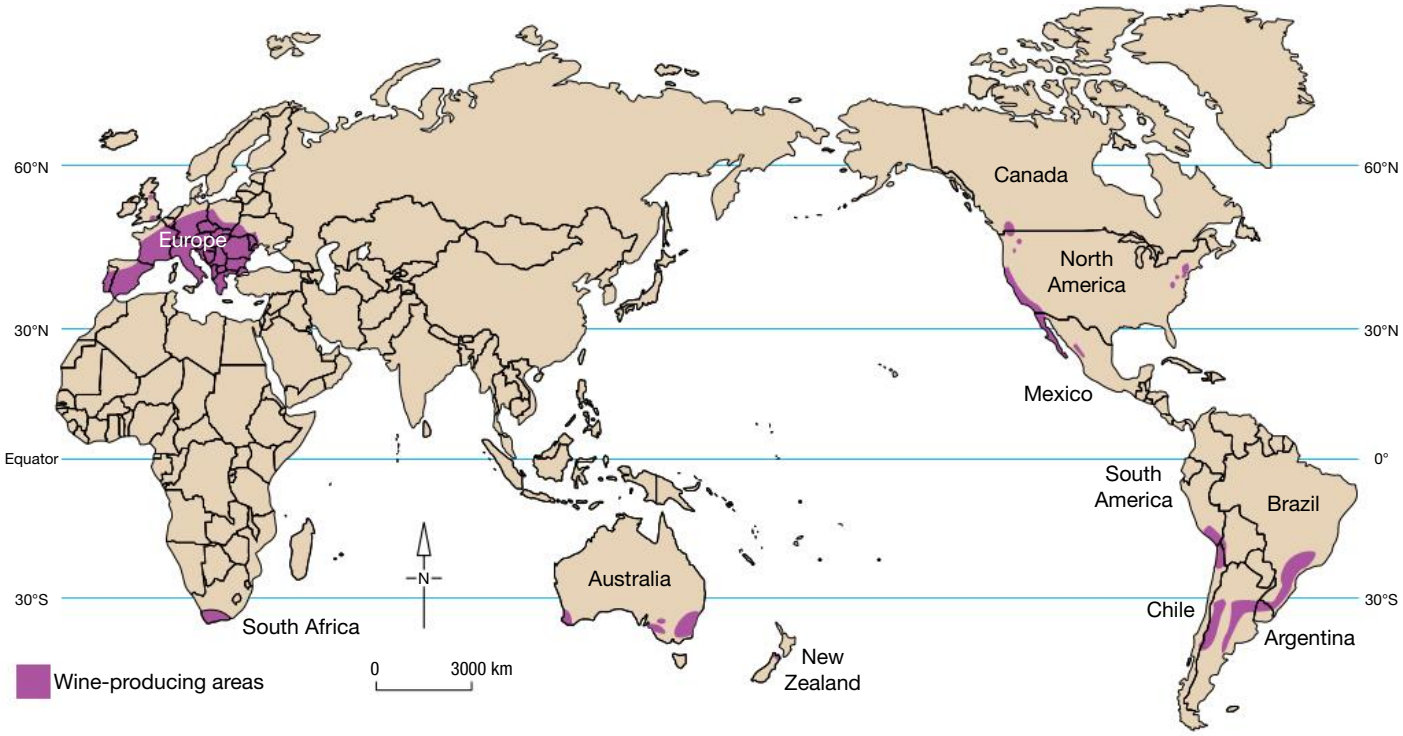
10.1.6 Simplified winemaking process



10.1.7 An oenologist (wine expert) checks the wine properties before closing the barrel.

The spatial patterns of the global viticulture and winemaking industry

The world's major grape-growing regions are located between the 30th and 50th degrees of latitude, in both the Northern and Southern hemispheres, and where mean temperatures are between 10°C and 20°C and rainfall is adequate. Grapes are sometimes grown beyond this range and wine is sometimes made in unexpected places. In these areas, grape growers have been able to adapt to the natural conditions. Figure 10.1.8 shows the world's major grape-growing regions and the major wine-producing countries.



Source: Australian Wine and Brandy Corporation

10.1.8 World map of wine producing areas

DID YOU KNOW?

After being the world's largest producer for more than a decade, France was overtaken by Italy in 2008. In 2016, Italy was the biggest producer with 48.8 million hectoliters, followed by France with 41.9 million hectoliters and Spain with 37.8 million hectoliters.

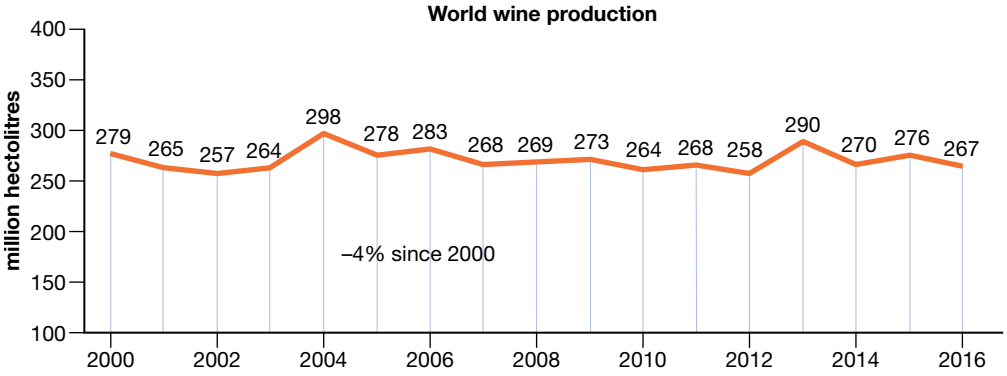
Some of the world's most famous wine-growing regions are France's Loire Valley and the regions of Bordeaux, Burgundy, Champagne, Alsace, Provence and Rhone; Italy's Tuscany, Piedmont, Umbria, Lombardy and Veneto regions; Germany's Rhine Valley; California's Napa and Sonoma valleys; the Western Cape Province of South Africa, and Australia's Hunter and Barossa valleys, Mudgee, Margaret River and Rutherglen regions.

The future directions of global wine production and consumption

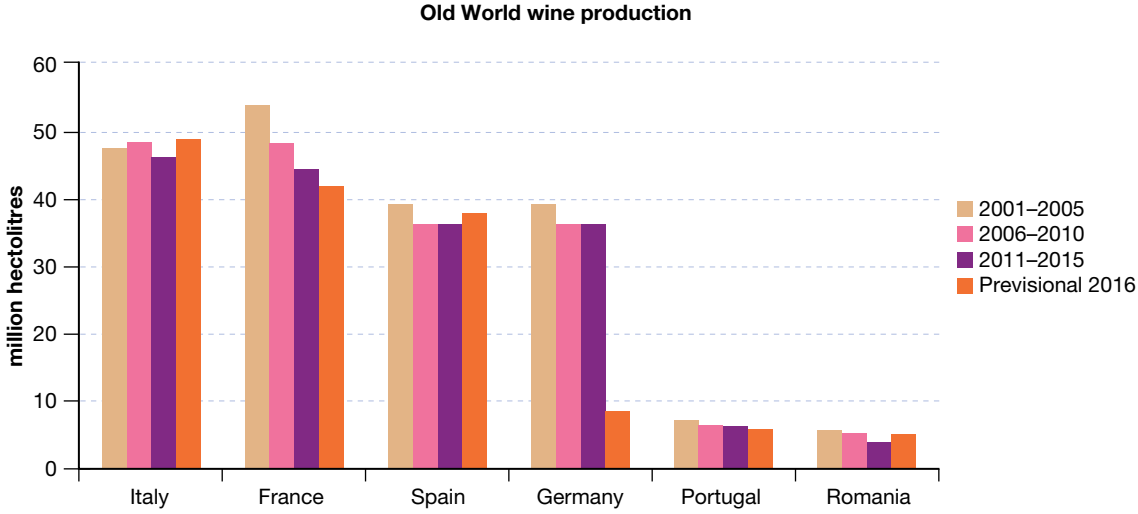
Global patterns of production

Since 2004 when wine production peaked, there has been a global oversupply of wine. The trend in production has been downward since then (see Figure 10.1.9), particularly in the main wine-producing countries of the Old World. The decline in Old World production started to ease in 2016 with both Italy and Spain increasing their production, as seen in Figure 10.1.10. In 2016, Europe was still the world's biggest wine producer with Italy, France and Spain making up 58 per cent of global output. However, it had lost ground from producing 73 per cent of the world's wine in 2001.

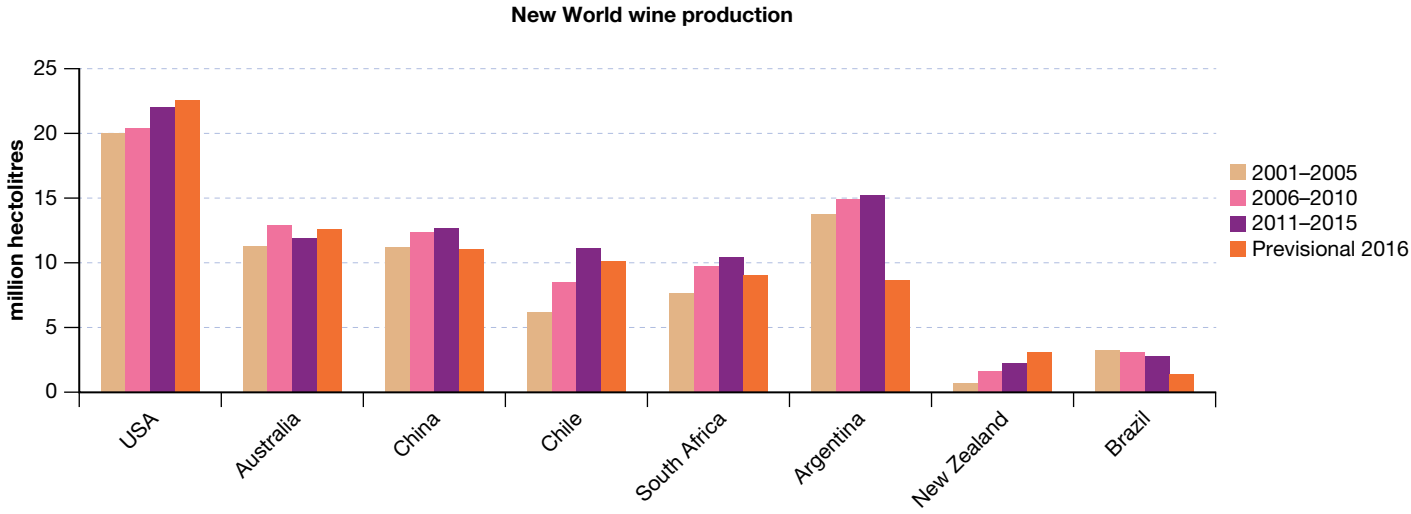
Of the top 10 wine producing countries in the world, only Argentina, China, South Africa and Chile had an increase in production from 2005 to 2016. The Old World's dominance of the global wine industry risks being swept away by well-marketed, consistent quality wine from these New World countries, seen in Figure 10.1.11.



10.1.9 World wine production 2000–2016

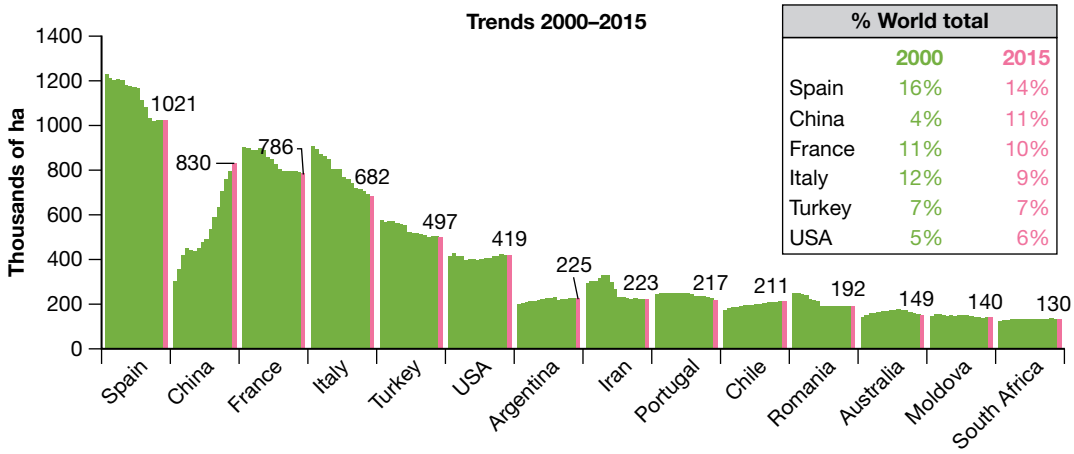


10.1.10 Wine production in the Old World 2000–2016



10.1.11 Graph of wine production in the New World 2000–2016

They have exploded on to world markets with their share of global production soaring. The most dramatic future growth in wine production is expected to be in China. Already China is producing over 640 million bottles a year annually, up from only 30 000 bottles a year in the 1980s. In 2015, China passed France to have the second largest area under grapevines in the world after Spain, shown in Figure 10.1.12. As many of these newly planted vineyards will be producing wine in another five years, China could well become one of the biggest wine producers in the world within a decade.



10.1.12 Trends in the area under grapevines throughout the world 2000–2015. It has been decreasing in Europe, Turkey and Iran. There was a strong increase for China which now has the second largest area under vineyards in the world. Southern Hemisphere countries as well as the USA have all stabilised, with little change in the area under vines.

SPOTLIGHT

Spare no expense!

A wine shop in the Dubai International Airport advertised in 2017, 'the world's most expensive bottle of red wine to ever be retailed.' The Le Clos wine shop in Terminal 3 was selling three balthazars (12 litre bottles) of Château Margaux 2009 priced at US$195 000 each.

In 2006, a US wine lover paid US$100 000 (or about US$17 000 a glass) for what is thought to be the most expensive bottle of white wine in the world: a 1787 vintage Sauternes from Château d'Yquem—a French vineyard owned by the LVMH Moët Hennessy Louis Vuitton SE Group. The wine, purchased from the Antique Wine Company of London, was bottled one year before the First Fleet landed at Sydney Cove. A bottle of 1907 Heidsieck was valued at $275 000 in 2017. More than 1000 bottles were discovered under a Swedish freighter, which was sunk by a German U-boat in World War I.

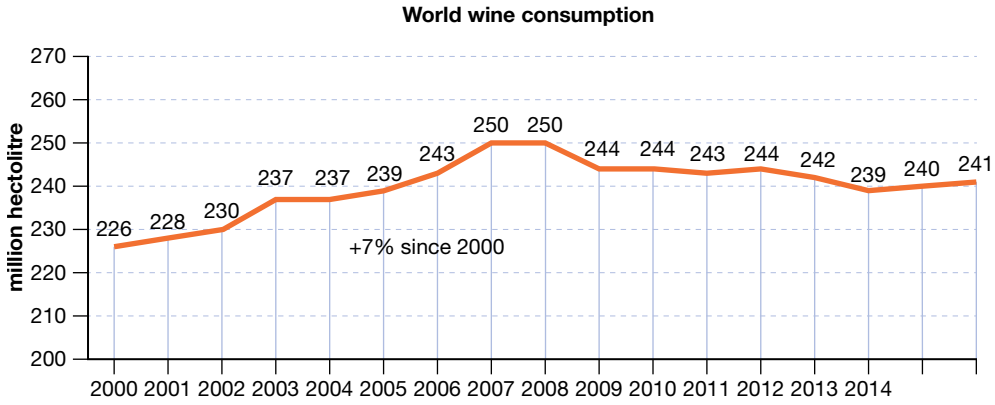
The most expensive bottle of fortified wine—a 1775 Sherry from the Massandra collection—sold at Sotheby's London in 2001 for $43 500. Located near Yalta in the Crimea, the Massandra winery was considered the finest in Czarist Russia. Its cellar contains over 1 million bottles of both Russian (some bearing the Imperial seal) and western European wines, the oldest of which was this sherry.

The most expensive bottle of wine bought at a charity auction was a 1992 Screaming Eagle Cabernet Sauvignon. It was sold at the 2000 Napa Valley Wine Auction for $500 000. The most expensive bottle of wine dropped and broken was a bottle of 1787 Chateau Margaux. It had been insured for US$225 000. In 2003, a 6 litre bottle of 1998 Penfolds Grange Hermitage achieved a record auction price for an Australian wine: A$54 000. The previous Australian record was also held by a Grange wine: a rare bottle of the 1951 vintage. It sold for A$52 000.

Global patterns of consumption

Historically, countries that have been big producers of wine have also been the biggest consumers, but in recent years there has been a significant drop in the per capita consumption of wine in Europe. Indeed, global per capita wine consumption has been falling for nearly two decades. The reasons for such trends are related to sociocultural changes that have taken place.

Europe still accounts for 60 per cent of world wine consumption, but the volume of wine consumed is expected to slide further with a projected contraction of 33.9 million cases by 2020. Globally the volume of consumption stalled at around 240 million hectolitres in 2016 (shown in Figure 10.1.13), buoyed by two countries that are driving wine consumption, which are the USA and China. Both with huge population bases, these countries are expected to increase their rates of consumption in the future.



10.1.13 World wine consumption 2000 to 2016

Activities

Understanding the text

1. Identify the various stages in the viticulture process.
2. Outline the beginning of winemaking in Europe.
3. Describe the spread of grape cultivation to the New World.
4. Identify the qualities that make the grape species *Vitis vinifera* suitable for winemaking.
5. Outline the activities involved in managing the grape growing agricultural system.
6. Explain the link between viticulture and wine quality.
7. Outline the distinct stages in winemaking.

Working geographically

8. Study Figure 10.1.1 Construct an annotated photo sketch highlighting the principal ways in which the viticulture agricultural system modifies the physical environment.
9. Study Figure 10.1.10 and answer the following questions.
   - **a** What country produced the most wine from 2001 to 2005?
   - **b** What country produced the most wine in 2016?
   - **c** What countries increased wine production in 2016?
   - **d** What country has experienced the greatest drop in wine production from 2000 to 2016?
   - **e** Calculate the percentage decrease in wine production in France from 2000 to 2016.
10. Study Figure 10.1.12 and answer the following questions.
    - **a** What country had the greatest increase of area under vines in the world from 2001 to 2015?
    - **b** What Old World country has experienced the biggest drop in its percentage share of the world's area under vines from 2000 to 2015?

CASE STUDY

New World and Old World wines

As the wine industry becomes increasingly globalised, notable distinctions between New World and Old World wines have emerged. Each is underpinned by quite different philosophies, traditions and approaches to what happens in both the vineyard and the winery.

Old World wines

Old World wines are usually made using grapes grown on a particular vineyard or in a specific geographical region, thus producing wines with distinctive regional characteristics. Many French winemakers describe wine as an expression of place and say that 'terroir' is of fundamental importance.

> Wine is a pure reflection of its terroir and no other single product sums up its geographical and historical origins in quite the same way. Each harvest yields wines that are a culmination of different climatic and human processes and no two wines are ever identical. Wine is as simple or as complex as you wish: on one level it can be an immense sensory pleasure, or at a deeper level, the embodiment of a piece of land and a moment in time.
>
> Richard Baudains, lecturer at the Università delle Scienze Gastronomiche.

The word terroir captures every component of the environment of a vineyard that may be no bigger than a single hectare. It includes:

- temperature (daily, monthly and annual variations)
- local microclimates
- temperature and humidity within the canopy of the vines
- aspect and exposure to sunlight
- soil moisture content and growing season rainfall
- mineral composition and organic content of the soil.

The focus in the Old World is on the terrestrial components of terroir and the French wines have a very close link with geography: both in a physical and a cultural sense. The character of these wines often varies from place to place and vintage to vintage. Due to variations in microclimates, there are often subtle differences in the wines from vineyards that are only metres apart, and this is especially celebrated in the renowned wine regions of France such as Burgundy and Bordeaux.

Once the grapes are harvested, a thousand-year history of traditional winemaking is strictly followed in the winery. The image of Old World wines is one of sophistication and exclusivity and this makes them very popular with consumers desiring wines with such an image.

New World wines

New World winemaking has a much shorter history and an innovative approach to both what happens in the vineyard and the winery. In the 1970s New World winemakers started to produce high quality wine that could compete with the 'classic' European vintages. As more producers entered the market, large-scale industrial wineries became common and bulk production resulted in a drop in quality and a global oversupply of wine as millions of bottles of wine were churned out. With the development of new technologies, the new millennium heralded higher quality and more reliability.

Technology is the main area of contention between Old and New World producers as it represents widely different philosophies. Technological advances in winemaking are often seen as the domain of the New World producers as they use technology to overcome or manipulate undesirable biophysical constraints. If there is a rainfall deficit, irrigation water is applied. Machinery is also used to harvest the grapes, thereby cutting costs and prices. Likewise, many innovative practices have been developed in winemaking, such as large stainless steel vats that moderate temperatures to enable wines to undergo a controlled fermentation.

In New World countries, grapes are also often blended; that is, wine is produced with varietal characteristics. Varietal branding began in California, and has become associated with wines from the New World. The Australian tradition is to produce blends of wine across district and regional boundaries. The wines of the New World are often described and marketed by grape variety rather than vineyard. New World wines are popular because of the consistency of the product from one vintage to another. Wines that are made in bulk have this reliability where each bottle, and each vintage, is much like another. They are often tailored to the demands of the mass market and offer the consumer value for money at every price point in the market.

The increasing importance of markets without strong traditions of wine consumption has meant that New World wines have played a significant role in fuelling the global expansion in the demand for wine over the past decade. New World producers have an aggressive approach to entering new markets. This approach and their branding strategies, which appeal to consumers who are unfamiliar with wine products, have become increasingly influential.

DID YOU KNOW?

At a blind tasting test in Paris in 1976 judges were surprised when they placed Californian cabernet–based wines on top, above a renowned French Cru Classé Bordeaux. This gave an enormous confidence boost to New World winemakers.

It might appear that there are tensions between the producers of the Old World and New World wines. However, it is important to recognise that the New World producers have been influenced by the successes of the Old World producers.

Branded verses estate wines

Just as it is important to differentiate Old World wines from New World wines, it is important to distinguish between estate and branded wines (see Figure 10.1.14).

Estate wines are associated with an identifiable piece of land, such as a single vineyard or sometimes several neighbouring vineyards. The people responsible for making and marketing the wine usually own these vineyards. The wine is often sold through the cellar door or through small wine retailers and restaurants.

Branded wines do not originate from a specific location, but are instead marketed by a brand name or 'make'. Branded wines are typically made from brought-in grapes, or grapes from several different sources, which may include many vineyards owned by the same company.

DID YOU KNOW?

Some Old World producers are favoured because their wines always bear the mark of the individual winemaker and the site on which the grapes are grown. They are said to have an intimate style that cannot be reproduced or matched by the large-scale 'industrial' wineries.

Characteristics of estate and blended wine production

Estate wines	Blended wines
■ Production is typically small scale and vineyard based. ■ Vineyards supplying the grapes are generally owned by the winemaker. ■ The purists argue that the estate wines show the real diversity of wine. ■ These wines are a true reflection of their land and culture. ■ Made on a smaller scale, they are more difficult to obtain, and can be significantly more expensive. ■ These are the wines that evoke passionate discussion, fervent opinions, and genuine loyalty. ■ When laid down to age for a few years, the wine flavours are often transformed. As a result of this aged complexity, the tastes and aromas are seen to linger on the palate and in the memory.	■ Wines are described by the variety of grape rather than the vineyard. ■ Production is carried out on a large scale, often using 'industrial' processes such as mechanical harvesting. ■ Wines are often made with grapes grown in different regions and transported to the winery. ■ The blended wines have become world 'brands'. ■ The reputation of branded wines is to make each batch and each vintage the same as the last. These are the wines in which reliability comes first. ■ They are tailored to meet consumer demand in the mass market. ■ As they are made in bulk, they are more affordable and widely available. ■ They are heavily marketed to build brand identification.





10.1.14 Characteristics of estate and blended wine production: **A** Moët & Chandon's Château de Saran in the Côte des Blancs **B** the Australian brand Yellowtail

Activities

Understanding the text

1 Define the term terroir.

Working geographically

2 Conduct a class discussion on the virtues of branded wines compared with estate wines, and which is likely to become more favoured by consumers in the future.

UNIT 10.2

Factors affecting the nature and spatial patterns

SPOTLIGHT

The art and science of winemaking

'Wine production is both an art and a science, a blend of individual creativity and innovative technology. But wine production is also a business, with economic factors driving manufacturing practices. To be successful in the modern marketplace, a winemaker must integrate the artistic and economic aspects of wine production, and possess a solid understanding of the intrinsic and extrinsic factors that underlie purchase motivation.'

L.F. Bisson, A.L. Waterhouse, S.E. Ebeler, A. Walker, and J.T. Lapsley, 'Insight Progress', *Nature*, 2002

The relationship between temperature and wine style

Temperature	Wine style
Very hot	Fortified wines
Hot	Full-bodied dry white and red wines
Warm	Medium-bodied dry white and red wines
Cool	Delicate dry white wines
Cold	Sparkling wines

10.2.1 The relationship between temperature and wine style

Biophysical factors play an influential role in determining the character of a wine. In contrast to other types of crops, grapes can be grown in diverse climates and soils. Although scientifically unproven, environmental stress is believed to enhance the sensory characteristics of the grapes which may result in a better vintage.

Biophysical factors

Site selection is especially important because it is the interaction between factors such as soil, slope, aspect and climate that influences the characters of the wine produced. Due to terroir—the distinctive site-specific qualities—the same vine species planted in different regions can produce quite different wines. The physical and chemical condition of the land, the natural environment and the geographical location, when combined with the cultural context, give rise to a highly distinctive product.

Climate

On a macro level, climatic factors determine the spatial distribution of grape growing on a global scale. Climate, for example, determines the length of the grape-growing season, the rate of plant growth and the quantity and quality of the fruit. Within the range of suitable climates, particular species are best able to tolerate more specific climate types. For example, in cooler regions, early ripening vines are preferable.

The Mediterranean climate is the most suitable climate for growing grapes. The wet winter provides subsoil moisture for early spring growth and the hot, dry, sunny summer promotes ripening. This type of climate is found around the Mediterranean Sea, but it also occurs in southern and south-western Australia, central Chile, coastal California and the Western Cape of South Africa.

Temperature

The ideal temperature for viticulture is 19°C for white grapes and 21°C for red grapes. Figure 10.2.1 shows the relationship between temperature and wine style. If the average temperature is below 10°C the vines may not produce grapes suitable for winemaking. At the ideal temperature, the vine produces the sugar needed for plant growth which, in turn, influences colour and flavour.

Sunlight

Since the level of solar radiation determines the rate at which photosynthesis occurs, plant growth is influenced by the amount of sunlight a plant receives. The aspect of the slope on which the grapes are grown is important. In the Southern Hemisphere, north-facing and west-facing slopes receive more direct sunlight than slopes facing east and south. The opposite is the case in the Northern Hemisphere.

