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Geography for the 9 Australian Curriculum

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Rex Cooke | Matthew Davidson | Cheryl Desha | Deirdre Dragovich
Tony Eggleton | Xiumei Guo | Karlson 'Charlie' Hargroves
Grace Larobina | David Lergessner | Dora Marinova | Simon Miller
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About the authors

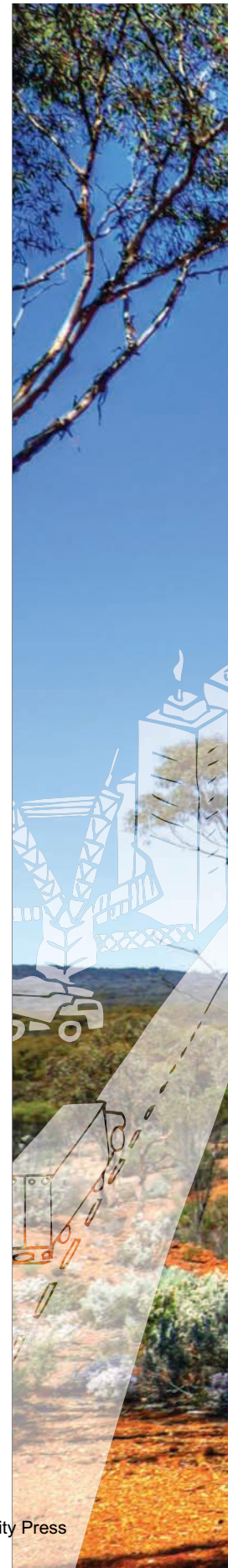
Catherine Acworth is a senior coastal specialist within the Crown Lands division of the NSW Department of Primary Industries and has been working in the field of coastal management for over five years. In addition to working on the Tweed River Entrance Sand Bypassing Project, Catherine has managed significant storm surge and coastal inundation projects for the Queensland Government Coastal Impacts Unit, in particular the Gulf of Carpentaria Storm Tide and Inundation Study. She has an Honours degree in Marine Science from the University of Sydney and a Masters in Coastal Engineering and Management from the University of NSW. She has travelled extensively in developing nations and her personal research involves using film and photography to document the effects of climate change and climate change adaptation strategies in coastal communities.

Alan Boddy teaches at Bendigo Senior Secondary College and lectures in Geography Method at La Trobe University, Bendigo campus. Alan has been involved in geography education for 32 years. He has taught geography for 9 years at the 7–10 level and over 20 years at the senior level. He was Head of Department in Humanities at Bendigo Senior Secondary College and a lecturer at La Trobe University's Outdoor Education and Environment Centre for several years. He was Education Officer at Melbourne Zoo, the Central Deborah Gold Mine and the Discovery Science and Technology Centre for the City of Greater Bendigo. He has also contributed to the recent publication *The travellers' guide to the goldfields*.

Tamara Boyer has been teaching geography, studies of society and environment and religious education to high school students in the Catholic sector. Tamara has been the Head of Society & Environment at Aranmore Catholic College for the past nine years. She graduated from Curtin University in Perth, Western Australia with a Bachelor of Education (Secondary) at the end of 1996. Her passion for geography led to her involvement as a Councillor for the Geographical Association of Western Australia. She was appointed as an adviser and writer for geography curricula at both state and national levels and contracted to write resources and exams and provide professional development for geography teachers. In 2008, she published her first textbook (*Sustainable planet: resource geography for senior school students*). She has also written online resources for the Australian Geography Teachers Association Australia and it is her goal to get as many young people as possible to love geography just as much as she does.

David Butler is the chief writer for Reconciliation South Australia in the development of the Foundation to Middle Years Reconciliation Education packs. David is an executive member of the Australian Association for Environmental Education (AAEE) and is coordinator of the AAEE Teacher and Teacher Education Special Interest Group (TTE SIG). He has over 30 years' experience in working with and writing geography curriculum and teaching and learning guidelines through his involvement with South Australian state geography committees and the Geography Teachers' Association of South Australia (GTASA). He is former President of the Australian Geography Teachers Association (AGTA) and the GTASA, and is a life member of GTASA. He was also Manager of the Society and Environment curriculum in the South Australian Education Department and an Australian Curriculum: Geography Advisory Panel member for the Australian Curriculum, Assessment and Reporting Authority (ACARA).

Rex Cooke is the Head of Social Studies at Waverley College. Rex has been teaching geography for 12 years in a number of schools in regional and city areas of New South Wales. He completed



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a Masters of Educational Leadership (School Education) from Macquarie University in 2009. He has extensive experience in teaching geography and is an experienced marker of the HSC Geography Examination and also a member of a committee that sets the Catholic Trial HSC Examination. He is also a lecturer at the University of Notre Dame Australia in Sydney for geography teaching methodologies.

Matthew Davidson has been Head of Geography at Waverley Christian College in Wantirna South, Victoria, for the past eight years. Matthew has presented sessions at various conferences and events, including the annual Geography Teachers' Association of Victoria (GTAV) conference, Victorian Certificate of Education (VCE) conferences and Christian Schools Australia (CSA) conferences as well as geography student exam revision lectures. He has also been a year level coordinator for a number of years and is currently a member of the GTAV Committee. He is an innovative geography teacher who is passionate about developing curriculum that is relevant and engaging.

Cheryl Desha has a degree in Engineering (Environmental, first class) and a PhD in rapid curriculum renewal. Her research for the last decade has focused on building capacity for sustainable development within tertiary education, including outreach and bridging with secondary schools, managing the development of high school resources on a range of sustainability topics in collaboration with the Australian Sustainable Living Challenge (UNSW, Griffith University). She is a Senior Lecturer in the School of Earth, Environment and Biological Science (Science and Engineering Faculty) at the Queensland University of Technology (Brisbane, Queensland), and a Principal Researcher with The Natural Edge Project (TNEP), a sustainability think-tank which operates as a collaborative partnership for research, education and policy development on innovation for sustainable development.

Deirdre Dragovich is an associate professor in the School of Geosciences, University of Sydney and has taught both undergraduate and postgraduate geography and geomorphology. Deirdre currently supervises four PhD students and is responsible for teaching two postgraduate units in environmental science. She is co-author of *The Australian physical environment* (2008) and co-editor of the earlier Meridian series of first year university Geography texts. Previously she contributed to curriculum discussions in Geography at matriculation level, wrote materials for high school teachers, and was involved in 'Geography Update' days. As Associate Dean in the Faculty of Science, she was instrumental in establishing 10 postgraduate degrees, several involving inter-faculty contributions from Electrical Engineering, Economics, Agriculture, Veterinary Science, Architecture and Arts. She was awarded the Macdonald Holmes medal for contributions to geographical education by the Geographical Society of NSW and was a member of the advisory committee for the national Geography curriculum.

Tony Eggleton is an emeritus professor of the Australian National University. Tony graduated with first class Honours in Science from the University of Adelaide, then completed the degree of Doctor of Philosophy at the University of Wisconsin, US. For his extensive research into mineralogy he was awarded the degree of Doctor of Science by the University of Adelaide in 1999.

Xiumei Guo is a research fellow at the Curtin University Sustainability Policy (CUSP) Institute in Australia. Xiumei completed her PhD examining Chinese immigration in Australia and her research interests are in the areas of demography, economic development, energy efficiency and sustainability studies, with a focus on China. She is currently conducting research for the

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Australian Research Council on energy efficiency, economic growth and the environment in China.

Karlson 'Charlie' Hargroves, after graduating from the University of Adelaide in 2000, and spending two years as a practising civil/structural design engineer, co-founded The Natural Edge Project (TNEP), an internationally recognised team of early career academics across various universities including Curtin University, Adelaide University, QUT, Griffith University and ANU. He has led the TNEP team to deliver four international books on sustainable development (selling over 80 000 copies in four languages) in collaboration with some of the world's leaders in sustainability, such as Gro Brundtland, Ernst von Weisacker, Amory Lovins, Rajendra Pachauri and Peter Newman. The first book won the Australian Banksia Award for Environmental Leadership, Education and Training in 2005, and the two most recent books were ranked among the 'Top 40 Sustainability Books' in the world in 2010 by the Cambridge Sustainability Leaders Program. He joined the Curtin University Sustainability Policy (CUSP) team in 2010 and works on a series of projects focused on the sustainable built environment, in collaboration with the Sustainable Built Environment National Research Centre and the Cooperative Research Centre (CRC) for Low Carbon Living.

Grace Larobina is the HSIE faculty geography subject facilitator at The Hills Grammar School in New South Wales. Grace has taught years 7–8 History, years 7–12 Geography and years 11–12 Legal Studies over her 25-year teaching career. She has had experience in both girls' education and coeducation at various NSW schools, including Cerdon College and Mary MacKillop College. She completed her teacher training at the Catholic College of Education, Sydney, where she graduated with a Diploma of Teaching, and at the South Australian College of Advanced Education, where she graduated with a Bachelor of Education. She has been employed by the Board of Studies for Geography School Certificate Marker and Higher School Certificate (2005), served on the Board of Studies Geography Reference Group (2012), served as the independent sector representative for the ACARA Mapping the Australian Curriculum Draft F–10 (2012) and is accredited by both the Independent Schools Teachers Accreditation Authority (ISTAA) at Classroom/Professional Excellence level (2007) as well as through the NSW Institute of Teachers to the level of Professional Accomplishment (2011). She has also served as a council member on the Geography Teachers Association of NSW since 2010. She has travelled extensively in Europe, the USA, the Pacific Islands and Canada, and has an intense interest in the geography and history of societies.

David Lergessner is a lecturer in Geography in the Faculty of Education, School of Curriculum at the Queensland University of Technology (QUT). David has written extensively on geography curriculum and pedagogy, and wrote the 'People and environment' series (1989–92) as well as *Geomorphology* (1995). He was a high school Geography Head of Department for 35 years before retiring and joining QUT. He has held almost all positions in the Geography Teachers' Association of Queensland (GTAQ) except treasurer and for many years was the journal editor and conference convenor. He is a regular presenter at GTAQ and Australian Geography Teachers Association (AGTA) conferences on topics to do with physical geography, with his study of environmental hazards taking him to many places around the world, including Mount St Helens, Greenland, New Zealand, Vanuatu and Antarctica.

Dora Marinova is a professor of sustainability and deputy director of the Curtin University Sustainability Policy (CUSP) Institute in Perth, Western Australia. Dora's current research

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relates to population and sustainability, the role of new technologies, technology policy and economic development in Australia, including transformation towards a low-carbon economy. She has produced more than 300 publications and has supervised to completion more than 40 PhD students. She has conducted research for the Australian Research Council, CRC Desert Knowledge, and industry as well as for the federal and Western Australian state governments.

Simon Miller is currently Head of Geography at Pembroke School in Adelaide. He has been a specialist geography teacher for 10 years, working in both the United Kingdom and Australia. Simon is the vice-president of the Geography Teachers' Association of South Australia, where he has served on the executive committee for six years. He has co-authored a workbook for the BBC Bitesize series in the United Kingdom, where he has also contributed to the Geography Association's *Geography teacher's handbook*.

Peter Newman is the professor of sustainability at Curtin University and the director of the Curtin University Sustainability Policy (CUSP) Institute. Peter is a lead author for transport for the UN's Intergovernmental Panel on Climate Change (IPCC). He is on the board of Infrastructure Australia, which is funding infrastructure for the long-term sustainability of Australian cities. He has written 15 books, including his book with Jeff Kenworthy, *Sustainability and cities: overcoming automobile dependence*, which was launched in the White House in 1999. In 2001–03 he directed the production of Western Australia's Sustainability Strategy in the Department of the Premier and Cabinet. It was the first state sustainability strategy in the world. In 2004–05 he was a sustainability commissioner in Sydney, advising the government on planning issues. In Perth, he is best known for his work in saving, reviving and extending the city's rail system. He invented the term 'automobile dependence' to describe how we have created cities where we have to drive everywhere. For 30 years since he attended Stanford University during the first oil crisis, he has been warning cities about preparing for peak oil. In 2011 he was awarded the Sydney Luker medal for his contribution to the science and practice of town planning. From 1976 to 1980 he was a councillor in the City of Fremantle where he still lives.

Nonja Peters is the director of the History of Migration Experiences (HOME) Centre at Curtin University. Nonja is an historian, anthropologist, museum curator and social researcher with a special interest in the preservation of immigrants' cultural heritage, in particular Dutch maritime, military, migration and mercantile connections with Australia since 1606; the migration experience; and immigrant entrepreneurship. She is currently involved in academic and community-based research in all these fields. She sits on the board of the National Library of Australia, on the Maritime Museum Advisory Committee, the National Archives Advisory Committee and the Associated Netherlands Societies of Western Australia. She has been awarded the Centenary Medal and a Dutch Knighthood for the preservation of immigrants' cultural heritage. She has also published widely on issues relating to migration, and her book *Milk and honey – but no gold: postwar migration to Western Australia 1945–1964*, was short-listed for the Western Australian Premier's 2001 Literary Award, the Queensland Premier's 2002 Literary Award for History and the New South Wales State Records John and Patricia Ward History Prize. She was formerly the director of the Migration, Ethnicity, Refugees & Citizenship Research Unit.

Ken Purnell is editor of *Geographical Education* and serves on several other journal boards. Ken is also an associate professor at Central Queensland University (CQU), where he teaches Geographical Education as well as holding various academic leadership roles (see www.kp.cqu.edu.au). He has been involved with boards of studies over the years and has since

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2005 represented higher education on the Queensland Studies Authority Curriculum Committee, having been on the governing board. He has a real interest in building students' love of geography as a way of seeing and experiencing their world.

Angela Reeve has a degree in Engineering (Environmental, first class) and is currently completing her PhD in policy pathways and mechanisms for change towards biophilic urbanism. Over the last 5 years, her research has been focused on fostering behaviour change for energy efficiency, rapid curriculum renewal for engineering programs in Australia to integrate more energy efficiency content into courses, and informing sustainability policies for regional plans. Angela is a PhD candidate at the Queensland University of Technology, and a researcher with the Natural Edge Project (TNEP), a sustainability think-tank which operates as a collaborative partnership for research, education and policy development on innovation for sustainable development.

Margaret Robertson is professor of Education at La Trobe University. Margaret is a former research director for the faculty and currently holds the position of Deputy Chair of the Australian Academy of Science's National Committee for Geography. Her long association with the International Geographical Union has included an eight-year period as executive secretary for the Geographical Education Commission. Her research and publication interests focus on cultural geography, particularly young people's geographies and applications of social media and digital technologies. She has been recognised for her contributions to education with a fellowship of the Australian College of Educators.

Heather Ruckert teaches geography and is part of the Careers Consultancy team at Tintern Schools in Melbourne. Heather has a diverse background with tertiary studies in geography, economics, information and communications technology, management and career development. She is a highly experienced teacher with curriculum writing expertise across all secondary levels, including the International Baccalaureate, and her career spans over 20 years in the independent schools sector. Her roles as a former Head of Geography and pastoral leader have shaped her holistic approach to student learning and her passion for geographic inquiry in the field.

Jesmond Sammut is an associate professor in Physical Geography, Faculty of Science at the University of New South Wales. Jesmond is also an adjunct professor and visiting professor at Gadjah Mada University and Hasanuddin University respectively. He conducts multidisciplinary research involving studies on soil and water processes, groundwater chemistry, river processes, causes of fish kills and fish disease outbreaks, the environmental impacts of development and sustainable development of coastal and inland resources. His current research involves improving food and income security in developing countries. He manages research and capacity-building programs in Indonesia, Vietnam and Papua New Guinea and has also worked in India, Thailand and the Philippines to apply geographical skills to environmental and aquaculture production problems. He teaches Environmental Impact Assessment (EIA) and Coastal Resource Management to undergraduate and postgraduate students in Australia and Indonesia, and also coordinates research and technical capacity building programs in developing nations. He is also the PNG Fisheries Consultant for the Australian Centre for International Agricultural Research (ACIAR) and an editor of the *Indonesian Aquaculture Journal*.

Laura Stocker is an associate professor in Sustainability at Curtin University and holds a PhD in marine ecology. In 1990, Laura established Australia's first university course in sustainable development. She now researches and teaches at the CUSP Institute in coastal sustainability,

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governance of coastal adaptation to climate change, sustainability education, and sustainability mapping and planning. She coordinates the Masters degree course in Sustainability and Climate Policy. She is also deputy leader of the Coastal Collaboration Cluster, funded by the CSIRO Wealth from Oceans and Climate Adaptation Research Flagships, and deputy leader of the Governance Theme of the Cluster.

Kate Thompson is the Head Teacher of Teaching and Learning at Chatswood High School and lecturer to postgraduate students studying Master of Teaching/Education at the Australian Catholic University. Kate was awarded the NSW Premier's Teacher Scholarship for Business Studies in addition to an Outstanding Professional Service Award issued by the NSW Minister for Education. She holds a Bachelor of Economics (Social Sciences), Master of Teaching, Master of Industrial Relations and Human Resource Management and a Certificate in Gifted and Talented Education. She has worked in curriculum development and support roles, developed HSC exams at the NSW Board of Studies and is passionate about engaging students and improving literacy. She is currently president of the Society and Culture Teachers Association and has co-written a widely used textbook for years 11 and 12 students. She is a regular presenter at professional development and student revision lecture days and has written a range of teaching materials published in the journal *Culturescope*.

Fiona Tonizzo is the VCAL and VCE educational leader at Pakenham Secondary College. Since beginning her teaching career, Fiona has been involved in curriculum development. She is passionate about teaching geography and has taught at Patterson River Secondary College, where she was the Head of Humanities. She counts being a foundation staff member at Kambrya College (formerly known as Berwick South Secondary College) as one of her most satisfying roles: she was a member of the team that began the school and oversaw the first few years of VCE at the college. She has always believed in maintaining professional ties to fellow educators, including the Geography Teachers' Association of Victoria (GTAV). She has presented many workshops through the GTAV at annual conferences, as well as at specialty conferences such as 'Thinking skills in the Geography curriculum and VCE'. She is currently the network leader for the Berwick group of the GTAV.

Andrew Walker teaches geography, history and English at Parade College in Bundoora. Andrew is also a teacher of Outdoor Education and has a hands-on approach to geography. He takes every opportunity he can to get his students out into the field with a map, a compass and a GPS.

Michelle Walker has a degree in Environmental Science with First class honours. She has worked on water planning and water conservation projects, with a focus on behaviour change, in remote central Australia and Townsville, and she is a Research Fellow with The Natural Edge Project (TNEP). Michelle has spent time volunteering with the Swatcha Ganga Abhiyan (Clean Ganges Campaign) in India, where she lived in the city of Varanasi and worked to build youth environmental leadership skills. Currently Michelle is undertaking a PhD, conducting research into the value of Indigenous knowledge in protecting freshwater resources in the Kimberley region, WA.

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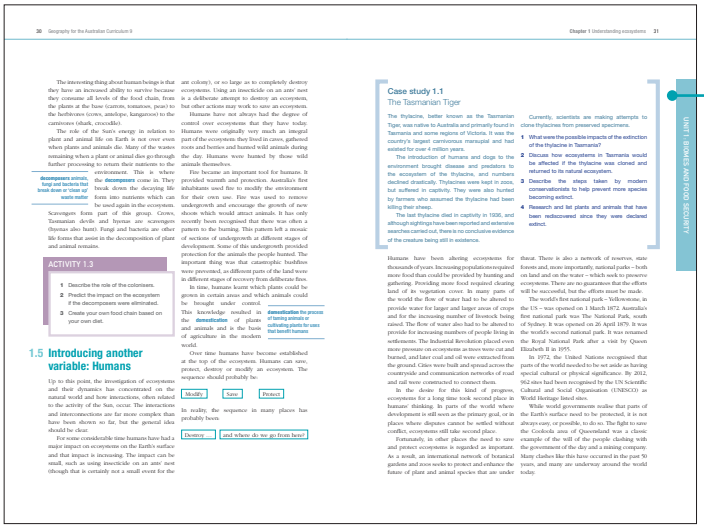
How to use this textbook

Chapter openers feature **Before you start** and **Let's begin** sections which focus your attention on the topics being studied and prepare you for your in-depth investigations.

Fieldwork activities provide step-by-step instructions on observing and recording information, enabling you to think like a geographer and utilise geographical skills outside the classroom.

Geographical facts highlight interesting information to enrich your learning.

Case studies extend on information to add another layer to your knowledge and understanding.



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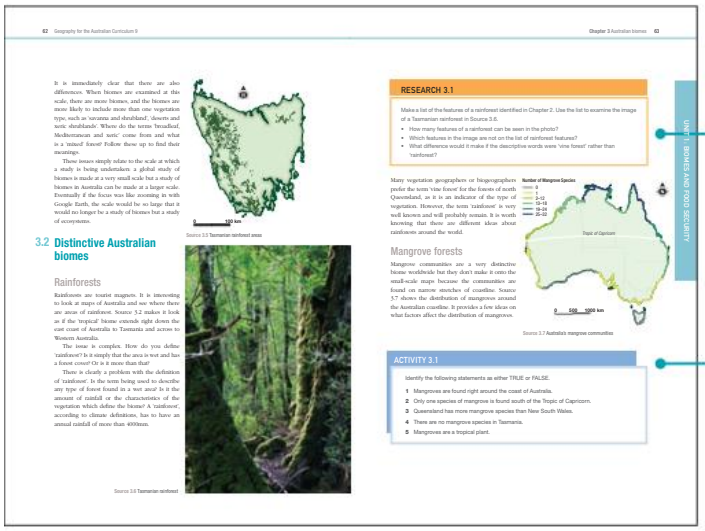
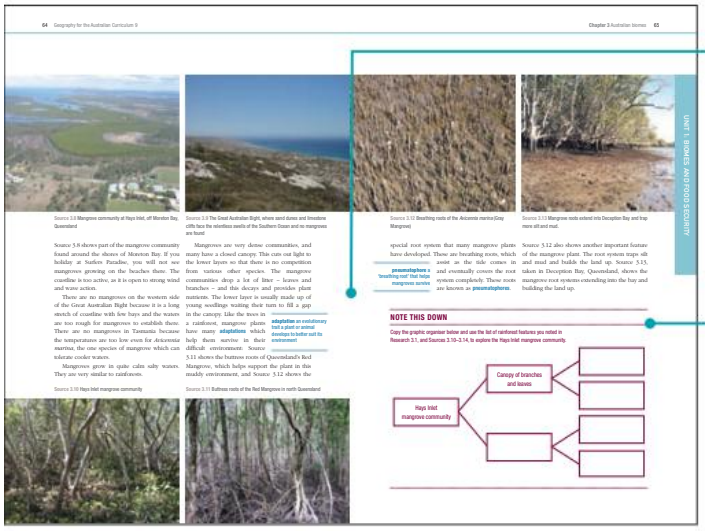
A variety of **activities** and **research tasks** explore key concepts, develop skills and draw back to the general learning capabilities and cross-curriculum priorities.