Wind

Excessive wind speeds can severely damage grapevines. Strong winds in exposed areas can cause extensive damage to tender new shoots in spring and early summer and inhibit growth by breaking the canes on the vines. For this reason, it is rare to find vineyards located in areas that regularly experience high wind speeds.

Wind also causes erosion, which removes topsoil, exposing root systems. This exposure lowers the vine's ability to obtain moisture from the soil, stunting its growth.

Rainfall

Vines generally need an average rainfall of approximately 700 millimetres a year. The majority of wine areas in Australia receive less than this figure necessitating irrigation to supplement natural rainfall in some drier regions. A reliable supply of water is crucial to the viability of vines. Heavy rainfall, especially if accompanied by hail in summer storms, can cause major problems. It can erode the soil, damage and even strip the ripening fruit from the vines. Hot humid weather that follows such rain events is conducive to fungal diseases in grapes such as powdery mildew.

The water budget of any wine-growing region or site varies depending on the rate of evaporation, the hours of sunlight, aspect and topography. A reliable supply of water, especially in drier regions, has been made possible via the use of irrigation technologies. Irrigation water can come from rivers or streams, bores, wells or springs, dams or the public (reticulated) supply. However over-irrigation can dilute the flavours in the grapes, so many viticulturists around the world choose to grow without irrigation. In France, viticulturalists are restricted by the *appellation d'origine contrôlée* (the certification granted to food and wine producers within certain regions in France) to the natural supply of rainfall. This reinforces the close locational relationship between river systems and wine-growing regions.

Frost

Vines are damaged by frost when temperatures drop below –1°C. This often occurs in late autumn and early spring, or the bud-burst period. Frosts are most common in winter, but as the vines are dormant with no leaves, winter frosts do not harm the vines. Soil management, irrigation and vine training patterns can be used to alleviate frost damage.

DID YOU KNOW?

Global production of wine in 2016 was among the lowest for twenty years, largely as a result of drought hitting three big producers: France, Argentina and Chile.

SPOTLIGHT

Icewine

Icewine is an intensely sweet dessert wine made from grapes that have been naturally frozen on the vine. It is believed that the Romans used frozen grapes to make wine and in the cool climate regions of Germany and Austria, icewine production dates back to the first century. The pinot noir grape is favoured as it is resistant to frost.

The super-ripe grapes are left on the vine to endure very cold temperatures and they are meticulously hand-picked the moment they are frozen through (see Figure 10.2.2). Only the water freezes in the grapes, leaving the sugars and other dissolved solids to be concentrated in a very intense super-sweet juice released when the grapes are pressed. Even within the winery, cellar staff must work in unheated spaces so as to not compromise the desired qualities of the frozen grapes during processing.

Icewine is expensive because conditions have to be just right for harvest. If the freeze comes too late, the grapes may rot on the vine or be eaten by birds and if the first freeze of winter is very severe, the grapes are too solid and no juice can be extracted. It is also very labour intensive as a large band of pickers must be ready at a moment's notice to harvest the grapes as soon as the signal is given. Only small amounts of icewine are produced worldwide and this is limited to those places where there is some regularity in the desired cold temperatures. Canada (see Figure 10.2.3) and Germany are the leading producers of icewine and Japan is the major export market for this wine type.



10.2.2 Long after the leaves have disappeared from the vine, icewine grapes remain until they are frozen through and ready to be picked. To avoid fruit being lost to birds in the vineyards of Inniskillin winery of Canada, canons are fired intermittently to scare the birds away.



10.2.3 Inniskillin is a Canadian winery located in Niagara-on-the-Lake in Ontario. This water moderated region of North America is particularly suited to icewine production. Inniskillin is renowned as the world leader in icewine. It played a major pioneering role in the Canadian wine industry.

Soil

Soil characteristics are also a major biophysical factor affecting global viticulture. The French regard soil as the most important factor determining wine quality as terroir is the greatest contributor to the art of wine. They hold that it is the mineral composition and organic content of the soil which nourishes vines and determines the flavour of the wine. New World producers are able to manipulate soils with the addition of fertilizers to boost nutrient content if necessary. So for them it is soil structure and texture that is considered more important in influencing the quality of wine that comes off a vineyard. These soil properties determine the water holding capacity of a soil and its ability to retain heat.

The nature of the soil depends on a number of factors, including the parent material and the physical, chemical and biological processes of weathering. The composition of the parent material (for example, granite, limestone or slate) will influence the properties of the soil and the character of the wine, as seen in Figure 10.2.4.

DID YOU KNOW?

The earliest known reference to terroir is in the medieval writings of the Cistercian monks of Burgundy. Apparently the monks actually tasted the dirt to understand its influence on wine production.

Typical soil types suitable for viticulture

Limestone	Granite	Slate	Clay	Loam	Gravel
					
Limestone produces soils that not very fertile which limits the vigour of vines and produces grapes packed with flavour. The limestone base of the Chalone Vineyard in California produces quality chardonnay.	Granite produces acidic crystalline soils. Granite country suits the syrah grape and has made Hermitage in northern Rhône, France famous for its wine.	Soil derived from slate retains heat and drains well. It also adds flavour and mineral character to a wine. The cool climate wine region of the Mosel Valley in Germany has dark mineral-rich slate soil, which is an ideal growing medium for riesling.	Clay soils tend to stay cooler and retain water which is advantageous in hot, dry regions. These soils are renowned for producing the boldest red wines. The great shiraz vineyards of the Barossa Valley in South Australia are found on clay soils.	Loam is equal parts clay, sand and silt as well as humus (organic matter). It is very fertile, resulting in vine growth being over vigorous. The wines from these vineyards often lack flavour and colour unless the vines are heavily pruned. The Napa Valley of California has sandy loam soil and it is the sand content the keeps the soil poor enough to produce quality wine grapes.	Gravel soils are warm and drain easily, which is beneficial in cool wet regions. Cabernet sauvignon is a late ripening grape and in Bordeaux in France it is grown on the top or south-facing slopes where gravel is dominant.

10.2.4 Typical soil types suitable for viticulture

DID YOU KNOW?

Napa Valley vineyards in California are intentionally farmed to produce low yields which result in vivid, concentrated flavours in the grapes.

Soils suitable for viticulture, particularly the growing of premium quality grapes, are generally not fertile or especially deep. The depth of the soil will assist with the development of the vine's root system. A deep soil structure with water reserves will be beneficial for bulk wine production. A shallower and drier soil is generally better for producing quality wines.

Soil determines the character and quality of a wine by influencing the water supply and temperature in and above the soil. In hot, dry areas the criteria for evaluating soil differs from those in cool, wet areas. In hot, dry areas good soil depth is required with a moderately high clay content to enhance its water storage capacity. Meanwhile in cool, wet areas good drainage might be more important to avoid waterlogging and to increase soil temperature.

Topography

The relationship of topography and climate plays a vital role in determining the character of the grapes and thus the wine. The elevation, aspect and incline of the vineyard must all be taken into account.

While it is often more straightforward to operate a vineyard on flat land many vineyards are located on undulating to steeply sloping land. They are planted on contour banks to prevent erosion, as is evident in the Mosel Valley in Germany, illustrated in Figure 10.2.5. These banks vary in their width and length according to environmental factors and the desired qualities of the fruit. The direction the vines are facing on the slope or the slope's aspect can also affect the vine's growth rate and the quality of the fruit produced. A slope can provide shelter or warmth and can affect drainage patterns. In the Southern Hemisphere, a north-facing slope is favoured in cooler climates and vice versa in warmer climates. The opposite holds for the Northern Hemisphere.

An increase in altitude of 100 metres decreases the average temperature by 1°C. This hinders the plant's growth, which assists in the ripening of the grape and changes the acidity level. Wine producers can control the quality and character of their grape harvest by using slopes of varying height above sea level. Vineyards at higher elevations can produce grapes in lower latitudes.

Microclimates are important in the development of grapes where distinctions need to be made between localised climatic variations and regional differences. An example of this is the ripening, and therefore the harvesting, of the same grape species weeks apart at different sites. Similarly, due to the microclimate conditions, a grape variety may display characteristics that differ from that of a nearby vineyard.



10.2.5 The vineyards along the sides of the Mosel Valley represent the largest continuous steep slope viticulture in the world. Over two thousand years ago the suitability of the unique geology (slate), topography, aspect and microclimate for grape growing was recognised and plantings started on the south-facing steep slopes of the river valley. Since the late nineteenth century Riesling has been the predominant grape variety that has given the region prominence.

DID YOU KNOW?

Shiraz and syrah are bold, full-bodied red wines and both derived from exactly the same grape variety. Yet there is a huge range of flavour dependent on where they are grown and the influence of terroir and style of winemaking. In Europe, such wines are known as syrah, whereas in Australia and South Africa the term shiraz is used almost exclusively.

Diseases and pests

Grapes are vulnerable to a range of diseases, many of which are influenced by the climate of the region. Generally, the more humid the summer, the more difficult it can be to control disease.

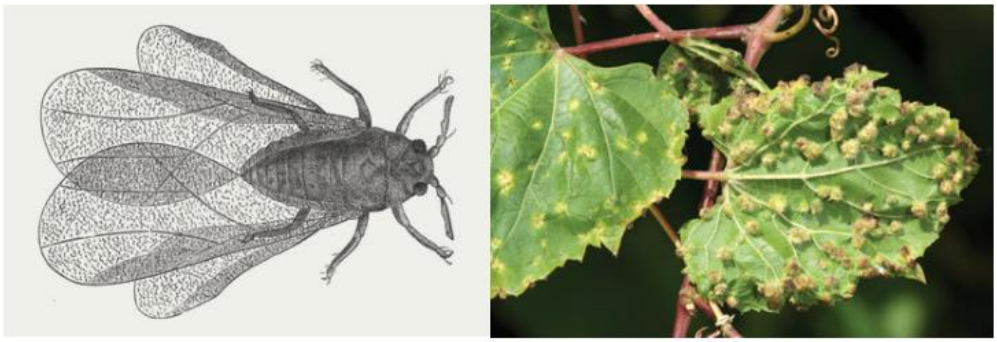
Fungus parasites are responsible for most grape diseases. Viral diseases that are spread by insects or in the soil are the most destructive and are almost impossible to manage effectively. Other diseases are preventable if care is taken. Eradicant fungicides and spray application technology have assisted with the management of disease.



10.2.6 Powdery mildew (left) and downy mildew (right) are persistent fungal problems in grapes and among the most widespread diseases of grapevines in the world.

An example of fungal disease is powdery mildew, seen in Figure 10.2.6. This is common in regions with high rainfall during the growing season. Botrytis bunch rot is another fungal disease that may attack vines during harvest when rainfall exceeding 60 millimetres is accompanied by relatively high humidity. This disease grows on the grape skins and allows moisture to escape. As a result, the sugar concentration increases rapidly. Although the disease is a problem, French winemakers have successfully used it to produce sweet table wines.

Phylloxera is a louse that lives in and eats the roots of vines, causing disruption to the vine's food supply and eventually killing it (see Figure 10.2.7). The global wine industry was almost destroyed by phylloxera. It arrived in France in 1860 embedded in vines imported from the United States. It then spread to England in 1863. By the end of the nineteenth century it had spread to almost all the wine-producing countries of Europe. Its advance was carefully watched in Australia. In 1877, phylloxera was identified near Geelong in Victoria. While there is no really effective chemical treatment for the disease, phylloxera is now rare in vineyards that use new vines grafted onto hardier root stock.



10.2.7 Phylloxera is a tiny insect that lives in and eats the roots of grapevines, effectively starving the shoots and grapes of nourishment. Despite its size, phylloxera can wreak havoc. Between the late 1860s and 1890s, the pest almost completely wiped out Europe's vineyards. Countless winemakers lost their livelihood. In an effort to save their crops they tried everything from potions and poisons to flooding (it was thought the pest could be drowned) and adding toxic chemicals to the soil.

Ecological factors

Sustainability is central to the future of any productive activity as it aims to meet the needs of the present generation without compromising the ability of future generations to meet their needs. Fundamentally, it involves understanding the complexities of the biophysical environment and working with nature rather than against it.

Ecological concerns associated with viticulture include:

- increasing pest resistance to existing chemical interventions
- soil compaction and erosion
- poor water infiltration
- low levels of organic matter in soils
- excessive water use
- excessive use of nitrogen-based fertilisers and nitrate leaching.

The severity of these concerns may be reduced with the adoption of sustainable land-use practices by viticulturalists, such as:

- groundcover crops being introduced between vine rows to prevent soil erosion, reduce compaction and increase the amount of organic material in the soil, as shown in Figure 10.2.8
- optimal fertilisation practices that reduce the amount of fertiliser used during the growth cycle of the plant
- leaf removal to allow air circulation and reduce fungal growth
- management of the supply of water to the plants through the use of drip irrigation
- use of biodegradable fungicides and promotion of biological controls
- reduced use of synthetic agrochemicals.



10.2.8 An organic vineyard in Languedoc-Roussillon, France. Their approach follows Terra Vitis or sustainable viticulture, respecting the rhythm of the vines and conserving the ecosystem. At each step, intervention is minimal.

Organic viticulture

Driven by concerns regarding the irresponsible use of manufactured or synthesised compounds in fertilisers, pesticides, fungicides and herbicides, the volume of organically produced wine is increasing rapidly. The products of organic agriculture are seen as being more than just a healthy alternative for consumers. They are seen as being ecologically responsible. Organic viticulture is practised to some extent in all the main wine producing regions of the world.

The philosophical basis of the organic production system includes an emphasis on producing natural, chemical-free, biodynamic and sustainably grown (or 'green') wines. Fundamentally an organic vineyard is a more natural environment unlike the monoculture of a conventional vineyard dependent on agrochemicals to protect the grapevines and improve soil quality. In an organic vineyard, the grapevine happily coexists with other plants, insects, birds and animals in a functioning ecosystem.

Management processes

Organic viticulture includes non-intrusive soil management processes, alternative means of protecting vines against disease, and strategies to minimise pollutants that might disturb the natural ecology of the area. The nutrients required are added to the soil by organic manures, such as animal compost, worms and the organic waste produced when grapes are crushed. Groundcover crops also control weed growth and when ploughed back into the ground they enrich the soil. The increase in organic matter in the soil also improves its water holding capacity. When nitrogen-fixing legumes are used, vine growth is invigorated.

Open canopy management is practised to decrease foliage moisture, thereby reducing germination of powdery mildew. Spraying sulphur or lime dust a few weeks after bud-break helps protect the vine against fungus spores. Non-organic viticulturalists use chemical pesticides to control these diseases.

The main method of managing insects is biological control. This involves encouraging natural enemy insect species to flourish, which keep the vine's enemies in check.

Certification

The manufacture and labelling of organic wine is not specially regulated in wine law. Certification can be made by any private organisation performing the functions relating to vineyard and/or manufacturing practices. In Australia, growers can seek certification from is the National Association of Sustainable Agriculture Australia (NASAA). Growers embark on the certification process, which involves entering into an agreement to adhere to NASAA's standards. Full certification involves three years of inspection to ensure the vigneron's ability to manage the vineyard organically. Only then can the NASAA certified organic logo be used.

Australian wine for export that claims it is organic must be certified by an organic certifying organisation approved by the Department of Agriculture and Water Resources. The organic organisations are also authorised by the Department of Agriculture and Water Resources, principally for the purpose of export certification. This is mandatory and forms part of Wine Australia's export approval process for all wine claiming to be organic.

Activities

Understanding the text

1 Outline the ways in which the various elements of climate impact on viticulture and the style of wine produced.

2 Explain the relationship between soils and the quality and character of wine.

3 Demonstrate the ways in which topography influences the growth of grapes and the character of a wine.

4 Identify and describe the diseases and pests that must be managed by viticulturalists.

5 Identify some of the environmental concerns associated with viticulture. Outline how these concerns can be addressed in an ecologically responsible manner.

Working geographically

6 Conduct a class discussion on the following topic: 'The best quality wine comes from a region with deep fertile soils and high rainfall.'

7 Study Figure 10.2.5. Account for the suitability for viticulture of the steep slopes of the Mosel Valley in Germany.

8 Investigate wine growing regions in the lower latitudes to establish why they are able to successfully grow wine grapes.

9 Study Figure 10.2.4. Compare two of the wine growing regions related to soil types.

10 Investigate organic agriculture. Write a report outlining your findings.

UNIT 10.3

Changing economic factors

Wine was one of the first commodities to be bartered by early civilisations engaged in trade. Then, as now, the most successful wine producers were those who grasped the economic factors: the market forces of supply and demand, and the prevailing expectations of consumers. Viticulture and winemaking has become a highly lucrative economic activity in the global economy.

Market forces of supply and demand

Supply

Over the last twenty years, the trends in the global wine market have clearly reflected the imbalances between the supply (the amount of wine produced) and demand (the amount of wine consumed). The global production of wine has continued to exceed consumption leading to a wine glut that has subsequently driven prices down.

In Australia, wine production in the period 1990–2005, increased from 383 megalitres to 1420 megalitres (a four-fold increase) and wine exports grew from 38 megalitres to 702 megalitres (an 18-fold increase). A generous Federal Government depreciation (taxation) incentive introduced in the mid-1990s led to a rapid expansion of the area of land devoted to viticulture. From 1996 to 2006 the area planted with grapes doubled to 154 000 hectares and annual production increased to almost 2 million tonnes of grapes, up from 883 000 tonnes in 1996. In 1998, some 16 200 hectares of land were planted with grapes. This increased the national cropping area by 22 per cent in just one year.



10.3.1 The E & J Gallo winery in the Central Valley of California is one of the largest wineries in the word. It is the leading exporter of wine from California.

Wine glut

Since 2004, the wine industry has battled with excess supply driven at first by large global harvests in successive years from 2004 to 2006 which added to the wine glut already sitting in storage. Since then there has been a downward trend in wine production.

By 2005 there was a surplus of some 15 million hectolitres of wine in Europe as a result of overproduction. The world's biggest producers were confronting falling domestic consumption and crumbling exports because of competition from New World producers (see Figure 10.3.1). There was enough wine in storage to meet a year's supply or fill 8000 Olympic sized swimming pools. This prompted the European Commission to embark on a 'root and branch' reform subsidising producers to slash 10 per cent of vines covering 400 000 hectares from 2006 to 2010. Bordeaux farmers received €15 000 a hectare amounting to €120 000 for the average producer with a vineyard plot of 8 hectares.

The downward trend in production in the Old World started to ease in 2016 with both Italy and Spain increasing their production. Globally the Old World still holds its traditional dominance with the world's biggest wine producers—France, Italy and Spain making up 58 per cent of global output. New World producers are building their market share and this will continue into the future. After Europe, South America is the world's most significant wine producing continent. Argentina is the leading producer by volume, but Chile has a growing reputation for quality and it is now ranked as the fourth biggest exporter in the world, and is expected to become more prominent in the future. Australia is also renowned for consistently producing quality wine and the wine industry is one of the country's great export success stories.

Demand

The global financial crisis of 2008 had the biggest impact on the total global consumption of wine. There is a direct relationship between the state of the global economy and wine sales. As disposable incomes decreased, so too did discretionary spending on wine and all facets of the global viticulture and wine industry were hit. Any ongoing financial insecurity means challenging trading conditions for wine producers.

DID YOU KNOW?

The 'wine lake' is the term given to the oversupply of wine produced in the European Union. It is estimated that 1.7 billion bottles of wine go unsold each year. Much of this excess wine ends up being used for industrial purposes as it is converted to ethanol to power factories.

The continuing fall in per capita wine consumption is largely a result of the significant drop that has occurred in Europe in recent decades. Sociocultural changes are behind this decline and yet, on the upside, other nations such as China and the USA are drinking more wine because of shifting attitudes to wine.

Competitive advantage

Competitive advantage exists within the viticulture and winemaking industry. It enables a country or region to produce either higher quality (or more competitively priced) wine, thus allowing it to be more successful in the global market. Competitive advantage is related to natural conditions, location and the existence of a skilled workforce.

Europe's competitive advantages

European producers enjoy a number of advantages that give them a competitive edge. These include:

- close proximity to the major wine markets
- a reputation for quality based on tradition
- ease of trade due to the accessibility of markets and the subsidies provided by the European Union
- continuing strong demand in non-European markets, especially China, for more exclusive (and expensive) labels.

With the increase in demand for New World wines, this advantage has started to shift. For example, the trade in Chilean and Australian wines is growing rapidly.

Enhancing Australia's competitive advantages

Australian producers also enjoy a number of advantages that give them a competitive edge in the global wine market:

- **Physical factors:** Appropriate varietal choices have been made by Australian wine growers. This, in turn, has increased the quality of the wine produced. Such change has been facilitated by lower land costs, a wide choice of climates and terroir, and the moderate availability of water. Australia, therefore, is well placed to compete with countries such as New Zealand and Spain.
- **Human factors:** Australia compares favourably with European countries, California and New Zealand in terms of its skilled viticulturists and winemakers, modern infrastructure and research and development. The industry is also free of the rigidity and focus on tradition that often stifles European producers.
- **Market factors:** Europe's dominance as the top-ranking market in terms of competitiveness is being challenged by Australia. This rank is based on image, reputation and branding. The Australian industry is developing in terms of attitude and relationships within the market, demonstrating a commitment to networks and a hands-on approach. It is increasing its competitive advantage through institutional support and marketing.

SPOTLIGHT

A snapshot of Chile's wine industry

The Chilean wine industry has become one of the pillars of the Chilean economy. Chile exports over 70 per cent of the wine it produces which makes its wine industry the most globalised of all wine producing countries. This is significant given that it is the isolation of the country that is in many ways responsible for competitive advantage it now enjoys.

The Spanish brought vines with them when they colonised the region in the sixteenth century. The environment was naturally suited to viticulture (see Figure 10.3.2) and local wine was soon favoured over what was being brought in from Spain. What was to set the country apart, however, was when the Chilean government gathered vine cuttings from each of the main wine regions of Europe in the early 1800s. They flourished when planted in Chile, while vineyards in Europe were decimated by the phylloxera louse.

Chile is the envy of other wine producing countries as it enjoys a competitive advantage of:

- a dependable climate with little variation
- warm to hot sunny days in summer
- extremes of heat moderated by elevation and mountain breezes
- ample and reliable water from snowmelt from the Andes Mountains
- lack of pests in the disease-free vineyards
- low costs.

Over twenty grape varieties are grown in Chile, which are mainly a mix of Spanish and French varieties. The most common grapes are cabernet sauvignon, merlot and Carmenère. As vineyards expanded, production rose. Chile wine producers have 1.5 billion customers each year and export to over 150 countries.



10.3.2 The world envies Chile for its warmth and sunshine, perfect for ripening grapes. Its isolation and dry conditions almost guarantee disease free vineyards. Snowmelt from the Andes Mountains normally ensures a reliable source of water for irrigation. The main threat to production is an extended, severe drought. In 2016, Chile had the worst drought in its history and wine production fell by 21 per cent.

SPOTLIGHT

The subtle appeal of wine

'Today wine is an integral part of the culture of many countries, a form of entertainment in others, and a libation of choice for advocates of its health benefits. Unlike many modern foods, wine's attractions rely not on bold consistent flavours, but on a subtle array of shifting sensations that makes its charm difficult to define. In essence, wine producers are selling a sensory experience to the consumer. Wine consumers in developed nations are typically prosperous, but wine is also consumed in impoverished areas where it is still safer to drink than the local water supply.'

L.F. Bisson, A.L. Waterhouse, S.E. Ebeler, A. Walker, and J.T. Lapsley, 'Insight Progress', *Nature*, 2002

The Australian wine industry has undergone a number of changes that demand a reassessment of its strengths and weaknesses relative to its competitors. This assessment can be examined in terms of physical, human and market factors. According to Strategy 2025 (an initiative of the Australian Wine Foundation), Australia's competitive advantage will be enhanced significantly by:

- developing an innovative industry culture, which will enable the adoption and adaptation of resources, technology and skills to meet the needs of consumers
- demonstrating product leadership in terms of intensity, complexity and diversity of flavour
- providing value at every price point
- developing image and brand strength.

Mobility of labour and capital

The increasing globalisation of the global viticulture industry has been accompanied by an increase the scale of operations. With mergers and acquisitions undertaken by the big players such as Constellation Brands, both labour and capital have moved around the world. Constellation Brands is the leading producer of premium wines in the world, with a portfolio that includes many well-known brands (for example, Banrock Station, Houghton and Leasingham in Australia). Based in Victor, New York in the United States, the company has more than 200 alcohol brands in its portfolio, has sales in about 150 countries and operates approximately 50 wineries in Europe, Australia, New Zealand, South Africa and Argentina.

As with any large transnational corporation, investment capital has been moved freely into countries on each of the arable continents to establish this global network of wineries. Likewise, highly qualified agricultural managers of vineyards and winemakers (such as microbiologists) have been transferred to oversee the operations of the corporation.

Sociocultural factors

Tradition

Tradition has played a significant role in the place of wine as a culinary staple throughout Europe. Vineyards have been in Europe for over 2000 years. While not all European nations are part of the global trade in wine, most European nations grow grapes. Many families grow a few vines in their yard, make their own wine and store it for use in the winter months.

Old World consumption figures illustrate the importance of wine to the European way of life—it is part of the culture. Historically the French have drunk nearly twice the amount per capita than Australians. Traditionally they have consumed it at various times of the day and with most meals. It is drunk by children in small quantities and sometimes diluted. But is an established part of French cuisine, not something to be over indulged or used for binge drinking.

Activities

Understanding the text

1 Outline the economic factors affecting the global wine industry.

2 Analyse the imbalance between the global supply and demand of wine over the last twenty years.

3 Explain why wine production soared in Australia between 1990 and 2005.

4 Describe a wine lake.

5 Compare the trends in wine production in the Old World and the New World.

6 Define the term competitive advantage.

7 Explain the competitive advantage held by European producers and what has favoured them in export markets.

8 Explain why there has been an increasing mobility in both labour and capital in the global viticulture and winemaking industry.