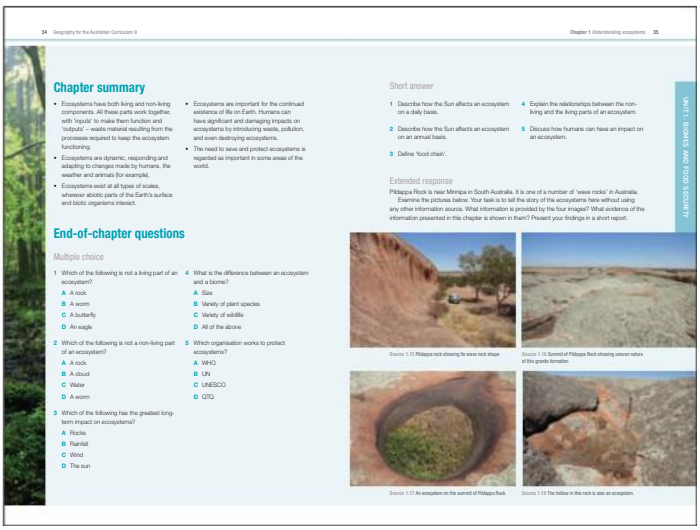


Glossary terms are bolded in the text, defined in the margins and collated at the end of the textbook for easy reference.

Note this down sections recommend the use of a range of graphic organisers to help you record and revise key ideas.

Chapter summaries review the main ideas of the topic to consolidate what you have learned.

End-of-chapter questions include multiple choice, short answer and extended response to test your knowledge through the reinforcement of key concepts and application of skills.



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Geographical skills toolkit

0.1 Introduction

Geography is the study of the Earth, especially the surface of the Earth: how it works and how humans interact with it. It involves describing, analysing and evaluating in order to understand and even predict how the elements that make up our world operate. It also includes the many ways that people can affect and use their environments, from the individual or family unit to larger groups, companies and even governments. How we live on the Earth and how we change the environment today influence what the planet will be like in the future. This geographical skills toolkit explains the skills and concepts used in the study of geography. These tools will help you to think like a geographer as you explore biomes and food production, and how people are connected to places.

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Source 0.1 The global growth of tourism affects the future of places.

0.2 Geographical inquiry and skills

What sets the geographer apart from others interested in the world is often the methods we use to investigate. Geographers are not truly happy until they have collected data in the field and developed a series of **hypotheses** to test their own work and investigation methods. Geographers enjoy working together in teams to share and discuss ideas. They know that the world is their laboratory and that inquiry-based research is highly effective. As a geography student, you will be using the methods of the professional geographer, although on a smaller scale. You follow an inquiry approach by working through a set of skills that represent a complete investigation:

hypothesis a proposition made on the basis of limited evidence, used as the starting point for further investigation

- observing, questioning and planning
- collecting, recording, evaluating and representing

Source 0.2 Geographers are involved in highly specialised work that helps us to live sustainably on the planet, minimising negative impacts and supporting biodiversity in the environment as well as improving the lifestyles of people around the globe.

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- interpreting, analysing and concluding
- communicating
- reflecting and responding.

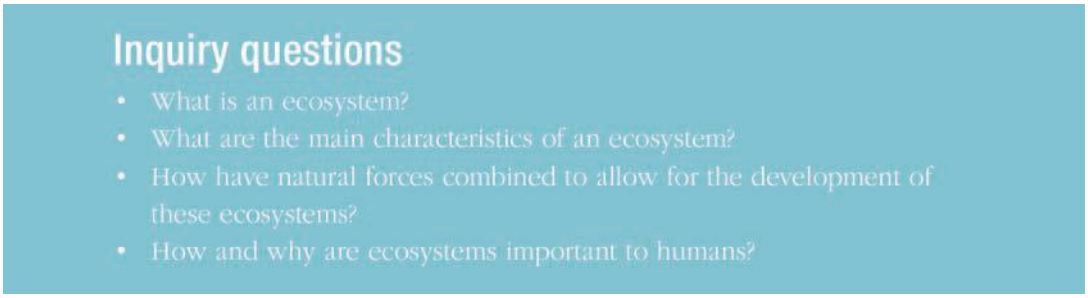
Depending on the type of inquiry, you may only need to focus on a particular skill. Your work becomes part of the complex web of data collected and analysed to ensure that we tread lightly on the planet, allowing only environmentally sustainable and responsible human activities.

Observing, questioning and planning

Geography is a scientific study and uses the same methods as other branches of science. The geographer begins planning an inquiry by observing issues or problems and developing geographically significant questions.

Developing geographically significant questions

Geographically significant questions are questions that are worth investigating. The inquiry questions at the beginning of each chapter form a model for geographical study, demonstrating the method used to construct a framework of questioning and learning. They prepare you for the learning to come and allow you time to prepare for the material ahead. They are not intended to limit your learning so that at the end of the chapter you are only able to respond to them; rather, they are a scaffold that supports you as you build your learning a level at a time, adding your own inquiry questions as appropriate. These questions become the language of our study, moving us beyond the known and into discussions and debates where there may be no right or wrong answer, just many options and challenges to be explored.



Source 0.3 Examining the questions from Chapter 1 'Understanding ecosystems', it is clear in what direction the study will develop.

Collecting, recording, evaluating and representing

How do we collect and record information? How do we evaluate and represent this information? The geographer uses a range of tools to gather information and needs to be aware of where information comes from in order to use it effectively.

Primary and secondary sources

Information gathered in the field or directly connected to our research is called a **primary source**. Primary sources are essential to valid scientific inquiry. They are targeted and specific to the task. We understand how they have been collected, the methodology used in the process and if there were any elements that may have given unexpected results.

Information collected by others – perhaps people not directly involved in our research – is called a **secondary source**. Secondary sources can also be valuable and can reduce the work we need to do directly. For example, the Australian Bureau of Statistics (ABS) conducts the Census every four years, collecting demographic (population) information for the country (refer to www.cambridge.edu.au/geography9weblinks for a

primary source information that comes directly from the event or area we are studying. It is 'first hand' and is how we classify the majority of data collected during fieldwork

secondary source information that is put together by someone else or someone not directly involved in the event or area that we are investigating

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link to the ABS website). Where do people live? How far do they travel each day to work or school and what transport do they use regularly? This is information that would be difficult for us to collect on our own on such a large scale, but can be very useful.

When collecting information, we need to be aware of ethical protocols including confidentiality, informed consent, citation and integrity of data.

NOTE THIS DOWN

Copy the graphic organiser below and summarise what you have learned about primary and secondary sources.

Sources	Definition	Examples
Primary		Field notes
Secondary		Census data

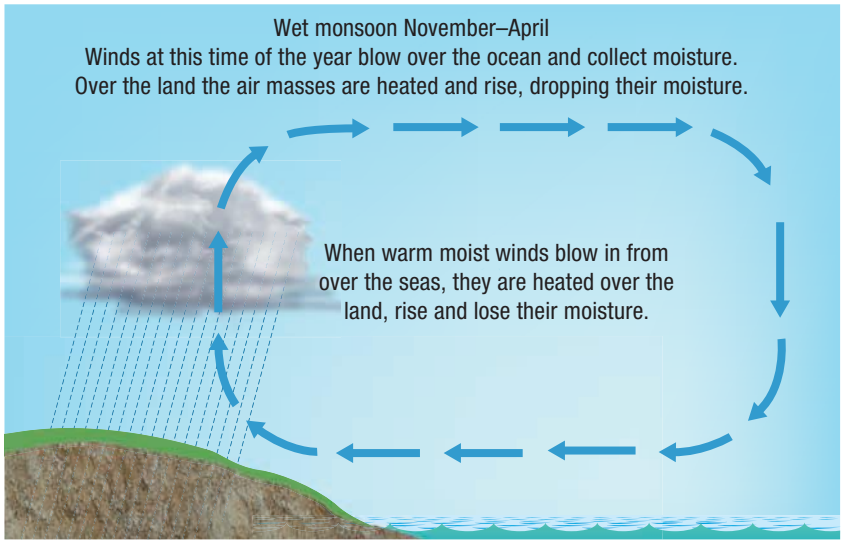
Evaluating for reliability, bias and usefulness

It is important that we can trust the data we use in our research. We need to know that the way they were collected has been appropriate and consistent. It is important that the way our data are gathered is reliable, but also that we are aware of any **bias** in the collection of the information that may make us review its value. If we are interviewing people in a town about where they prefer to source their food supply, it is relevant to the integrity of the information to know if the person being interviewed is a farmer, or works in a greengrocery store, or is a consumer with no particular economic interests in any food supply networks. Knowing this allows us to evaluate whether we can trust the information and how useful it will be in our work.

bias mindset with a particular interest or view that limits one's ability to make a fair judgement

Representing data

Once we have collected our data, we need to present them in the most appropriate form. Some information easily fits into a written discussion, while numerical or quantitative data may work better in a visual representation such as a graph or diagram. Other data work well in an annotated photograph, a sketch or a map. Geographers not only analyse the data they have, but also view them critically to decide what the best format for sharing that information will be.



Source 0.4 Data can be represented in a range of appropriate forms including scatter plots, tables, field sketches and annotated diagrams.

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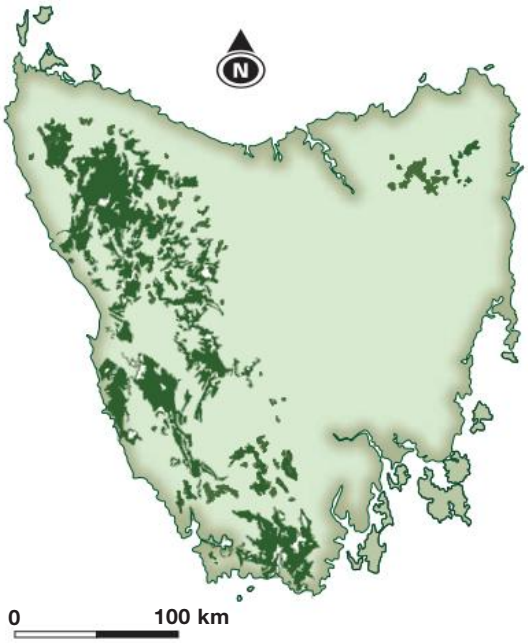
Constructing maps

The same river can be viewed on a series of maps with information adding to our understanding of the system. We can see how steep the river valley is, the direction it flows and the type of landscape it flows through. All of this information allows us to predict the impact of changes to the river if the surrounding environment changes.

Maps have a series of conventions that help us to construct and interpret them, including symbols, colour coding, orientation and scale presentations. They allow us to present and analyse data in a visual format, giving us the ability to understand the information spatially, as separate parts of the environment.



Source 0.5 Maps are probably the best-known geographic tool.

Interpreting, analysing and concluding

Setting a series of inquiry questions and gathering information to try to answer those questions is important, but how we understand our information is vital to any geographic study. As a geography student, you need to be able to identify and propose explanations for spatial distributions, patterns and trends, and infer relationships. What is it that our data are showing? Do they point to further questions that require investigation in order for our work to be considered complete?

If the initial inquiry questions are clear and detailed, and if the research was appropriately targeted, then we have the information required to make informed conclusions. Let's take a closer look at what that means:

- Was your inquiry specific and measurable?
- Did your research include data collection?
- Did you also check your data with another research tool, such as the internet?

If you can confidently answer 'yes' to all of the questions above, then you are ready to begin analysing your data and reaching logical conclusions. Start by answering your inquiry questions, not with a yes or no, but by explaining why/how you are sure of your response. What are the data you have that back up your answer? Do they clearly show that you have an answer, or is there a qualifying statement to be made? For example, 'The survey data from our visit to the city, where we took responses from 250 people over a 1-hour period, show that 83% of those people would prefer …' and 'from this, we can say that the local council should seriously consider … as a part of their management plan for the area.'

It is important to not only analyse your information, but to also decide what it is telling you. Are you able to make any reasonable and logical statements based on your data? Are some aspects of them unclear? Sometimes we need to be honest enough to say that our research may not have covered all angles and we need to investigate further before we can really be sure about what is going on. Acknowledging a weakness in your initial inquiry or data collection shows your ability to reflect upon your work and identify areas or directions for further work.

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Quantitative and qualitative methods

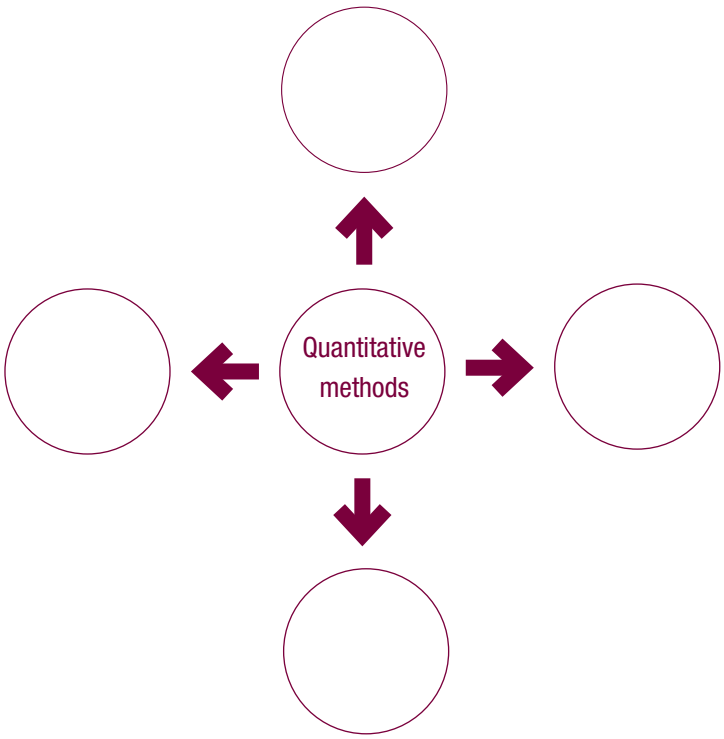
quantitative methods methods used to gather data that are expressed in numerical form

qualitative methods methods used to gather data that are expressed in non-numerical form (and therefore can only be described)

To assist with interpreting, analysing and developing conclusions, geographers use **quantitative methods** and **qualitative methods** to gather data. If we examine a river, we can talk to people who use the river to gain an understanding of how and when they use it, giving us qualitative methods for collecting information; quantitative methods could include collecting information on the numbers of fish sighted or the flow rate of the water. This information may be gathered using measures that give numerical results. Both types of methods are important to present a complete picture of the river.

NOTE THIS DOWN

Copy the graphic organiser below and summarise some examples of quantitative methods. Use the same organiser to summarise examples of qualitative methods.



ACTIVITY 0.1

1 Discuss the importance of inquiry questions.
2 Identify some of the ethical protocols we need to be aware of when collecting information.
3 Explain why it is important to use standard geographic conventions when creating a map.
4 If we analyse a river as an effective biome, what qualitative and quantitative methods could we use to gather our data?

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Communicating

There are many ways to communicate the results of investigations. These include (but are not limited to) written, oral, graphical and visual methods. When deciding on which method to use to present findings, arguments and explanations, we need to consider the subject matter, purpose and audience. It is also important to use relevant geographical terminology and digital technologies where appropriate.

Communication forms

Written

The most common method to convey research results is the written report. Other methods include essays and extended responses. There is a need to ensure that written pieces are easy to understand, logically organised and fluent and use the conventions for spelling, punctuation and grammar. It is always a good idea to use a plan that keeps the work on track, especially if there is more than one writer.

Oral

It is just as important to have a plan with an oral presentation as it is with a written report. The aim is to present your findings to an audience, so there is a need to make sure the audience can access your information. When using computer tools to create visual displays or presentations, be aware of the strengths and weaknesses of the program you are using. Make sure you use a font that is easy to read and a background that doesn't make it more difficult to see the information. Always keep the amount of text onscreen to a minimum, saving the space for visuals and allowing your presenter to reveal the information while speaking.

Graphical

Some data are better presented visually, through graphs and diagrams, rather than in words. If you are using a graph in a written report, always refer to it and discuss what it shows, ensuring that it is an important part of the report, not just a pretty image designed to fill some space. If it is worth using, it is showing something important and deserves to be discussed.

Visual

Other visual items add interest and understanding to your work, allowing your audience to clearly see what your work is about and how you have gone about your research. Make sure that all images are clearly labelled with a title and have a purpose for being included in your work. Annotation (notes added to the picture) of field sketches you have made (or other images) is useful in a report so you can easily highlight and refer to important sections. You should always acknowledge the source of an image if you did not take it yourself, in the same way as you list information sources in a bibliography.

Using geographical terminology

Any subject you study will have specific terminology for particular ideas and topics. These words form a vocabulary, which makes it easier to convey ideas and meaning in the subject area. Important vocabulary is listed at the beginning of each chapter, highlighted and listed separately in the margins of the pages, and collated in the glossary at the back of the textbook.

Key terms

- Climate
- Climax vegetation
- Decomposers
- Ecosystem
- Food chain
- Primary producer
- Weather

Source 0.6 You should take the time to memorise and build your geographical vocabulary as it is introduced in each chapter.

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ACTIVITY 0.2

With a partner, spend 5 minutes memorising the words in the vocabulary list below. When you and your partner are confident that you know all the vocabulary, select some words and test each other to see who remembers more.

agriculture the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool and other products

arable suitable for farming

biodiversity the diversity of plant and animal life in a particular habitat

biofuel fuels made from natural sources

biome groupings of plant and animal communities which have adapted to inhabit particular parts of the Earth's surface

capitalism an economic system in which resources and means of production are privately owned and prices, production, and the distribution of goods are determined mainly by competition in a free market

commodity a raw material, such as an agricultural product, that can be bought and sold

domestic tourism where people travel within their own country for recreation

economy of scale the advantage that a larger producer or consumer has over a smaller one because of costs that do not increase proportionately with size or amount purchased

ecosystem an area of the Earth's surface where living organisms interact with parts of the Earth

e-waste (electronic waste) the rubbish created by throwing away used electronic devices and components, such as batteries; also, the disposal of materials involved in their manufacture or use

fair trade trade based on the buying and selling of products (usually from poorer nations) that have been mined, grown or manufactured under humane working conditions, with appropriate wages for the workers and minimal environmental impact

food chain the sequence of feeding arrangements in an ecosystem in which each member may be food for the next highest member of the chain

food security the knowledge that enough food will be provided for the population now and in the future

globalisation when an idea or product reaches a worldwide scale

Green Revolution a period beginning in the 1940s when new agricultural techniques brought great increases in production and greatly decreased the incidence of hunger worldwide

industrialism when countries' economic and social systems become based around the production of goods through mechanised industries in urban centres, rather than through agriculture

irrigation the process of supplying water to a crop, typically via channels

megatrend a major movement, pattern or trend emerging in the global environment

migration movement from one location to another

personal mobility one's ability to move around

savanna a grassy plain with only a few trees

staple food the most commonly eaten food in a specific region

trade the buying and selling of goods and services

transnational companies companies that operate their businesses in and across more than one country; also called multinational companies

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Digital and spatial technologies

The use of digital and spatial technologies in geography is becoming more important, both in geographic work and in the wider community. Not only is this an employment growth area, but also digital information has become part of everyday life for many people. There is also a range of digital communication technologies such as blogs and wikis, electronic surveys and social media applications that can be used effectively to gather data and share results. The trick is to make sure we use them because they are the best tools available for the specific task at hand.

Source 0.7 We easily view satellite maps and weather radar on smartphones from anywhere in the world without thinking about the technology that makes it all possible.

Reflecting and responding

As already mentioned, we should always reflect on the information we have, looking critically to understand what it shows and to see what work still needs to be done to make it more useful.

This also applies to data, whether we collected them or whether they are being presented to us by others. Can the information be checked through another source, or do we trust it because of a known collection method? What is the information showing us? How can we respond to it? How can we use it? These are the crucial questions that must be asked if we are to make effective use of the information rather than allow the data to exist without analysis or response.

Thinking about the material allows us to absorb and bring together the key ideas, leading us to a point where we can put forward solutions to challenges in the world. When putting forward solutions, it is important that we take into account environmental, economic and social considerations. The purpose of our inquiry is to understand the current situation and to propose thoughtful options for the future.

A possible method for achieving this is through a PMI chart, as outlined below:

Plus	Minus	Interesting
Information here is positive and includes things we would wish to maintain in the future.	Information here is negative and involves things we would prefer to change in the future.	The items listed here are neither positive nor negative, but add to the research and knowledge base.

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Once our information is categorised into the PMI chart, we can start to analyse it more efficiently. Any plan for the future would want to keep the 'Plus' items, while minimising the impact of the 'Minus' information. The 'Interesting' column helps us to look for creative solutions that not only improve the current situation, but also keep the most unusual features. Specifically, a PMI could be used to analyse the sustainability of food production in a region. 'Plus' points would be linked to what is happening now that is effective and sustainable, such as high yields from seasonal crops, while 'Minus' points show where there are food shortages or a lack of variety in foods available at certain times of the year. The 'Interesting' section may indicate that a neighbouring region is able to supply certain foods during times when there is not enough production or that the installation of additional food processing plants would make food supplies more reliable.

Fieldwork

Fieldwork is at the heart of geographic inquiry. It is any activity conducted outside the classroom, whether that is in your local area or in a more distant location. It forms the framework for valid scientific research and supports the development of inquiry questions that make sure we are able to consider a range of strategic solutions and management plans to maintain sustainable environments.

In this textbook, you will find a number of fieldwork activities that provide step-by-step instructions on observing and recording information. There are a number of ways to communicate your observations and data, including in the form of a fieldwork report. This method is used in the textbook and explained below.

Front page	***Title and name*** Ensure that you have your own name (or names of group members) clearly identified. The front page should also contain a clear title indicating what your research was focused on.
Contents page	***Do this last, as well as numbering pages***
Page 1	***Aims and methods*** What was your intention when you started the research? List your inquiry questions here, and if you are able to predict what you may find, do that here too. Describe the way you collected data to test your questions and hypothesis.
Page 2	***Location map*** One of the key tools for the geographer is mapping. Make sure your map is clear, easy to read and follows the mapping conventions of BOLTSS and uses the recognised symbols and colours of maps, such as blue for water. **BOLTSS** **B**order – the border should surround your map and everything that is a part of the map (title, scale, legend, etc). It encloses the information and shows that it all relates to the map. **O**rientation – show where north is using one of the conventional symbols, for example an arrow or full compass. **L**egend – the legend or key shows what all the symbols and colours you have used on your map mean. **T**itle – make sure your map has an accurate title that explains what the map is showing, for example Shopping Centre Traffic Flow, 1–3 pm, Thursday, 26 December 2013. **S**cale – the map's scale shows how big the area shown on the map is in the real world. **S**ource – indicate where you obtained the information for the map. This could include your own measurements, a search engine, GPS mapping system or the local council offices.

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Page 3	***Introduction*** Give a brief description of the study sites and any noteworthy features.
Pages 4–5	***Description of uses and photos*** What is the area currently used for? A written description accompanied by photographic evidence is good practice.
Page 6	***Table of usage*** Effects of current use (positive or negative, short-term or long-term). A table is an excellent way to display this information. Keep your points simple and refer to any photographs or other data in your fieldwork report that supports this information.
Pages 7–8	***Description of effects of use, sketches and/or photos*** This section needs to be quite detailed and show that you understand the area your fieldwork is based on. Annotate any field sketches or photographs you use to highlight and explain the space.
Page 9	***Association between use and effects of use*** Make the links between how the space is used and the impact of those uses on the space. It might seem obvious, but you need to be explicit and openly state what is going on.
Page 10	***Table or written description of management strategies*** What are the current management strategies being used in this space? Depending on how many applicable strategies there are, you may choose to organise them in a chart or table to separate them and make it easier to discuss them later.
Page 11	***Photos or sketches of management strategies*** Do not underestimate the impact of images in your work. It is often easier to show how a management strategy is working than to explain it in words, and it could be more interesting for the reader. Make sure your photos or sketches are clearly labelled or annotated.
Page 12	***Evaluation of these strategies*** How well are the current management strategies working? Are there any parts of them that are supporting the space well? Perhaps other sections of the plan need rethinking? What would you change if you had the chance? Evaluate, do not just describe. Make sure you are giving clear and balanced feedback on the current strategies.
Page 13	***Appendix, bibliography, glossary*** An appendix is the section at the end of the book that provides additional information that supports the main work. You should include an appendix to add meaning to your work. If you undertook a survey as a part of your fieldwork, the results could be included here. The bibliography is an important piece of any research. Make sure you list all information sources, websites and people who informed your work. Here's one method: Author/s surname first, then initials (publication year in brackets). Title in italics. City location of publisher. Publisher's name. A glossary is a mini-dictionary for your work. You should include any words in the glossary that your reader needs to know or understand.

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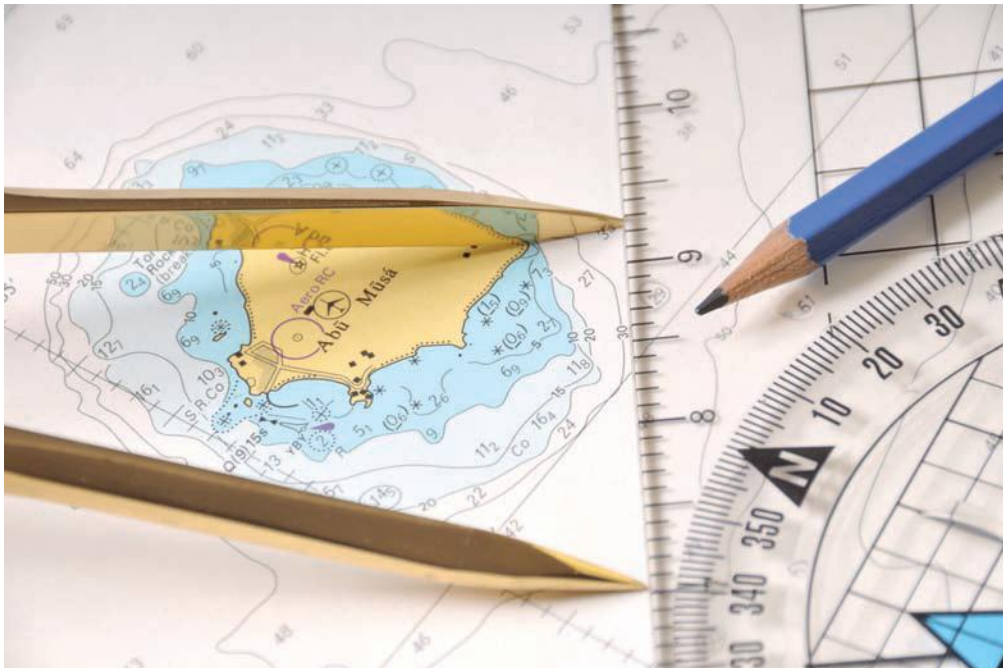

Source 0.8 The geographer at work: marking points on a map

ACTIVITY 0.3

1. What are the considerations we need to take into account when reflecting and responding to an issue or problem?
2. List five digital and spatial technologies and, using a PMI chart, evaluate their usefulness in developing a fieldwork activity.
3. Identify two ways of communicating your observations and data (when undertaking a fieldwork activity) other than in the form of a report.

0.3 Concepts for geographical understanding

It is useful to have a framework that supports and guides us in our geographic studies: a range of tools and ideas that allow us to target our inquiry and support our learning. The concepts for geographical understanding (place, space, environment, interconnection, sustainability, scale and change) provide this, helping us to understand and build on the work of others in the same field of study. In addition, it makes it possible for us to confidently understand the work we do and its place as valid geographic research.

Place

The world is made up of places that are given different meanings by people. For Aboriginal and Torres Strait Islander peoples, places can be given spiritual meaning and shape their culture and identity. Places range in size from your classroom to a world region. Places are important locations for major events, and social and human interactions, as well as areas that have importance in the natural environment.

Where something is – its location – is very important to our studies. We can use the co-ordinates on a map, called lines of **latitude** and **longitude**, to show

latitude an imaginary line measured in degrees north and south of the Equator

longitude an imaginary line measured in degrees east and west of the Prime Meridian (or the Greenwich Meridian)

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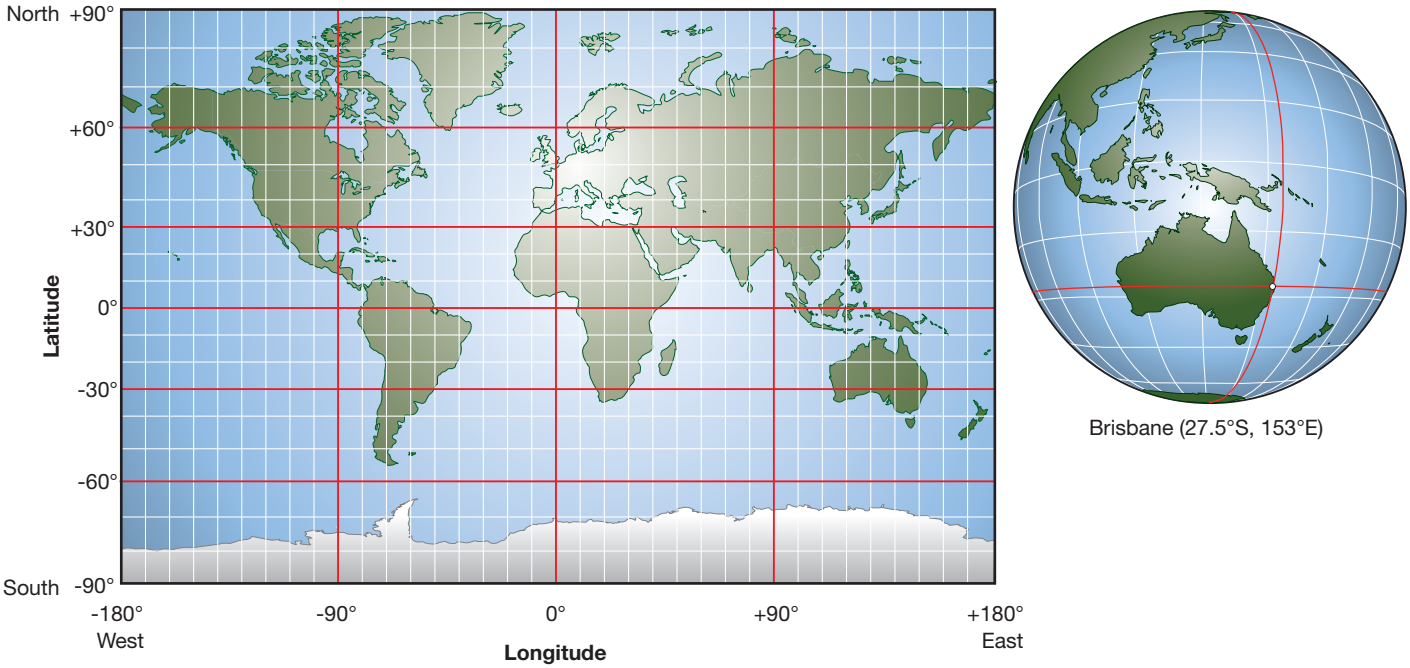

Source 0.9 The best-known system for locating a place is latitude and longitude. This is an imaginary grid that covers the Earth, allowing people all over the world to use and share consistent references.

others where something is. Latitude and longitude lines divide the world up into a grid, and when we use them, latitude is always stated first. You can see in Source 0.9 that the position of Brisbane is 27.5°S, 153°E.

Sometimes a description can help to show others where something is, or landmarks can help us to explain a place's location; for example, it is next door to the house with the red letterbox. Maps often have their own simple system of coordinates to help us find particular places easily. We can be directed to the north-east corner of the forest (for example, C4), allowing us to find the correct section of forest.

Space

In geographical terms, space is the distance between things and can involve spatial patterns. The space around us, rather than outer space, is the key. Space refers to the organisation of an area, where things are (location) and their distribution. It is about how the area is perceived, structured and managed. If we examine a town, we can see patterns in the street layout or the green spaces, how far apart services like schools, churches or shopping centres are and the pattern of major transport networks like highways and trains. In the natural world, we can see mountains with a range, the web of streams and rivers in a catchment area or the frequency of lakes within a landscape. Space refers to the distribution of items as well as their frequency and helps us to describe the patterns we see.

Environment

The environment has great importance in our world. It is a term that is often used but rarely defined, so what do we mean by 'environment'? It encompasses the external factors that exist within an area or region – for example air, water, minerals, plants and animals – and how they work together to form a system. The term is often used to mean natural systems such as forests and oceans, but it also applies to human-altered (anthropogenic) systems such as cities. Sometimes, environments are not easy to classify and we need to recognise the importance of both natural and human-altered elements (geologic/rock, atmospheric/air, hydrological/water, edaphic/soil, biotic/living and human). A natural water system such as the Murray-Darling Basin supports not only the plants and animals of the region, but the towns and

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human populations as well. The river is modified to provide year-round irrigation for farmers and drinking water for the city of Adelaide.

Interconnection

'Interconnection' is based on the concept that nothing can be viewed in isolation, but has a relationship to other processes and systems. It recognises that within an environment or space, there are real connections and influences that alter the way the space operates and is viewed. We analyse these connections and examine the level of influence to determine impact and predict future patterns. It makes us look at geographic phenomena such as urbanisation, global warming or erosion as processes within real and complex environments. Interconnections can be very detailed and lead us to look at spaces or environments holistically rather than viewing each element in isolation.

Sustainability

'Sustainability' refers to the ability to maintain balance in the long term, often in the environment; it refers to things that are not harmful, but able to continue far into the future. Sometimes, sustainability is thought of as being a 'hippie' concept, something that only environmentalists would concern themselves with, but it is increasingly applied to any system (natural or human-made) that is in a healthy state of balance. It helps to direct people to accept their responsibility for their environment and to formulate plans to protect it for the future.

Scale

The main focus of this geographic concept is to see things at different levels, from the personal to the local, national and through to global levels. How we view an issue or the types of solutions we can put forward changes as we move through these different scales. Growing food for personal use is at a low scale and very controllable, with variables such as fertilisers and pest control being our own responsibility. Food production on a national or global scale is very different, with a supply chain that includes producers, consumers and many levels of transport, processing, marketing and sales in between.

We also need to understand that choices and management plans at one level can influence the situation at another level. This occurs when governments pass legislation that impacts on how the individual is able to operate or changes processes on a local level: for example, the introduction of a the Murray–Darling Basin Plan. The Plan impacted on individual farmers, small towns and major cities and was produced by the Australian Government.

Source 0.10 The concept of sustainability helps us to question the current state of a space and to pose management solutions to issues and challenges that we identify.

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Cambridge University Press

Source 0.11 The Murray–Darling Basin Plan impacted on individual farmers, small towns, major cities and was produced by the Australian Government.

Change

Change refers to both space and time. It is a concept that covers the impact of movement and history, with human-altered and natural environments both being affected. Looking specifically at our local area, it is clear that it is dynamic. Homes are built, roads are upgraded, gardens are rejuvenated and this is just the beginning. In fact, there is so much change over time in our local neighbourhoods that it would seem very unusual if it all stopped.

Change over space might initially seem more difficult. Think about what happens in your local area if a new shop opens. Consumers who were purchasing goods in another neighbourhood will begin to change their shopping patterns. As a result, traffic patterns and parking requirements may also change. This is spatial change on a local scale.

ACTIVITY 0.4

1. In your own words, describe the concepts needed for geographical understanding.
2. Explain how latitude and longitude are used by geographers. What is their link to world time zones?
3. Evaluate the long-term sustainability of your home. Develop a plan to improve its sustainability including power supplies, water and food production.

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UNIT 1
Biomes and food security

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Cambridge University Press

1 Understanding ecosystems

Source 1.1 Bialowieza Forest, where abiotic parts of the Earth's surface and biotic organisms interact.

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Before you start

Main focus

One way of looking at the Earth's natural environment is to look at the different ecosystems which form the basis of life on Earth.

Why it's relevant to us

Knowledge of the Earth's ecosystems is basic to understanding how the natural environment operates, how that environment can impact on people and the effects people may have on that environment.

Inquiry questions

- What is an ecosystem?
- What are the main characteristics of an ecosystem?
- How have natural forces combined to allow for the development of these ecosystems?
- How and why are ecosystems important to humans?

Key terms

- Climate
- Climax vegetation
- Decomposers
- Ecosystem
- Food chain
- Primary producer
- Weather

Let's begin

Geographers make sense of the world by dividing it into regions. The physical world around us – the plants, animals, soils, slopes and climate – can be divided into different-sized regions, depending on the scale of the study being undertaken. Even the study of a small part of the Earth's surface may divide that area up into different ecosystems.

An ecosystem is a natural region – a hill slope, a pond, a beach, a backyard. This natural region is based on a physical feature upon which a group of plants, animals and microorganisms have developed. Some geographers studying ecosystems take a large-scale approach to their studies. These geographers examine relationships between plants and animals, and natural and human features, in a small area. Geographers who take what is known as a small-scale approach examine regions covering a much larger area. These regions are known as biomes and are the subject of the next chapter.

It is sometimes difficult to map ecosystems and biomes because they are subject to change – which may be long term, such as in the changes caused by the uplifting of mountains, or rapid, as in change following a cyclone, flood or bushfire.

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1.1 Ecosystems

An **ecosystem** is an area where non-living (abiotic) parts of the Earth's surface and biotic (living) organisms interact. They interact in such a way that a small area may be identified as a region. Geographers may be interested in studying this ecosystem from a variety of viewpoints. They may be interested in what causes the ecosystem to function as a unit or in how the ecosystem is changing over time and what might be causing that change. They may also be interested in what changes might occur in the ecosystem if certain changes were made to it.

ecosystem an area of the Earth's surface where living organisms interact with non-living parts of the Earth

The key part of the word is 'system'. The various parts work together just as the parts of your body do or the parts of a car do. Ecosystems require 'inputs' to make them function – just as your body needs food and a car needs fuel of some sort. Ecosystems also have 'outputs' – waste material resulting from the processes required to keep the ecosystem functioning. Your body may sweat. It certainly emits various wastes as gases, liquids and solids. A car converts the fuel into the energy required to move it forward and emits various gases as a result of the energy transformation process.

The ecosystem, the body and the car all require inputs from the world around us. This world can be divided into two parts – the abiotic and the biotic.

Geographical fact

The hair on your head is an interesting ecosystem: thousands of microscopic creatures live in and on your hair. These creatures actually wage war on each other. For them, the entire universe is your head.

Abiotic components of an ecosystem

The abiotic part of an ecosystem is that part of the ecosystem which is non-living. There are many abiotic components of an ecosystem. All of these are essential parts of the ecosystem and contribute to the type of ecosystem that develops. Those components are as follows.

- **Sunlight** is vital to life on Earth. The location of the sun in relation to the Earth's surface affects the length of time when there is daylight. It affects the temperatures that humans experience. It affects the amount of water in the atmosphere. Most importantly, it is essential for photosynthesis. This is the process by which plants turn the carbon dioxide breathed out by humans into oxygen.
- **Temperature** affects ecosystems daily, annually and over long periods of time. There are parts within an ecosystem that are affected by the sun, and thus by seasonal changes that are brought about by the Earth's revolving on its tilted axis around the sun over a year. Long-term changes in the world's **climate** zones also have an impact on ecosystems.

climate the long-term changes in temperature and rainfall experienced in an area

- **Wind** also affects ecosystems daily, annually and over long periods of time. The movement of air over the Earth's surface is influenced by other abiotic factors – the sun and related temperature changes. Wind affects the growth patterns of trees and the flight patterns of birds and insects and can significantly alter an ecosystem in a matter of hours.
- **Rainfall** is more correctly referred to as precipitation. This is any moisture that falls from the sky, and includes rain, hail, sleet and snow. This abiotic part of an ecosystem is also essential for the long-term survival of an ecosystem.
- **Rocks** are the basis of all ecosystems. There are many types of rocks, made of many different compounds. Rocks are not only the basis of life on Earth; they also form the largest part of the Universe we see at night around us.

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- **Soil** develops from rocks as a result of physical and chemical interactions between rocks and the atmosphere. It also has a link to the biotic part of an ecosystem, as the actions of plants, humans and animals can affect its development.
- **Gas** and dust combined some 4.6 billion years ago to form the planet on which we live, according to scientists. Today the interior of our planet is a swirling mass of chemicals. From time to time these chemicals produce gases which are forced out under pressure. Sometimes the pressure is extreme; sometimes it is just a slow, regular release through an outlet. These gases become part of the Earth's atmosphere and can impact on the ecosystems that evolve around them.

Biotic components of an ecosystem

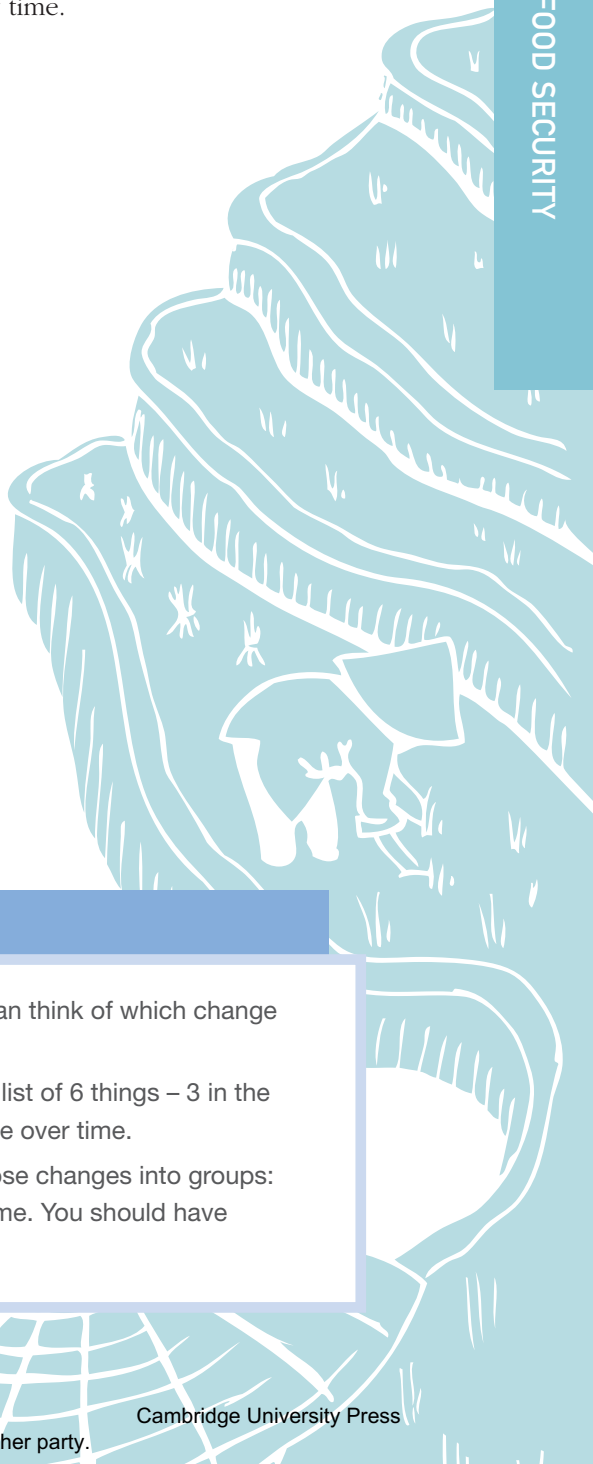
The biotic parts of an ecosystem are its living parts. These are closely related to the abiotic components of the ecosystem. The biotic parts of an ecosystem include the following.