Working geographically

9 Conduct a class discussion on the topic: 'The blame for the global oversupply of wine rests with New World producers'.

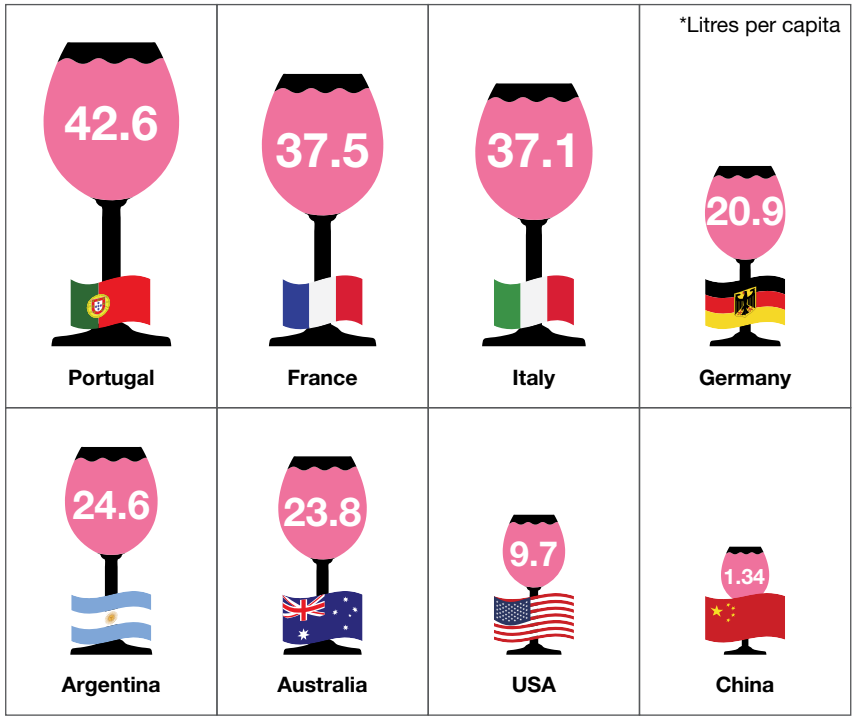
10 Write a brief report comparing the relative strengths of Chile's wine industry in the global export market.

Changing lifestyles

Declining consumption in Europe

Global per capita wine consumption has been declining for nearly two decades. Much of the decline can be attributed to the French and Italians, down to 37.5 and 37.1 litres per person annually (see Figure 10.3.3) from 73 and 62 litres respectively in 1990. The tradition of farm and factory workers having wine with lunch and dinner is fading. Generations have changed and driving laws and occupational safety regulations have become stricter.

Europeans are drinking less, but they are drinking better quality wine. There is more choice for drinkers—cider, spirits and boutique beers have become popular. In France, the average age of wine consumers has risen to over 55 years compared to 35 only a generation ago.



10.3.3 Old World countries still have the largest per capita wine consumption in the world.

Changing lifestyles in the New World

The drinking of table wines has only established itself as part of the New World social experience since the 1970s. The combined effects of increasing affluence and an interest in wine in countries such as the USA and Australia has made drinking wine fashionable. The growth of the cafe society in places like New York, Sydney, Melbourne and Auckland has made eating out a popular social experience.

Globally, the wine industry is prospering in the baby boomer demographic as they have the means to easily purchase it. Around 30 per cent of the volume of wine is consumed by people over 50 years of age. As the younger generations age, there is no guarantee that they are going to move into wine as a drink of choice.

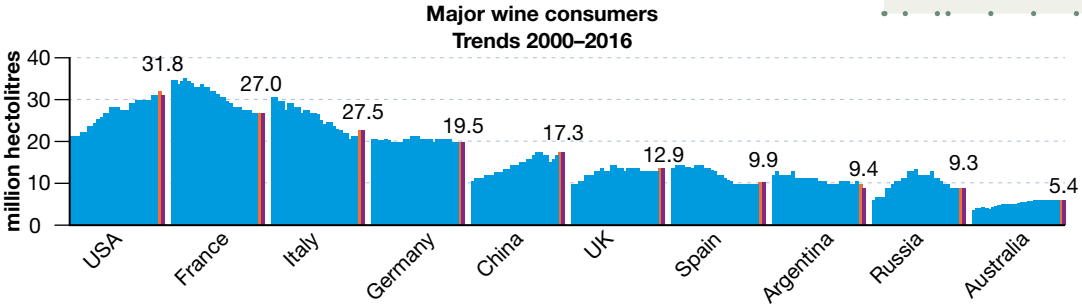
Americans are drinking more wine than ever and the United States has established itself as the top wine consuming country in the world as is evident in Figure 10.3.4. Over the last fifty years, wine has outperformed beer and spirits as their preferred drink. There has been a fivefold increase in consumption of wine in this period. Even though the United States is a strong wine-producing country, local wine producers can't provide enough for their whole market, so the country's imports are expected to increase.

SPOTLIGHT

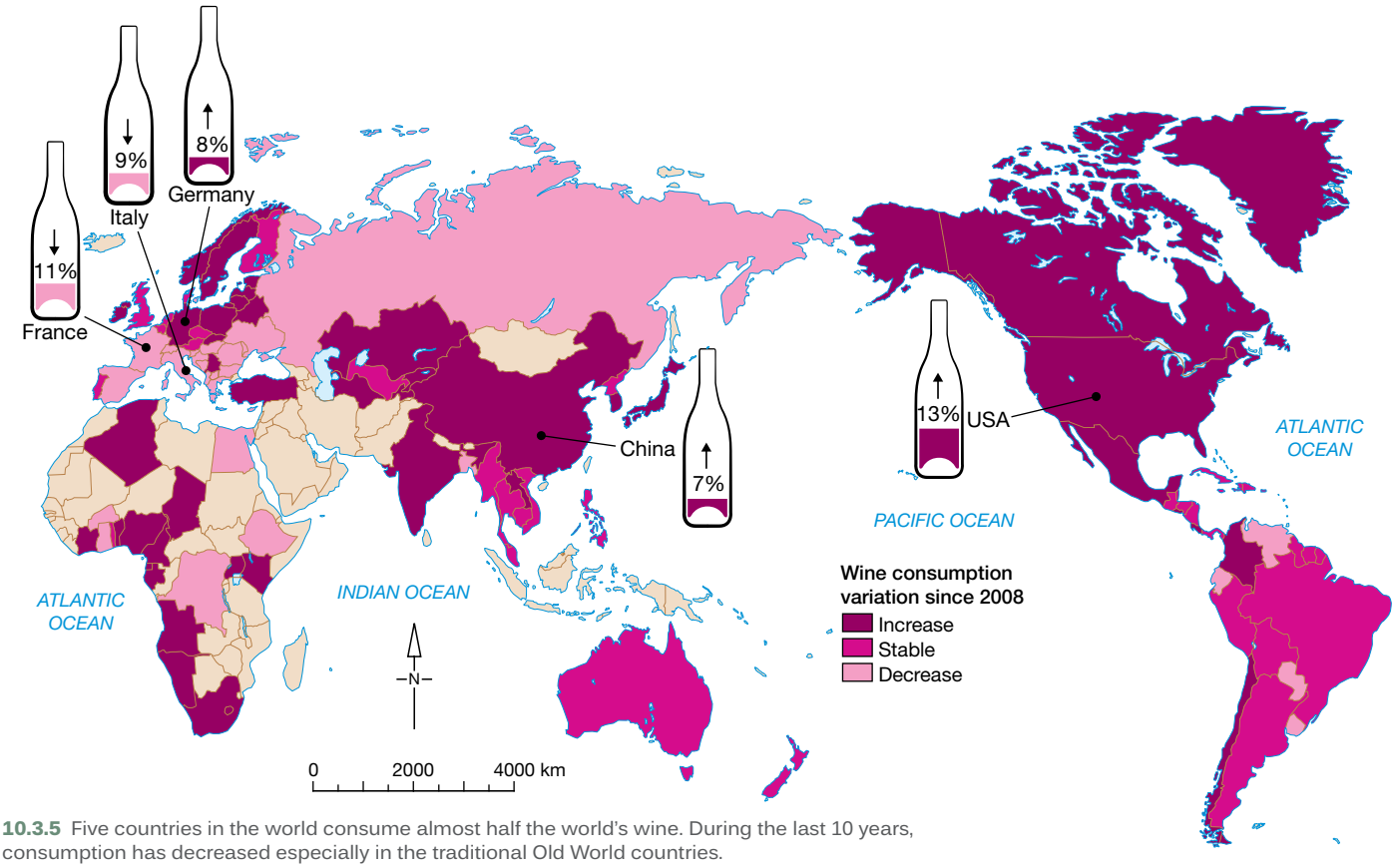
The definition of quality

'In past generations the definition of quality was the preserve of the wine producer, and consumers who did not like a particular style of wine were often made to feel uncultured. But globalisation and the accompanying rapid worldwide access to information has resulted in a more knowledgeable and empowered consumer with a more sophisticated understanding of product value and a discriminating demand for quality. The control of the definition of quality has shifted to the consumer. Success as a wine producer in the twenty-first century requires a thorough appreciation of human behaviour and product choice.'

L.F. Bisson, A.L. Waterhouse, S.E. Ebeler, A. Walker, and J.T. Lapsley, 'Insight Progress', *Nature*, 2002



10.3.4 The USA has confirmed its position as the biggest global consumer since 2011.



10.3.5 Five countries in the world consume almost half the world's wine. During the last 10 years, consumption has decreased especially in the traditional Old World countries.

SPOTLIGHT

Wine tourism

Major wine-producing regions such as California's Napa and Sonoma valleys, France's various wine regions, Italy's Tuscany and Umbria and Germany's Rhine Valley are also major tourist destinations. Visitations to wine regions to experience the unique qualities of this contemporary lifestyle are increasing. Consumer demand for the 'ultimate wine experience' has developed into more than simply tasting wine. It includes the appreciation of wine through education at the vineyard and cellar door. Some are attracted to the restaurants and cafes attached to the wineries in the winemaking regions, while others take in the landscape and cultural activities, which can include music festivals and art galleries.

Increased affluence and a desire for Western culture in Asia

Consumption of wine in Asia has been increasing for some time, and China is now leading a market shift in the global consumption of wine (see Figure 10.3.5). The level and rate of income growth in the emerging middle class of China is being accompanied by a westernisation of culture. The process of cultural convergence is underway as a result of advances in global communications and trade. Wine is being advertised in newspapers and lifestyle magazines in China, appealing to young professionals living and working in cities such as Shanghai and Beijing.

Wine is seen as a desirable and sophisticated alternative to the local Baijiu, a strong distilled spirit made from grain that is between 40 and 60 per cent alcohol by volume. The Chinese government would rather people drink wine rather than spirits for their health and the cereal grains used to make spirits are needed for food in a country with such a large population.

The Chinese have had a strong preference for red wine which once accounted for 90 per cent of consumption. This is shifting, largely as Chinese tourists experience the cuisine of countries they visit overseas and white wine is paired with many dishes. Similarly, champagne is becoming popular at weddings and imports of sparkling wine into China are expected to grow.

Seeking wellness and protecting the environment

Consumers increasingly expect wines to be healthful and produced in an environmentally sustainable manner. Increasing consumer interest in its potential health benefits has also driven growth in wine consumption. It is claimed that polyphenols occurring in red wine reduce the risk of heart disease, stroke and cancer, with possible beneficial effects for those suffering from muscular degeneration and Alzheimer's disease.

The typical wine consumer is well-educated and affluent with a growing awareness of the vulnerability of the environment. Purchasing decisions are being influenced by a judgement on the sustainability of the practices carried out both in vineyards and wineries. Increasingly, consumers are favouring certified organic wine and the industry is responding.

Organisational factors

The Old World is fragmented

Traditionally the very nature of the viticulture and winemaking industry made it a fragmented industry. Historically, the industry has been dominated by small, often family owned and operated estate-based enterprises. This remains very common in Europe today. Italy has over one million growers and there are over 12 000 producers in Bordeaux, France. There is often a patchwork of tiny parcels of land where a footpath marks the border between two vineyards as illustrated in Figure 10.3.6. Generations of winemakers have built the reputations of the various regions of France, protected by their *appellation d'origine contrôlée* (AOC).



10.3.6 Tiny parcels of vineyards in the Alsace region of France

Concentration of ownership and control

The nature of ownership and control in the global wine industry has been changing over the last twenty years. Through corporate takeovers and mergers, globalisation has led to the emergence of large, international wine corporations, particularly in the New World.

The process of globalisation and consolidation within the global wine industry occurred as key regional and national players sought to reposition themselves as global wine producers. They wanted to capitalise on the growing demand for wine in developed and emerging markets.

Constellation Wines, a division of the New York–based Constellation Brands, is the world's largest wine business. Constellation Brands is a Fortune 500 company and is an industry leader as an international producer and marketer of beer, wine and spirits. It was established in 1945 selling bulk wine to bottlers in the eastern United States. In 2017 it had 9000 employees and more than one hundred brands in its portfolio.

As with any large company, brand building and profit are the focus. When big companies take over family vineyards, foreign capital can lead to growth, the updating of equipment and can open up new global channels to market the wine. While investors are happy when wine sales are up, these vineyards do well, but they are always at the mercy of the strategic plans of the company. When the global financial crisis in 2008 hit and there were weaker sales, Constellation Brands sought cost savings and cut its workforce. Since then the company has acquired more premium labels, and has sold off high volume low-profit brands.

The viticulture and winemaking industry is a slow-moving industry and many analysists believe that the only way to grow is through increasing the scale of operations through mergers and acquisitions. The biggest players will continue to acquire smaller wineries and form international joint ventures. Globally, the wine industry remains highly fragmented as there are still many small vineyards and wineries in both the Old World and New World.

The place for small boutique wineries

Counterbalancing the trend towards consolidation and globalisation is the development of small boutique wineries in the New World. The ongoing existence of hundreds of small estate-based wineries ensures that the local character of wine regions is sustained and even enhanced with the support of wine tourism. Overall there are tensions between the processes of globalisation and localisation. These tensions are show in Figure 10.3.7

Globalisation		Localisation
Global	↔	Local
Transnational corporations	↔	Small (boutique)
Profit driven	↔	Family (often lifestyle driven)
Mass-produced wines (industrial processes)	↔	Innovative wines ('traditional' processes)
Economic considerations dominate	↔	Cultural influences strong
'Generic' in terms of locality	↔	Terroir: distinctive in terms of locality
Branded wines	↔	Estate wines

10.3.7 Tensions between globalisation and localisation

The global regulatory organisation: the OIV

The institutional or regulatory framework in which the industry operates includes a variety of intergovernmental organisations and government agencies. At a global scale the most important of these is the International Organisation of Vine and Wine (OIV), which is the peak international wine industry body. This Paris-based organisation (established in 1927) has 47 members, including almost all the world's major wine-producing and wine-consuming countries. The OIV makes recommendations on growing, winemaking and other regulatory matters that form the basis of wine-related laws in many countries.

The OIV is an intergovernmental organisation whose principal activities are of a scientific and technical nature. It is widely recognised for its expertise in matters concerning vines, wine, wine-based beverages, table grapes, raisins and other vine-based products. The organisation's principal role is to:

- provide a forum where the concerns of producers and consumers can be addressed
- assist other international organisations, both intergovernmental and non-governmental, especially those that carry out standardisation activities
- contribute to the international standardisation of existing practices and standards
- where necessary, develop new international standards that improve conditions for producing and marketing vine and wine products, and to help ensure that the interests of consumers are taken into account.

The OIV also promotes grape and wine-based research and development, and makes recommendations regarding grape production and the labelling and marketing of wine. It encourages international norms in terms of practice within the wine industry. Further information about the OIV can be found on its website.

Technological factors

Technological developments have been applied within the global wine industry. This is especially the case in the wine-producing regions of the New World, where the traditions and practices of hundreds of years of successful viticulture and winemaking aren't so culturally embedded.

Technology has been applied in all aspects of the viticulture and winemaking process, including:

- **The use of geospatial technologies (GIS):** GIS are used in site selection, site monitoring and management.
- **Water storage and management:** Irrigation technologies are used to better manage plant growth and enhance the quality of fruit, and in-ground moisture probes can be used to monitor soil moisture and automatically adjust the output of drip irrigation systems (see Figure 10.3.8).
- **Transport and storage:** Sophisticated systems facilitate the movement of wine on a global scale while maintaining quality.
- **Biotechnology:** Molecular genetics, which is essentially genetic engineering, and systems biology are used to genetically modify desired genes from one species and transfer them to another. Biotechnology is used to engineer disease-resistant species and for the development of reliable yeasts that can be used for fermentation.
- **Cloning:** This is used to achieve consistent grape quality. A cloned plant is an exact genetic replica of another organism.
- **Harvesting and pruning:** Mechanised harvesters and pruners reduce labour. However, they can damage the vine and collect unwanted material, including canes, leaves, insects and unripened grapes. Mechanical pruning and harvesting are slowly being adopted as the technologies involved improve. It is not, however, a priority where labour is available at relatively low cost.
- **Information technologies:** These include sales and marketing using the internet. For example, technology can be used to monitor financial transactions and industry trends and developments.



10.3.8 Technologies such as a drone and a sensor are used to collect environmental data in a vineyard.

- **Wine manufacture:** Scientific processes and industrial processes are used to enhance wine quality and brand consistency.
- **Winery design:** The principles of passive solar design and natural ventilation can be applied to help minimise the use of energy-intensive heating, ventilating and air-conditioning equipment.
- **Bottling:** High-capacity automated labelling and packaging machines can be used.

Political factors

The political factors affecting the global wine industry can be divided into factors that operate on a national level and those that impact on the industry at an international level.

International political context

The growth of international trade is just one of the aspects of the complex evolution of the global viticulture and winemaking industry. Of all commodities traded, wine possesses probably the greatest variations in price and its markets are almost as varied as the wine varieties themselves. With the global oversupply of wine, the industry has become fiercely competitive. National governments have been active in supporting their own producers by providing financial support in the form of subsidies or protecting them from overseas competition by imposing tariffs, quotas, surcharges or imposing technical regulations and standards.

The growth of the international wine trade has been supported by the World Trade Organization, the use of economic integrated areas and bilateral trade agreements.

The World Trade Organization (WTO)

The WTO is an intergovernmental organisation dealing with the rules of trade between nations. It aims to help producers, both importers and exporters, to conduct their business and to ensure that trade runs smoothly. It negotiates agreements which are signed by the bulk of the world's trading nations and ratified in their parliaments.

The primary purpose of the WTO is to open trade for the benefit of all. It has made progress towards a general and progressive reduction of tariffs that restrict trade between countries. The Australian Government negotiates within multilateral forums such as the WTO to secure better access to overseas markets for Australian producers.

Economic integrated areas

A number of economic integrated areas have considerable influence on international trade in wine. The European Union is the largest free trade bloc in the world with all members operating within a single market. The European Union is also heavily involved in providing funding in the form of subsidies to improve the competitiveness of the wine industry in member nations. Access to funding and finance gives wineries a strong boost in production and sales, and France receives the largest share of the subsidies. The average European vineyard receives €700 per hectare. Across all of the countries of the European Union, the subsidies amount to 15 euro cents per bottle. To help seek out new markets and consolidate existing markets, wine tastings and promotional events are also organised in countries with potential interest. This funding is planned to continue until 2020.

There are other economic integrated areas that influence the trading of wine. The North Atlantic Free Trade Agreement (NAFTA) eliminates most tariffs and trade restrictions between the USA, Canada and Mexico. Mercosur is a sub-regional bloc promoting free trade between Argentina, Brazil, Paraguay and Uruguay.

SPOTLIGHT

The true meaning of champagne

In Europe and most other countries, the term 'champagne' can only be given to sparkling wines produced in the Champagne region of France. This right was established by the Treaty of Madrid (1891) and reaffirmed by the Treaty of Versailles, which was signed at the end of World War I. Since 2005, even the use of the term 'méthode champenoise', or champagne method, is unlawful.

Sparkling wines are made all over the world, and many use specific terms to define their own sparkling wines: Spain uses *cava* and Italy calls it *spumante*. A sparkling wine made from Muscat grapes in Italy is known as *asti*. In Germany, *sekt* is a common sparkling wine.

Most countries (including Australia) have labelling laws that prevent the use of the term champagne. However, some (including the United States) permit wine producers to use the name champagne as a generic term. US wine producers are allowed to use European regional names because the Treaty of Versailles, though signed by President Wilson, was never ratified by the US Senate.

SPOTLIGHT

Cork versus screw cap

While the manner in which a bottle of wine is sealed may seem of little significance it is, in fact, very important. The effectiveness of the seal determines whether the quality of the wine will be preserved or diminish. Traditionally, corks were used but a poorly fitting cork can result in the oxidation or bacterial spoilage of the wine. To minimise the financial loss resulting from oxidation, metal screw caps are now widely used. These caps are spun onto the bottleneck complete with a seal and wadding to maintain pressure. The use of screw caps has lengthened the shelf life of sulphur-free wines. Even re-sealable caps to lock in the bubbles of sparkling wine are now available.

Bilateral trade agreements

Some nations seek a bilateral trade agreement with another country which gives each party favoured trading status. The Australian Government has sought to promote exports of Australian wine at a bilateral level and it is fortunate to have secured free trade agreements with both the USA and China, as these counties have enormous population bases. The United States has become the biggest wine consuming country in the world and China is expected to be the main driver of the international wine market in the next decade as its consumption grows. These trade agreements enhance Australia's access to these markets.

The China–Australia Free Trade Agreement entered into force in 2015 and under this agreement, tariffs on wine will be cut to zero by 2019. The Australia–United States Free Trade Agreement came into effect in 2005 and by 2015 there was no tariff imposed on imported wine. Australia also has bilateral trade agreements with Japan and Korea.

National political context

In addition to engaging in the types of multilateral and bilateral initiatives, governments are responsible for managing national economies. Maintaining strong economic growth as well as low inflation and employment helps to bolster consumer confidence (and therefore spending) and investment by enterprises (thereby increasing productive capacity).

In addition to these responsibilities and interventions, governments are responsible for putting into place the national regulatory framework in which the industry operates. The level of intervention does vary from country to country.

France's *appellation d'origine contrôlée* (AOC)

The geographic locations or growing areas governed by rules and regulations set down by the government has long been considered a significant feature of the European wine industry. The regulations cover a host of variables:

- the kinds of grapes grown in a region
- the way they are planted, pruned and picked (for example, no irrigation allowed)
- the strength of alcoholic content
- the information on the label.

Only those vineyards that comply with all these regulations are allowed to call their product an AOC wine to guarantee authenticity.

Activities

Understanding the text

1 Outline the sociocultural factors affecting the global pattern of wine consumption.

2 Explain why the global viticulture and winemaking industry is fragmented in both the Old World and the New World.

3 Analyse the emergence of large corporations in the global viticulture and winemaking industry.

4 Explain why small boutique wineries continued to be viable in the face of globalisation and consolidation.

5 Outline the role of the International Organisation of Vine and Wine.

6 List the technological factors helping to reshape the global viticulture and winemaking industry.

7 Describe the role of the World Trade Organization in the wine industry.

8 Justify the existence of economic integrated areas and explain how they affect the global trade in wine.

9 Describe the bilateral trade agreements Australia has secured and how these assist Australian exports of wine.

10 Compare the level of political control of the viticulture and winemaking industry in Australia and France.

Working geographically

11 Study Figures 10.3.3 and 10.3.4. If Both China and the USA have such low per capita consumption why are they both major wine consumers?

12 Study Figures 10.3.2 and 10.3.6. Construct an annotated photo sketch of each and make a comparison of the two regions. Consider what might be the comparative advantage for wine producers in each region.

CASE STUDY

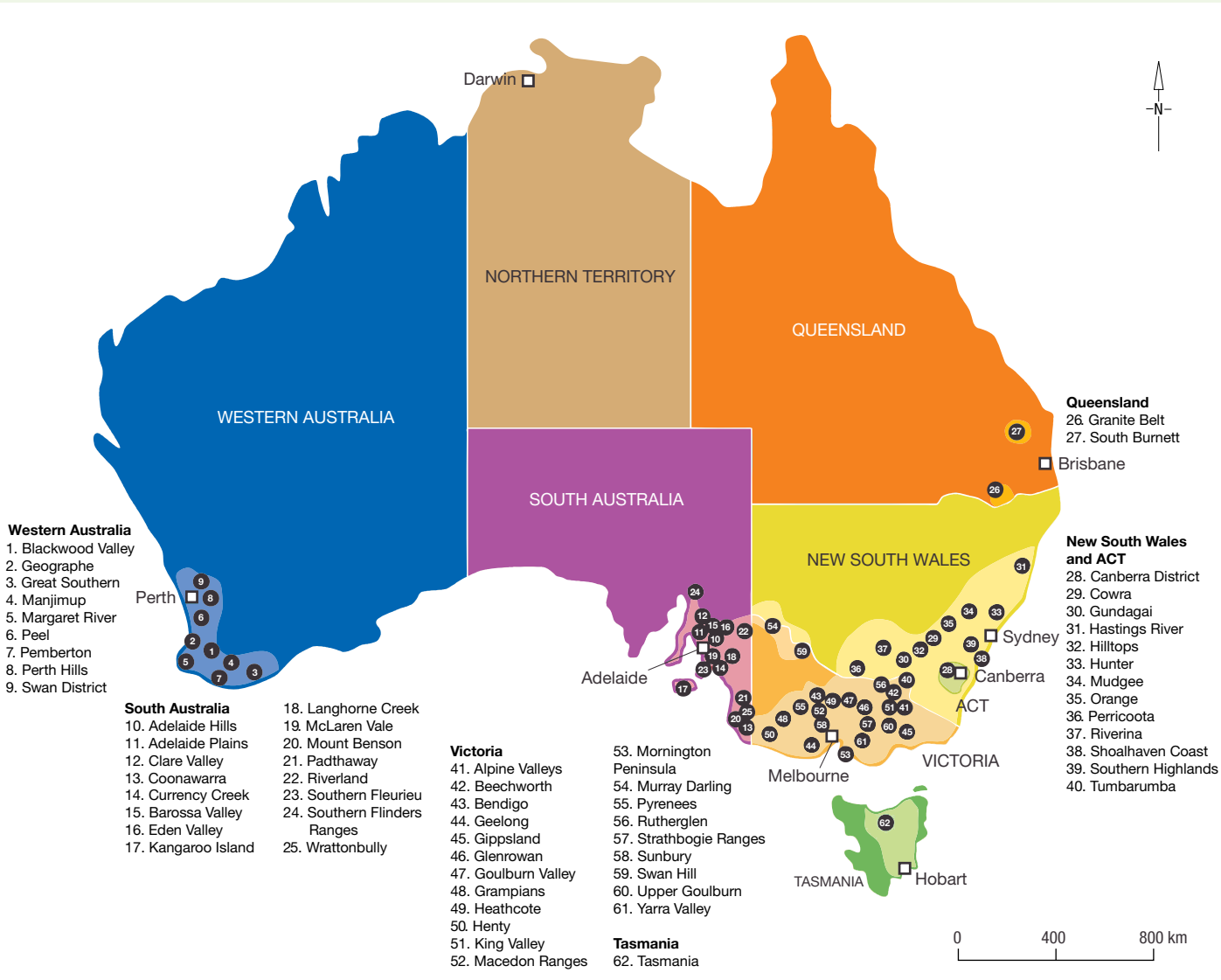
The Australian wine industry

Australia's wine industry has a global reputation for quality, innovation and depth. It has 62 designated wine-producing regions spread across the continent. With its range of climate and soil types Australia is one of the few countries in the world that produces each one of the major wine styles. Among the best known of the wine-growing regions is the Margaret River region of Western Australia; the Barossa, Coonawarra, Padthaway and McLaren Vale districts of South Australia; the Yarra Valley of Victoria; and the Hunter Valley in New South Wales (see Figure 10.3.9). However, it is not unusual to find a vineyard almost anywhere in the country, even Alice Springs.