- **Flora** is the plant life found in a region at a particular time. This includes trees, shrubs, ferns, grasses, cacti, bacterial organisms and algae.
- **Fauna** is the animal life found in a region at a particular time. This includes all levels, from herbivores, carnivores and omnivores to, very importantly, humans.
- **Fungi** look like plants but are in fact organisms (such as smuts, moulds, mushrooms and mildews) which can grow in low moisture. They do not contain **chlorophyll**, do not have roots or leaves, and cannot manufacture their own food; they obtain their food by decomposing dead plant material.

chlorophyll the green substance in plants that allows them to use the energy from the sun

How do ecosystems work?

Ecosystems are dynamic. The parts operate together just as the parts of a human body or a car work together. Ecosystems are subject to change. These changes may occur daily, annually or over a longer period of time.



ACTIVITY 1.1

- **Think:** On your own, in 2 minutes, make a list of 6 things you can think of which change over time.
- **Pair:** Choose a partner and, in 5 minutes, produce a combined list of 6 things – 3 in the abiotic and 3 in the biotic parts of an ecosystem – which change over time.
- **Share:** Share your lists with your class, and then categorise those changes into groups: those which occur daily, annually and over a longer period of time. You should have developed an interesting table.

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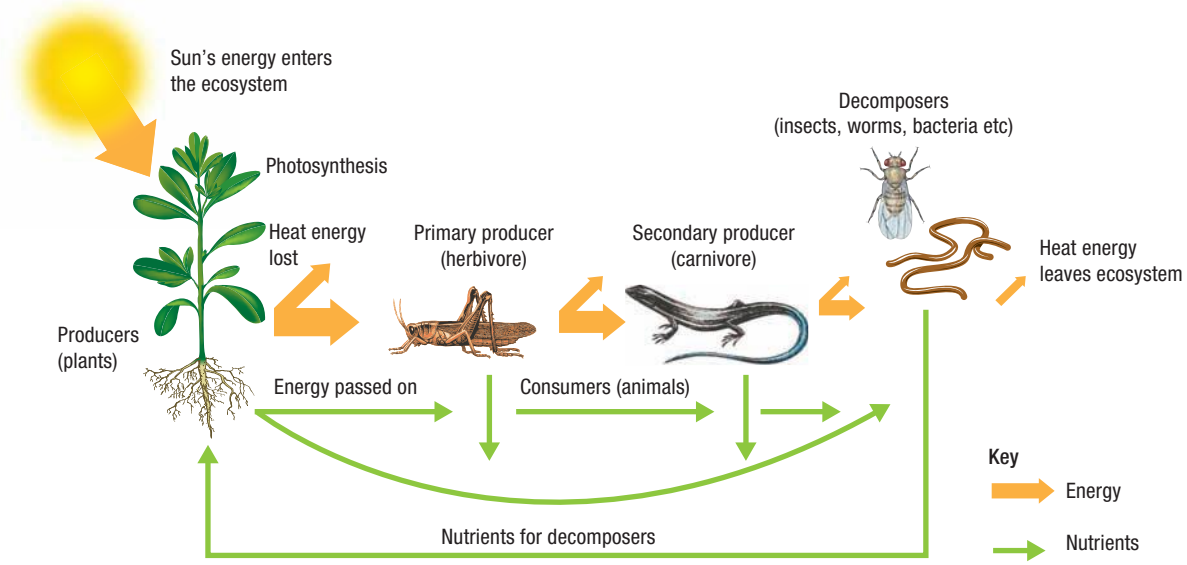
Ecosystems on Earth are driven by the power of the sun. Radiation from the sun provides the heat which is essential for life on Earth. Without the sun, Earth would be a frozen rock whirling through space. Approximately 30% of this radiation is reflected back into space by clouds, aerosols, ice and snow. The remaining radiation is absorbed by the land, the oceans, the atmosphere and human structures.

The amount of radiation directed to Earth by the sun varies. Sunspot activity increases the amount of radiation. There are also long-term cycles in the activity of the sun which affect the amount of radiation Earth receives (see Source 1.2, which shows the simple relationships within an ecosystem).

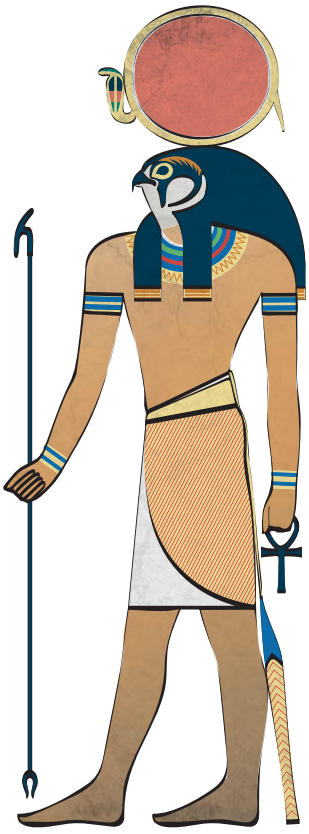


Source 1.2 Simple ecosystem diagram

The sun provides the Earth with light and heat. If you are a light sleeper, you will notice the arrival of the sun as the sky brightens and birds begin their daily activity. If your house has solar panels, you will notice that the output from the panels increases as the day progresses. The reverse occurs as the sun begins to set.

Humans today know much about the activity of the sun and its role in affecting life on Earth. This was not so in the past, so it is interesting to see how people regarded the sun then.

Early Egyptians worshipped many gods, but one of the most important was the god Ra (see Source 1.3). This god sailed across the world each day bringing light and warmth. At night, Ra sailed through the underworld, to return in the morning. One of the roles of the priests was to ensure the return of Ra each morning.



Source 1.3 Ra, the Egyptian Sun god

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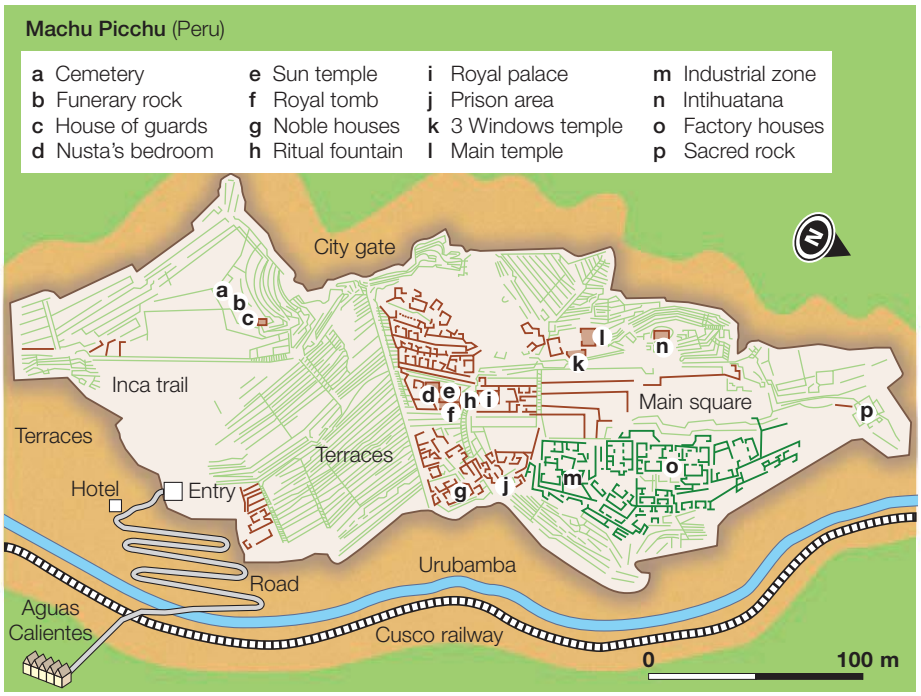
Machu Picchu, in Peru, is a favourite destination for international travellers. Machu Picchu was constructed by the Incas around the middle of the 15th century, but was abandoned by them when the Spanish invaded Peru. The city was reclaimed by the surrounding vegetation and was not shown to the world until 1911, when its location was revealed by US historian Hiram Bingham.

Machu Picchu has a layout that excites modern geographers and town planners, with clear areas set aside as a main square, an area for the upper classes or nobles, an industrial area and an area for workers' housing. Surrounding the city centre, and separated from it by a wall, was an agricultural area. Perhaps the most significant feature of the town was its orientation in relation to the sun.



Source 1.4 Machu Picchu town plan

solstices the two times of the year when the sun is at its greatest distance from the celestial equator. The summer solstice is the longest day of the year and the winter solstice is the shortest.

The sun temple is designed so that the rays of the sun on the winter **solstice** shine into it. Some distance away is the Sun Gate. This is the point through which the sun's rays first light up Machu Picchu each day.

Source 1.5 Machu Picchu, high in the Andes Mountains, was carefully oriented in relation to the sun.

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RESEARCH 1.1

There are other sites around the world where structures have been built to allow people to worship the sun.

Carry out an internet search to locate these, then produce a world map showing where they are and when they were built. What are they used for today?

Many Australians worship the sun, but in a far different way from these ancestors and with far different results. Source 1.6 shows the effects of sun damage on the author of this chapter.

Source 1.6 Skin cancer kills many young people each year. The author was lucky his sister was a doctor and spotted a basal cell carcinoma on him in its early stages. The author has been having regular surgery since then (late 1980s) to halt the progress of this disease. Even now it is still recognised as having the ability to cause the author's death simply because the body will become worn out fighting the disease.

1.2 The sun and the abiotic environment: weather

The sun has a major impact on the abiotic environment. Let's start by examining the impact of the sun on **weather**. Weather refers to the day-to-day changes in the Earth's atmosphere in terms of:

weather the state of the atmosphere at a given time

precipitation water, in forms such as rain, snow, sleet or hail, that condenses in the air, becomes too dense to remain suspended, and falls to the Earth's surface

- **precipitation**
- temperature
- humidity
- wind speed and direction
- air pressure.

How does the sun affect these variables?

The main variable it affects is temperature. The sun heats up the land and water surfaces of the Earth. The heating up of water bodies, whether they are oceans, seas, lakes or ponds, leads to the evaporation of water. Water can exist as a liquid, solid or gas.

This evaporation drives one of the major cycles on Earth – the water cycle. Humidity is a reflection of this evaporation: it is a measure of the amount of water the atmosphere is capable of holding, recorded as a percentage of the total amount of water vapour the air can hold. If the humidity is high (80%, say), there is a large amount of water in the atmosphere and rainfall is possible. If the humidity is low (20%, say), there is room in the atmosphere for more water, and evaporation is still possible.

Because land is a solid and water is a liquid, their surfaces heat up at different rates and lose heat at different rates. Land heats up quickly and loses heat quickly. Water will distribute heat more effectively, and so heats up slowly and loses heat slowly. These differences between the heating rates of land and water generate movement within the atmosphere too.

As air is warmed, it expands, and the pressure it exerts on the Earth's surface decreases (because

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there are fewer molecules per cubic metre). This warming creates regions of low pressure. In cold areas the air contracts, which means more molecules per cubic metre; this creates an area of higher pressure. The Earth's atmosphere works to equalise air pressure across the Earth's surface – wind is the movement of air from an area of high pressure to an area of low pressure. The movement of the wind affects ecosystems.

ACTIVITY 1.2

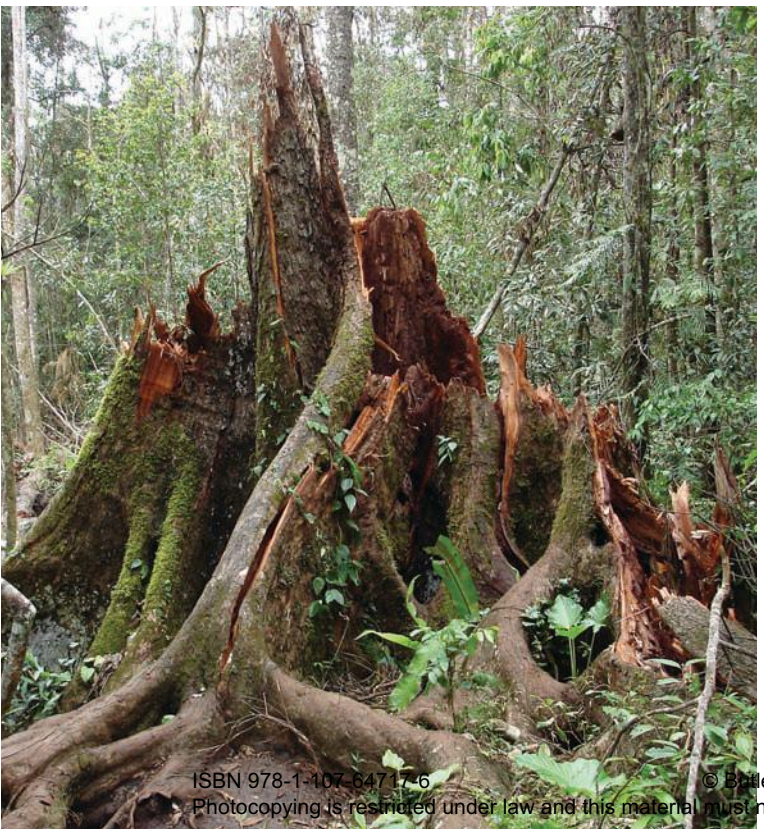
Answer the following questions and explain your responses using terms from the above paragraph.

1. What happens when you blow up a balloon?
2. What happens if you blow the balloon up too much?
3. What happens if you let the balloon go when you have blown it up?

The balloon exercise shows that air moves from areas of high pressure to areas of low pressure. This movement between areas of low pressure and high pressure generates wind, cyclones, typhoons and thunderstorms. Short-term atmospheric events such as these will affect ecosystems. Flooding, erosion and loss of habitat can also occur as a result of these events.

How is the movement of wind measured? One of the earliest measures of wind speed was based on the impact wind had on parts of an ecosystem. The Beaufort Scale, devised by Francis Beaufort in 1805, is still used by people on land or sea to estimate wind speed. It was based on observable changes in the environment – both natural and human – caused by the movement of air from one place to another.

Source 1.7 Giant Red Cedar felled by Cyclone Larry



Source 1.8 The collapse of this tree immediately changed the ecosystem around it.

The Beaufort Scale

Beaufort scale number	Descriptive term	Units in km/h	Units in knots (1 knot = 1.852 km/h	Description on land	Description at sea
0	Calm	0	0	Smoke rises vertically.	Sea like a mirror.
1–3	Light winds	19 or less	10 or less	Wind felt on face; leaves rustle; ordinary vanes moved by wind.	Small wavelets, ripples formed but do not break; a glassy appearance maintained.
4	Moderate winds	20–29	11–16	Raises dust and loose paper; small branches are moved.	Small waves – becoming longer; fairly frequent white horses.
5	Fresh winds	30–39	17–21	Small trees in leaf begin to sway; crested wavelets form on inland waters	Moderate waves, taking a more pronounced long form; many white horses are formed – a chance of some spray.
6	Strong winds	40–50	22–27	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty.	Large waves begin to form; the white foam crests are more extensive with probably some spray.
7	Near gale	51–62	28–33	Whole trees in motion; inconvenience felt when walking against wind.	Sea heaps up and white foam from breaking waves begins to be blown in streaks along direction of wind.
8	Gale	63–75	34–40	Twigs break off trees; progress generally impeded.	Moderately high waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked streaks along the direction of the wind.
9	Strong gale	76–87	41–47	Slight structural damage occurs – roofing dislodged; larger branches break off.	High waves; dense streaks of foam; crests of waves begin to topple, tumble and roll over; spray may affect visibility.
10	Storm	88–102	48–55	Seldom experienced inland; trees uprooted; considerable structural damage.	Very high waves with long overhanging crests; the resulting foam in great patches is blown in dense white streaks; the surface of the sea takes on a white appearance; the tumbling of the sea becomes heavy, with visibility affected.
11	Violent storm	10–117	56–63	Very rarely experienced – widespread damage.	Exceptionally high waves; small and medium-sized ships occasionally lost from view behind waves; the sea is completely covered with long white patches of foam; the edges of wave crests are blown into froth.
12+	Hurricane	118 or more	64 or more		The air is filled with foam and spray; the sea is completely white with driving spray; visibility very seriously affected.

Source 1.9 The Beaufort Wind Scale

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The scale used elements of the natural environment – smoke, dust and vegetation – to indicate what was happening as air moved over the surface of the Earth.

Geographical fact

Smoke was used as an indicator in 1805 but is unlikely to be used today. Why was smoke used then but isn't used now?

1.3 The sun and the abiotic environment: rocks and soil

Temperature changes associated with the heat of the sun are a major cause of mechanical or physical weathering, which is the breakdown of rocks **in situ** as a result of different components of rocks heating up and expanding at different rates or water in cracks and crevices in the rocks freezing during the cooler hours of the night and the rock being broken apart by the expanding ice.

in situ in the original position; not having been moved

Granular disintegration is directly caused by the sun. Dark-coloured compounds in rocks will heat up more quickly than lighter compounds. The dark compounds expand more quickly and can cause small grains of rock to break off the parent rock. This is most evident in a volcanic rock known as granite; the results are grains of sand which may eventually find their way to beaches. The breakdown of granite results in white sand beaches. The breakdown of basalt, a black rock, results in black sand beaches such as those found on the Big Island of Hawaii.

1.4 The sun and the biotic environment: flora and fauna

Sunlight generates the process of **photosynthesis** in plants. This process is essential for much of life on Earth. Photosynthesis is a complex chemical process, involving chlorophyll, carbon dioxide, water and sunlight, and produces the carbon and sugar compounds necessary for plant growth and the release of oxygen so necessary for animal life (read human life) on the planet.

photosynthesis the process of plants converting sunlight to energy

Source 1.10 Black sand beach in Hawaii formed by the erosion of basalt.

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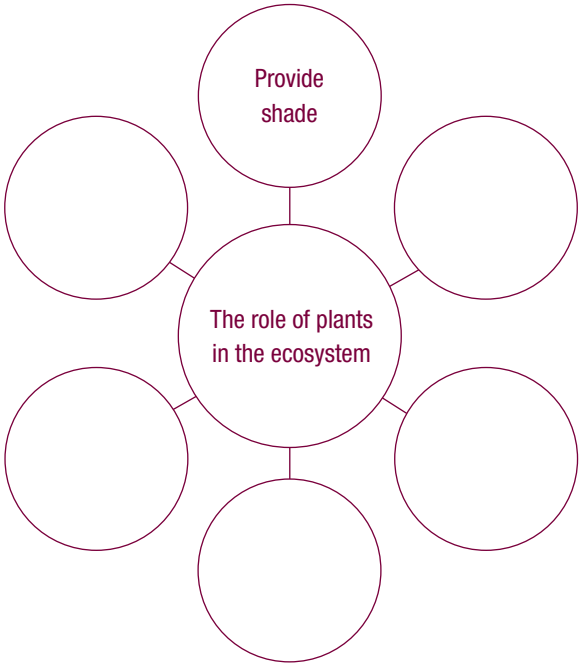
Plants have a number of roles in ecosystems. Some plants provide shade in which other plants will grow. Some plants are hosts for other plants; climbers and epiphytes, for example, need host plants. Many plants have special adaptations which allow them to grow in specific areas (mangroves and cacti, for example). All plants die, and in death they decompose and provide food for other plants.

Around the world there are some very difficult areas for plants to colonise. The growth of plants in these areas requires colonising plants with very special adaptations. These plants stabilise the environment and allow other plants, plants that are not adapted to the initial conditions, to eventually move into an area.