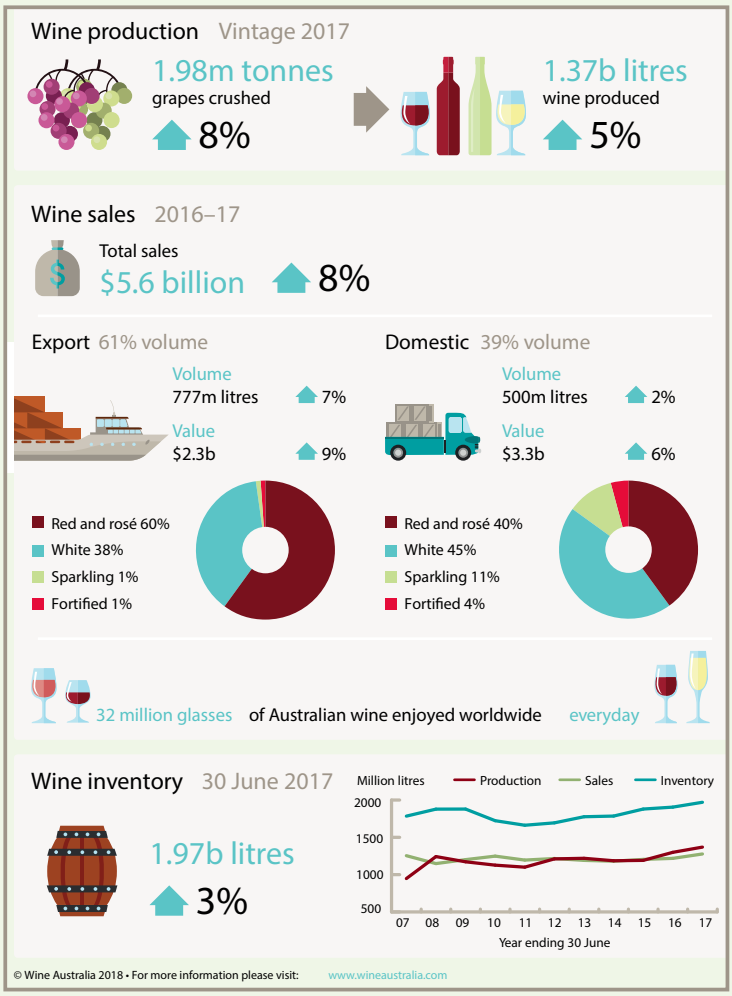
Australian wines can now be found for sale in over 120 countries. Surprisingly, the United Kingdom imports more wine from Australia than it does from France just across the English Channel. Some Australian brands are internationally recognised and are a common sight in wine shops overseas. First released in 2000, Yellow Tail is one of the fastest growing wine brands in history and became Australia's biggest wine brand selling into the United States. It quickly became synonymous with affordable consumption. Outlets such as Costco had huge displays of the brightly coloured bottles with the unmistakeable wallaby on labels.

As well as developing brand loyalty for consistent quality wine providing value for money, Australia has won medals at almost every international wine show. Tyrrell's wines in the Hunter Valley is one of Australia's most awarded wineries with over 5000 medals and trophies. In 2009 its Vat 1 Semillon 1998 was awarded the best semillon at the International Decanter Wine Awards.

In 2016–17, the value of Australian wine exports grew by 10 per cent to $2.31 billion and volume increased by



10.3.9 Wine producing regions of Australia



10.3.10 Australian wine production, sales and inventory, 12 months to September 2017



10.3.11 Wine Australia's export report 2017

7 per cent to 778 million litres. Australia remained the world's fifth biggest exporter of wine, behind France, Italy, Spain and Chile, but outperformed all four in the rate of growth over the year. Overall, an additional $201 million in revenue was generated by Australian wine exporters compared to the year prior.

Figures 10.3.10 and 10.3.11 provide an overview of the Australian wine industry from 2016 to 2017. Several trends are noticeable that are expected to continue into the future, including that:

- the 2016 vintage saw the highest production since 2008
- more wine is exported than is consumed domestically
- total exports are increasing in both volume and value
- the increasing value of exports is underpinned by strong export growth to China and the USA; China has been at the hub of the revival of Australian wine exports
- the strongest growth has been in premium wines
- there has been a strong demand from Asian markets for premium Australian wines
- red and white wine production were both up, but exports are still dominated by red wines.

The long term trend for Australian production and sales is positive with continuing sales growth expected in export markets, especially Asia and the USA.

The shift to higher valued quality wine will continue to increase competition and aggressive marketing.

The major wine companies operating in Australia are shown in Figure 10.3.12.

Concentration of control of retail outlets

Modern retailing is big business. In recent years the trend is away from the small, independent retailer towards the large-scale, multi-outlet, branded/franchised operator. To survive in this new retail landscape retailers need to be big, highly visible and have lots of outlets.

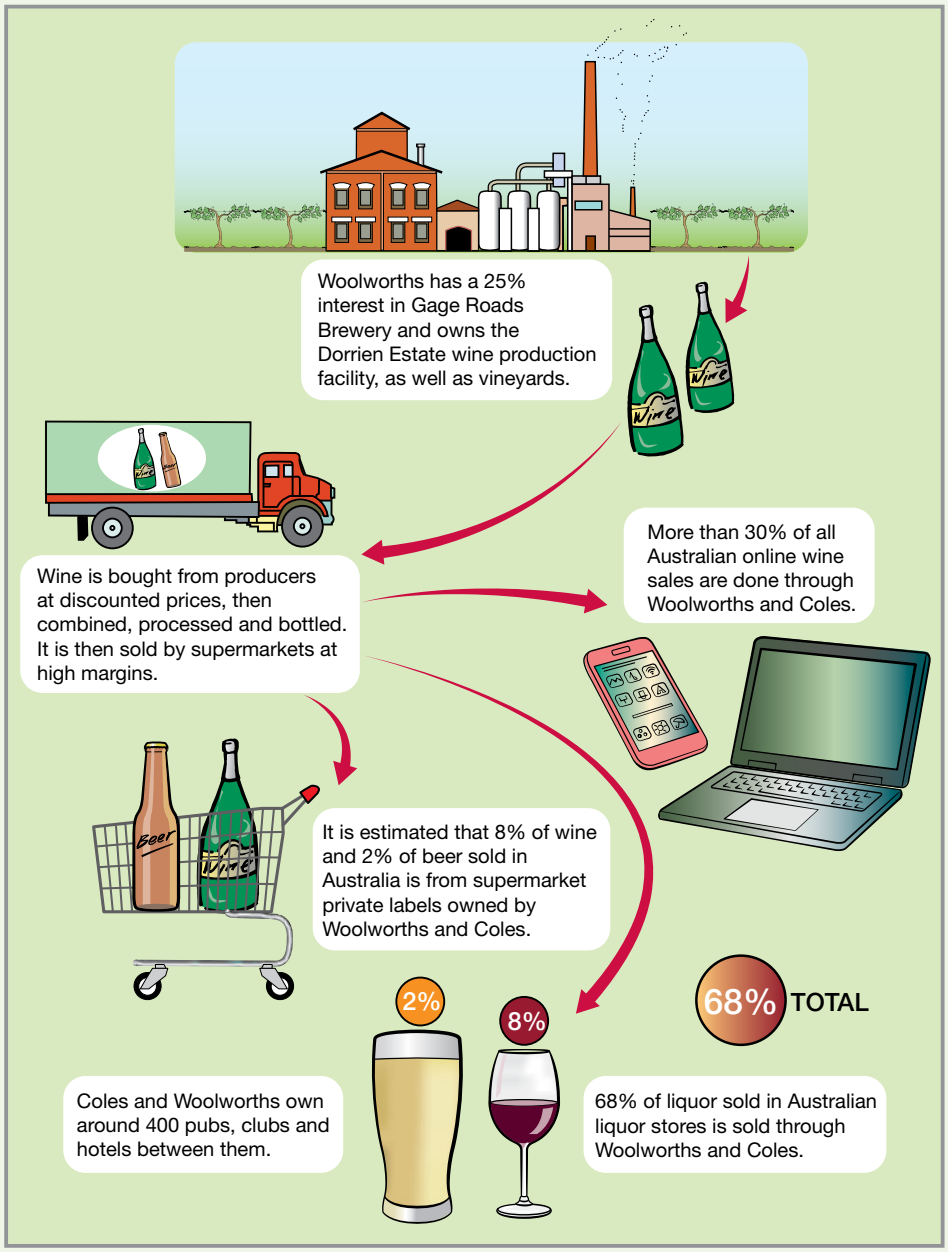
In Australia, the small, independent wine retailer is finding it increasingly difficult to complete with the two retail giants: Woolworths and Coles. Together, these supermarket giants have invested heavily in acquiring independent liquor stores and chains. Woolworths-owned wine outlets include Dan Murphy's, BWS (Beer, Wine & Spirits) and Woolworths Liquor. Coles-controlled liquor retailers include First Choice Liquor, Liquorland and Vintage Cellars. The majority of this market dominance has been built in recent years. In 2004 Woolworths and Coles together controlled 32 per cent of the market, but by 2017 this had risen to 65 per cent.

The major wine companies operating in Australia				
Company	**Treasury Wine Estates**	**Accolade Wines**	**Pernod Ricard Winemakers**	**Casella Family Brands**
Ownership	Australian owned Divested from Foster's Group in 2011	Owned by CHAMP Private Equity Fund, Australia (Constellation Brands, United States, retains 20%)	Owned by French based Pernod Ricard	Australian owned Based in the Riverina, NSW
Known brands	■ Annie's Lane ■ Lindeman's ■ Mildara ■ Penfolds ■ Pepperjack ■ Rothbury ■ Wolf Blass ■ Yarra Valley ■ Yellowglen	■ Banrock Station ■ Bay of Fires ■ Goundrey ■ Hardy's ■ Houghton ■ House of Arras ■ Leasingham ■ Omni ■ Tintara	■ Gramps ■ Jacob's Creek ■ Montana ■ Morris ■ Orlando ■ Richmond Grove ■ Stoneleigh ■ Trilogy ■ Wyndham Estate	■ Crate 31 ■ Mallee Point ■ Reserve ■ Yellow Tail ■ Yendah

10.3.12 Four major wine companies in Australia host a range of well-known brands.

Continuity of supply and economies of scale are very important to these big players and this has motivated supermarkets to move beyond retailing as illustrated in Figure 10.3.13. Woolworths, having acquired Cellarmasters, is now the largest online retailer in Australia.

Woolworths has taken control of Dorrien Estate, a wine producer in the Barossa Valley in South Australia with its own bottling and storage facilities. Coles is likewise buying into all levels of the supply chain. According to market research company IBISWorld, the supermarkets have 'exploited their market position to reduce shelf space dedicated to branded products and push their own, higher-margin private and control-label beer and wine'. This makes sales more difficult for smaller producers.



10.3.13 Woolworths and Coles are buying in at all levels of the supply chain.

Quality control

Australia does not have the same strict control of viticulture and winemaking as other countries such as France. However, high standards must be followed as for any food or beverage marketed in Australia or exported overseas. In Australia, three institutions play a major role in the regulation of the grape-growing and winemaking industries. These are:

- Wine Australia
- Austrade
- Food Standards Australia New Zealand.

Wine Australia

Wine Australia is the statutory authority responsible for the promotion and regulation of Australian wine. Its principal role is to enhance the operating environment for the benefit of the Australian wine industry. It does this in the following ways:

- **Developing markets for Australian wine:** Through its offices in Adelaide, Sydney, London and Shanghai, Wine Australia provides assistance to Australian wine producers with their export activity. It produces point-of-sale material (such as in-store promotional posters) in a number of languages. It also sponsors visits by influential international wine writers and buyers to Australian wine regions and events.
- **Dissemination of information and promoting better decision-making:** Wine Australia collects and analyses an extensive array of wine industry data. This data is made accessible on Wine Australia's website.
- **Research and development:** Wine Australia invests in and directs research, development and extension to support a competitive Australian wine sector. These investments are guided by the strategic research priorities of the Australian Government and the Australian wine sector.
- **Maintaining the industry's reputation:** The corporation's regulatory activities protect Australian wine's internationally recognised reputation for quality and integrity. Wine Australia inspects and issues permits for all Australian wine exports.

Under the provisions of the Australian Grape and Wine Authority Act 2013, Wine Australia's functions include putting in place the regulatory framework that enables Australia to fulfil its obligations under prescribed international wine-trading agreements. It also determines the boundaries of the various regions and localities in Australia in which wine is produced, gives identifying names to those regions and localities, and determines the varieties of grapes that may be used in the manufacture of wine in Australia. It ensures the accuracy of the statements made on wine labels and in advertising, especially as it relates to the vintage, variety or location of wine manufactured in Australia.

Activities

Working geographically

1. Refer to Figure 10.3.9. Investigate the two wine regions in Queensland to determine how wine can be successfully produced at this low latitude.
2. Study Figure 10.3.10 and answer the following questions.
   - a. Is more wine consumed on the domestic market or exported for overseas consumption? Validate with the use of statistics.
   - b. Calculate the difference in the percentage of red wine consumed domestically and that exported.
   - c. How many glasses of Australian wine are consumed worldwide each day?
   - d. In what year was the most wine produced in Australia?
   - e. How much wine was produced in Australia in 2016?
3. Study Figure 10.3.11 and answer the following questions.
   - a. Rank Australia's major trading partners in wine and identify where the growth is occurring.
   - b. Identify the price point that earned the greatest revenue.
   - c. Identify the price point that had the most growth.
4. Study Figure 10.3.12. Select one well-known brand name from each of Treasury Wine Estates, Accolade Wines and Premium Wine Brands. Investigate the history of each winery and consider why the brand name was not changed if the ownership changed.
5. Access the websites of the following Australian wine producers: Jacob's Creek and Schild Estate. Locate each winemaking enterprise on the localisation–globalisation continuum against each of the criteria listed in Figure 10.3.7.
6. Investigate the role of Austrade and Food Standards Australia New Zealand in the wine industry of Australia.

UNIT 10.4

Environmental, social and economic impacts

The operation of both vineyards and wineries has yielded many economic benefits for those involved. However, it has come at a cost both environmentally and socially. These problems must be addressed if the industry is to remain both financially and ecologically sustainable in the future.



10.4.1 **A** Natural vegetation in the Mediterranean: woodlands and scrublands of hard-leaved species—ecosystems in balance. **B** The monoculture of *Vitis vinifera* takes over, maintained by agrichemicals to fertilise the soils and keep insects, disease and weeds under control.

Environmental impacts

At all stages of the production process from growing the grapes, to making the wine and then distributing it to markets, this economic activity has substantial environmental impacts.

Resource depletion and land degradation

Viticulture and winemaking rely on the use of natural resources, particularly land, soil and water.

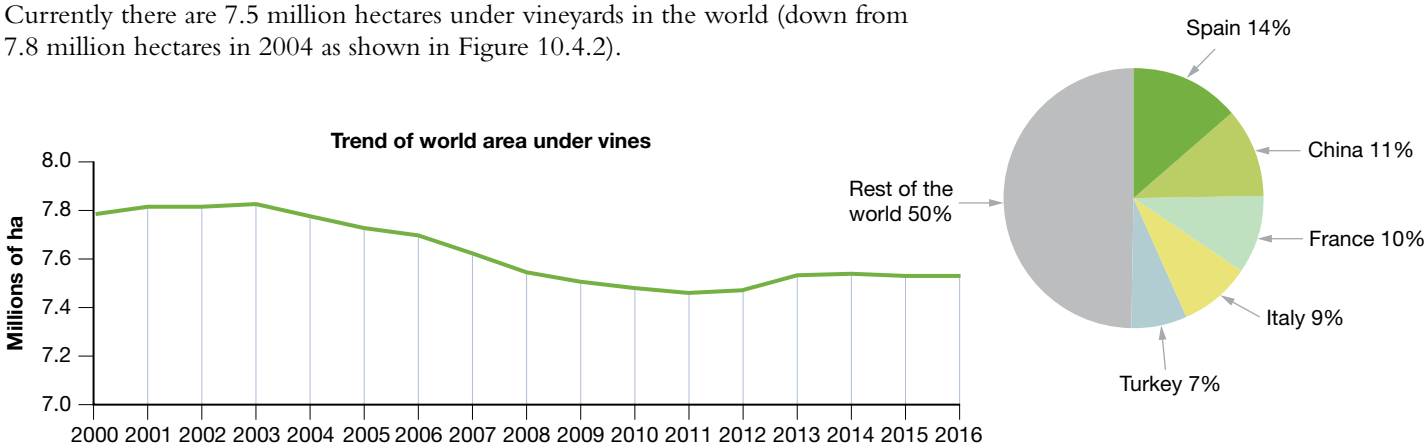
Land clearance reduces biodiversity

New vineyards are established on land cleared of natural vegetation and replaced with the monoculture of *Vitis vinifera* (see Figure 10.4.1). The Mediterranean climate traditionally favoured by viticulture supports diverse woodlands and shrublands with all the natural checks and balances in place. When it is replaced with the monoculture of *Vitis vinifera*, humans often have to intervene with fertilisers and other agrichemicals to maintain productivity over time.

Such land clearance can have a number of impacts on the biophysical environment, including:

- loss of native habitat rich in biodiversity
- diminution of natural pest-control species such as owls which predate on rodents such as mice that damage vines; the dominance of the monoculture creates a haven for pests and diseases that have no predators or natural controls which may necessitate the use of agrichemicals
- destabilised soil and accelerated soil erosion; sediment loads in waterways lower water quality by increasing turbidity and delivering nutrients that promote algal blooms.

Currently there are 7.5 million hectares under vineyards in the world (down from 7.8 million hectares in 2004 as shown in Figure 10.4.2).



10.4.2 Trend of world area under vines

With the global oversupply of grapes combined with the global economic downturn, most nations have been reducing their vineyard surface area as is evident in Figure 10.4.3. Most notable is the drop in Italy and France, but the rate of decline has slowed and the area under vines in Europe has stabilised. The most significant increase in vineyard surface has been in China where grasslands have been removed in the Xinjiang region and Ningxia region of north-western China as new vineyards have been established.

Main world vineyards						
Thousands of ha	**2012**	**2013**	**2014**	**2015**	**2016**	**Variation 2012–16 in ha**
Spain	969	973	975	974	975	+6
China	706	757	796	830	847	+141
France	792	793	789	785	785	–7
Italy	713	705	690	682	690	–22
Turkey	497	504	502	497	480	–17
USA	430	449	448	443	443	+13
Argentina	222	224	226	225	224	+2
Iran	226	223	223	223	223	–3
Chile	206	208	213	214	214	+8
Romania	192	192	192	191	191	–1
Portugal	231	224	219	199	190	–41
Australia	162	157	154	149	148	–14
Moldova	142	137	140	140	140	–2
South Africa	135	133	132	130	130	–5
Uzbekistan	121	122	127	127	127	+6
India	120	119	120	120	120	0
Greece	110	110	110	107	105	–5
Germany	102	102	102	103	102	0
Brazil	91	90	89	85	85	–6
Algeria	74	74	74	74	74	0
Egypt	71	69	69	69	69	–2
Hungary	52	56	62	68	68	+16
Bulgaria	67	68	66	67	67	0
Russia	62	62	63	63	63	+1
Serbia	44	54	54	54	54	+10
Morocco	48	49	49	49	49	+1
Georgia	48	48	48	48	48	0
Austria	44	44	45	45	46	+2
New Zealand	38	38	38	39	39	+1
Peru	26	28	32	32	32	+6
Mexico	29	29	29	30	32	+3
World	7473	7523	7533	7515	7516	+53
						Source: OIV, OIV Experts, Trade Press

10.4.3 Main world vineyards

Over-application of irrigation water causes salinisation

A major environmental impact of viticulture has been salinisation, which is caused by rising water tables—a problem that exists in the Riverland irrigation area district of South Australia. This viticultural region is fully dependent on irrigation as it only averages 250 millimetres of rainfall a year. Water is supplied from the Murray River and used in the vineyards. The Riverland soils are shallow and sandy with very low water-holding capacity. Initially flood and furrow irrigation was used as seen in Figure 10.4.4. This was very inefficient and caused the water table to rise, delivering salt to the surface (see Figure 10.4.5). Once the salt is in the root zone of plants it renders the land toxic to most life, leaving the land bare, even salt encrusted. Saline groundwater seeping into waterways seriously impairs water quality and aquatic life.



10.4.4 Furrow irrigation of a Riverland vineyard, showing excessive water application in the late 1970s. Poor crop health of the vines is evident.

Some adjustments have been made with good irrigation practices where the water applied to the vines exactly matches the needs of the vines. Viticulturalists have made great strides, where the irrigation furrows and overhead sprays have been replaced by computer-controlled under-vine micro-jet systems and drippers. They are linked to soil probes which automatically turn off before the soil becomes overloaded with water which would not be taken up by the vines.

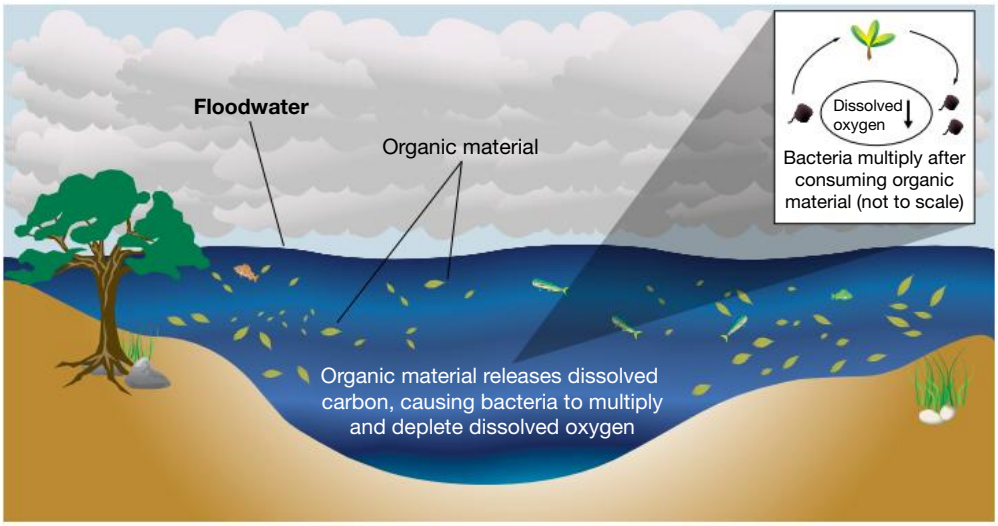
Water withdrawal degrades waterways

The water footprint for viticulture is substantial. A glass of wine requires 120 litres of water, most of which is used in growing the wine grapes.

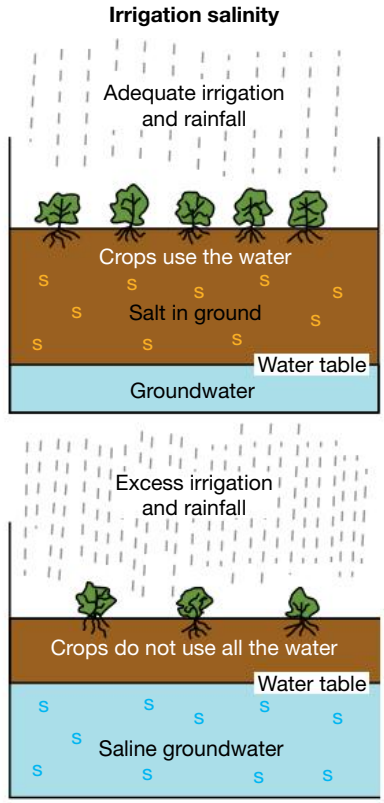
In a water deficient country such as Australia, the withdrawal of irrigation water has become a real issue and caused considerable conflict over water allocations. The publicly funded multibillion-dollar Murray–Darling Basin Plan was meant to secure the long-term environmental health of the river by buying back water rights from the consumptive users (the irrigators). The effectiveness of this plan has been questioned with controversial claims in 2017 that the river has diminished in its lower reaches as a result of extractions upstream and allegations of water theft.

Excessive water extraction results in less frequent floods, allowing organic material such as dead leaves and wood to accumulate on the floodplains and banks of the river. Then when a flood does happen this material is washed into waterways. As Figure 10.4.6 illustrates, the increased bacterial activity during a blackwater event can lead to the deoxygenation of the water. Native fish and crustaceans are particularly vulnerable to oxygen deprivation and may die along with other aquatic organisms.

Unique native species such as the Murray cod, southern purple-spotted gudgeon and southern pygmy perch are under threat. They have also had to compete for food and space with invasive species which are more suited to higher salt content in the water.



10.4.6 Primary drivers of blackwater events



10.4.5 Excessive application of irrigation water causes the water table to rise, dissolving the salt in the ground as it creeps towards the surface.

Pollution

Agrichemicals

The very nature of a monoculture makes it susceptible to attack from a host of pests and weeds. In spring and summer the luxurious growth on vines after budburst attracts leaf-eating pests and the high humidity promotes fungal growth (see Figure 10.4.7). With the expansion of vineyards, chemically based fertilisers, pesticides and herbicides are frequently used. As well as the vines being bombarded with sprays, the soil below is also treated with artificial fertilisers to maintain soil nutrients as the grapevines are a perennial and harvesting of the grapes removes these nutrients. Herbicides are also applied to keep in check weeds that quickly sprout on any disturbed ground and would compete with the vines for water and nutrients.



10.4.7 The grape flea beetle has the capability to do significant economic damage if left unchecked. Application of the pesticide carbaryl esfenvalerate is used to control the beetle and its larvae.

Viticulture has been heavily reliant on agrichemicals and their use is being questioned as:

- residues are being found in the surrounding environment, accumulating in soils and running off into waterways; toxic copper has been found in European soils and fungicide and pesticide residues are present in some underground aquifers in the United States
- any trace of chemicals in wine can have severe repercussions for a winery as there are strict health regulations in many importing countries
- the occupational health and safety of vineyard workers may also be put at risk
- persistent organochlorine pollutants may be responsible for reproductive problems, decreased male reproductive capacity (fertility) and increased incidents of breast cancer in women.