NOTE THIS DOWN

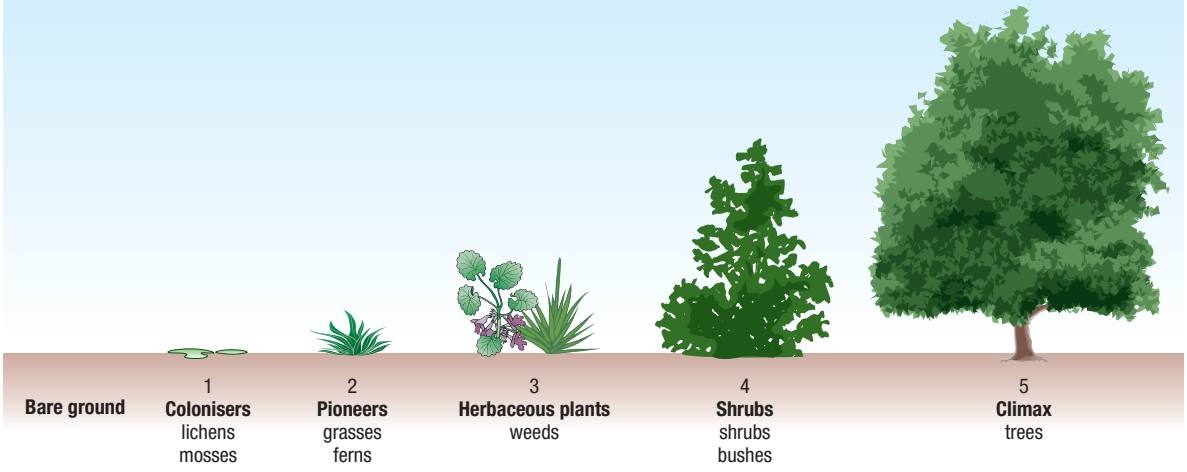
Copy the graphic organiser below and explore the different uses of plants.



RESEARCH 1.2

Sandy beaches and muddy estuaries support two entirely different ecosystems. Compare these two ecosystems and explain their difference and what factors affect them. Present your findings in a poster.

Source 1.11 shows how plant communities change over time: the character of an ecosystem changes as a result of its earlier plant communities.



Source 1.11 Transition from bare ground to a forest cover

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colonisers the first plants to inhabit an area

climax vegetation the most dominant form of vegetation in an area

The first plants to inhabit an area are known as the **colonisers**. The role of the colonisers is to establish an environment which will allow other plants to grow. The colonisers help break down the rock into soil and when they die they provide plant nutrients for a later group of plants. Eventually the environment is changed significantly by different groups of plants. A soil layer is developed and larger plants then provide protection for seedlings of still larger plants. The most dominant form of vegetation in an area is known as the **climax vegetation**. Climax vegetation is the major plant community that will develop in an area given the existing climatic conditions. For a large part of eastern Australia, the climax vegetation is eucalypt forest. Don't lose sight of the fact that it is the sun that is driving this vegetation development.

The animal kingdom is affected by sunlight in two ways. The time of day can have a significant effect on when animals are active. Some are **diurnal**. These animals are active during the day: giraffes and wildebeest, for example, are diurnal. Some are **nocturnal**. These are active at night: owls and flying foxes, for example, are nocturnal. Some are **crepuscular**. These are active in the twilight hours of early morning and early evening: many birds, for instance, use these hours to visit water sources. Deer too are most active in the twilight hours.

diurnal active during the day

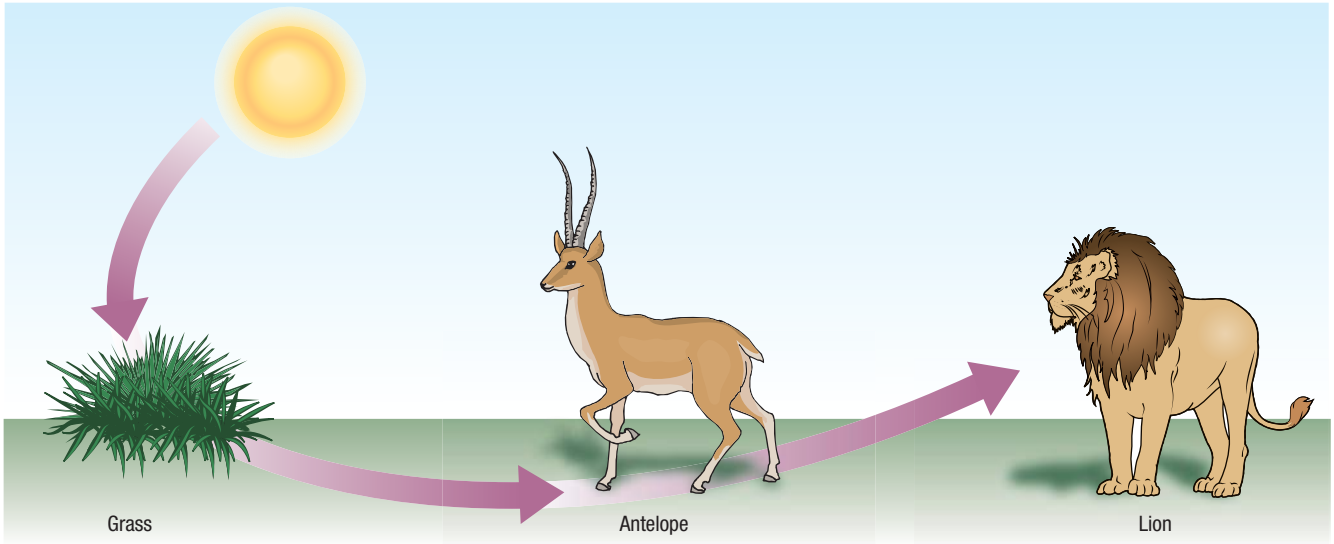
nocturnal active at night

crepuscular active at dawn or in the early evening

The other way sunlight affects the animal kingdom is through its effect on vegetation. There are animals which only eat plant material. These are the **primary producers** in an ecosystem. Primary producers are as small as caterpillars and as large as giraffes. They convert plant material into the food needed for their survival. They also produce waste products, in the form of gases, solids and liquids, which assist in the breakdown of plant material. On a more important level, many primary producer animals are the food of the next level of animals in the **food chain** – the carnivores. These animals eat other animals.

primary producer an animal that eats only plant matter

food chain the sequence of feeding arrangements in an ecosystem in which each member may be food for the next highest member of the chain



Source 1.12 Simple food chain in a small ecosystem

Source 1.12 is a simple version of what happens in many parts of the world. The sun provides the necessities for plant growth. A herbivore grazes on the plants and a carnivore consumes the herbivore.

The actual situation is not that simple. The study of biomes in the next chapter will investigate the relationships between plants, animals and the environment in more detail.

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The interesting thing about human beings is that they have an increased ability to survive because they consume all levels of the food chain, from the plants at the base (carrots, tomatoes, peas) to the herbivores (cows, antelopes, kangaroos) to the carnivores (sharks, crocodiles).

The role of the sun's energy in relation to plant and animal life on Earth is not over even when plants and animals die. Many of the wastes remaining when a plant or animal dies go through further processing to return their nutrients to the environment. This is where the **decomposers** come in. They break down the decaying life form into nutrients which can be used again in the ecosystem. Scavengers form part of this group. Crows, Tasmanian devils and hyenas are scavengers. (Hyenas also hunt.) Fungi and bacteria are other life forms that assist in the decomposition of plant and animal remains.

decomposers animals, fungi and bacteria that break down or 'clean up' waste matter

ACTIVITY 1.3

1. Describe the role of the colonisers.
2. Predict the impact on the ecosystem if the decomposers were eliminated.
3. Create your own food chain based on your own diet.

1.5 Introducing another variable: humans

Up to this point, the investigation of ecosystems and their dynamics has concentrated on the natural world and how interactions, often related to the activity of the sun, occur. The interactions and interconnections are far more complex than have been shown so far, but the general idea should be clear.

For some considerable time humans have had a major impact on ecosystems on the Earth's surface and that impact is increasing. The impact can be small, such as using insecticide on an ants' nest (though that is certainly not a small event for the ant colony), or so large as to completely destroy ecosystems. Using an insecticide on an ants' nest is a deliberate attempt to destroy an ecosystem, but other actions may work to save an ecosystem.

Humans have not always had the degree of control over ecosystems that they have today. Humans were originally very much an integral part of the ecosystem: they lived in caves, gathered roots and berries and hunted wild animals during the day. Humans were hunted by those wild animals themselves.

Fire became an important tool for humans. It provided warmth and protection. Australia's first inhabitants used fire to modify the environment for their own use. Fire was used to remove undergrowth and encourage the growth of new shoots, which would attract animals. It has only recently been recognised that there was often a pattern to the burning. This pattern left a mosaic of sections of undergrowth at different stages of development. Some of this undergrowth provided protection for the animals the people hunted. The important thing was that catastrophic bushfires were prevented, as different parts of the land were in different stages of recovery from deliberate fires.

In time, humans learned which plants could be grown in certain areas and which animals could be brought under control. This knowledge resulted in the **domestication** of plants and animals and is the basis of agriculture in the modern world.

domestication the process of taming animals or cultivating plants for uses that benefit humans

Over time humans have become established at the top of the ecosystem. Humans can save, protect, destroy or modify an ecosystem. The sequence should probably be:

Modify → Save → Protect

In reality, the sequence in many places has probably been:

Destroy … and where do we go from here?

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Case study 1.1
The Tasmanian Tiger

The thylacine, better known as the Tasmanian Tiger, was native to Australia and primarily found in Tasmania and some regions of Victoria. It was the country's largest carnivorous marsupial and had existed for over 4 million years.

The introduction of humans and dogs to the environment brought disease and predators to the ecosystem of the thylacine, and numbers declined drastically. Thylacines were kept in zoos, but suffered in captivity. They were also hunted by farmers who assumed the thylacine had been killing their sheep.

The last thylacine died in captivity in 1936, and although sightings have been reported and extensive searches carried out, there is no conclusive evidence of the creature being still in existence.

Currently, scientists are making attempts to clone thylacines from preserved specimens.

1 What were the possible impacts of the extinction of the thylacine in Tasmania?
2 Discuss how ecosystems in Tasmania would be affected if the thylacine was cloned and returned to its natural ecosystem.
3 Describe the steps taken by modern conservationists to help prevent more species becoming extinct.
4 Research and list plants and animals that have been rediscovered since they were declared extinct.

Humans have been altering ecosystems for thousands of years. Increasing populations required more food than could be provided by hunting and gathering. Providing more food required clearing land of its vegetation cover. In many parts of the world the flow of water had to be altered to provide water for larger and larger areas of crops and for the increasing number of livestock being raised. The flow of water also had to be altered to provide for increasing numbers of people living in settlements. The Industrial Revolution placed even more pressure on ecosystems as trees were cut and burned, and later coal and oil were extracted from the ground. Cities were built and spread across the countryside and communication networks of road and rail were constructed to connect them.

In the desire for this kind of progress, ecosystems for a long time took second place in humans' thinking. In parts of the world where development is still seen as the primary goal, or in places where disputes cannot be settled without conflict, ecosystems still take second place.

Fortunately, in other places the need to save and protect ecosystems is regarded as important. As a result, an international network of botanical gardens and zoos seeks to protect and enhance the future of plant and animal species that are under threat. There is also a network of reserves, state forests and, more importantly, national parks – both on land and on the water – which seek to preserve ecosystems. There are no guarantees that the efforts will be successful, but the efforts must be made.

The world's first national park – Yellowstone, in the United States – was opened on 1 March 1872. Australia's first national park was the National Park, south of Sydney. It was opened on 26 April 1879. It was the world's second national park. It was renamed the Royal National Park after a visit by Queen Elizabeth II in 1955.

In 1972, the United Nations recognised that parts of the world needed to be set aside as having special cultural or physical significance. By 2012, 962 sites had been recognised by the UN Educational, Scientific, and Cultural Organization (UNESCO) as World Heritage listed sites.

While world governments realise that parts of the Earth's surface need to be protected, it is not always easy, or possible, to do so. The fight to save the Cooloola area of Queensland was a classic example of the will of the people clashing with the government of the day and a mining company. Many clashes like this have occurred in the past 50 years, and many are under way around the world today.

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Geographical fact

It is interesting that the majority of sites identified are of cultural significance – the pyramids and the Mayan temples, for example. Only 188 sites are considered to be of significance because of their physical environmental characteristics.

At the end of 2012, Australia had 19 sites listed and 2 sites awaiting approval.

ACTIVITY 1.4

1 List the impacts that humans have had on the environment.

2 Suggest other types of creatures that have had a negative impact on an ecosystem.

3 Describe how humans can have a positive impact on the environment.

4 Evaluate the methods used to determine whether or not to preserve an area or site. Are some sites more significant than others? Explain why.

Source 1.13 Australia's World Heritage listed sites

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FIELDWORK 1.1 EXPLORING THE MANGROVES OF AN INLET

Aim

To examine a section of mangroves, such as Hays Inlet mangroves, to identify human impact on this ecosystem and the response of the mangrove community to this impact.

Method

A selected area of the mangroves, such as between Duffield Road and the sewage outfall pipe by Hays Inlet, will be examined.

Preparations

Use Google Earth, or an available map of the inlet, to prepare a base map of the area to be studied. Identify the various ecosystems you are likely to encounter. You will also need to take a camera, a GPS, old shoes in a plastic bag, insect repellent, a hat, sunscreen, a clipboard with the base map and the data collection sheet, and a pen.

Data collection

The suggested path for this trip is along the high-water line or lines of the mangroves. Use the GPS to record your route and to locate any significant evidence of human impact on the mangroves. Record data about the items you find along the high-water mark as well as any other evidence of human impact in the area.

List all the ways in which the mangroves appear to be being used. Take photos of these activities. Mark the location of these spots on your blank map. Provide a key to display your data collection. Are these activities active or passive? How often would the mangroves be used for these activities? How many boats did you see or hear during your time on the Inlet?

1. Explain the extent to which location along the inlet influences the type of activities evident in the mangroves.
2. Describe the positive and negative and short-term and long-term impacts of these activities on the mangroves. Sketch two examples of the ways in which the use of the area has affected the environment. Annotate your sketch with as much information as possible about the use and its impact.
3. Observe the features surrounding the mangroves that humans have created. Describe these. How do you think the mangroves have influenced these developments?
4. List some of the management strategies that you observe. Determine if you think the strategy is working or not and explain your reasoning. Suggest a new strategy for one of the impacts you identified in Item 2.

Fieldwork presentation layout

Front page	Title and name
Contents page	Do this last, once you have numbered the pages
Page 1	Aims and methods
Page 2	Location map – Hays Inlet area, for example
Page 3	Introduction – brief description of the study sites
Pages 4–5	Description of uses (and photos)
Page 6	Table of usage: effects of use (positive or negative, short-term and/or long-term)
Pages 7–8	Description of effects of use (and sketches and/or photos)
Page 9	Association between use and effects of use
Page 10	Table or written description of management strategies
Page 11	Photos or sketches of management strategies
Page 12	Evaluation of these strategies
Page 13	Appendix, bibliography, glossary

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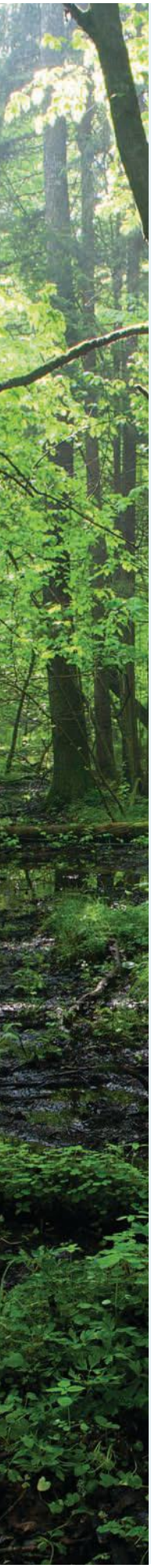

Chapter summary

- Ecosystems have both living and non-living components. All these parts work together, with 'inputs' to make them function and 'outputs' – waste material resulting from the processes required to keep the ecosystem functioning.
- Ecosystems are dynamic, responding and adapting to changes made by humans, the weather and animals (for example).
- Ecosystems exist at all types of scales, wherever abiotic parts of the Earth's surface and biotic organisms interact.
- Ecosystems are important for the continued existence of life on Earth. Humans can have significant and damaging impacts on ecosystems by introducing waste and pollution, and even destroying ecosystems.
- The need to save and protect ecosystems is regarded as important in some areas of the world.

End-of-chapter questions

Multiple choice

1 Which of the following is not a living part of an ecosystem?

A A rock
B A worm
C A butterfly
D An eagle

2 Which of the following is not a non-living part of an ecosystem?

A A rock
B A cloud
C Water
D A worm

3 Which of the following has the greatest long-term impact on ecosystems?

A Rocks
B Rainfall
C Wind
D The sun

4 What is the difference between an ecosystem and a biome?

A Size
B Variety of plant species
C Variety of wildlife
D All of the above

5 Which organisation works to protect ecosystems?

A WHO
B UN
C UNESCO
D QTQ

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Short answer

1 Describe how the sun affects an ecosystem on a daily basis.

2 Describe how the sun affects an ecosystem on an annual basis.

3 Define 'food chain'.

4 Explain the relationships between the non-living and the living parts of an ecosystem.

5 Discuss how humans can have an impact on an ecosystem.

Extended response

Pildappa Rock is near Minnipa in South Australia. It is one of a number of 'wave rocks' in Australia.

Examine the pictures below. Your task is to tell the story of the ecosystems here without using any other information source. What information is provided by the four images? What evidence of the information presented in this chapter is shown in them? Present your findings in a short report.

Source 1.14 Pildappa rock showing its wave rock shape

Source 1.15 Summit of Pildappa Rock showing the uneven nature of this granite formation

Source 1.16 An ecosystem on the summit of Pildappa Rock

Source 1.17 The hollow in this rock is also an ecosystem.

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2 World biomes

Source 2.1 A major regional or global biotic community, such as a grassland or desert, is characterised by its chief forms of plant life and its climate.

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Before you start

Main focus

To look at the world's environment on a global scale, geographers combine ecosystems into larger areas known as biomes.

Why it's relevant to us

People have adapted to living in different biomes and biomes have been altered, for better or for worse, by humans.

Inquiry questions

- What are the world's major biomes?
- What are the characteristics of these biomes?
- What physical factors affect the location of biomes?
- How do plants and animals interact in biomes?
- How have humans impacted on biomes?

Key terms

- Aspect
- Biome
- Coniferous
- Desert
- Orographic rainfall
- Rainforest
- Savanna
- Zonation

Let's begin

The word 'biome' refers to groupings of plant and animal communities which have adapted to inhabit particular parts of the Earth's surface.

Before the domestication of plants and animals, the main thing biomes had to adapt to was the world's changing climate. In recent times, biomes have had to adapt not only to a changing climate but also to human interference.

It may be difficult to believe, but the current pattern of the world's biomes is not the pattern which was evident even as recently as 15 000 years ago, when most of Canada, and Central Park in New York, for example, were covered by an ice sheet hundreds of metres thick.

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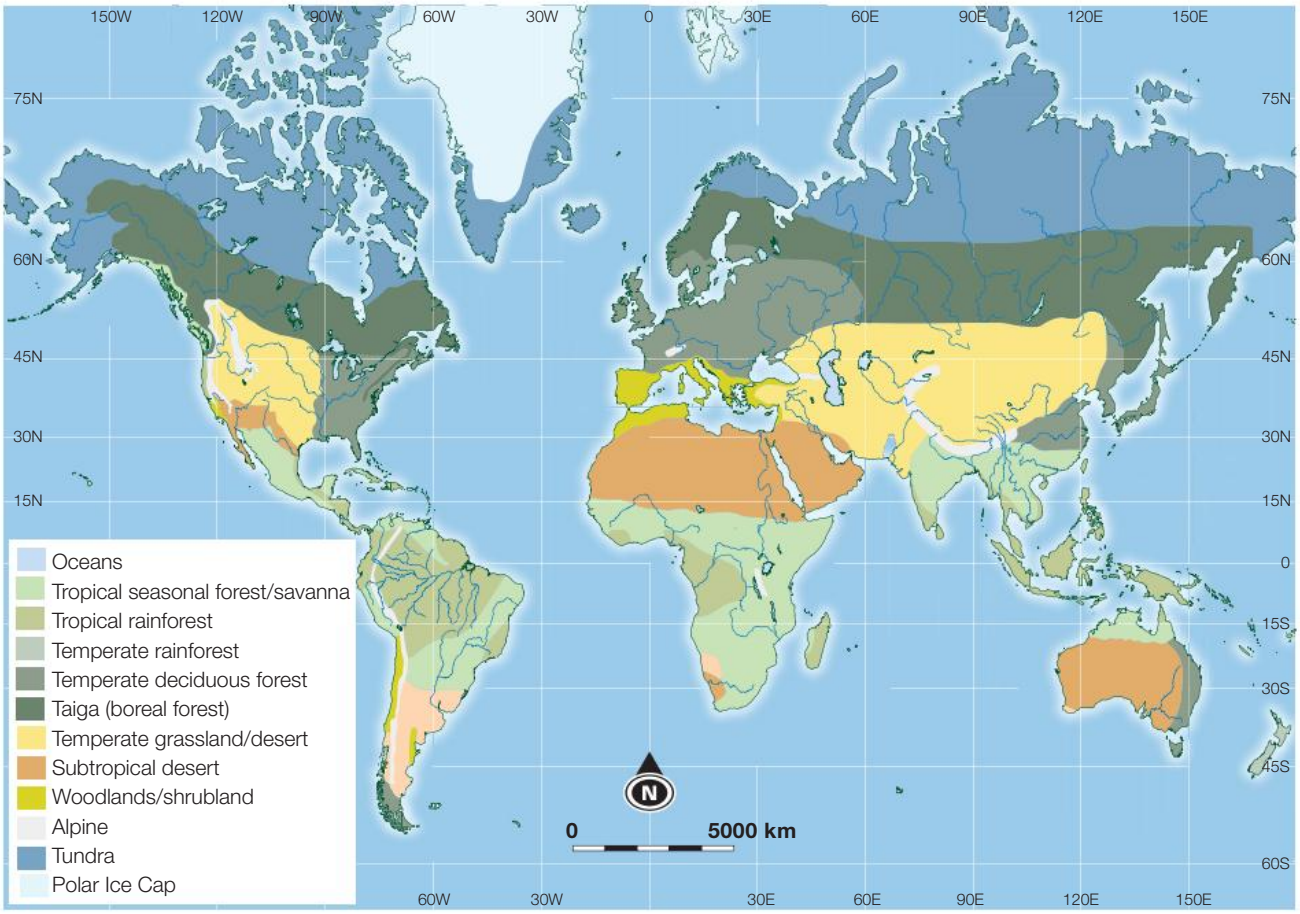
2.1 Understanding the world's biomes



Source 2.2 World's major biomes

biomes groupings of plant and animal communities that have adapted to inhabit particular parts of the Earth's surface

Source 2.2 shows the world's **biomes**. An internet search will show that there are many different maps of the world's biomes. Some use different terminology for the biomes. Students should note that the map would be even more complicated if the ocean's biomes were added to it.

2.2 Location pattern of the world's biomes

The normal way of looking at this location pattern is to look at the change from the Equator to the Pole. For example, in Source 2.2, start with Africa and move to the North Pole along 10°E longitude.

NOTE THIS DOWN

Copy the graphic organiser below and name a country that would have this biome.

Biome	Country
Tropical rainforest	
Tropical seasonal forest/savanna	
Subtropical desert	
Woodland/shrubland	
Temperate deciduous forest	
Taiga (boreal forest)	
Tundra	
Polar ice cap	

This examination shows the transition of biomes from the hot, wet **rainforest** of the tropics to the polar ice caps. The same biomes are found in different parts of the world. There is a pattern of biomes from north to south across the globe.

rainforest a tropical forest environment with a large rainfall

RESEARCH 2.1

1. The class should be divided into 4 groups.
2. Each group will be allocated one of the following lines. Identify the biomes along your line:
   - i the Panama Canal to the North Pole
   - ii Singapore to the North Pole
   - iii the Panama Canal through South America to the South Pole
   - iv Singapore to the South Pole via Indonesia and Australia.
3. Share your results with the other groups and determine if there were similarities in the changes in:
   - i the northern hemisphere profiles
   - ii the southern hemisphere profiles.
4. Share your results with the other groups and determine if there were differences in the changes in:
   - i the northern hemisphere profiles
   - ii the southern hemisphere profiles.
5. Discuss the following:
   - i If there were similar patterns observed in the northern and southern hemispheres, what factors could have caused these similarities? Equally, if there were differences, what might have caused them?
   - ii Was there an anomaly in the pattern? (An anomaly is something which doesn't fit the general pattern.)
   - iii Which biomes are poorly represented in the southern hemisphere? Why is this so?
   - iv Which biome is the anomaly? This is the biome that does not fit the pattern as it can be found in zones from the Equator to the Poles. (This anomaly will be examined later.)

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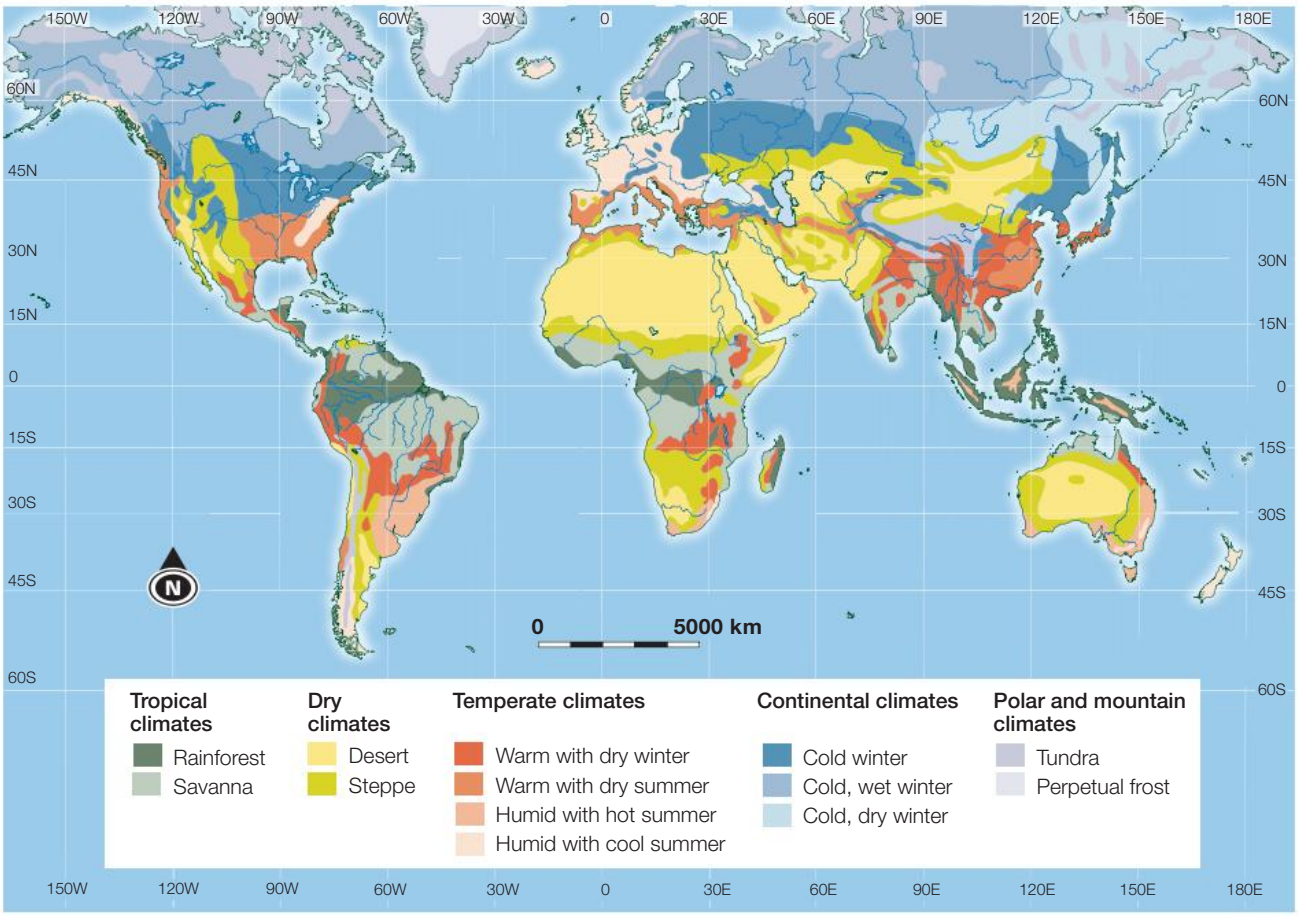
Climate and the location of the world's biomes

There are many factors affecting the location of the world's biomes but one factor stands out above any others: climate. The plant and animal communities of our world respond to variations in climate. It is their response to the variations in climate that give the world both this distinctive pattern of biomes and the pattern of changes in biomes as one moves from the Equator to either Pole.

This relationship between vegetation and climate was recognised by Russian/German climatologist Wladimir Koppen when he was devising his world climate classifications between 1884 and 1936. His classification recognises that vegetation patterns are a reflection of climate patterns.



Source 2.3 Koppen's world climate classification

savanna a grassy plain with scattered trees and shrubs

desert an area that receives less than 250 mm rainfall per year

perpetual frost an area that is constantly covered in ice, such as the polar caps

Many of the names Koppen gave to his climate regions were based on vegetation terms – rainforest, **savanna**, **desert**, tundra. Other descriptors are more related to climate terms – **perpetual frost**, dry climates. This raises the issue of how phenomena are classified. Vegetation areas should be named after vegetation terms. The classic example is 'rainforest', which is a climate zone named after a vegetation term.

The study of ecosystems in the previous chapter showed the important roles of temperature and rainfall in ecosystems. It should then be no surprise that climate is the major controlling factor in the distribution of biomes. It should not take too much thought to work out the other major controlling factor. Again, this factor is important in controlling ecosystems – people.

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ACTIVITY 2.1

On this page are images of three different biomes.

Think: Examine the photos and try to find the characteristics that could be used to identify different biomes. Take several minutes on your own to examine the photos and write down the characteristics you think are important.

Pair: Then work with a partner to come up with a list of 5 or 6 characteristics that you think could be used to identify different biomes.

Share: Share these ideas with your class.

Your activity would have identified many features which could be used to identify biomes. The list may have included:

1. plant species
2. special adaptations
3. special relationships between plants.

Source 2.4 Rainforest biome – Central America

Source 2.5 Savanna biome

Source 2.6 Australian desert biome

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2.3 Rainforest biomes

Rainforests are one of the world's most interesting biomes. As Source 2.2 showed, they are found on several continents, both north and south of the Equator.

Rainforests are such complex biomes that it is often difficult to take a photograph that allows a person to see all their features. These features include:

1 height
2 density
3 coverage
4 plant species
5 special adaptations
6 special relationships between plants.

Height

Rainforest trees are usually very tall. They have few branches until the top (or canopy) of the forest.

Source 2.7 Rainforest vegetation in the Cooloola National Park, New South Wales

Density

Rainforests have a high density of trees per hectare compared with other forests. How is 'tree' defined here? A tree may be defined as a woody plant which has a girth (circumference) of at least 25 cm at a height of 130 cm. This is often referred to as circumference at breast height.

Coverage

One of the distinctive features of a rainforest is that the canopy is 'closed' – the branches of the trees link together at the canopy. This means that very little light reaches the forest floor, which has a major effect on the characteristics of the forest. Having no light reaching the forest floor means that one plant species is excluded from the rainforest. That species is found in many biomes and is the curse of the urban backyard. Can you guess what it is? Final clues:

- it is green
- it grows rapidly after rain
- keeping it under control in your backyard usually requires physical exertion with a machine, and most species contribute to greenhouse gases.

If you don't know the answer it may be because you live in a unit or apartment.

Plant species

A rainforest is characterised by a wide variety of plant species growing at various height levels. It will have a number of canopy tree species, and many of them will not grow outside a rainforest environment. Attempts have been made to grow some of the commercially profitable rainforest species in plantation environments but the plants will not thrive.

Lower storeys of a rainforest also host a wide variety of plant species. Some of these are young plants of the canopy layer, waiting for a canopy tree to fall and create a space for them to grow up into. Others are plants which have adapted to living in the moist, humid, dark environment of the rainforest understorey. Mosses, lichens, epiphytes and palms fall into this category.

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Source 2.8 Drip-tipped rainforest leaf of the Macaranga plant

Source 2.9 Buttress roots on a tree growing on a steep slope near Cairns, Queensland

Special adaptations

The plants of a rainforest show evidence of many adaptations they have made to live in their environment.

The trees need to grow tall and straight very quickly if they are to take their place in the canopy layer. In order to compensate for the trees forming a closed barrier to sunlight reaching the ground, the leaves of the canopy trees have adapted so that rainfall will not be trapped in the canopy and evaporate back into the atmosphere but instead will make its way to the ground where it can be absorbed by plants. Source 2.8 shows the leaf of a Macaranga plant found in rainforests throughout New Guinea and in coastal Queensland. It is easy to see how this leaf has evolved to assist the movement of rainfall to the ground.

Some rainforest trees have an adaptation which has puzzled scientists for many years. These trees have what are known as 'buttress' roots. The architects who built some of the world's greatest cathedrals used the buttress to support large structures – and they have done so for hundreds of years. Nôtre Dame Cathedral in Paris is a famous example. The buttresses help support the weight of the building. However, what works for buildings isn't so easy to explain in the natural world.

The assumption is that the buttress roots support the weight of the tree to prevent it from falling over. If that is the assumption, then would the following be true?

Geographical fact

The canopies of a tropical rainforest are so densely packed that rain falling on the trees at the top can take up to 10 minutes to reach the ground.

- All trees of the same species growing on steep slopes will develop buttress roots.
- All trees of the same species growing in strong wind areas will have buttress roots.

They don't. This is why scientists are baffled about why rainforest trees develop buttress roots.

It is now your turn to play scientist.

RESEARCH 2.2

Use the internet to research what other theories have been proposed to explain the development of buttress roots.

If you live near a rainforest area that can be visited easily, visit that area and conduct some simple research. If you don't live close to an area of rainforest, you may have to use Google Earth or images on Google to examine an area.

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Special relationships between plants

The rainforest has many plants which co-exist. Vines – both woody and fleshy – grow on the trunks of trees and form part of the interlacing of plants in this biome.

Epiphytes, staghorns and orchids have found their own special place in the rainforest: they grow in places where falling plant and leaf litter accumulate and rot and provide food for them or, in the case of epiphytes, they grow in a cup-like shape so that they trap their own food.

Mosses, lichens and fungi play their own role, breaking down plant material at or near the forest floor so that it becomes food for the plant life above. It all works very well. All the species work together to support the future of the biome. But sometimes there is a problem.

Source 2.10 Epiphyte growing on a rainforest tree near Barron River Falls, north Queensland

Source 2.11 Woody vines grow from tree to tree and work as a highway for animals in the forest

Case study 2.1
The strangler fig

One plant has adapted so well to the rainforest environment that it may, if unchecked, take over that environment in some areas. The plant is the strangler fig. This plant has taken adaptation to a very high level. The fruit of the strangler fig is eaten by birds. The seeds of the fruit are then deposited by the birds, often in the forks of trees high above the forest floor. The fig germinates in the fork of the tree and sends its roots down the tree. These roots develop a stranglehold on the host tree. The fig needs the host tree to support its early growth, but once the fig's root system is solidly fixed into the ground, the host tree is effectively strangled and rots away. In many places it is possible to climb up the inside of a strangler fig, as there is a hollow core where the host tree once was. The strangler fig is a parasite. It is a plant which lives off another plant and eventually kills the plant it lives off.

1. Explain why you think this plant is called the 'strangler' fig.
2. Analyse whether you believe people should intervene in a natural process and limit the spread of strangler figs.
3. Investigate and name another parasite that may take over the rainforest environment if unchecked.

Source 2.12 A strangler fig

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There is one final relationship between the plants of a rainforest which needs to be examined. Rainforests are among the most magnificent expressions of life on Earth. The profusion of plant life and the size of the forest – in terms of height and area – have led people to believe that this biome grows on very fertile soils. What else could account for the prolific growth?

However, in many rainforest areas the soil was not originally fertile. Over time, the rainforest converts the soil on which it grows into fertile soil that will support its growth. Rainforests expand their area by converting the soils around their edges into soils suitable for this growth. Rainforests are not the only plant communities that change the nature of the soil they grow on, but they are the best at this process. How does a plant community change a soil type?

When you see a fallen tree, one of the things you may notice is how shallow the root system is. The root system which supports and nourishes the tree may be only a few centimetres deep. Only in certain areas do trees have very deep root systems. The reasons for this will be examined in a later chapter.

The same thing in fact happens at your home or on a farm; the size of the area and the type of soil don't matter. First, the same three things occur:

- the soil is turned over to aerate it
- water is added
- fertilisers are added.

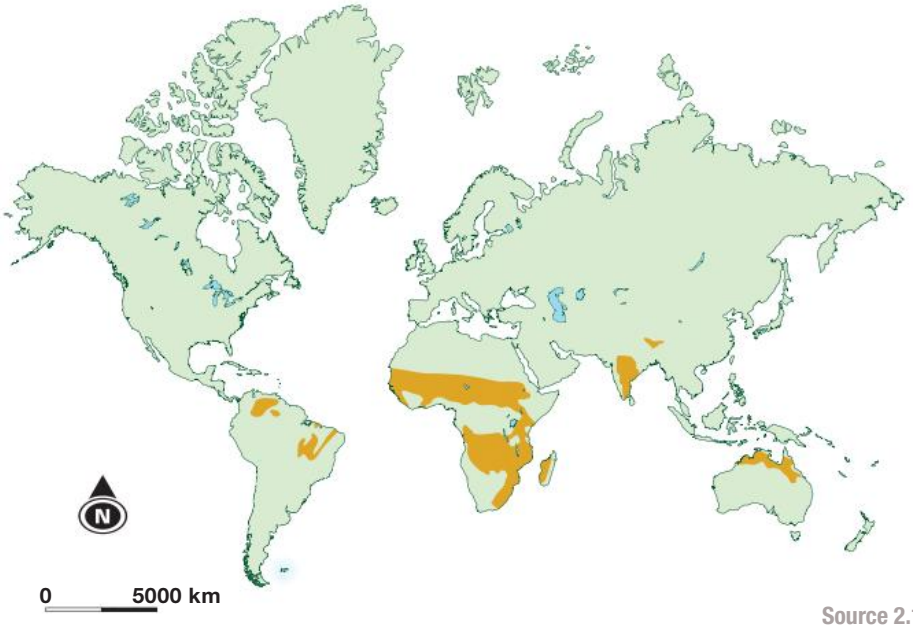
The rainforest does all this by itself:

- the soil is turned over by the developing root systems, and by the animals which inhabit the soil, such as worms
- the drip-tipped leaves ensure that water reaches the ground
- fertiliser is added. Rainforests create their own fertiliser: a deep layer of what is known as 'humus' is created by fallen branches, leaves and eventually the rest of the trees. These decay rapidly in the moist, humid environment and provide the plant food necessary to sustain the life of the forest. Fertiliser is thus provided for the whole rainforest system, including the epiphytes and parasites.

What happens when the forest is removed? That will be examined in a later chapter.

2.4 Savanna biomes

The savanna biome is completely different from the rainforest biome. The rainforest biome is dominated by its plant life. The savanna biome is dominated by its animal life. The plant life is important, but it is the animal life of this biome that attracts the most attention. The world's savanna areas are shown in Source 2.13.



Source 2.13 Savanna biomes

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The plant life associated with this biome will be examined first, followed by the factors that affect that plant life, and then the animals which inhabit this exciting biome.

Vegetation

The images below show typical savanna landscapes.

The criteria used for examining vegetation in the rainforest biome will also be used here.

Height

The trees do not grow very high. There is often a sparse shrub layer, and the ground cover is primarily grass.

Density

The density of the tree and shrub layers is very low but the density of the grass layer can be quite high.

Coverage

The trees and shrubs cover very little of the ground. The primary ground cover is grass.

Plant species

There are more species in the ground layer than in the tree and shrub layers.

Source 2.14 Savanna near the slopes of Mt Kilimanjaro, Tanzania

Source 2.15 A group of lionesses basking in the sun following a successful night's hunt

Source 2.16 Giraffe on the savanna

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Special adaptations

There are many special adaptations that plants have developed to survive in this environment. These include:

1 The canopy has a spreading shape, to shade the root layer.
2 Many plants have developed thorns and prickles to prevent animals eating the vegetation.
3 Some plants have developed tissues that retain a supply of water they can use during the dry season.

These are not the only adaptations associated with this landscape, but they are the ones that help make it a distinctive biome.

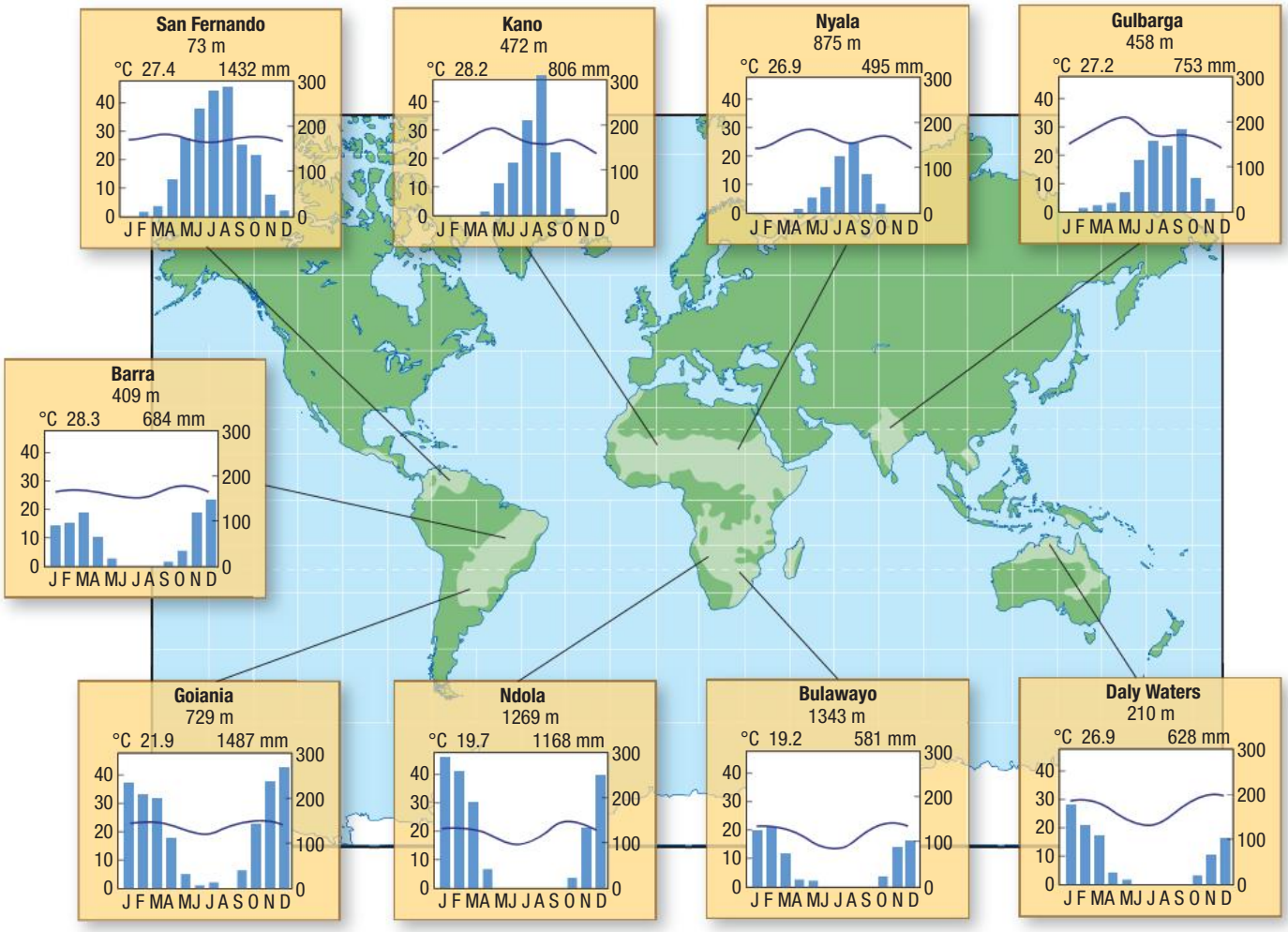
Special relationships between plants

There does not appear to be any special relationship between the plants in the savanna as there are in the rainforest.