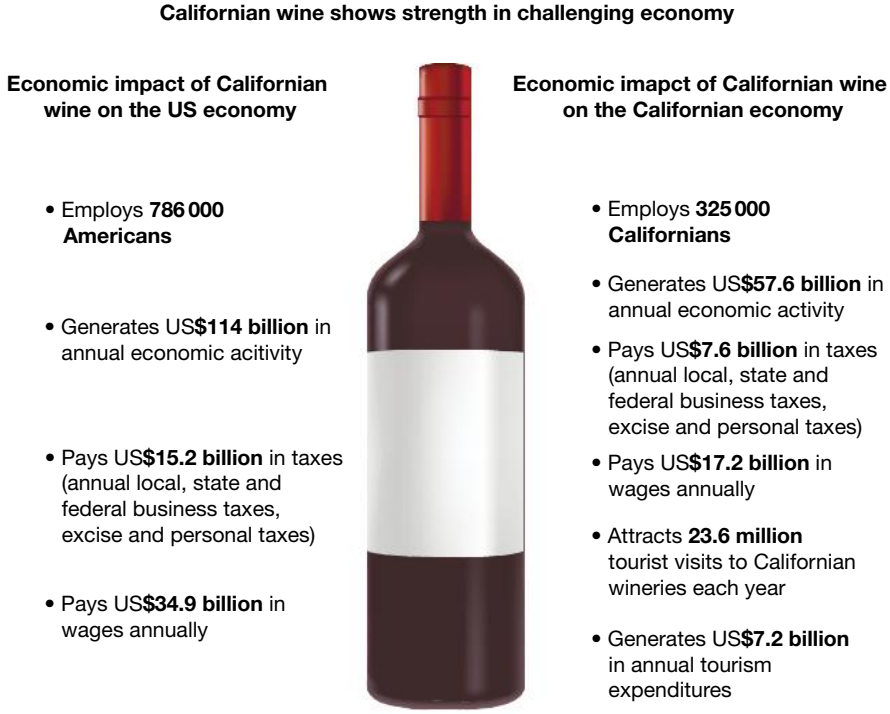
Greenhouse gases

Given the substantial energy requirements both in the vineyard and the winery, the industry should be at the forefront of promoting energy efficiency and embracing renewable technologies. Only a limited number of world wineries have adopted solar renewables in the form of solar thermal and photovoltaics (PVs), but the number is growing. With the abundance of sunshine on offer in summer, there is a viable case for solar energy to be used with substantial savings in both energy use and greenhouse gas emissions.

Economic impacts

Value of the global wine industry

Viticulture and winemaking has become a highly lucrative economic activity in the global economy. In 2017 the market was valued at US$304 billion and is expected to reach at US$380 billion by 2022.



10.4.8 Californian wine is an economic engine for the whole nation. The full economic impact is not limited to the revenue generated within the region, it also extends to what is generated by businesses throughout the United States linked to the Californian wine industry. For example, many of the oak barrels used to age the wine come from forests in Oregon and the eastern states. Much of the agricultural equipment used in the vineyards, such as tractors and mechanical harvesters are manufactured in the Midwest, in states such as Wisconsin.

Economic impact on a national scale

For wine producing countries and regional economies, the industry generates revenue from both exports and domestic sales, employment and taxation revenue. Wine in particular has a substantial value-added component as both a capital-intensive and labour-intensive industry. The multiplier effects extend beyond this to include tourism and income generated by industries that supply the wine industry (such as fertiliser in the vineyards, bottles and packaging for the wine). The full economic impact of the viticulture and winemaking industry in California on both the regional and national economy can be seen in Figure 10.4.8.

DID YOU KNOW?

South Australia produced 80% of Australia's premium wine in 2016, valued at $2.11 billion.

When the ripples hurt

The financial viability of the viticulture and winemaking industry depends on the market forces of supply and demand. The industry became the victim of the overproduction of wine that flooded the market and peaked in 2004. This imbalance was compounded by the global financial crisis of 2008 and the downward trend in production continued. The European Union subsidised producers to slash their vines between 2006 and 2010. In Australia, many vineyards were taken out of production as the prices fell. The competition on the global market has become fierce, with many producers from small estate vineyards to the big players like Constellation Brands pursuing premium high quality wine as the way forward. The global map of wine production will continue to be redrawn in response to market forces.

Social impacts

The history of the global wine industry is a story of cultural convergence. Viticulture and wine consumption spread from the Old World to the New World. Over time, colonisation, immigration and globalisation have led to the diffusion, adoption and adaptation of viticulture, winemaking techniques and wine consumption on all the inhabited continents. It is important to consider how wine impacts on those who drink it.

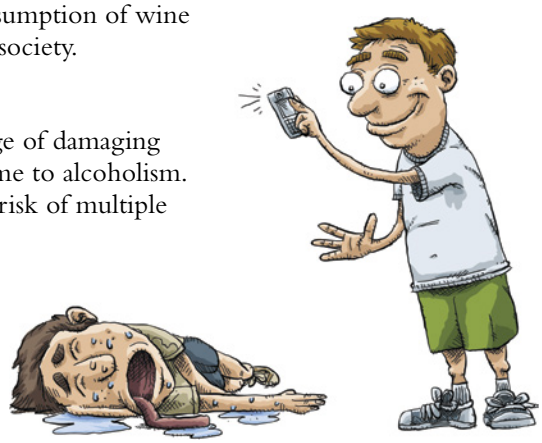
The dark side of wine consumption: overindulgence

As with any alcoholic beverage, overconsumption of wine comes at a cost to the individual, and to society.

Cost to the individual

Excessive drinking can cause a wide range of damaging health effects from foetal alcohol syndrome to alcoholism. Drinking is associated with an increased risk of multiple health problems, the most serious being liver cirrhosis, brain damage, obesity, sleep deficiency and acute pancreatitis.

In households where alcohol is abused, livelihoods are lost, relationships break down and both partners and children can be psychologically damaged.



10.4.9 The unfortunate result of too much alcohol

There are serious issues associated with binge drinking when an individual drinks heavily in a short amount of time or continuously over several days (see Figure 10.4.9). Alcohol is considered to be the most widely used recreational drug in Australia. Ingrained in the social scene is the acceptance of drinking alcohol after work, at a celebration, watching sport or attending a barbecue. Quite apart from the health risks, excessive drinking impairs a person's ability to make sound judgements. Nights out drinking can ruin lives, both for the victims and perpetrators of alcohol-fuelled violence.

Cost to society

A drunk person will take risks such as getting into a car driven by someone else who has been drinking. Alcohol is a major cause of injury and death in many countries throughout the world, particularly in young people. Alcohol impairs reaction time and can have costly impacts on others. With the advent of motor transport, car accidents are often a result of drinking and driving, and tragic accidents and fatalities can occur.

Activities

Understanding the text

1 Describe how clearing land for vineyards affects biodiversity.

2 Explain why salinity has occurred in the Riverland region of South Australia.

3 Assess the withdrawal of water to irrigate vineyards.

4 Explain why the water is stained in a blackwater event.

5 Describe the emergence of wine tourism.

6 Outline the costs of excessive alcohol consumption in the community.

Working geographically

7 Conduct a class discussion on the use of agrichemicals in viticulture.

8 Study Figure 10.4.8. Write a brief analysis of how the economic impact of Californian wine extends beyond that state.

9 Study Figure 10.4.3. Given where Australia is ranked in terms of the area under vineyards, suggest reasons why it is ranked so highly as a global exporter of wine.

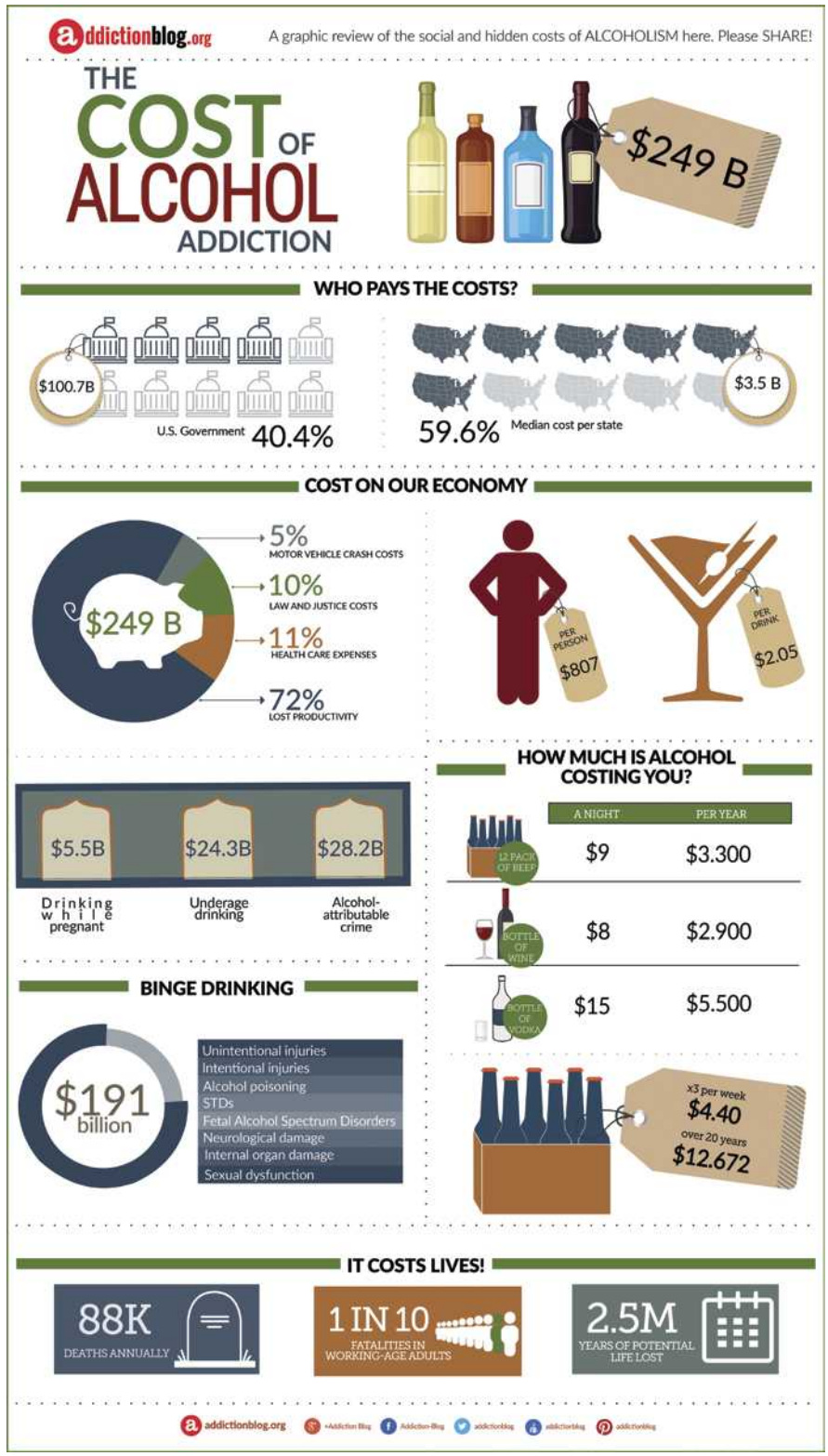
10 Study Figure 10.4.3 and answer the following questions.

- **a** List the countries that experienced a decrease in the area under vineyards from 2012 to 2016 and indicate if they are in the Old World or New World.
- **b** List the countries that experienced an increase in the area under vineyards from 2012 to 2016 and indicate if they are in the Old World or New World.
- **c** What was the size of vineyards in Argentina in 2014?
- **d** What was the percentage decrease of the area under vines for Italy from 2012 to 2016?
- **e** Where did the most significant increase in the area under vines occur from 2012 to 2016?
- **f** What country has experienced the greatest reduction of the area under vines from 2012 to 2016?

11 Study Figure 10.4.9. What message is the cartoonist trying to convey?

12 Study Figure 10.4.10 and write a newspaper article on the real cost of alcohol addiction to a country.

The aggressive behaviour fuelled by alcohol creates a stressful and quite dangerous situation in emergency rooms were those injured are treated. The medical costs of treating alcohol-related accidents and diseases places an enormous burden on public funding. The substantial cost to the community of alcohol abuse in the United States is shown in Figure 10.4.10.



10.4.10 The real cost of alcohol addiction in the United States. All figures are in US dollars.

Exam-style questions

Extended responses

- Examine the nature, spatial patterns and future directions of one economic activity in a global context.
- Assess the environmental, social and economic impacts of one economic activity in a global context.
- Analyse the biophysical, economic and technological factors that explain the nature and spatial pattern of one economic activity at a global scale.
- Analyse the social and political factors that explain the nature, spatial pattern and future directions of one economic activity at a global scale.
- Outline the factors that explain the nature and spatial pattern of one economic activity at a global scale.
- Analyse the changing spatial and ecological dimensions of one economic activity in a global context.
- Access the International Organisation of Vine and Wine website. Locate the most recent data relating to the global production and consumption of wine. Use these data to update the statistical data presented in this unit.
- Working in pairs locate news reports or media releases relevant to the global wine industry. Use the material collected to compile a list of issues critical to the industry in the medium to long term. Share the findings of your research with the rest of the class.
- Investigate one of the popular wine regions of the world to determine:
  - location
  - varietals grown in the region
  - history of the growth of wine tourism
  - attractions/amenities provided for tourists
  - economic and social impact of tourism in the region.

Glossary

agrochemicals chemicals used in agriculture to destroy insects, fungi, bacteria, pests and weeds (such as pesticides, herbicides and fungicides) and to regulate plant growth (such as fertilisers)

appellation a wine classification system based on geographical location

competitive advantage the existence of various advantages (including natural resources, location and a skilled workforce) that give a producer (or country) a competitive edge over rival suppliers (countries)

ecological sustainability using, conserving and enhancing the Earth's natural resources so that ecological processes, on which all life depends, are maintained and the total quality of life, now and in the future, can be increased

fortified wine a wine in which brandy or other spirits have been added to increase the alcohol content; sherry and port are examples

graft the process of splicing varietal vine bud onto the root stock of another type, usually one resistant to particular pests or diseases

marketing the set of techniques used to attract and persuade consumers

microclimate the climate within a small, defined area (possibly different from the area directly surrounding this area) that can dramatically affect the character of the wine produced there

New World wines a term used to describe those wines from the New World countries (particularly Australia, Latin America and the United States) when contrasting with Europe's Old World wines

organic agriculture a system of ecologically sustainable agriculture that relies on biological processes to maintain the fertility of the soil and the health of plants and animals rather than relying on synthetic chemicals and genetically modified plants

price point a point on a scale of possible prices at which something may be sold

root stock the root onto which a bud is grafted

terroir a French term used to describe the site-specific differences in wine that result from factors such as soil types, drainage, local microclimate and exposure to sunlight

varietal wines wines classified by grape type rather than the region in which they are grown

vintage the year in which the grapes for a given wine were harvested

viticulture the cultivation and harvesting of grapes, especially for use in the production of wine

water budget a budget of the incoming and outgoing water from a region, including rainfall, evaporation, run-off and infiltration

wine an alcoholic beverage produced by the fermentation of fruit, typically grapes

winemaking the production of wine via the crushing and fermentation of grapes

CHAPTER

11 The local winemaking industry: First Creek Wines

Grape growing and winemaking in the Hunter Valley date from the early 1820s. By 1823 some 10 acres of vineyards had been planted in the Dalwood area, west of Maitland. Most of these early plantings have been attributed to the effort of the amateur viticulturalist James Busby. On returning from the second of two study tours of the winegrowing regions of Europe, Busby proceeded to develop vineyards using 500 vine cuttings drawn from collections and private plantings in Europe and South Africa.

Another of the earliest producers was George Wyndham, an English immigrant to the new colony of New South Wales. Wyndham first planted grapes on the banks of the Hunter River at Dalwood in 1828. The first vintage in 1835 received rave reviews, and by 1862 he was exporting wine to England and India. Now known as Wyndham Estates, the vineyard continues to produce some of Australia's more popular wines.

Some of the famous old names in Australian winemaking are no longer directly associated with the vineyards and wineries they founded; their interests having been sold, consolidated into larger holdings or taken over by one or other of the multi-brand giants now controlling much of the Australian industry. Many of today's winemaking families can still trace their involvement with the Hunter's winemaking industry back to the mid-nineteenth century. The Tyrrells, Draytons, Tullochs and McGuigans are among the families that remain closely identified with winemaking in the lower Hunter Valley.

First Creek Wines is, by comparison, a new player in the local industry. Established in 1996 by a group of local winemakers, the company has invested heavily in plants and equipment and now provides a range of wine-related services to its clients. As an integrated winemaking, bottling and storage enterprise the company represents a particularly interesting case study of an enterprise operating at a local scale.

> **In all aspects of the winemaking process we aim to preserve and enhance the essence of the grape, producing wines to be enjoyed for their character and finesse.**
>
> **Greg Silkman, Managing Director, First Creek Wines**

11.0.1 The entrance to First Creek Wines


FIRST
CREEK
WINES
CELLAR DOOR
OPEN
7 DAYS
Mon - Fri 9am - 5pm
Saturday 10am - 5pm
Sunday 10am - 4pm

UNIT 11.1

The nature of the economic enterprise

The First Creek Wines family

Key team members include:

- Greg Silkman, CEO/Managing Director and Senior Winemaker: Having built his reputation as a winemaker by bringing Tamburlaine wines to prominence in the 1990s, Greg established First Creek, the Hunter Valley's premium contract winemaking operation. Greg led the production planning and staff development of the team, offering a new level of professionalism in winemaking, bottling and storage services.
- Liz Silkman, Chief Winemaker: appointed into this role in 2008.
- Shaun Silkman, Chief Operating Officer: manages the two First Creek Bottling lines, warehousing and logistics, which are all pivotal parts of First Creek's contract services to the industry.
- Annabel Holland, Assistant Winemaker.



11.1.1 The Silkman family (left to right): Liz Silkman, Shaun Silkman, Greg Silkman, Jenny Silkman and Katie Silkman. Liz, Shaun and Greg lead a team of winemakers who aspire to transform the best fruit characteristics into premium varietal wine styles.

First Creek Wines is a family owned and operated winery based in the Hunter Valley of New South Wales, Australia's oldest wine producing region. It is one of Australia's most successful medium-sized wine-based enterprises. The key to the family's success as winemakers is its attention to detail throughout the winemaking process. First Creek's award-winning wines sell on both the domestic and international markets.

From its base in Pokolbin, New South Wales, the company has combined its considerable expertise in winemaking and marketing with investments in the latest technology to produce a premium product sold to consumers across four continents.

In an industry facing an oversupply of grapes and a domestic market of limited capacity, First Creek Wines has achieved commercial success by diversifying its business and building new markets for its products. In addition to its winemaking activities, First Creek Wines provides a range of value-added wine-related services to other, often smaller, producers. These services include winemaking, bottling and storage. Contract winemaking services are sold to over 25 clients who then sell their estate wines under their own labels. First Creek Wines provides a bottling and storage service to over 160 clients.

First Creek Wines is unique in another important respect. It does not grow the grapes used to produce estate, or terroir, wines. Rather, it sources its fruit from independent suppliers who are able to supply premium grapes of a consistently high standard. The wine varieties produced at First Creek include semillon, chardonnay, verdelho and shiraz.

Winemaking

Winemaking is a highly specialised skill. It involves years of experience and training and is characterised by a high level of creativity. Each wine has its own unique characteristics. These are derived from the variety of grape selected; the climatic, soil and topographic conditions under which the grapes are grown; the winemaking process itself (the techniques, processes and technologies used); commercial considerations (price points; production costs; consumer tastes, preferences and expectations) and a range of cultural attitudes and influences.

Producing high-quality wines of a consistent standard is the aim of all winemakers. A skilled winemaker knows how to bring out the unique characteristics of the fruit of each vintage. Often it is the intangible factors that determine the specific nature or character of a particular wine. The intangible factors include influences such as the winemaker's cultural background, mentors and teachers; the institution in which the winemaker undertook their formal wine-based education; and the winemaker's individual talent and well-developed palate. The blending of wine from different regions, the focus on research and quality control, the emphasis placed on innovation and the application of the latest winemaking technology, when combined with the expertise of the company's winemakers, ensure that wines produced by First Creek Wines are of a consistently high standard.

Another distinguishing feature of the enterprise is its focus on building a global market for its premium wines. Wines produced by First Creek Wines are now sold in Canada, the United States, the United Kingdom, Switzerland, the Netherlands, India, China and New Zealand. The diversified nature of the business and the company's global perspective make First Creek Wines an ideal local case study of a wine-based economic enterprise.

Key members of the First Creek team are shown in Figure 11.1.1.

The winemaking philosophy of First Creek Wines

At First Creek Wines, the winemakers understand that premium wines can only be produced using the best fruit, the best oak barrels and tireless attention to the winemaking process.

Fruit is sourced from growers in the Hunter Valley, Orange, Mudgee and the Hilltops region of New South Wales. Growers are selected for their dedication to consistently producing premium grapes. The barrels, shown in Figure 11.1.2, are selected to complement and enhance the fruit characters of the grape. Malolactic fermentation and time on yeast lees after fermentation are used to impart character and individuality to premium chardonnay blends. Red wines are aged in oak for 12 to 14 months. The wine undergoes minimal filtration before bottling. In all aspects of the winemaking process the aim is to preserve and enhance the essence of the grape, producing wines to be enjoyed for their character and finesse.



11.1.2 First Creek have the capacity to store 1950 barrels of wine. The smaller barrels hold between 220 and 500 litres of wine. The larger barrels can be used with capacities in the range of 1000 plus litres. On average the 225 litre barrel makes 300 bottles of wine or five dozen. The cost of the barrels ranges from $1500 to $2500. French and American oak barrels are the best due to the flavours and the porous nature of the wood. Wines can see 12 to 14 months in a barrel and each barrel can be used approximately five times before all the oak flavour has disappeared. The barrels are then sold to garden outlets.

SPOTLIGHT

Hunter Valley wine country

The Hunter Valley is one of the most important markets for national and international tourism in NSW. Being only two hours' drive from Sydney it is ranked as the most popular destination outside the state capital. In turn, the lower Hunter vineyards around Pokolbin represent the single most important attraction within the Hunter region. The Broken Back Range is a spectacular backdrop to one of Australia's best-known wine regions. There are more cellar doors (small shops in wineries that offer wines for tasting and purchase) here than in any other wine region in Australia with wine tours available for those who wish to learn more about the local vintages (see Figure 11.1.3).

The tourism and hospitality industry in Hunter Valley Wine Country has experienced significant growth in recent years. In addition to the 'wine experience', tourist-related attractions include annual food, wine and music festivals, hot air ballooning (see Figure 11.1.4), concerts, galleries, restaurants, farmers' markets, the Hunter Valley Gardens and golf courses. The popularity of these attractions has led to the rapid expansion of the infrastructure required to accommodate the tourists. Accommodation options suit a range of budgets—from luxury resort-style hotels, guesthouses and 'bed and breakfast' accommodation to self-catering cottages, cabins and youth hostels—all of which can accommodate thousands of people. The hotels and resorts of the Pokolbin area are also popular conference and wedding venues.



11.1.3 Tasting wine at cellar doors is popular among visitors to the Hunter Valley Region.



11.1.4 Ballooning is just one of the many attractions in the Pokolbin area.

Activities

Understanding the text

1. Describe the location and nature of the First Creek winemaking enterprise.
2. Explain the basis of the commercial success of First Creek Wines.
3. Outline the ways in which First Creek Wines might be considered unique within the Australian winemaking industry.
4. Outline the knowledge and skills necessary to produce high-quality wines of a consistent standard.
5. Outline the relationship between winemaking in the Hunter Valley and the tourism industry.

Working geographically

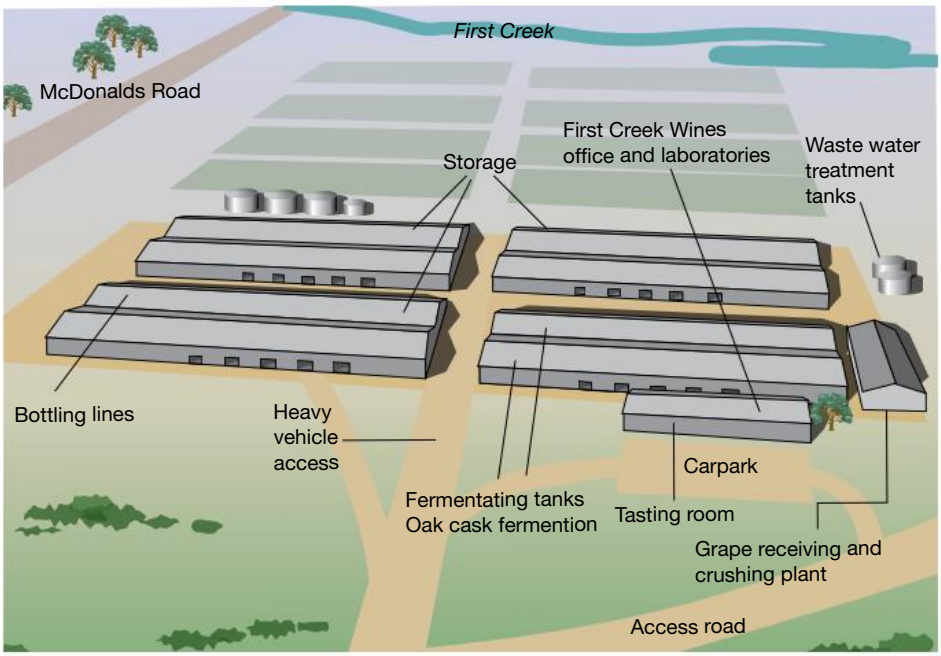
6. Use Google Earth to explore the wine-producing region of the lower Hunter Valley. Using the information in the text, try to locate the First Creek Wine Centre.
7. Access the First Creek Wines website and familiarise yourself with its contents. Then access the website from another winery that is located in the same region. Compare the two websites, then write a short review rating the level of information and how easy the website is to use.

UNIT 11.2

Locational factors



11.2.1 The Pokolbin wine producing area



11.2.2 The First Creek Wine Centre houses winemaking, bottling, storage and a retail facility.

First Creek Wines is located at Pokolbin in the Hunter Valley, Australia's oldest wine-producing area. Pokolbin is readily accessible from Sydney, via the F3 Freeway, and from Newcastle, which is just 40 kilometres to the east, as seen in Figure 11.2.1. The First Creek Wine Centre, the company's principal asset, is located on a 29 hectare site in the heart of Pokolbin. First Creek, from which the company takes its name, runs along the property's northern boundary.

The centre's four large buildings, which provide over 10 000 square metres of space, accommodate the company's offices, winemaking facilities, laboratories, storage facilities and lines, and a retail wine outlet as illustrated in Figure 11.2.2. The company's plant and equipment includes a 3500 tonne winemaking facility and three Italian designed and built bottling lines capable of processing 7000 bottles an hour.

Lower Hunter Valley: tourism

The vineyards of the lower Hunter Valley are an important tourist destination. A high level of interdependence exists between the area's tourism-related industry and wine producers. Pokolbin's location relative to the large population centres of Sydney, Newcastle and the Central Coast combined with the area's unique physical and human attractions (many of these are associated with the wine industry) have made the area popular with the 'short-break' tourism market. Weekends are particularly busy.



11.2.3 The landscape of the Pokolbin wine producing area

The Pokolbin area, seen in Figure 11.2.3, now boasts a number of four-star and five-star resort-style hotel complexes. Local wine producers, faced with an increasingly competitive business environment, have invested heavily in impressive cellar door retail 'shop-fronts' through which to promote and sell their products. The concentration of tourism-related activities and attractions has encouraged other forms of investment. The area now boasts numerous upmarket restaurants, non-wine related attractions (such as the Hunter Valley Gardens) and new housing estates, some of which are integrated into the area's three golf courses. Many homes in these estates are the holiday homes of wealthy Sydneysiders.