Factors that affect the savanna vegetation pattern

The key factor that governs most biomes is climate. The characteristic of the climate that has created the savanna vegetation pattern is simply its seasonal change.

In savanna areas, the climate changes from hot and wet to hot and dry. The hot and wet season brings an explosion of plant growth to the savanna, especially in the grasses. This vegetation change has a major impact on the animal life of this biome.



Source 2.17 Temperature and rainfall graphs from savanna areas around the world

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Animal life

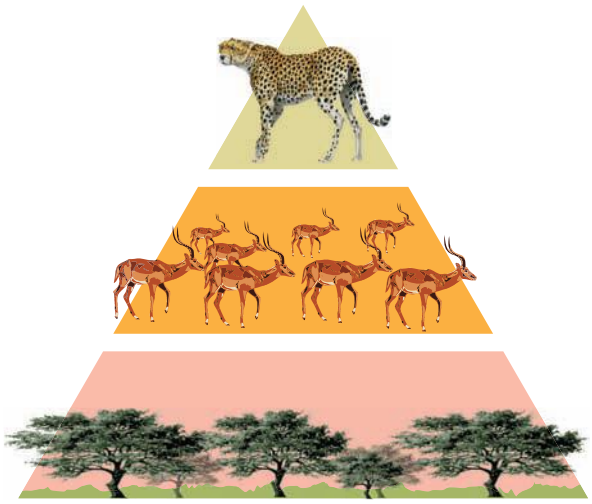
When the rains come, the savanna vegetation springs to life. The most rapid response is from the grasses, which have died back during the dry period just as they do in your backyard. The rains bring a rapid spurt of growth. This growth attracts a group of animals known as grazers or herbivores. These animals advance as the pastures grow and retreat as the pastures die out. This movement of herbivores is known as a 'migration'.

The herbivores eat the grass. They migrate into an area where the rains have caused the grass to grow and retreat as the area dries up. They breed, and their numbers multiply. While most herbivores graze on the grasses, some, such as the giraffe and the elephant, graze on other new vegetation too. The giraffe's long neck allows it to reach new shoots and its thick rubbery lips allow it to avoid thorns and prickles. The elephant simply knocks the tree down to get at the leaves it wants.

The herbivores bring with them another group of animals: the carnivores. These animals eat meat. They prey on the herbivores – they eat the weak, the young and those not paying attention to their surrounds. Some, such as the crocodiles, congregate at river crossings and attack the herbivores as they cross.

Decomposers make up the final major group of animals on the savanna. They obtain their nutrients by eating the rotting flesh left behind by carnivores and devouring the bones of dead animals. These animals, like many other animals on the savanna, produce droppings which dung beetles – probably as far removed from the top of the food chain as it is possible to be – use to do their work: they convert the droppings into nutrients, which return to the soil and are used by the plants for their growth. Thus the 'circle of life' is completed on the savanna.

Source 2.18 is a simple food chain for the African savanna.



Source 2.18 Simple African savanna food chain

ACTIVITY 2.2

1. Explain why the carnivores are important.
2. Discuss how the removal of weaker herd animals could actually be a benefit.
3. What might happen in a savanna if the herbivores had no predators?

Geographical fact

Grasslands cover almost one-fifth of the land on Earth. They can be found on every continent except Antarctica.

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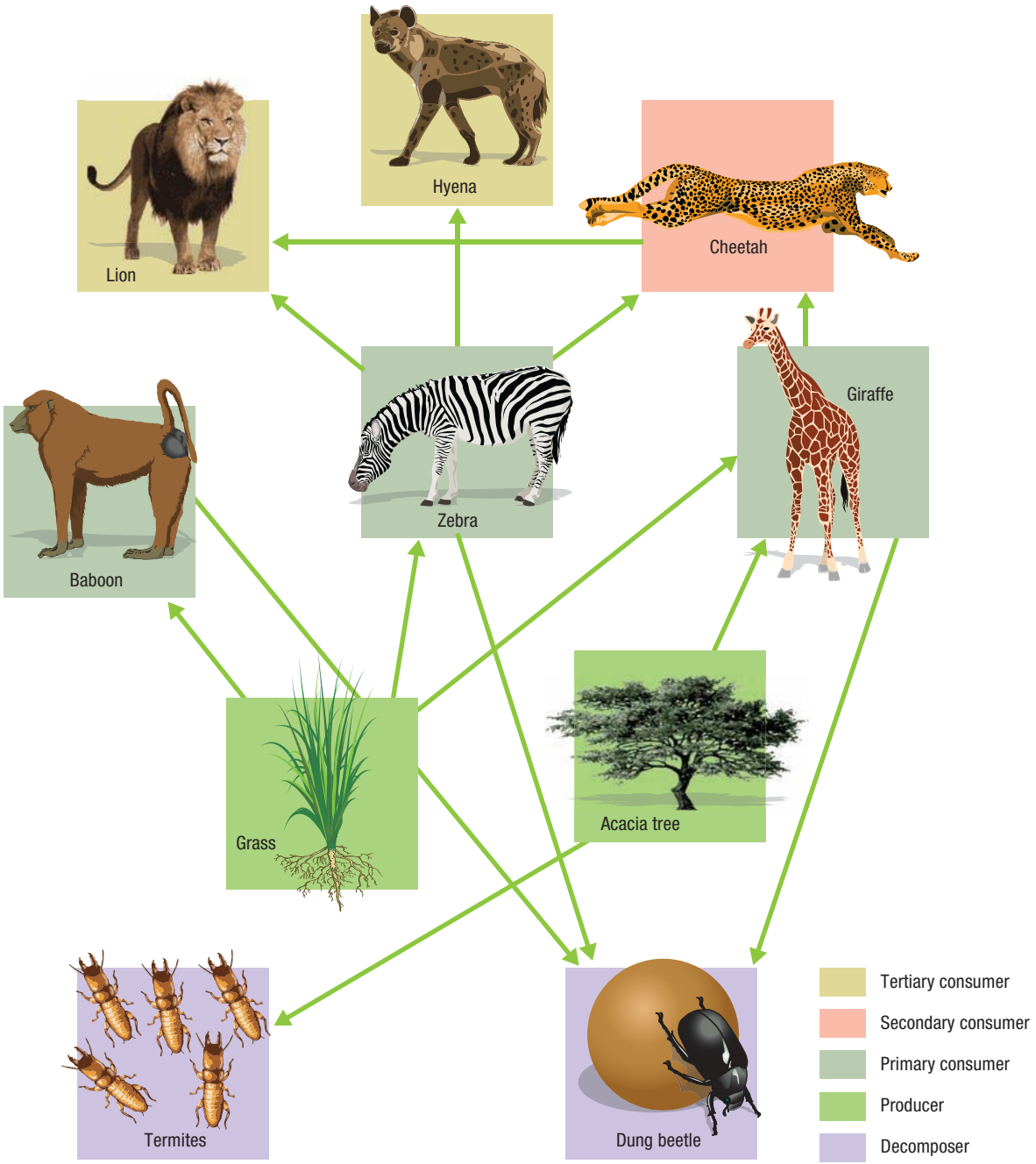

Source 2.19 More complex African savanna food chain

ACTIVITY 2.3

1 Australia has savanna areas. Explain why the Source 2.19 diagram doesn't work for the Australian savanna areas.

2 Source 2.19 is a more complicated interpretation of the same food chain, but still does not show the full extent of the relationships between the plant and animal communities of the savanna. For example, where do the hippopotamus, the warthog, the wildebeest, the ox-pecker and the gnu fit?

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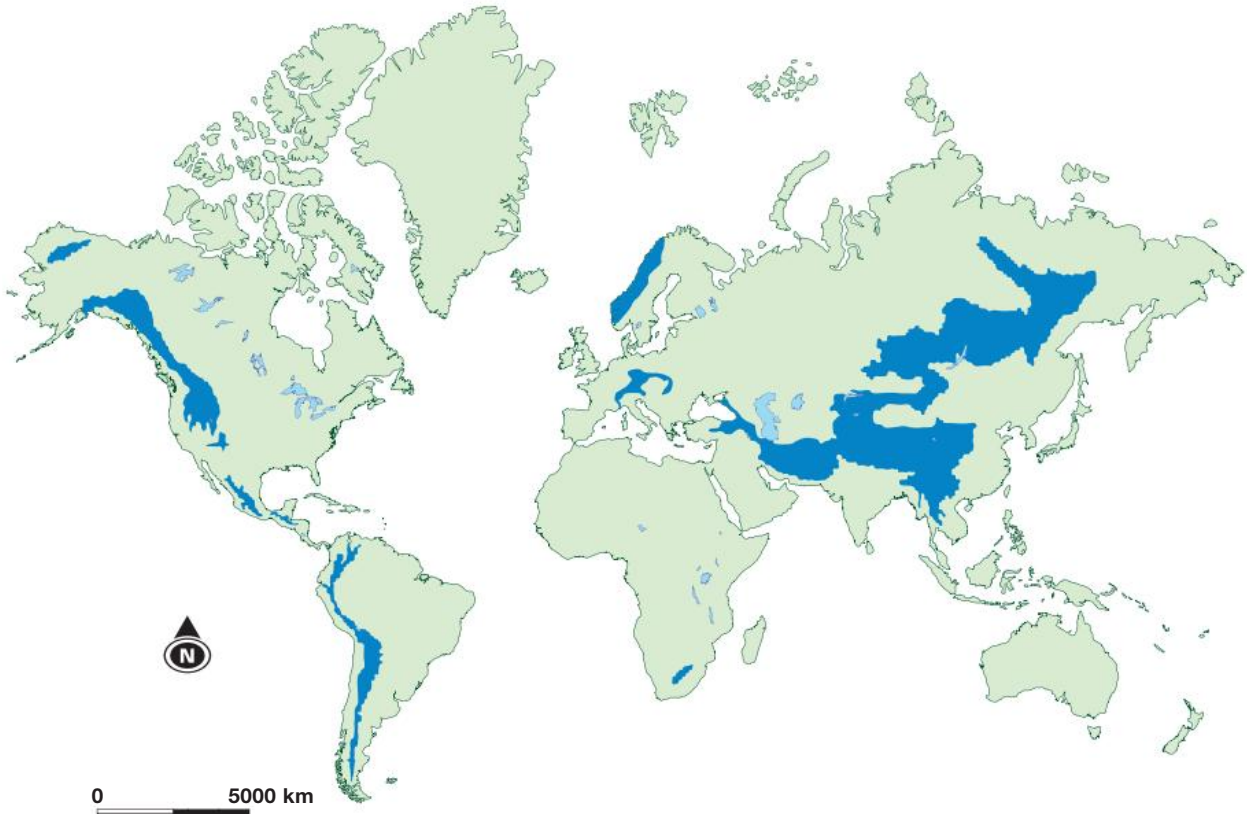
Though it has been impossible to cover all aspects of the savanna biome in this chapter, it has been established that:

- the vegetation community is distinctive
- the vegetation community responds to variations in climate, especially rainfall
- the animal life responds to the variations in the vegetation communities
- there are very complex relationships between the various animal communities.

2.5 Alpine biomes



Source 2.20 Alpine or mountain biomes

The alpine (or mountain) biome is the anomaly: it doesn't fit the pattern based on climate that has been observed to this point. As can be seen in Source 2.20, it stretches north and south from the Equator in North and South America and stretches east to west across the continent of Eurasia.

We need to take a different approach to examine this biome. In countries where mountains tower thousands of metres into the sky, a simple field trip from the base of the mountain to the top of the mountain would have shown the main characteristics of this biome. Australia doesn't have mountains that rise thousands of metres into the sky. Many Australians would not notice that vegetation patterns change with altitude, but they know where Australia's alpine areas are and they know that at certain times of the year the higher parts of Australia's eastern highlands are snow-covered.

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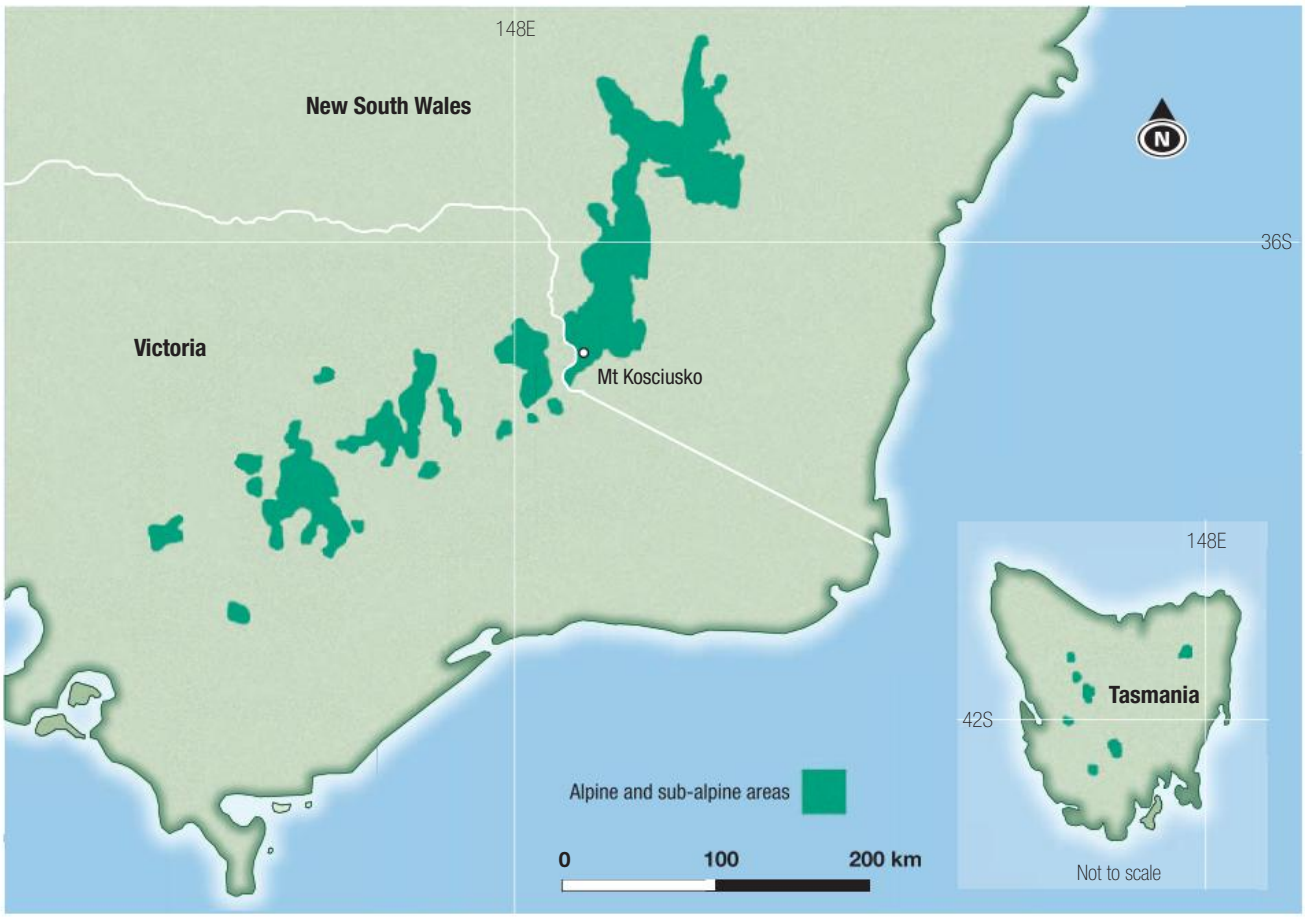


Source 2.21 Australia's ski fields

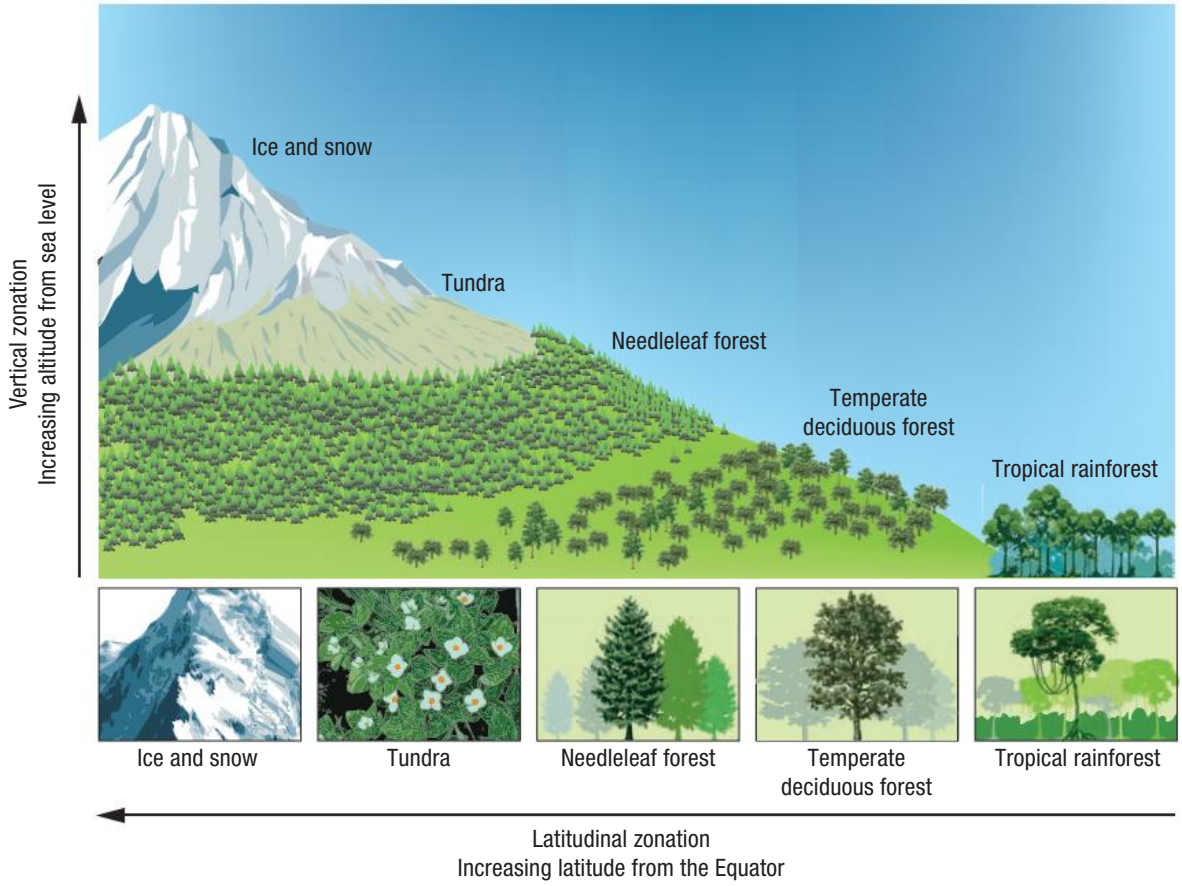
The world map (Source 2.2) did not show any alpine areas in Australia because the scale of the world map is too small. The alpine areas in Australia can only be seen on larger-scale maps.

The following images show some of the features of the alpine biome in Australia. It is clear that the vegetation changes as altitude increases. What happens in other parts of the world with 'real' mountains, which are normally over 3000 m high? Australia's highest 'mountain' is only 2228 m high.

Source 2.22 Vegetation in a valley close to the summit of Mt Kosciuszko, New South Wales

Source 2.23 Looking towards the summit of Mt Kosciuszko in summer

The study of Australia's 'mountain' biome shows that the vegetation changes as the altitude increases. Studies in other parts of the world show the same changes. For many places, models can be obtained that show the changes in vegetation as altitude increases far beyond the heights of mountains in Australia. Source 2.24 is one example of these models.



Source 2.24 Vegetation changes with altitude and latitude

zonation variation in plant life due to differing environmental conditions

Source 2.24 shows there is a change of vegetation with altitude (**zonation**). It also demonstrates that the same types of changes occur with changes in latitude. The relationship is simple:

- vegetation changes as altitude changes
- vegetation changes in a similar way as latitude changes between the Equator and the Poles.

There is a simple reason for this. Temperature decreases as altitude increases. Air expands as it rises, as it expands the pressure decreases, and as pressure decreases, air cools. This means that it is possible in some mountainous areas near the Equator to begin a mountain climb in rainforest and finish it at the top of a snow- and ice-covered peak.

Two other factors affect the vegetation pattern in mountain biomes.