Cellar door wine sales are an important aspect of the commercial activities of most wine producers in the Hunter Valley. A popular pastime for tourists is to go from winery to winery, tasting (and the wineries hope, buying) wines. The smaller, estate wine producers are especially dependent on cellar door sales. Visitors are encouraged to join a mailing list, which can be used to generate future sales and the internet is used extensively to market wines.

Biophysical factors

First Creek Wines has elected not to grow its own fruit. Given the high costs of establishing and maintaining vineyards, the directors of First Creek Wines see significant commercial and operational benefits in buying fruit from established growers in the Hunter Valley, Orange, Canberra and Tasmania. This approach has four main advantages:

- It is cheaper, especially in market conditions characterised by substantial overproduction.
- First Creek Wines is able to respond quickly to shifts in consumer tastes. The company's winemakers can quickly adjust the mix of grape varieties they purchase rather than being limited to those grown in any company-owned vineyard.
- The quality of grapes can be better monitored. Due to the geographical spread of the vineyards supplying fruit, First Creek Wines can also limit any adverse impacts that climate variability, pest infestations or outbreaks of fungal diseases may have on the quality of fruit.
- The company can pursue a strategy of acquiring fruit from those microenvironments that are best suited to growing each particular variety of grape. This is why the company sources cooler climate fruit such as pinot noir from Tasmania.

The biophysical factors that determine the location of First Creek Wines' fruit suppliers include soil type and climate.

Soils

Developing a vineyard begins with site selection. Soil type is an important consideration. A deep, gravelly soil allows a vine's roots to penetrate to a greater depth than would be possible in soils that are rocky, shallow or overly compacted. Deep root systems encourage vigorous plant growth whereas shallow soils result in stunted plant growth and root systems that are slow to develop.

Climate

Grapevines, shown in Figure 11.2.4, grow best in sunny, stable climates with a relatively low incidence of persistent rain during the growing season. Three factors are important:

- First, the length of the growing season must be considered. The season at a particular site must be long enough to allow both the fruit and the vegetative parts of the vine to mature. It must also provide enough heat energy to ripen the fruit.
- Second, there must be adequate sunlight hours to ensure a sufficient supply of carbohydrates are produced by photosynthesis to mature the fruit and vine and to maintain the plant's future productive potential. The factors that influence the supply of heat and light energy include the macroclimate (the climate of the greater region), the mesoclimate (the climate of a specific site) and the microclimate (the climate of the grapevine itself).
- Third, there must be a steady and sufficient supply of water to allow the plant to function properly. However, soil water must not be in excess or grapevine roots will suffer. In areas where vines are not irrigated, the soil must retain enough water in the root zone to provide for the plant's needs between rains.

The selected site should neither receive nor retain excessive moisture, and it should allow cold, dense air to drain away from the vineyard. Otherwise cold-related stress or water logging may occur.

Australia's relatively dry climate—compared to that experienced by most of the world's other grape-growing regions—means that supplementary irrigation is often necessary in order to achieve efficient and reliable production. Irrigation allows the grower to manage the rate of growth during spring and summer, balance fruit and vegetation growth, maintain a balance between acid and sugar, and manage the accumulation of flavour and colour in grape berries. Drip irrigation and moisture monitoring, in addition to conserving water, are used to maximise the quality of the grape.



11.2.4 First Creek buys grapes from established growers.

Choice of grape variety

The choice of grape variety is a major consideration, as are decisions about whether to have own-rooted vines or those grafted onto rootstock of a hardier vine species that is resistant to salinity, pests and diseases, and water shortages. Growers will often select varieties for their rootstock that are easier to manage and control, especially in terms of the health and development of young vines.

The varieties of grapes grown in Australia are the same as those found in other parts of the world with the same soil types and climate.

Biophysical hazards

A range of natural hazards can adversely affect grape quality. These hazards include drought, excessive rain, hail, severe frost, pest infestations and fungal diseases.

Sociocultural factors

Various sociocultural factors interact to influence the commercial operations of First Creek.

Demographic and social change

Australia's population is ageing. This is a product of declining birth rates, increased life expectancy and the baby boomers moving into retirement. The ageing of the population, combined with an increase in the number of couples choosing not to have children, as well as the tendency towards later marriage and the growth in the number of two-income families has significantly increased disposable incomes. This has generated a demand for luxury (discretionary) goods and services, such as wine, restaurant meals and vacations.

Changing lifestyle expectations

Since the 1970s, wine consumption has grown in popularity. The reasons for this are complex and include influences from European immigration on the Australian lifestyle, and more active and well-financed retirements which are a product of increased life expectancy. Other influences are improvements in medical care, the accumulated superannuation assets of the baby boomers, the emergence of a cafe and restaurant culture and increased affluence (for some).

The growth of tourism

The demographic and social changes outlined have underpinned the growth in international and domestic tourism. The Pokolbin area is a major tourist destination. Wine tasting is an important part of the tourism experience. The popularity of visits to cellar doors allows wine producers, big and small, to promote and sell their products. Visitors can sample wines, tour the winery and often talk with the people who made the wine.



11.2.5 Visitors to the cellar door at First Creek can sample wines while watching the daily activates of a working winery from a viewing window.

Cellar door sales are very responsive to changing economic circumstances and variations in the number and nature of tourist visitations. The promotion of Pokolbin as a wedding destination, for example, is seen by some as having an adverse impact on cellar door sales, since wedding guests have little time to travel from vineyard to vineyard sampling and buying wines.

While First Creek operates a cellar door retail outlet, shown in Figure 11.2.5, the cellar door forms only a small part of the enterprise's commercial operations.

Changing consumer tastes

First Creek Wines monitors shifts in consumer demand and attempts to take advantage of them. It can respond quickly to changes in preferred styles of wine and has become particularly skilled at meeting the demands of niche markets. The flexibility enjoyed in sourcing fruit from different producers enhances the company's capacity to respond to changing consumer demand.

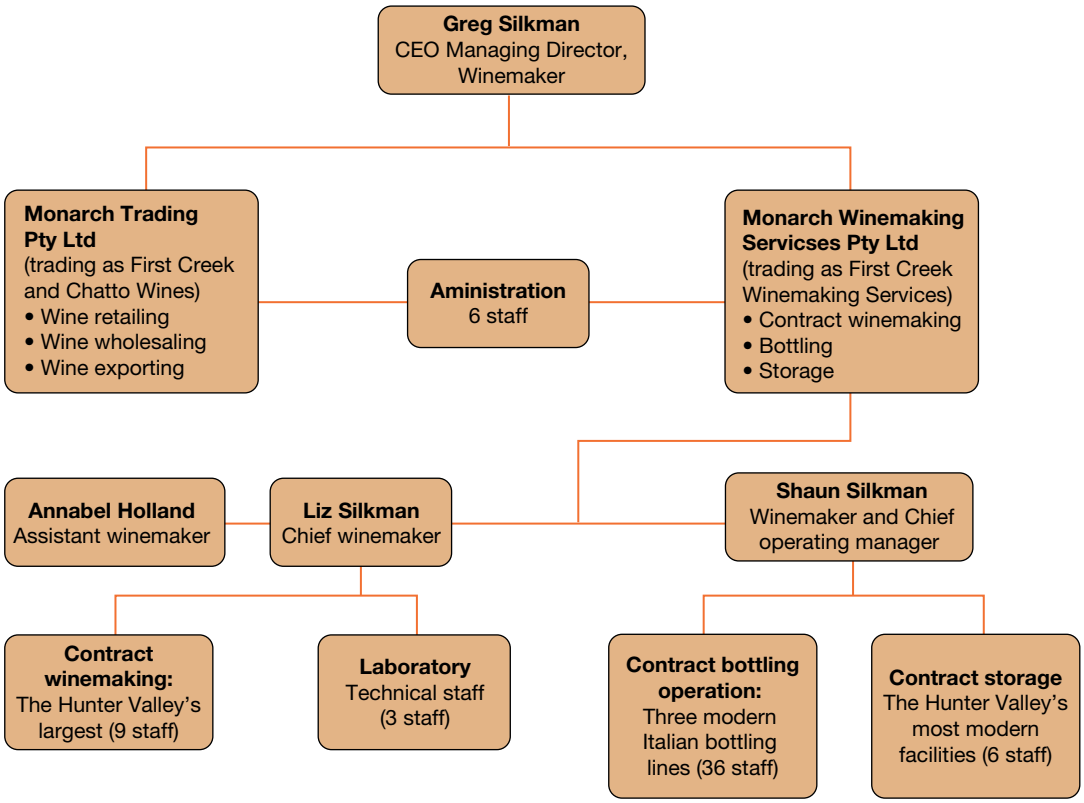
Organisational factors

First Creek Wines had its beginnings in 1996 when four experienced winemakers decided to pool their talents and financial resources to develop the Allanmere Vineyard. Early success at the London International Wine Challenge and Vinexpo (one of the largest exhibitions for wine professionals in the world), combined with the perception that the growing number of vineyards that only produced grapes were poorly serviced by the major labels they sold to, convinced the winemakers of the need for expansion.

The subsequent decision to supply winemaking, bottling and storage services for other wine producers would secure the financial viability of the enterprise. The company's diversification has helped buffer the enterprise from some of the uncertainties that have adversely affected the Australian wine industry in recent years. The company prides itself on being an enterprise that offers 'winemaking for winemakers by winemakers'.

Corporate structure

The First Creek Wine Centre is home to two sister companies: Monarch Winemaking Services Pty Ltd (trading as First Creek Winemaking Services) and Monarch Trading Pty Ltd (trading as First Creek Wines), as shown in Figure 11.2.6. Monarch Winemaking Services Pty Ltd accounts for the majority of the group's annual turnover. Both companies are privately owned. First Creek Wines employs 45 permanent staff plus an extra 20 during vintage time.



11.2.6 Corporate structure of First Creek Wines

Decision-making context

Decision-making at First Creek Wines takes place within both a national and international context. The strengths (opportunities) and weaknesses (threats) shaping the company's operational environment are outlined in Figure 11.2.7.

Internal strengths	**Weaknesses**
■ Efficient production methods: First Creek Wines is strong on innovation and the application of technology ■ The ability to blend wines from different geographical regions, which results in a much more consistent product compared with the industry in France, for example, which is still regionally focused ■ Very strong research and development and quality control focus ■ Great winemaking climate with many different microclimates suited to a wide variety of grapes ■ Strong government support for planning, innovation, quality and marketing	■ The global oversupply of grapes has put downward pressure on prices and, in turn, the return on the capital invested ■ Limited domestic marketing opportunities, with the retail sector dominated by two large retail chains: Coles and Woolworths ■ Many smaller wineries lack marketing expertise
External opportunities	**Threats**
■ Growing acceptance of New World wines on the international market ■ Growing awareness and appreciation of 'Brand Australia' in key world markets: United Kingdom, United States and Canada ■ The big four (Treasury Wine Estates, Accolade Wines, Premium Wine Brands and Casella) dominate the industry and these companies provide a bridgehead in export markets for small companies to follow	■ Growing competitiveness of other New World producers: South Africa and Chile ■ Fluctuating value of the Australian dollar affecting international competitiveness ■ Growing popularity of boutique beers and ciders among the next generation of potential wine drinkers

11.2.7 Decision-making context: strengths (opportunities) and weaknesses (threats)

SPOTLIGHT

James Busby, Australian wine industry pioneer

James Busby is recognised as the founder of the Australian Wine industry. Born in Scotland in 1801, Busby emigrated to the colony of New South Wales in 1824. Before he left Scotland, and with no prior knowledge of viticulture or winemaking, he spent some months in France's wine regions, learning as much as he could about these activities. During his time in Europe he gathered up living samples of a large number of different grapevine varieties. Of these, 363 survived the long trip to Sydney, packed in moss, sand and soil, and were planted in the Royal Botanic Gardens in Sydney. This collection is the likely origin of Hunter Valley shiraz and today the Hunter Valley is home to some of the oldest own rooted vines in the world with some vineyards boasting vines that are in excess of 120 years of age.

Political factors

Government support and regulation

Like all companies, First Creek Wines must abide by a range of laws and regulations enacted by governments at the local, state and federal level. They must abide by the laws and regulations covering workplace relations, occupational health and safety, environmental protection, corporate governance and accountability, taxation, planning and building codes and regulations, employees' entitlements (for example, the Superannuation Guarantee Levy), bottle labelling and food standards.

Federal level

A number of government departments and statutory authorities support and regulate the Australian wine industry, these include Wine Australia, Austrade and Food Standards Australia New Zealand.

State and local levels

State-based laws and regulations include the granting of a liquor licence. This is required before an enterprise can serve and/or sell alcohol. Other state-based laws and regulations affecting the commercial operations of First Creek Wines include environment protection legislation and occupational health and safety laws.

At a local scale, First Creek Wines must deal with local government rules and regulations. For example, the development of the First Creek Wine Centre was undertaken after being granted a Development Approval by Cessnock City Council. The council's Local Environment Plan sets out the rules governing land and water use with the aim of protecting the local area's physical environment.

The NSW State Government also supports research and development within the industry. The National Wine and Grape Industry Centre is a joint initiative of the NSW Department of Primary Industries, Charles Sturt University (CSU) and the NSW Wine Industry Association. The centre was formed in 1997 with the goal of maintaining the wine industry's internationally competitive edge by integrating research, teaching, training and information exchange. CSU offers undergraduate programs in wine science, viticulture and winegrowing. Many of First Creek's winemakers are graduates of CSU.



11.2.8 First Creek now has three Italian-made bottling lines.

Activities

Understanding the text

1 Describe, with the aid of an annotated sketch map, the location of First Creek Wines.

2 Describe the facilities of First Creek Wines, including its plant and equipment.

3 Explain the relationship between winemaking in the Hunter Valley and the tourism industry.

4 Identify the advantages enjoyed by First Creek Wines in sourcing its grapes from established growers.

5 Explain why soil type is an important consideration in terms of vineyard site selection.

6 Outline the aspects of climate that need to be considered when locating a vineyard.

7 Explain why irrigation is necessary in the Australian context. What are the benefits of its use?

8 Identify the factors taken into account when selecting grape varieties.

9 List the biophysical hazards that can adversely affect grape quality.

10 Explain how demographic and social change and changing lifestyle expectations interact to influence the commercial operations of First Creek Wines.

11 Explain the commercial relationship between the vineyards of the lower Hunter Valley and tourism.

12 Explain why the promotion of Pokolbin as a wedding destination is seen as having an adverse impact on cellar door sales.

13 Outline the ways First Creek Wines takes advantage of shifts in consumer demand.

14 Outline the origins of First Creek Wines.

15 List the internal strengths and weaknesses shaping the decision-making context of First Creek Wines.

16 Outline the external threats and opportunities that shape the decision-making context of First Creek Wines.

Working geographically

17 Write a paragraph describing the attractions of the Pokolbin area as a tourist destination.

18 Study Figure 11.2.7 and write an extended response outlining the internal strengths and weaknesses and external opportunities and threats that determine the decision-making context of First Creek Wines.

Business incentives

An example of the State Government's support of the state's wine industry was the provision of a $21 000 grant to assist First Creek Wines' purchase of a state-of-the-art, Italian-made bottling line. Costing $2 million, the bottling line is capable of processing 7000 bottles of wine an hour (see Figure 11.2.8). The grant came from the NSW Government's $10 million Hunter Advantage Fund. Launched in 1997 following the closure of BHP's Newcastle steelworks, the fund is designed to help create 2500 new jobs. This grant follows an earlier grant that supported the initial construction phase of the First Creek Wine Centre.

Industry-based organisations

First Creek Wines is a member of a number of industry groups. These promote the interests of the industry, sometimes acting as lobby groups; that is, groups that seek to influence the decision-making processes of governments. These industry groups include the following:

- **Winemakers' Federation of Australia (WFA):** The WFA is the wine industry's peak body. Its principal role is to advance and protect the interests of Australia's winemakers. Voluntary membership currently represents more than 90 per cent of wine produced in Australia. Each Australian state has its own affiliated state-based association.
- **Australian Wine Research Institute (AWRI):** The AWRI is owned by the Australian wine industry and is funded by Australia's grape growers and winemakers through their payment of the Wine Grape and Grape Research levies, with matching funds from the Australian Government. The institute's role is to undertake world-class research relevant to the needs of the Australian wine industry.
- **Cooperative Research Centre for Viticulture (CRCV):** The CRCV is Australia's leading viticultural research and development organisation. The centre's aim is to promote the economic and environmental sustainability of Australia's grape-growing industries through quality viticultural management. The centre was established in 1992 under the Australian Government's Cooperative Research Centre (CRC) initiative. The CRCV is an Australia-wide joint venture of 12 core organisations carrying out research and development in a collaborative way and delivering innovative technologies to Australia's viticultural industries.

UNIT 11.3

Ecological factors

Wine production involves the interaction between people and the environment, with each impacting on the other. It involves a significant transformation of the physical environment and a disruption of natural environmental processes. The challenge for those involved in the industry is to manage these impacts in ways that minimise the environmental impacts and enhance the potential for ecologically sustainable development.

The aim of ecologically sustainable development is to use, conserve and enhance the community's resources so that ecological processes on which all life depends are maintained, and the overall quality of life, now and in the future, can be increased.

Environmental issues relevant to grape growing and winemaking

Grape growing

The distribution of grape growing in Australia is determined by soil type and climatic conditions and involves the replacement of natural vegetation (or other pre-existing land uses) with a monoculture. Some of the environmental issues that are associated with grape growing are discussed below.



11.3.1 Drip irrigation under vines

Water quality and use in viticulture

The management of water is critical to the growth of vines and the quality of fruit produced. It is also important in terms of weed control. The shift towards drip irrigation, shown in Figure 11.3.1, has helped address the issue of rainfall variability. Water can be delivered to individual plants at times that maximise growth and fruit formation. Drip irrigation also minimises the amount of moisture that is available for surface weeds to grow.

Water availability at the macro level is also an issue. Grape growers and wine producers compete with other agricultural, industrial and domestic users for a scarce resource. How water is allocated between users is an increasingly important political issue. All water users need to develop ways of conserving water.

Management of solid waste products

Solid waste products used in grape growing include treated timber posts. These posts are used to support the wires on which grapevines grow. They have traditionally been treated with toxic creosote or chromated copper arsenate (CCA) to protect them against attack from termites, fungi and rot. Arsenic is a known carcinogen that can produce skin and liver cancers. While the absorption of arsenic by grapevines does not appear to be an issue, the disposal of treated logs can be problematic. Burning the logs releases the arsenic into the atmosphere. The WFA is developing an environmental strategy that focuses on finding alternatives to, and the safe disposal of, treated logs.

Use of pesticides: insecticides, fungicides and herbicides

The use of chemicals is a major issue in all agricultural industries. Their excessive use can have a range of environmental impacts. They can enter the food chain and accumulate in consumer organisms (including humans) towards the end of the food chain. The consumer-driven trend towards organic forms of agriculture has encouraged grape growers to adopt more ecologically sustainable practices. Weeds (which compete with vines for nutrients and host fungal diseases) can be controlled through mulching (which prevents weeds from germinating and growing). Mechanical cultivation (which uproots and buries weeds) and better water management (drip irrigation minimises the amount of moisture available to weeds) are other approaches to managing weeds. New organically acceptable herbicides have been also been developed.

Grapevines are susceptible to attack from a variety of insect pests, including phylloxera. This is an aphid-like, sap-sucking insect that attacks grapevine roots, slowly causing a decline in vine health and ultimately destroying the vine. Vines are also prone to fungal diseases; for example, grey mould and downy and powdery mildews. Chemical sprays can control some of these insects and diseases but are expensive and often have unintended environmental impacts.

Land use conflicts with local communities and other industries

Grape production competes with other agricultural and commercial land uses for the best land. In the Pokolbin area of the lower Hunter Valley, vineyards must compete for land with tourism-related infrastructure (such as resort hotels and golf courses), urban expansion and the coalmining industry. Open-cut coalmining poses a threat to groundwater flows and water quality throughout the lower Hunter.

Impacts of climate change

Rising global temperatures, changing rainfall patterns and the increased incidence of extreme weather events may ultimately affect the viability of grape growing in some regions.

Maintenance and enhancement of natural ecological systems and protection of biodiversity

All vineyards impact on the environment to some extent. Native vegetation is replaced by a monoculture, with biodiversity being reduced as a consequence. Impacts can be limited by ensuring that as much as possible the operation of the vineyard does not adversely affect the surrounding environment. For example, retaining areas of natural vegetation can provide a habitat for local plant and animal species. Managing effluent effectively can protect ground and surface water quality.

Environmental initiatives of the WFA include a review of the effectiveness of current domestic and international environmental management frameworks and the development of an environmental management kit. This kit contains environmental 'best practice' templates, appropriate case studies and other environmental management tools, such as risk assessment frameworks.

Winemaking

First Creek Wines is well advanced in terms of environmental management. Wastewater, as noted on the following page, is treated on site (see Figure 11.3.2) and passed through a reed bed system. UV sunlight completes the final phase of the water treatment. This achieves the highest standards of final output before it is recycled for the watering of lawns and gardens. Treated wastewater is also used via irrigation to support native landscaping projects. Natural vegetation is retained on 70 per cent of the site, with the remaining unused land covered with a mix of native and introduced grasses.

In addition to the specific environmental initiatives of First Creek Wines, the Australian winemaking industry is sponsoring research into better ways of managing wastewater (for example, its reuse in winery processes or irrigation), the ways wineries can use electricity more efficiently, and alternatives to the use of caustic soda in the production process.

SPOTLIGHT

Adapting to climate change

According to a report by the CSIRO, climate change will impact upon the timing of maturity of wines. The warming climate means that maturity occurs earlier in the season and grapes ripen when it is warmer, this affects the sugar levels and aromas of the grapes. This in turn may impact on the quality and the style of the wine. Adaptation techniques including irrigation, pruning and trellising are being practised, other adaptations include growing different grape varieties due to the changing conditions. Some of the larger companies are purchasing agricultural land in cooler regions like Tasmania, anticipating the changing climate will make grape growing there more feasible for particular varieties.



11.3.2 Waste treatment facility



11.3.3 Storage tanks hold between 2500 and 50 000 litres of wine. Dimple plates are installed on the outside of the tanks. The plates are pumped full and circulated with chilled water to achieve a temperature between 12°C and 15°C. Oak chips may be added to give a subtle flavour to the wine.

Generation and disposal of wastewater from winemaking and packaging

Winemaking and the production of packaging materials are water and energy intensive; see Figure 11.3.3. Following an initial period of transporting water by truck, First Creek Wines exercised its easement right and constructed a pipeline across a neighbouring property. This allowed the company to use much cheaper reticulated town water to meet winemaking demands.

Water used in wineries averages between 1.5 and 2.5 litres for every litre of wine produced. With careful water management, water use can be reduced to the lower end of this range. Water is used in conjunction with various chemicals to clean winemaking tanks, barrels, pipes and equipment. Sterile, filtered water is also used to mix some wine additives prior to use in the wine. Bentonite, a clay derivative, is used to stabilise the proteins in white wine and to help the wine settle.

The introduction of high-velocity, reduced-volume hose nozzles is one example of how a reduction in water use has been achieved at First Creek Wines. The hoses are used to clean tanks and other processing areas and equipment. The estimated saving in water consumption is in the order of 500 000 litres per annum. Additionally, reduced water use in the winery's operations results in savings in the form of reduced energy costs for water treatment.

Winery wastewater typically contains high levels of organic matter and may also contain materials such as sugar, ethanol, acids, salts and cleaning chemicals. At First Creek Wines, water containing pollutants and waste products is treated by removal of solids, pH correction and oxygen saturation to convert all dissolved sugars and dramatically reduce biological oxygen demand. Winery wastewater is very high in nutrients and can support the growth of anaerobic bacteria. If the water is not treated properly the growth of the bacteria will produce a very unpleasant smell.

First Creek Wines has developed a seven-stage treatment process:

- use of screens to separate any solids
- adjustment of the pH to 7
- primary aeration by blowers in a 120 000 litre tank
- secondary aeration and settling in a second 120 000 litre tank
- decanting of clear water
- discharge through a reed filtration treatment system
- use of clear water to irrigate landscaping projects.

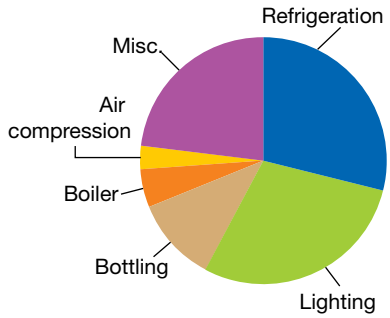
The disposal and treatment of wastewater is heavily regulated by the NSW Environment Protection Agency. If untreated, the effluent could damage the ecology of local waterways. It may result in oxygen depletion, an increase in pollution by suspended solids and eutrophication.

Paper and cardboard production is the third most energy intensive of all the manufacturing industries. It also consumes up to one-third of all the wood harvested from forests. By choosing packaging made from recycled materials, winemakers are able to reduce the amount of forest felled and water and energy used. Some of the cardboard packaging used by First Creek Wines is produced from recycled cardboard. All the company's carton dividers are made from recycled cardboard.

Energy use

Winemaking is energy intensive. However, the relative newness of the company's plant and equipment ensures that it is among the most energy efficient available. Figure 11.3.4 shows the distribution of First Creek Wines' electricity consumption. First Creek Wines has achieved reductions in electricity use through several measures.

- Staff have been encouraged to better control the use of lighting in work areas, resulting in a reduction in overall electricity consumption.
- The power consumed by brine (a water and methanol solution) circulation pumps has been reduced. The winery requires a powerful brine distribution system to maintain wine temperatures during fermentation and cold stabilisation. Fitting the winery's brine pumps with a variable speed drive has enabled First Creek Wines to achieve the desired pressure without excess volumes of brine being circulated through the system. This resulted in considerable energy savings.
- Heat from the winery's refrigeration chillers has been recovered and reused. The winery's powerful refrigeration system consumes large amounts of energy to 'cold stabilise' wines. As it does so, it radiates heat to the atmosphere. The wines then need to be warmed prior to bottling, thus consuming more energy. Fitting a heat exchanger to the cooling system has enabled heat to be captured and reused for heating the wine, thus saving electrical energy.



11.3.4 First Creek's electricity consumption by end use. Power factor correction systems have been installed to enhance the efficiency of large motors that drive the cooling process. This has reduced electricity consumption and the company's energy costs.

Management of solid waste products

Solid waste products in the winemaking process include grape marc (the solid grape skins, pulp and stems left after the juice has been extracted) and filter material. At First Creek Wines, grape marc is collected and made available to interested parties, including potting mix companies and farmers who may desire high-quality organic supplements for poor-quality land.

Certain solid wastes (plastic, glass and cardboard) are separated and compacted (where appropriate) and then collected by recycling operators (see Figure 11.3.5). This reduces both the cost of waste collections and the total quantity of solid waste sent to the local landfill.

By reusing filter cartridges from the winery in the bottling line filter housings, First Creek Wines has been able to reduce solid waste and save money without compromising the product's quality or security.



11.3.5 Waste material ready for recycling

Activities

Understanding the text

1. State the aim of ecologically sustainable development.
2. Outline the key environmental issues associated with grape growing. Explain how these issues are being addressed by First Creek Wines.
3. List the specific environmental challenges associated with winemaking at First Creek Wines. Explain how First Creek Wines seeks to minimise any adverse environmental impact.

UNIT 11.4

Internal and external linkages and flows

Inputs

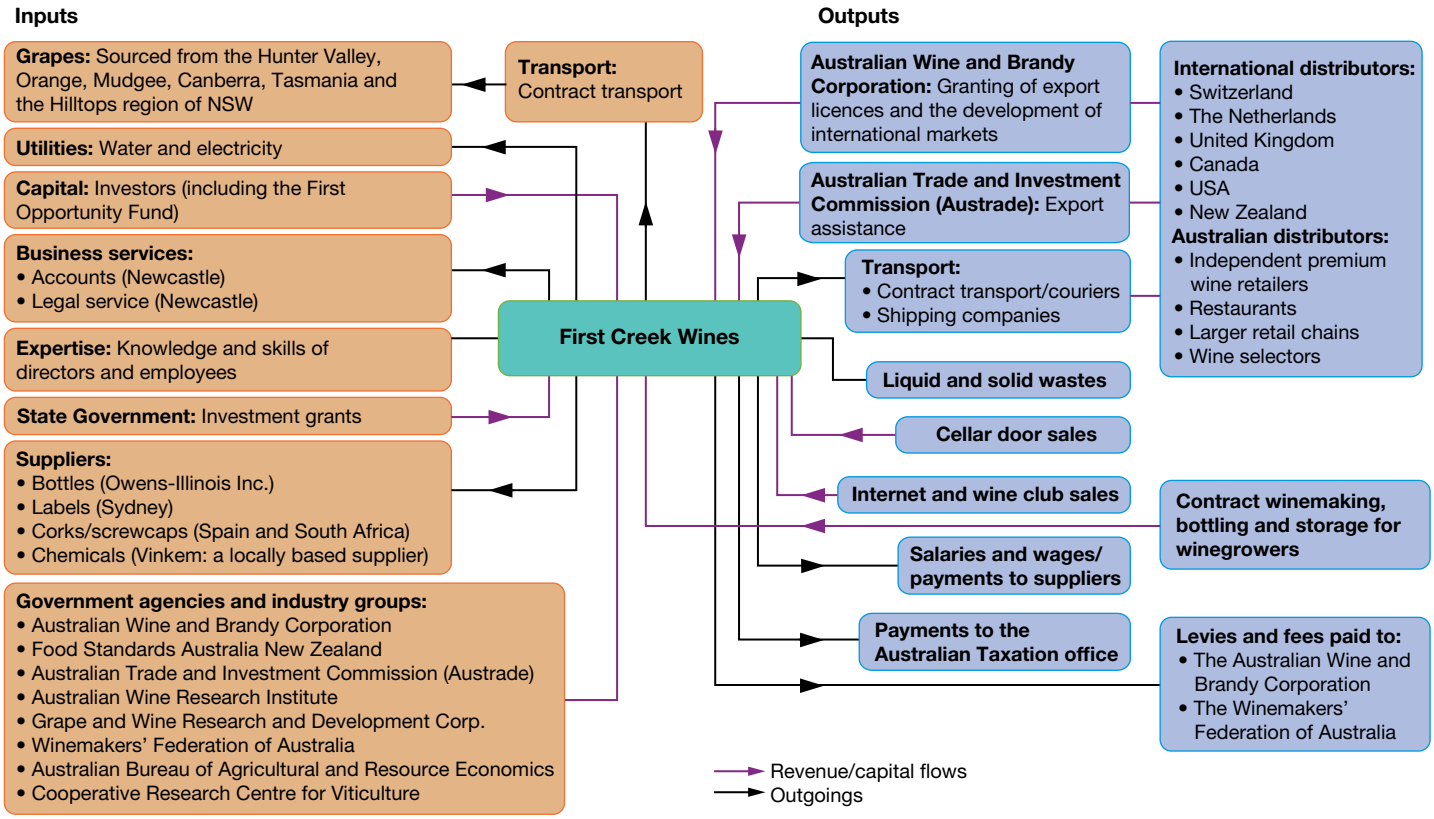
As shown in Figure 11.4.1, winemaking involves a range of inputs. These are sourced from established suppliers. Bottles, for example, are purchased from Owens-Illinois Inc. (formerly ACI Packaging), labels are designed and printed in Sydney by Assta Label House or Clear Image Labels, and screwcaps come from Spain (Torrent Caps) and South Africa (MCG Industries). The chemicals used are purchased from Vinkem Packaging: a local winery chemical and cork supply company. Other inputs are supplied by publicly owned utilities and a range of private service providers.

Flow of people and ideas

The commercial success and reputation of a wine-based enterprise does not just depend on the quality of wines it produces. The marketing of the product is also critical. First Creek Wines' response to the increasingly competitive state of the Australian market (a result of supply exceeding demand) has been to develop a presence in key export markets. This includes both the established wine markets of North America and Europe and the emerging markets of the Asia–Pacific region, especially China.

Workforce

First Creek Wines' most important asset is its 'human capital': the experience, knowledge and skills of its employees. First Creek Wines has 65 permanent and casual employees. Some (including the winemakers and laboratory technicians) are highly skilled and would normally be expected to have tertiary qualifications in Wine Science or related fields. Some have trade-related qualifications from TAFE while others are semi-skilled or unskilled labourers.



11.4.1 First Creek Wines linkages

The workforce includes winemakers, laboratory technicians (responsible for product quality control), marketing specialists, an accountant, sales representatives, administrative staff, production supervisors, bottling machine operators, forklift drivers and warehouse staff.

Staff members are trained and experienced in winery-related activities: winemaking, administration, marketing, bottling line operation and warehousing. The company encourages multiskilling and the upgrading of skills through additional training and further education.

The retention of experienced winery staff is often difficult given the competitive nature of the industry. Above-award wages are common in the industry and personal relationships are important in building workforce loyalty and commitment.

Marketing and distribution

Successful marketing programs build consumer awareness of a product and enhance the consumer's perception of the product's quality. The ultimate aim is to trigger the consumer's preference for (and purchase of) a particular brand. At the heart of First Creek Wines' marketing strategy is brand building. First Creek Wines' marketing department is responsible for this aspect of the company's promotional activities.



11.4.2 First Creek Wine's marketing strategy includes the use of eye-catching labels.

Marketing and distribution within Australia

Given the nature of the services provided by First Creek Winemaking Services in the region, the company does not need to actively market this part of its business. For the most part, these services are sold to local producers who lack the scale of production, expertise or capital equipment required to make their own wine.

First Creek Wines' marketing activities are, therefore, principally focused on the promotion of the First Creek labels. The key elements of a successful wine marketing campaign include:

- identifying and then targeting specific markets
- establishing and maintaining a positive, supportive relationship with distributors
- using eye-catching labelling and packaging (see Figure 11.4.2)
- ensuring product placement in stores
- using targeted advertising in magazines and local tourism-related publications
- conducting in-store and special event wine tastings
- utilising 'non-advertising' coverage in relevant publications and programs
- participating in wine competitions to gain the recognition and publicity they generate
- emphasising the wine's New World origins and Australia's clean and green environmental qualifications.

SPOTLIGHT

Cork

While cork has been used for thousands of years to seal wine in bottles, in common with an increasing number of winemakers, First Creek Wines has switched to screwcaps. The problem with cork is that it can produce bacteria that ruin as many as one in 10 bottles of wine. These bacteria give wine a musty, mushroomy taste. By contrast, the screwcaps guarantee that the quality and consistency of a wine is maintained in every bottle.

Traditionalists contend that people want a dining experience, and wine service is a part of that. There is, they argue, a lot of romance associated with the pulling and sniffing of the cork. On the other hand, many restaurateurs prefer the screwcaps because they are easier for staff to open and customers reject fewer bottles of 'corked' wine.

Wines produced by First Creek Wines are marketed through independent wholesalers (both domestically and internationally), the internet (wine can be ordered via the company's website) and the First Creek Wine Club. They are also sold directly to restaurants, which then feature them on their wine lists.

DID YOU KNOW?

Successful marketing programs build consumer awareness of a product and enhance consumer perceptions of the product's quality. The ultimate aim of the marketing program is to trigger the consumer's preference for a particular brand.

International marketing and distribution

The decision to pursue an export strategy was based on a number of developments within the global wine market. These included:

- a growing consumer acceptance of, and preference for, brand wines (often at the expense of the market share of terroir or estate wines)
- increasing acceptance of New World wines on the international market
- greater appreciation of 'Brand Australia' (that is, recognition of Australian wines as a quality product) in key world markets: the United States, the United Kingdom and Canada
- a bridgehead established in key export markets by Australia's big wine corporations.

The challenges First Creek Wines confronts in implementing its export strategy include:

- the growing competitiveness (in terms of price and quality) of other New World producers, especially those from Chile, New Zealand and South Africa
- the relatively high value of the Australian dollar—an appreciating Australian dollar makes Australian wines more expensive
- domestic overproduction in many key export markets putting downward pressure on prices
- restrictive liquor-based laws, especially in the United States, which complicate the cross-border movement and marketing of wine
- changing consumer tastes—the growing popularity of spirit-based beverages, especially among young people, is having an impact on wine consumption in some key markets.

Wholesale distributors

First Creek Wines places great emphasis on building a global network of wholesale distributors. Greg Silkman and other senior staff travel internationally two to three times a year, establishing and maintaining the company's relationship with its wine distributors. In the United States, First Creek has sought to build profitable relationships with a group of independent distributors across a wide range of states.

SPOTLIGHT

A tax incentive at what cost?

The origins of the 'crisis' affecting Australian viticulture and winemaking can be traced back to 1993, when winemakers lobbied the Federal Government to boost the supply of grapes so that winemakers could take advantage of the surging global demand for Australian wine. The Government responded by rewriting the industry's depreciation rules. This meant that growers could now write off the cost of buying and planting vines over just four years, rather than over the lifetime of the vines. This provided existing and potential growers with a lucrative tax shelter.

It took some time for the incentives to take effect but by the late 1990s new and expanded vineyards were spreading across the Australian landscape. Unfortunately, many of the new growers were more skilled in minimising tax than recognising the realities of supply and demand. In just three years (1997–99) an additional 40 000 hectares of vines were planted: a 40 per cent increase over the 100 000 hectares already in production. It had taken 30 years to plant the previous 40 000 hectares.

Other factors contributing to the surge in plantings included the decline in the value of the Australian dollar. As the currency declined, Australia increased its competitive price advantage over other wine producers.

Australia finally scrapped the industry's tax breaks in 2004. It has, however, taken years for the industry to come to grips with the overproduction generated by the tax incentives.



11.4.3 The First Creek Wines website

Activities

Understanding the text

1. Outline the nature of the inputs used in the wine-production process.
2. Identify the two factors critical to the success of a winemaking enterprise.
3. State what is mean by the term 'human capital'. Outline the nature of the human capital employed by First Creek. What challenges are there in recruiting and retaining the necessary staff?
4. Outline the factors impacting on First Creek's decision to pursue an export strategy. What challenges did it confront?
5. Identify the ways in which First Creek fosters its relationship with wholesalers.
6. Outline the importance of online sales and the role of the First Creek Wine Club.

Working geographically

7. Study Figure 11.4.1 Write an extended response outlining the flow of people, goods, services and ideas within the economic enterprise.
8. Study the Spotlight box on screwcaps. Identify the key arguments for and against the introduction of screwcap technologies.
9. Study the Spotlight box, 'A tax incentive at what cost?'
   a. Explain how the Federal Government's response to the lobbying of winemakers contributed to the current 'crisis' in the Australian grape-growing industry.
   b. Outline the impact of the Government's package of tax-based incentives on the industry.
   c. Identify the other factors that contributed to the surge in grape plantings.
   d. Outline any other factors contributing to the oversupply of grapes and the overproduction of wine.
   e. Outline the industry's response to the crisis.

Of particular interest are distributors who can increase sales using a range of distributor incentives (for example, customer loyalty programs); are flexible in terms of their response to consumer needs; and are able to maintain profit margins on competitively priced, quality products.

While technology (especially email and video conferencing) is used to maintain the relationship with individual distributors, emphasis is still given to face-to-face contact. The international travel undertaken by the management and senior employees is an important aspect of this relationship building. The same approach is applied to domestic distributors. The company's sales representatives visit restaurants and independent wine retailers promoting the First Creek labels. Incentives for retailers to stock the company's wines include the ability to maintain attractive gross profit margins from wines that are not advertised as discounted product lines with mass merchants (such as those run by Coles or Woolworths). Other incentives are First Creek Wines' customer loyalty program and effective third-party endorsements in point-of-sale advertising.

Internet sales

The internet has revolutionised the way many small to medium-sized firms do business. It has provided a relatively cheap way for companies such as First Creek Wines to promote their products and services to the global marketplace. It also provides a new and convenient way for consumers to select and purchase goods and services. Consumers can select and pay for First Creek wines online, shown in Figure 11.4.3. The goods are then transported, by courier, to the consumer's doorstep.

Wine clubs

Wine clubs are used throughout the industry to promote a sense of exclusivity, build consumer (brand) loyalty and secure regular sales.

The First Creek Wine Club

First Creek Wines operates a wine club. While club membership is free, members are committed to buying First Creek Wines at regular intervals. Members are able to purchase wine packages carefully selected by the company's winemakers. Wines are delivered quarterly (in March, June, September and December). Delivery is free, and members pay up to 30 per cent less than they would if buying the wines from retail stores.

Other membership benefits include discounts on all wine purchased via the First Creek Online Store; complimentary winery tours; an initiation to the annual Winemaker's Reserve Lunch; and a bi-annual newsletter that contains winemaker reports, tasting notes and special offers, and updates members on upcoming events and new release wines.

UNIT 11.5

Effects of global changes on the enterprise



11.5.1 Export opportunities exist for sparkling wine, as Chinese consumers are increasingly drinking sparkling wine at celebrations such as weddings.

First Creek Wines has successfully adapted to changes in both the Australian and global wine industry and the major challenge is to remain commercially successful in an increasingly competitive global market. Given Australia's status as a mature wine market (meaning that the potential for increasing the per capita consumption of wine is limited), First Creek Wines must convince existing wine consumers to purchase its products in preference to those of other producers. Alternatively, or in addition, it must continue to build new markets in the traditional wine-consuming markets of North America and Europe or the emerging markets of Asia, especially China (see Figure 11.5.1), India, Japan, South Korea and Malaysia.

First Creek Wines must compete with other Australian producers, including the industry's big four global wine producers: Treasury Wine Estates, Accolade Wines, Premium Wine Brands and Casella. The global reach of these large corporations acts as both an opportunity and a threat for smaller producers. They can establish a bridgehead into new markets which smaller producers may then be able to follow. Their large marketing budgets raise the profile of Australian wines in these markets. Australia is not, however, the only producer seeking to make inroads into established and emerging wine markets. Other New World producers (Chile, Argentina, South Africa and New Zealand) compete with Australian wines in international markets.

Global impacts

The global overproduction of wine grapes has put downward pressure on the price of fruit and threatens the commercial viability of many producers. First Creek Wines is, however, well positioned to see out the present crisis, since the price it pays for fruit has declined substantially. Any significant restructuring of the industry could, however, impact adversely on the wine-related services provided by the company. A reduction in the number of vineyards could, for example, result in a decline in demand for the company's winemaking, bottling and storage services.

Local impacts

The retail domination of Coles and Woolworths in the Australian domestic liquor market threatens to limit shelf space and put downward pressure on retail prices, resulting in lower returns for producers. The buying power of these large corporations distorts normal market forces as producers are 'forced' to accept lower prices in return for market access and increased sales volumes.

Variations in the value of the Australian dollar present the industry with another challenge. When the Australian dollar appreciates in value it becomes harder to sell Australian exports in foreign markets. When the value declines relative to that of other currencies, Australian wine become more competitive and is easier to sell in foreign markets. There is little, if anything, producers can do to protect themselves from currency fluctuations. The value of the Australian dollar is determined by global demand for the currency. For example, in the years following 2010, the surging demand for Australian mineral exports (driven principally by the rapid expansion of the Chinese economy) and a steady decline in the value of the US currency (due principally to its enormous trade deficits) led to a steady rise in the value of the Australian dollar. Since then, the value of the dollar has eased back, which is beneficial for exporters.

Competition from other beverages poses a long-term threat to the industry. The growing popularity of boutique beers and ciders as well as spirit-based drinks is seen, by some, as a potential threat. Promoting wine consumption among younger consumers may help correct this trend but often conflicts with campaigns aimed at reducing alcohol consumption generally.

Activities

Understanding the text

1 List the changes in the global winemaking industry that impact on the commercial operations of First Creek Wines.

2 Explain how the role of the 'big four' winemakers acts as both a challenge and an opportunity for First Creek Wines.

Working geographically

3 Write a media release predicting the most favourable trends in the global wine market that would assist the competitiveness of First Creek Wines against overseas wine producers.

Exam-style questions

Extended responses

- Analyse the factors affecting the nature and location of an economic enterprise operating at a local scale.
- Account for the location of an economic enterprise you have studied at a local scale, and describe the ecological dimensions related to this enterprise.
- Describe how environmental constraints and human impacts influence the nature of an economic enterprise you have studied at a local scale.
- Analyse the linkages and flows of people, goods, services and ideas related to an economic enterprise you have studied at a local scale.
- Explain how global changes in an economic activity have affected an enterprise you have studied at a local scale.

Glossary

brand building promoting a brand's image and standing with a view of exploiting the medium-term and long-term commercial benefits derived from brand awareness and value

depreciation a tax deduction; an allowance for a decline in the productive capacity of an asset over time

easement a right held by someone to use land belonging to someone else for a specific purpose; mains, drains and water pipes are usually covered by an easement

eutrophication the over-enrichment of a water body with nutrients, resulting in excessive growth of organisms and depletion of oxygen concentration

lobby to seek to advance a particular sectional interest; often involves trying to influence the decision-making processes of governments, corporations, institutions and/or nongovernmental organisations

malolactic fermentation a secondary fermentation occurring in most bottled wines; this process converts the naturally occurring malic acid into softer lactic acid plus carbon dioxide gas, which reduces the wine's total acidity and adds complexity to whites such as chardonnay and softens reds such as cabernet and merlot

own-rooted vines vine cuttings that develop their own root system

tax shelter a financial arrangement designed to reduce tax liability

vigneron French term for winemaker

yeast lees yeast sediment used to facilitate the process of ageing red wine

Index

A

Aboriginal and Torres Strait Islander people
  fire-stick farming 25, 27, 45, 70
  poverty among 239
  relationship with the environment 35, 45–46, 70, 85, 91–92
  sites of cultural significance 46, 274
advantage, patterns of 240, 243–47
adventure travel 301, 323
aeolian transport 52–53
ageing population 187, 209, 229, 401
agriculture
  cash crops 29
  chemical use in 389–90, 406–7
  and economic restructuring 122
  environmental impact of 89–90
  government support for 313
  history of 30, 102, 358
  species under cultivation 34
  use of technology in 42
aid programs 30
Airbnb 298
aircraft 92, 292, 308–9
airlines 298, 304, 305, 306, 316
air pollution 147–48, 157, 158, 263, 299
air quality 27, 41, 160, 265, 273, 322
air travel 287, 292, 324, 325
alcohol 391–92, 414, *see also* wine
algae 16, 82, 86, 89, 387
alpine ecosystems 339–40, 353
alpine resorts 334, 346–47, 348, 349, *see also* Perisher Ski Resort
anchors 87, 89, 93
Antarctica 9, 12, 18
anthropogenic world view 34
Apple 109, 211
apps 308
aquaculture 89
asthma 158
atmosphere, the 12, 52–53, 79, 83
Australia
  economic transformation of 212
  social structure of 237–41
  tourism industry 286, 293
  wine industry 383–86
autotrophic organisms 14

B

Baltimore 183
banks 118, 121, 122, 123, 131, 133
Barangaroo 179, 181, 212, 265
BHP Billiton 25
big cities 102–4
bilateral trade agreements 382
bioaccumulation 14–15, 33
biodiversity 17–18, 19, 21, 24, 29, 31, 32, 33
biogas 142, 270
biological controls 18, 33, 74, 373
biomes, *see* terrestrial ecosystems
biosphere, the 13–14, 81–84
biotechnologies 42, 380
bitou bush 69, 74
blowouts 57, 63, 71
Blue Mountains, the 36, 170, 208
boats 87, 89, 93, 94
Bowral 170, 171
branded wines 367, 400
Brazil 25, 301
British Empire, the 108, 120
brownfield sites 180–81, 229
bubonic plague 146
buses 165, 166, 204, 234, 263, 264–65
bushfires 340
business parks 206

C

carbon cycle, the 10–11
carbon dioxide 23
carbon monoxide 158
car dependence 165, 185, 265, 268
cargo handling 179, 208, 214
carnivores 10, 14
car ownership, *see also* congestion
  in Australia 166, 168, 263
  in Europe 164
  in India 143, 148
  in Mexico City 153, 160
  in the United States 169
cars, pollution from 341
cash crops 29
Chandeleur Islands, the 55
chemical contamination 27, 30
child labour 130, 132, 134, 153
children, death of 146, 147
Chilean wine industry 374, 375
China
  population growth 130
  Special Economic Zones 131
  tourists from 286, 293, 297, 299, 311, 314
  wine consumption and production in 364, 375, 378, 388
China–Australia Free Trade Agreement 382
cities, *see also* megacities; world cities
  big cities 102–4
  within cities 193
  emergence of 102
  growth of 173
  hierarchy of city functions 115
  large cities 104, 206–9
  new hierarchy of 114–15
class 169, 196, 237, 240
climate and tourism 288–91
climate change
  attitudes to 43
  climate refugees 132
  and ecosystems 69, 85–87, 341, 353
  and fossil fuels 90, 185
  Paris Agreement, the 44
  and tourism 325–26
  and viticulture 407
climatic patterns 5
climax communities 60, 68
coal-fire power plants 148
coal mining 90, 123, 407
coastal development 66–68, 88
coastal dune ecosystems
  biophysical environment of 52–61
  distribution of 50–51
  fauna in 61
  formation of 56–58
  human impacts on 65–69
  management of 70–74
  natural changes to 62–64
Coles 44, 219, 384–85, 403, 413, 414
colonialism 108, 128, 391
communications 109, 117
communities (of organisms) 7, 13, 60, *see also* genetic diversity
commuting 143, 170, 193, 208, 249, 263, 272
compaction 339, 372
congestion 157, 218, 263–65
connectivity 115, 194
consumer behaviour 44
consumers (in an ecosystem) 8, 11, 14
containerisation 179, 208, 214
coral polyps 81–82, 86
coral reefs 16–17, 78–90
Coral Sea, the 86, 89
corporate headquarters 113, 114, 118, 121, 211
corporations, *see also* transnational corporations
  in Australia 118
  and the concentration of capital 206, 219
  in the tourism industry 298, 303, 305–6
  in the wine industry 379, 385
cost of living 220, 269
counter-urbanisation 172–73, *see also* exurbanisation
cover crops 73
crime 197, 241
cruise ships 310–11, 322
crustaceans 82
cultural heritage 274, 288, 294, 295, 321
cultural tourism 294, 301
culture of place 256–58
cyclones 62

D

Darling Square development 191–92
data management 307, 311–12
data processing 208
DDT 14–15, 33, 182
decentralisation 172–73, 208
decomposer organisms 7, 8, 11, 12, 13, 14
deforestation 29
degraded ecosystems 21, 40
Department of Planning and Environment, the (NSW) 347
department stores 221, 223–24
deregulation 114, 155
desalination plants 269, 270
desegregation 252–53
desertification 34
developed countries 29, 111, 115, 293
developing countries, *see also* megacities
  capital flows into 115
  debt reductions for 39
  employment in 129, 130–34
  manufacturing industry in 109
  population growth in 29
  rates of urbanisation in 104, 105–6
  tourism in 293, 313, 323
  urbanisation in 110
development, controls on 70, 288, 320, 344
Dhaka 132–33, 150
digital nomadism 281, 292
dioxins 14, 33
disadvantage 169, 240–41, 243–47
diseases 138, 146, 387
distribution 178, 220
domestic tourism 282–83
doughnut effect, the 188
dredging 66, 142
drinking water 138, 139, 146, 149, 153, 156
drones 324
drought 269, 325
drugs 138, 151, 240, 241, 243
dual occupancy 234
Dubbo 124, 173
dugongs 83, 91
dunes, *see also* coastal dune ecosystems
  dune lakes 54, 73
  dune migration 63
  dune protection 70–71
  dune soils 58
  dune vegetation 59–60, 65, 67–68
  foredunes 56, 60

formation of 56
reconstruction of 71–72
stabilisation of 71–74

E

earthmoving equipment 71, 74
east coast lows 64
Eastern Creek 178, 273
eastern suburbs (of Sydney) 67
ecocentric world view 34, 35
ecologically sustainable development 38–40, 344
ecology 4, 7
economic attitudes 41–42
economic development and tourism 293, 313, 323
economic restructuring 122, 167, 206–7, 211, 215, 232, 237, 243
ecosphere, the 7
ecosystem diversity 18
ecosystems
changes affecting 20
classification of 4–7
ecosystem change 27–30
extent of 17
functioning of 12–15
location of 16–17
management of 37–46
productivity of 8–11
rehabilitation of 40
resilience of 19
role of diversity in 31–33
size of 7
stresses on 19–24
value of 33–36, 39
variations in 4
vulnerability of 16–18
ecotourism 35, 42, 317–18
edge cities 193, 263
education 41, 93, 240, 243, 245
educational institutions 113, 120, 121
effluent 407, 408
elevation 13, 335–36
emissions 147, 160, 185, 270, 342
employment, *see also* digital nomadism; economic restructuring
and counter-urbanisation 175
in developing countries 129, 130–34
impact of telecommunications on 208, 292
near places of residence 263, 268
at Perisher Ski Resort 346
segmentation in the labour market 207
suburbanisation of 193
in Sydney 212–13, 217–18, 272
in the tourism industry 293, 313, 318, 321, 324
in the wine industry 410–11
of women 248–49
workforce restructuring 220
endangered species 21, 31, 42
energy, in informal housing settlements 140
energy efficiency 390, 409
energy in ecosystems 8–10
environmental audits 37
environmental degradation 34
environmental disasters 28
environmental economics 41–42
environmental hazards 288
environmental impact assessments 40
Environmental Protection Agency, the 182, 274, 408
erosion 30, 62–63, 65–66, 72, 90, 368
estuarine ecosystems 15
ethnic diversity 119
ethnicity and urban morphology 251–53
Europe
tourism industry 284, 287, 294, 301, 302, 325
wine consumption and production in 374, 376–77, 379, 382
evictions 135, 144, 157
evolutionary change 27, 32, 36
exclusionary zoning 196–98
expedition tourism 323
experience-oriented holidays 298
experiential travel 301
extinction 19, 20, 29, 31, 32, 42
exurbanisation 170–71, 208

F

family types 187, 209, 234–35, 239, 401, *see also* household types
farm tourism 302
fast fashion 220
favelas 138
fertiliser 19–20, 29, 42, 89, 94–96, 372, 387, 389
festivals 262, 294
finance industry 112, 113, 114, 118, 121, 206, 212, 237
financial institutions 107, 113, 216
financial markets 109, 114
First Creek Wines 397–414
fishing 85, 87, 92
floods 142, 149, 389
flows of capital 115
flows of information 115
flows of people 116, 121, 122
food chains 10–11, 87
food contamination 146
food webs 8–9, 10, 18
foreign exchange 29, 110, 121, 293, 313, 318
forestry industry 29
fossil fuels 19–20, 42, 185
Fourth Industrial Revolution, the 324
fragmentation of habitats 21
freeways, *see* motorways
fringing reefs 80, 94
fungal diseases 371–72, 373, 389, 400

G

garment manufacturing 133, 134
gated communities 196–98
gay and lesbian community 230, 248, 250
gender and urban morphology 248–49
generators 148
genetic diversity 17, 31–33, 39
genetic engineering 42
gentrification 167, 177, 180
global capital markets 114, 155
global cities, *see* world cities
global corporations, *see* transnational corporations
global economy, the 120, 202
global financial crisis, the 314, 374, 391
globalisation
of commodity prices 123
of culture 117
of economies 114–15
and the emergence of world cities 108–9
impacts of 110, 129, 354
and international travel 284, 297
and the new economy 207
and the wine industry 377, 379
global supply chain, the 109
global warming 16, 17, 23, 341, 353, *see also* climate change
golf courses 68
governments
responses to informal housing 135, 150, 160
response to urban decay 183
and tourism 294, 297, 309, 313, 315–16, 320
wine industry regulation 404–5
grapes
cultivation of 359–60
factors affecting 358
grape-growing regions 362
oversupply of 396, 403, 414
pests and diseases of 371–72, 375, 387, 400, 406
varieties of 366, 371, 375, 401, 404
grasses 34, 56, 57
Great Barrier Reef
biophysical interactions of 79–84
economic value of 34
impact of cyclones on 79
location of 78
management of 91–96
species diversity in 82–84, 87
stresses on 85–90
greenfield developments 165, 186, 196, 260, 261
greenhouse gases 41, 44, 90, 185, 270, 390
green politics 44
Green Square 180–81, 233
groundwater 151, 156, 159, 389

H

habitat destruction 21, 29, 318, 320, 387
habitats 7
healthcare 246–47
health in megacities 146–48
heat recovery 409
heat waves 325
herbicides 19–20, 389, 406
herbivores 10, 14, 17
high-speed rail 175, 309–10
high-tech companies 217
homelessness 239, 241
home ownership 167, 244
horizontal integration 304–5
hotel sector 303–4, 305
households, size of 188, 190
household types 187, 229, 261
house prices 225, 230, 239, 244, 257
housing
access to 244
cost of 186
in megacities 135–38, 156
housing affordability 225–27, 261
housing assistance 183
housing booms 169
housing density
changes to housing stock 190
and household type 229–30, 235
in the inner city 234
in Sydney 226, 227–28
and urban consolidation 185–86, 218, 260
housing shortages 165
housing stock 190, 227–30
housing supply 260
human activity
and coastal dune ecosystems 62, 65–69
environmental impacts of 17, 21, 25–30, 37, 40
and the Great Barrier Reef 85–90
and habitat destruction 19
measuring the effects of 29–30
and plant diseases 23
Hunter Valley, the 394, 398, 399–400, 404, 407
hunting 21, 30, 45, 85, 320
hurricanes 55
hydrosphere, the 12, 53, 81, 83

I

income distribution 238, 243
independent retailers 219, 220, 221
Indigenous peoples 35, 38, 45–46, 294, *see also* Aboriginal and Torres Strait Islander people
Indigenous Protected Areas 46
industrial parks 131, 207, 214, 215
Industrial Revolution, the 41, 108, 287, 324
industrial sites, redevelopment of 181–82, 214–18, 229, 233, 261
inequality
in Australia 167
and globalisation 110, 129
and income distribution 238–39
spatial inequality 185, 206, 215, 225, 239, 243–47, 246

infilling 259, 261, 262
informal economy, the 130, 132–33
informal employment 129, 131, 155
informal settlements, *see* squatter settlements
information-based economy, the 207, 211, 217–18
information flows 115
information technology
  in hotel management 304, 311
  role in suburbanisation 215–16
  use of at Perisher Ski Resort 350
  use of in the wine industry 380
infrastructure
  degradation of 183, 184
  development of 30
  goods infrastructure 131
  in growth centres 260, 272
  impact of subsidence on 151
  in informal settlements 137, 138, 149, 160
  in Kosciuszko National Park 346
  leisure infrastructure 194
  in megacities 139–45
  in Mexico City 156
  obsolete infrastructure 179, 181–82
  and population density 186
  and quality of life 194
  at ski resorts 354
  tourist use of 294, 296, 309, 316, 407
  transport infrastructure 175, 265, 297, 309
  and urban decay 177
  water infrastructure 156
inner-city areas
  cost of housing in 186
  decay of 169, 177
  the gay and lesbian community in 250
  manufacturing in 178
  and religion 255
  renewal of 167, 206, 229
  residential development in 234
  retailing in 223–24
innovation 107, 113, 114, 207, 209
insecticides 406–7
integration 209
interdependence of species 18
intergenerational equity 39, 341
intergenerational unemployment 243
intergovernmental organisations 110
international governance 120
introduced species 21, 24, 33, 68–69, 74, 88
invasive species 18, 389
irrigation 29, 369, 380, 382, 389, 401, 406
ISIS 27
island-based tourism 88
Island National Parks 92
isolation 194, 240

J

Jakarta 142, 149
Japan 107, 114, 115, 309
jet travel 287, 292
jobs, *see* employment

K

kerosene 140, 141
knowledge-based development 147
knowledge hubs 216
knowledge-intensive industries 213, 216
Kolkata 144
Kosciuszko National Park 339, 342, 346–47

L

labour market, the 207
land-based ecosystems 4–6
land clearing 21, 89, 177, 387
land degradation 30
landfill 141, 153, 156, 270, 273, 409
land reclamation 66
landslides 138
land use activities 170, 178, 265
land use diversification 218
land values 230, 234
large cities 104, 206–9, *see also* megacities; world cities
latitude 336
lead 147, 156, 158
leisure 280, 346
leisure infrastructure 194
LGBTQ community 230, 248, 250
life-cycle assessment 43
life-cycle stages 189, 234–35
life expectancy 156, 188, 189, 209
lifestyle
  alternative lifestyles 176
  and coastal communities 174
  and counter-urbanisation 175
  expectations of 188
  and exurbanisation 170, 171, 173, 208
  and household types 234–35, 261
  in inner-city areas 256
  and the location of corporate headquarters 211
  urban renewal and 214
  and wine consumption 377–78, 402
light rail 175, 265, 268, 273
lithium batteries 42
lithosphere, the 12–13, 56–58, 80
liveability 228, 262, 265
locational disadvantage 240
London
  links with other world cities 116
  as a megacity 128
  population 173
  role of in the British Empire 108
  the Underground 164
  as a world city 107, 112, 114, 115, 119–21
longshore drift 54, 66
lower-income groups 169

M

Mabo, Eddie 91
Macquarie Links Estate 196, 197, 257
Macquarie Park 217–18
malleability 19
malnutrition 146
management of ecosystems 37–46
management strategies 37–38
manufacturing industry
  in Australia 118, 124
  decline of 183, 212, 237, 244
  in developing countries 109, 115, 131
  in edge cities 193
  employment in 129, 167
  garment manufacturing 133, 134
  government support for 313
  growth of 169
  in London 121
  in Mexico City 151, 155
  processes of 43
  rationalisation of 206–7, 211
  role of in urbanisation 128–29
  suburbanisation of 178, 214, 215
  in Sydney 182, 272
marine transport safety 92
marine use agreements 91
maritime infrastructure 179
marketing 410, 411
marriage, age of 188, 189, 209
mass tourism 282, 286, 297, 321
McMansions 241
media organisations 107, 110, 114
medical services 246–47, 348
medical tourism 299
medicines 32
megacities
  in China 103
  definition of 102
  dominance of 110
  economic characteristics of 129
  employment in 130–34
  health and living standards in 146–48
  housing in 135–38
  inequalities in 129
  the informal economies of 130
  location of 104
  manufacturing in 128–29
  Mexico City 151–60
  responses to challenges of 149–50
megafauna 30
melaleuca 60
Melbourne 118, 174, 189, 190, 211
methane 270
Mexico City 135, 151–60
microclimates 16, 366, 371, 400, 403
microfinance 131, 133, 136, 150
migrating dunes 63, 70, 71
migration
  to Australia 123, 167, 173, 174, 188, 251, 254–55
  of guest workers 129
  rural–urban migration 132, 133, 135, 152
millennials 292, 301, 323
mining 25, 29, 90, 92, 118, 123, 407
molluscs 82
monocultures 19–20, 24, 69, 373, 387, 389, 407
mortgages 165, 244
motorways
  and commuting 209
  and decentralisation 178
  future plans for 266–67, 273
  in the global economic corridor 217
  minimising impacts of 268–69
  negative responses to 268
  in peri-metropolitan areas 175, 261
  and suburbanisation 232
mountain pygmy possum 339–40
multicultural society 252–53
Mumbai 143, 146–47, 160
Mundalla Yellows 23
Murray–Darling Basin Plan, the 389
Myer 221, 223, 224

N

national parks, value of 34
National Parks and Wildlife Service (NSW) 335, 346
native title 91
natural disasters 19
natural heritage 36
natural selection 27, 32
negligence 28
new economy, the 207, 209, 211, 215, 217–18
New Towns movement, the 164–65
New York 107, 113, 114, 128, 224
NGOs, *see* non-governmental organisations
niche tourism 323–24
nitrogen dioxide 158
nitrogen oxides 147
non-governmental organisations 110, 120, 131, 136, 149
non-renewable resources 41
North American Free Trade Agreement 155, 159, 381
nutrient cycles 4, 9, 10–11, 12, 82
nutrient leaching 30, 89
nutrient upwellings 87

O

off-road vehicles 67, 69, 71
oil spills 88, 89
oil wells 27
online retailing 220, 350, 413
organic matter 22, 58, 60
organic wine 373, 378
organisms 7
organochlorides 33, 390
overcrowding 146, 164
overfishing 21
overgrazing 30

over-ruralisation 128
over-urbanisation 128
owner-occupied housing 226
ozone pollution 158

P

package tours 300, 305
parabolic dunes 57–58
parallel dunes 56–57
Paris 107, 113
Parramatta 272–73
particulate matter 158, 322
people, flows of 116, 121, 122
peri-metropolitan regions 170, 175, 261
Perisher Ski Resort
  access to 338
  capital requirements of 350
  competition to 353–54
  development of 336–37
  economic impact of 345–46
  emissions plan 342
  environmental impact management of 339–44
  flows of people, goods and services at 347–48
  management plan 342, 343, 344, 353
  pollution from 341
  response of to climate change 341–42
  revegetation at 340, 341, 342
  scope of 330
  snowmaking at 352
  use of technology at 349–50, 351–52
  visitors to 335
Perisher Valley 331–32, 336
permafrost soils 13
Perth 118
pesticides 17, 19–20, 29, 33, 42, 94, 389, 406–7
photosynthesis 4, 10, 11, 14, 78, 368
phylloxera 372, 375, 407
pioneer plant species 57, 59, 72, 83
planning controls 70, 185, 229, 259, 260, 261
plant communities 13
plant succession 60
poaching 21
Pokolbin 398, 399–400, 402
polarisation 239
political activism 144
pollutants 12, 14, 24, 41, 89
pollution
  air pollution 147–48, 157, 158, 263
  from boats and ships 87, 94
  environmental threat of 17, 21, 27
  and land degradation 30
  and locational disadvantage 241
  at Perisher Ski Resort 341
  prevention of 408
  from viticulture 389–90
population
  ageing of 187, 209, 229, 401
  of Australia 173
  of China 130
  curbing growth of 39, 45
  in developing countries 120
  impact of on ecosystems 17, 32
  impact of on infrastructure 143
  of London 119
  of Melbourne 174
  of Mexico City 151–52, 159
  of Sydney 173, 174, 175, 189, 228, 259–61
  in urban areas 27, 100, 102–5, 173
population densities 185
populations (of organisms) 7, 27
poverty, *see also* squatter settlements
  alleviation of 130, 142, 149
  in Australia 238–41
  cycle of 243
  feminisation of 235
  ghettos of 185
  impact on health 146–47
  in Mexico City 151, 155
  and rural–urban migration 132
  in Sydney 206, 237
  and urban decay 183
poverty line, the 239
powdery mildew 372, 373, 407
precipitation 4, 7, 12, 53, 336, 340, *see also* rainfall
priority transport corridors 260
privatisation 129, 209
producers (in an ecosystem) 8, 14
property prices, *see* house prices
public housing 157, 165, 206, 226, 235, 237
public schools 260
public sector restructuring 122, 207, 209
public services, cuts to 240
public spaces 185, 194, 209, 248, 261
public transport, *see also* railways
  access to 249
  in Brazil 138
  and car ownership 168
  in Mexico City 153, 156, 157, 158
  in Mumbai 143
  nodes of 234
  promotion of 185, 268
  and quality of life 194
  and suburbanisation 166
  in Sydney 175, 233, 263–65
  use of 189
purchasing networks 220

Q

quality of life 39, 194, 228, 263, 292
quarantine 92
Queensland Parks and Wildlife Service 94

R

race 169, 183, 196, 198, 243
railways, *see also* high-speed rail
  future rail projects 268, 269
  in Mexico City 157
  in peri-metripolitan areas 175
  role in suburbanisation 164, 165–66
  role in urban development 204, 233, 234, 264–65
  safety of 249
  Skitube 330, 332–33, 338, 341
  in Sydney's global economic corridor 217, 218
rainfall 54, 63, 69, 369, 389, 406
rainforests 13, 24, 32, 318
rationalisation 206, 207
rats 146, 156
rebuilding 234
recreation 35, 280–81, 346
recycling
  of nutrients 82
  of waste 141, 142, 153, 160, 270, 273, 409
  of water 269, 270
regeneration of vegetation 62
regional centres 121–24, 172, 173, 263
religion 254–55
remote working 292
renewable energy 42, 390
renewable resources 39
rented accommodation 226, 244
residential land 225–30
resilience 19, 31–32, 60
respiration 11
respiratory diesases 146
retail industry
  elements of retail image 221
  employment in 167
  online retailing 220, 350, 413
  online sales 413
  at Perisher Ski Resort 348
  restructuring of 122
  in Sydney 193, 219–24, 256
  wine retailing 384, 398, 400, 402
retirement 174, 212, 235, 292, 402
revitalisation 260
road projects 266–67
romanticism 38
run-off 89
rural areas 170–71, 173, 174
rural tourism 362
rural–urban migration 132, 133, 135, 152, 159
rust belt, the 115

S

salinisation 30, 388–89
salinity 78
saltation 52–53
Samarco dam disaster, the 25
sand 50, 58, 63, 65–66, 68, 74, *see also*
  coastal dune ecosystems
sand fences 72
São Paulo 160
scarcity 41
scavenging 141, 145
schools 245, 260
sea levels 4, 69, 70
sea walls 67, 71, 72
sediments 54, 56, 65–66, 80
seeds 22, 83, 84
segmentation 209
segregation 193, 196, 245, 252–53
services, loss of 169, 208
service sectors 207, 211, 237, 244
sewage 138, 139–40, 156, 158, 269, 341
sexuality and urban morphology 250
shipping industry 208, 322
ships 88, 90, 120, 310–11, 322
shopping centres 122, 164, 169, 193, 207,
  220–21, 223
Silk Road, the 295
site-and-service projects 137, 156, 157
skiing 331–32, 333, 335, 340, 349–50, 351, 353,
  see also snow sports
ski instructors 346, 347
ski resorts 334, 346–47, 348, 349, *see also*
  Perisher Ski Resort
Skitube railway 330, 332–33, 338, 341
slums, *see* squatter settlements
small towns 122–23
smart phones 308, 311
Smiggin Holes 331, 343, 350
snowboarding 333, 335, 340, 347, 353, *see also*
  snow sports
snow grooming 340, 349
snowmaking equipment 349, 351–52
snow sports
  in Australia 334
  demographics of 353
  economic value of 328
  equipment used in 350
  impact of climate change on 341
  at Perisher Ski Resort 331, 335
  popularity of 333
  risks of 348
Snowy Mountains Hydro-electric Scheme,
  the 331, 338, 340
social change 237–41
social disadvantage 240–41
social impacts of tourism 280
social media 264, 292, 308, 323, 350
socioeconomic status 237, 240, 245
soils 12–13, 30, 58, 83, 370, 387, 400
solar energy 4, 9, 11, 41, 78, 390
solar power 141
solar radiation 368
spatial exclusion 196–98
spatial inequalities 215, 225, 239, 243–47, 246
species 7
species diversity 18, 39, 87
squatter settlements
  in Bangladesh 132, 150

improving health in 146–47
in India 144–45
in Indonesia 150
in megacities 135–38, 149
in Mexico City 153, 155, 156, 160
self-help settlements 156, 157, 160
water and sewerage infrastructure in 139–40
standards of living 38, 237, 239, 297
stewardship 38, 45
stock exchanges 113, 114, 121
storm damage 62–63, 65, 66
storms 54, 69
stress on ecosystems 19, 31, 65
subdivision 234
subsidence 151
suburban developments 232, 241, 261
suburbanisation
affect of on property taxes 184
history of 164–69
of manufacturing 214, 215
multi-centre structure of 229
and the rise of shopping centres 220–21
role of transport in 204, 207–8
suburbia, gay and lesbian people in 250
succession 60
sulphur dioxide emissions 147, 158
supermarkets 219, *see also* Coles; Woolworths
surface creep 53
surface run-off 89
suspension 52
sustainable development 38–40, 46, 321, 322, 344
swales 54, 56, 60, 73
swamps 73
sweatshops 134
Sydney
age structure of 235
the CBD 216, 265
Central Industrial Area 214–15, 232, 272
as a cruise ship destination 310
the Cultural Ribbon of 262
culture of place in 256–58
demographic trends in 229
economy of 118, 211–13
edge cities of 263
employment in 212–13, 217–18, 263, 272
Epping 166
ethnic communities in 194, 251–53
functional precincts of 2657
gay and lesbian community in 248, 250
gender-related issues in 248–49
global economic corridor 212–13, 217–18
growth and development of 259–70
housing market of 225–35
housing stock in 190, 227–30, 260
identity and urban morphology 248–55
and information flows 115
knowledge hubs 110
liveability of 228
maritime infrastructure of 179
migration to 174
peri-metropolitan regions of 170
physical environment of 204–5, 274
population of 173, 174, 175, 177, 189, 228, 259–61
public transport in 175, 217–18, 233, 234, 249, 263–65, 267–69, 273
religion in 254–55
retail sector 219–24
road infrastructure 266–67
schools in 260
society and culture of 209, 237–41
suburban development 166
transportation in 204, 207–8
transport planning for 264–70
urban consolidation in 186, 191–92
urban decay and renewal in 177–82, 180–82
urban dynamics of 206–9
urban villages 193–95
waste management 270
water supply 269–70
WestConnex 266–67, 268–69, 273
western suburbs of 257, 268, 272–74
Sydney Gay and Lesbian Mardi Gras 250, 262
Sydney Harbour 14, 204

T

tax incentives 412
technology
digital technologies 109
high-tech companies 217
high-tech travel 283
in manufacturing 129, 178, 207
in the ski industry 349–50, 351–52
sustainable technologies 39
in the tourism industry 291–92, 297, 308–12
transport technology 207–8
use in ecosystem management 42
in winemaking 366
telecommunications 114, 208, 215–16
temperature 4, 53, 78, 86, 368
tenure 137, 160
terrestrial ecosystems 4–6
terroir 366, 370, 371, 375
terrorism 314–15, 325
Tesla 42
threatened species 339–40
Thredbo 337, 346, 354
tidal flats 50
toilets 139–40, 145, 147
Tokyo 107, 114, 115
topsoil, loss of 30
Toronto 103
tourism, *see also* Perisher Ski Resort
advantages and disadvantages of 319
an an export category 287, 293
characteristics of 281–82
consumer tastes in 298
consumption patterns of 300–302
cultural change resulting from 294
definition of 280–81
economic impacts of 280, 293, 313
environmental impact of 88–89, 93–94, 319–20
factors affecting 288–95
forms of 282–83
future of 325–26
global patterns of 284–87
history of 286–87
impact of climate change on 325–26
internationalisation of 297
nature of 280–83
organisation of 297–98
political and economic factors affecting 314–16
as a productive activity 296
seasonal variability of 335
and security concerns 314–15, 325
social factors influencing 292
social impacts of 321
and technological change 291–92
tourist attractions 299
types of 302
wine tourism 378, 398, 399–400, 402
winter tourism 331, 339, 353
in world cities 113, 120
tourism industry
concentration of ownership and control in 306
support organisations in 307
technological innovation in 308–12, 324
tourism infrastructure 316
tourism operators 303–7
tourism spending, impact of terrorism on 314, 315
tourist operators 298
tourists
to alpine regions 349
hostility to 321
at Perisher Ski Resort 347, 348
resource requirements of 289
travel planning by 308, 311
tourist seasons 290
trade 108, 109, 155, 313, 381
trading hours 220
traffic congestion, *see* congestion
trains, *see* railways
trampling 67–68, 71, 73, 89, 320
trams 164, 165, 166, 204, 267
transnational corporations, *see also* corporate headquarters
and environmental degradation 29
and the hierarchy of cities 114–15
manufacturing processes of 129
Mexican facilities of 159
personnel of 116
in Sydney 204, 206, 211
in the tourism industry 313
in the wine industry 375
in world cities 107, 109
transport
in Australia 189
and economic growth 124
priority transport corridors 260
technical innovations in 193, 207–8, 324
and tourism 286, 296, 297
transport technology 291–92, 308–11
and urban consolidation 260
transport infrastructure
in growth areas 263, 272–73
impact of 268–69
to the snowfields 338, 348
tourist use of 297, 316
transport poverty 241
transverse dunes 56–57
travel, reasons for 283, 286–87, 300
travel advisories 314
tropical cyclones 79, 85
trucking 178
Trump, Donald 44, 68

U

undeveloped countries, tourism in 293
unemployment 155, 183, 237, 239, 240
United States, the
counter-urbanisation in 172, 173
exurbanisation in 171
gated communities in 197–98
suburbanisation in 169
urban decay in 183–84
urban renewal in 184
wine industry 370, 377
university graduates 243
urban consolidation 167, 185–92, 218, 260–62
urban decay 177–79, 183–84, 240
urban development, impact of 67
urban dynamics 206–9
urban fringe, the 167
urban geography 99
urban growth 104, 169
urban infilling 261, 262
urbanisation 99–106, 100, 128–29, 151, 173–74
urbanised regions 105–6
urban renewal 120, 169, 180–82, 184, 208, 214–18, 274
urban sprawl 152, 166, 169, 185
urban villages 193–95, 256

V

vegetation, *see also* weeds
in dune ecosystems 57, 59–60, 63, 67–68, 72–74
human modifications to 26
management of 407
regeneration of 62, 69, 72–74, 342
in volcanic landscapes 22
vertical integration 304–5

viticulture
appellation d'origine controlée 382
in Australia 374
biophysical factors 368–71, 400–401
environmental impact of 372–73, 387–90, 406–7
impact of climate change on 407
industry organisations 405
organic viticulture 373
process of 358, 359–60
spacial patterns of 362
water use in 380, 406
volcanic eruptions 22

W

wages 238, 239
wage stagnation 220, 240
warehouses 178, 208, 214, 233
washovers 62, 63
waste management 270, 343, 408–9
waste pickers 141, 153, 160
wastewater 156, 269, 408
water
contamination of 146
drinking water 138, 139, 146, 149, 153, 156
grey water 147
groundwater 151, 156, 159, 389
supply of 138, 139
water consumption
in hotels 319
in Mexico City 151, 156, 159
by snowmaking equipment 351, 353
in Sydney 269–70
water quality 94–96, 269, 341
water recycling 269–70
water supply 30, 150, 156, 269–70, 340
water treatment 407–8
wave energy 81, 83
waves 54
weeds 18, 24, 33, 67, 68–69, 73–74, 406
welfare dependency 175, 238
Western Sydney 257, 268, 272–74
wetlands 13, 33, 89
wildlife, human interaction with 89, 94
wind 50, 52–53, 56, 368
wind energy 83
wind erosion 63, 72
wind power 42
wine
blended wines 367, 396, 400, 403
bottle closures 382, 411
cultural role of 376
demand for 374–75, 376–78
estate wines 367
global consumption of 365
global production of 362–64, 369
history of 358–59
market competition with 377, 414
organic wine 378
oversupply of 362, 374, 381, 388, 391, 412
potential health benefits of 378
quality of 377, 386
record prices for 364
retailing of 220
social impacts of 391–92
supply of 374
Wine Australia 386, 404
wine industry
in Australia 383–86, 398, 403, 412
cellar door sales 398, 400, 402
competitive advantage in 375
concentration of ownership in 379
distribution 412–13
economic impact of 390–91
government regulation of 404–5
industry groups 405
marketing 410, 411, 412
Old World and New World wines 362–67, 370–79
organisation of 379–81
political factors affecting 381–82
water use in 369, 389, 401, 406, 407–8
wine clubs 413
Winemakers' Federation of Australia 407
winemaking
environmental impact of 387–90, 407–8
inputs 410
process of 346–97, 358, 360–61
spacial patterns of 362
wine tourism 378, 398, 399–400, 402
wine varieties 359, 371, 375, 401, 404
winter sports 331, 333, 338, 353
winter tourism 331, 339
women 132, 142, 150, 248–49
Woolloomooloo Wharf 233, 274
Woolworths 44, 219, 384–85, 403, 413, 414
work, nature of 207
workforce restructuring 220, 243
world cities, *see also* London; New York; Paris; Sydney; Tokyo
in Australia 118
as centres of cultural authority 117
characteristics of 107, 109–10
and globalisation 109
in the new hierarchy of cities 114–15
and the operation of global networks 115–16
roles of 114
spatial distribution of 111–12

Z

zoning 70, 92, 230, 260
zooxanthellae 78, 82, 86

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