Many mountain ranges are close to the coast. They block rain-bearing winds that move onto land from the sea and force these winds to rise. As the winds rise, the air cools and water condenses out of the air to form clouds. This often results in heavy rainfall, known as **orographic rainfall**. This can produce biomes associated with high rainfall, particularly rainforest, on the coastal sides of the mountains. The inland slopes of the mountains often receive little rainfall, so very different biomes, such as savanna and desert, may be found on these slopes. These areas are said to be in a rain shadow.

orographic rainfall rainfall produced when rain-bearing winds are forced upwards by mountain ranges; they then form clouds and (often) rain

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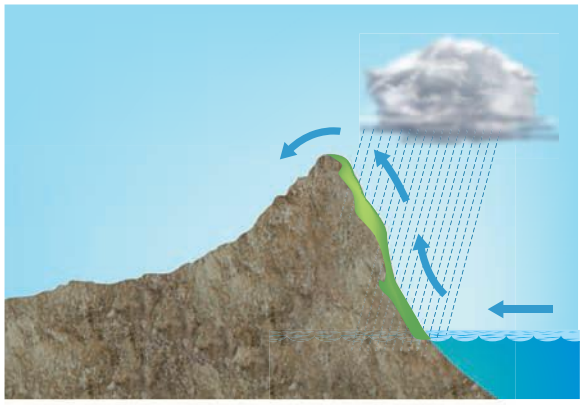
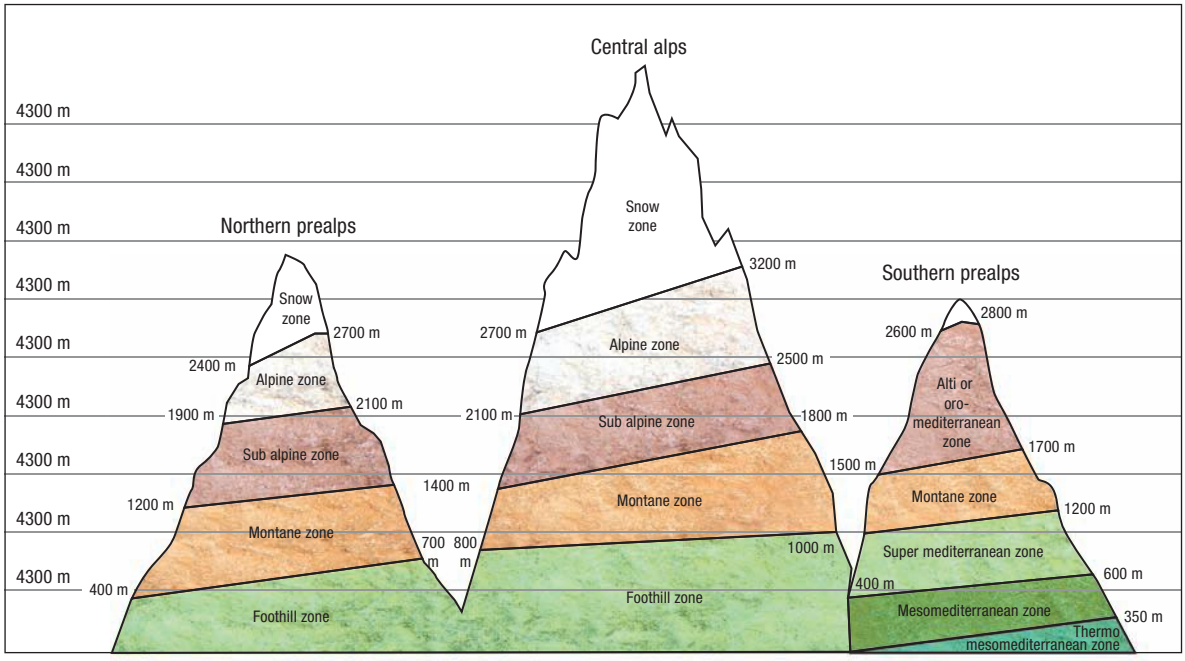
The other factor that makes mountain biomes so complex is the impact of the sun's rays as they warm the land. Mountain slopes that receive direct heat from the sun lose their snow cover quickly. Mountain slopes that do not are cooler, and have a slightly different vegetation pattern. This warming effect is known as **aspect**. It affects mountain biomes closer to the poles most: some slopes only receive sunlight for a few months of the year.

aspect the warming effect of the sun's rays on vegetation



Source 2.25 Impact of mountains on rainfall



Source 2.26 Influence of mountains on vegetation

Source 2.24 shows the different vegetation patterns associated with alpine biomes from the southern part of the Alps to the northern part of the Alps in Europe.

Geographical fact

The majority of animals in the alpine biome are warm-blooded. Such animals include the alpaca, the llama, the chinchilla and the snow goat.

ACTIVITY 2.4

1. Briefly describe the changes in vegetation shown in Source 2.24.
2. Describe the link between vegetation types and the amount of sunlight a mountain slope receives.
3. List other factors associated with changes in vegetation patterns that are demonstrated in this diagram.
4. Discuss how a warmer climate might affect mountain biomes.

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From Source 2.26 it is clear that this very small scale cannot show the changes of biomes on mountains. Koppen decided on a 'mountain' classification for climate, and that decision has been carried over into the mapping of the world's biomes. Imagine looking vertically down on Source 2.26, or go to Google Earth and look at the opening image, and see if you could identify changes in biomes in the world's mountainous regions. Of course you can see the changes if you zoom in, but that significantly alters the scale of the study. That change to a large-scale view changes the perspective of the study from globally distributed biomes to local ecosystems.

RESEARCH 2.3

The class needs to be divided into three groups, to study:

- the **coniferous** forest biome
- the temperate deciduous forest biome
- the tundra biome.

coniferous tree an evergreen tree that grows cones

Complete the following tasks, then give a short presentation of your findings:

1. Describe the vegetation character of the biome.
2. Identify the factors which have given rise to the development of the biome.
3. Identify the special adaptations plants have made to survive in the biome.
4. Examine the relationship between the plants and animals in the biome.
5. Discuss how animals have adapted to survive in the biome.

NOTE THIS DOWN

Copy the graphic organiser below and summarise what you have learned about biomes.

	Biomes		
Biome	Distinctive features	Special adaptations	Special relationships
Rainforest			
Savanna			

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Chapter summary

- Biomes are groupings of plant and animal communities that have adapted to inhabit particular parts of the Earth's surface.
- Before the domestication of plants and animals, the main factor that biomes had to adapt to was the world's changing climate; now, biomes also have to adapt to human interference.
- The major biomes of the world include the rainforest, savanna and desert biomes. Each biome has its own characteristics, according to its climate.
- The plant and animal communities of the world respond to variations in climate. These responses give the world this distinctive pattern of biomes.
- The rainforest biome is dominated by its plant life.
- The savanna biome is dominated by the response of its animal life to seasonal changes in rainfall.
- The alpine biome doesn't fit the pattern based on climate. It stretches north and south from the Equator in North and South America and east to west across the continent of Eurasia.

End-of-chapter questions

Multiple choice

1 Which of these is not a biome?

A Rainforests
B Deserts
C A pond
D Coniferous forests

2 Which of these is not found in the southern hemisphere?

A Coniferous forests
B Rainforests
C Deserts
D Savanna

3 Which of these is not a factor in the distribution of biomes on the Earth's surface?

A Temperature
B Asteroids
C Rainfall
D Altitude

4 Which of the following is not a carnivore?

A Elephant
B Hyena
C Lion
D Leopard

5 Which biome extends across all latitudes?

A Rainforest
B Desert
C Savanna
D Mountain

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Short answer

1 Compare the differences between a biome and an ecosystem.

2 Discuss some of the explanations for rainforest trees developing buttress roots.

3 Describe the causes of the major seasonal changes on the savanna and how they affect animal life there.

4 Identify the factors that cause the major changes in mountain biomes.

5 Explain why there are few seasonal changes in rainforest biomes.

Extended response

This chapter concentrated on one aspect of the world's biomes: their physical geography. The next chapter is a geographical study on a larger scale and will include the human geography side of the geographical equation. How might this chapter have been different if the human side had been given more emphasis? Look at only the three main biomes examined in this chapter – rainforests, savanna and mountains. Consider how these biomes may change when influenced by human behaviour.

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Source 2.27 Mariposa Grove Redwoods, Yosemite National Park

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3 Australian biomes

Source 3.1 Flora and fauna of the Australian outback

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Before you start

Main focus

This chapter will examine a range of Australia's biomes and how they have evolved to fit into the Australian environment.

Why it's relevant to us

The sale of Australia's resources – food and minerals – is a major source of income for the nation but it comes at a cost to the country's biomes.

Inquiry questions

- What are Australia's biomes?
- What factors influence the location of these biomes?
- How have humans impacted on these biomes?

Key terms

- Adaptation
- Biomes
- Deciduous
- Desert
- Ocean current
- Pneumatophores
- Rainforest
- Scale
- Temperate
- Torrid
- Xeric

Let's begin

Australia has developed a unique set of biomes because of its isolation from other continents for millions of years. As the Australian continent has drifted northwards over these millions of years, the flora and fauna which make up the biomes have adapted to the changing environment. At times large parts of the current continent were the floors of shallow seas, and at times the climate was very different. A completely different set of biomes existed in places that are now desert or semi-desert. Today's biomes are a result of climatic and altitudinal factors discussed in Chapter 2. Other local factors, together with the role of humans in the mechanics of a biome, will be discussed in this chapter.

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3.1 Australia's biomes using the geography concept of 'scale'

biomes groupings of plant and animal communities that have adapted to inhabit particular parts of the Earth's surface

temperate zones broad climate zones between the tropics and the poles

deciduous trees trees that drop their leaves each year, typically for winter

scale (on a map) the amount by which the real world has been reduced so that it fits onto the map

The examination of world **biomes** in Chapter 2 identified 5 biomes in Australia:

- tropical rainforest
- tropical seasonal forest/savanna
- **temperate deciduous** forest
- subtropical desert
- woodland/shrubland.

Chapter 2's examination of biomes was based on a map of the world with a very small **scale**. Small-scale maps can only show a certain amount of detail. The focus is now on the biomes found in Australia. This requires study at a much larger scale, where more detail can be shown.

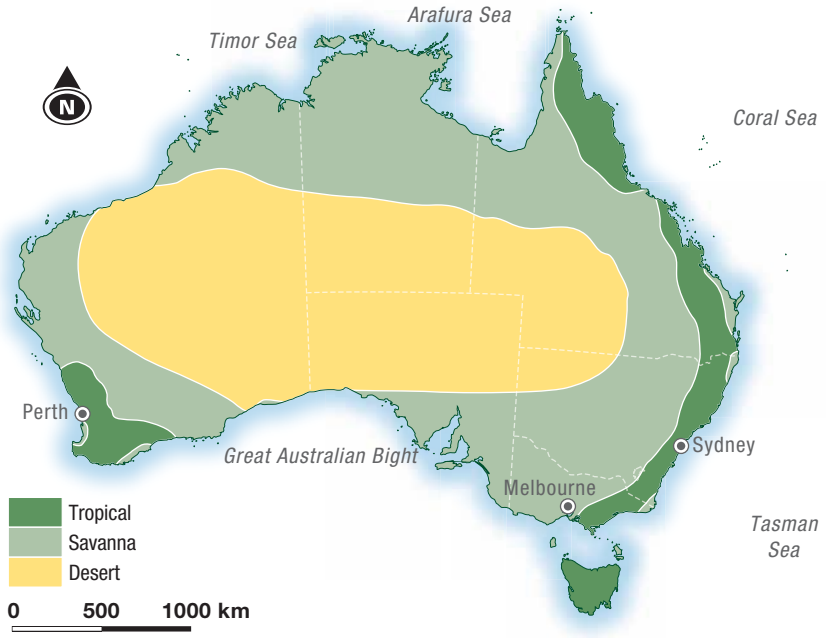
Here are two sources representing Australia's biomes. Which is better?

Source 3.2 is simple and uses the terms used in Chapter 2. Source 3.3 is more complex. There are more biomes identified, and they have more complicated names.

It is like classifying the world's population. There are two types of people – males and females. That is much like Source 3.2. But just think how many types of people those men and women could be divided into. That is more like Source 3.3. The task here is not to divide the world's population into different classifications, though; it is to look at the best way of examining Australia's biomes.

If Source 3.2 is used, it is clear that the study will be very general. Another issue with Source 3.2 is the terminology. The terms 'desert' and 'savanna' are fine, but defining the rest of Australia as 'tropical' is a problem. Perth, Hobart and Sydney are all in 'tropical' areas. Even Aristotle, who divided the world up into climate zones hundreds of years before Koppen, would not have considered these cities as being in 'tropical' areas. Aristotle's idea of '**torrid**' is now referred to as 'tropical'. Aristotle lived from 384 to 322 BCE, and of course had no idea of the existence of Australia or Antarctica.

torrid hot and dry



Source 3.2 Australia's biomes

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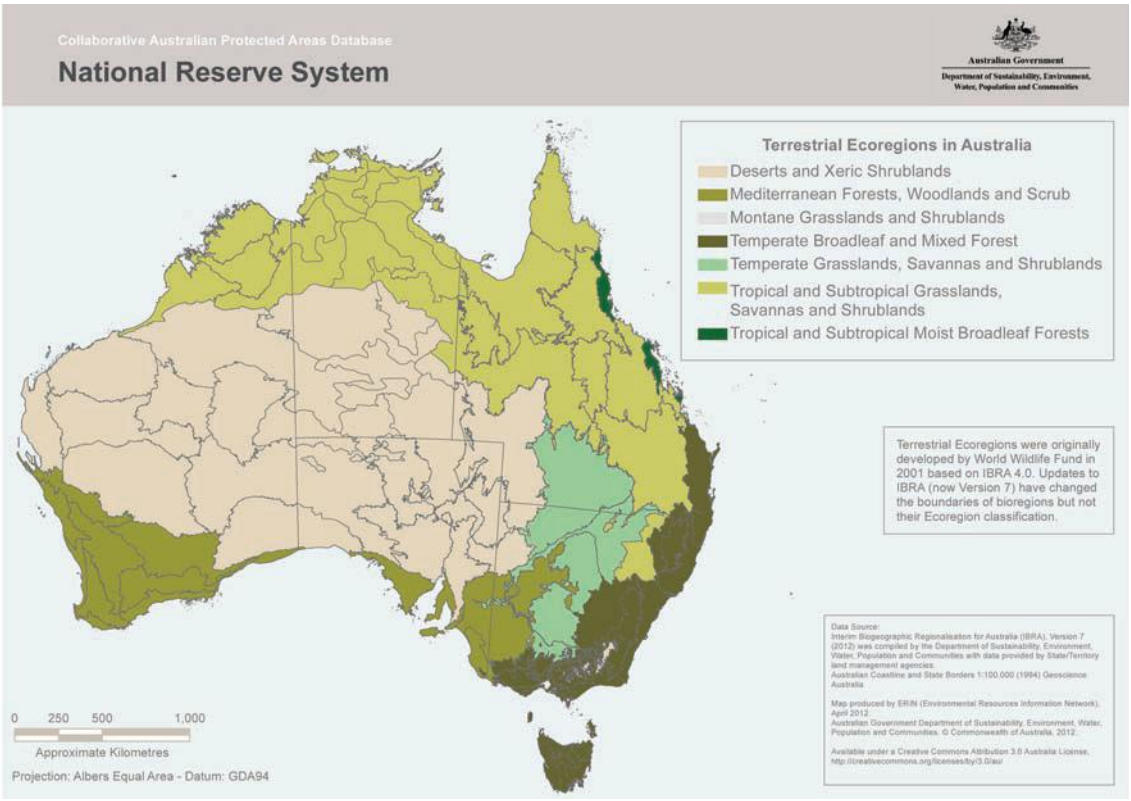
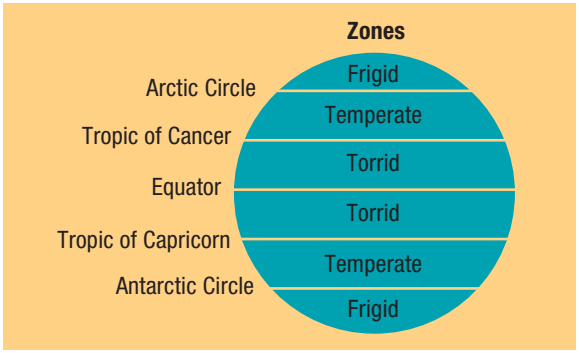


Source 3.3 Australia's biomes



Source 3.4 Aristotle's world climate zones

Source 3.3 identifies 7 biomes on the Australian continent. There are some broad links to the biomes identified in Chapter 2. Let's revisit these:

World biome	Australian biome
Tropical rainforest	Tropical and sub-tropical moist broadleaf forests
Tropical seasonal forest/savanna	Tropical and sub-tropical grasslands, savanna and shrubland
Temperate deciduous forest	Temperate broadleaf and mixed forest
Woodland/shrubland	Mediterranean forests, woodland and scrub
Sub-tropical desert	Deserts and **xeric** shrublands

xeric extremely dry, or adapted to extremely dry conditions

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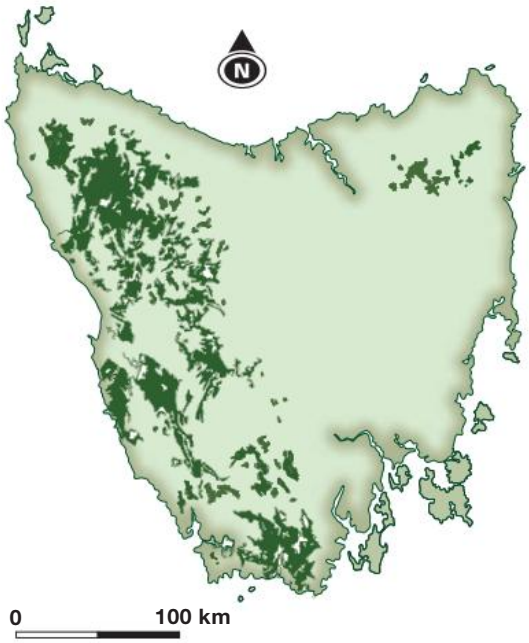
It is immediately clear that there are also differences. When biomes are examined at this scale, there are more of them, and the biomes are more likely to include more than one vegetation type, such as 'savanna and shrubland', or 'deserts and xeric shrublands'. Where do the terms 'broadleaf, Mediterranean and xeric' come from and what is a 'mixed' forest? Follow these up to find their meanings.

These issues simply relate to the scale at which a study is being undertaken: a global study of biomes is made at a very small scale but a study of biomes in Australia can be made at a larger scale. Eventually, if the focus was like zooming in with Google Earth, the scale would be so large that it would no longer be a study of biomes but a study of ecosystems.



Source 3.5 Tasmanian rainforest areas

3.2 Distinctive Australian biomes

Rainforests

Rainforests are tourist magnets. It is interesting to look at maps of Australia and see where there are areas of rainforest. Source 3.2 makes it look as if the 'tropical' biome extends right down the east coast of Australia to Tasmania and across to Western Australia.

The issue is complex. How do you define 'rainforest'? Is it simply an area that is wet and has a forest cover? Or is it more than that?

There is clearly a problem with the definition of 'rainforest'. Is the term being used to describe any type of forest found in a wet area? Is it the amount of rainfall or the characteristics of the vegetation that defines the biome? A 'rainforest', according to climate definitions, has to have an annual rainfall of more than 4000 mm.

Source 3.6 Tasmanian rainforest

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RESEARCH 3.1

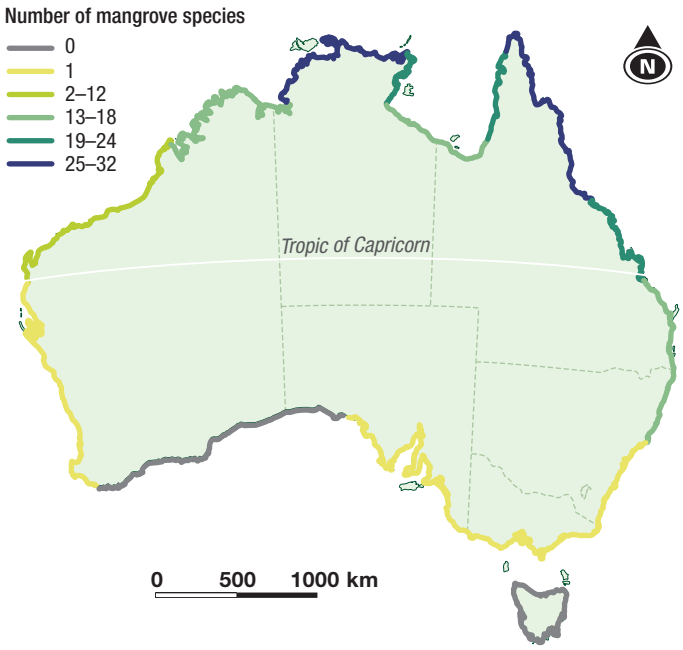
Make a list of the features of a rainforest identified in Chapter 2. Use the list to examine the image of a Tasmanian rainforest in Source 3.6.

- How many features of a rainforest can be seen in the photo?
- Which features in the image are not on the list of rainforest features?
- What difference would it make if the descriptive words were 'vine forest' rather than 'rainforest'?

Many vegetation geographers or biogeographers prefer the term 'vine forest' for the forests of north Queensland, as it is an indicator of the type of vegetation. However, the term 'rainforest' is very well known and will probably remain. It is worth knowing that there are different ideas about rainforests around the world.

Mangrove forests

Mangrove communities are a very distinctive biome worldwide but they don't make it onto the small-scale maps because the communities are found on narrow stretches of coastline. Source 3.7 shows the distribution of mangroves around the Australian coastline. It provides a few ideas on what factors affect the distribution of mangroves.



Source 3.7 Australia's mangrove communities

ACTIVITY 3.1

Identify the following statements as either TRUE or FALSE.

1. Mangroves are found right around the coast of Australia.
2. Only one species of mangrove is found south of the Tropic of Capricorn.
3. Queensland has more mangrove species than New South Wales.
4. There are no mangrove species in Tasmania.
5. Mangroves are a tropical plant.

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Source 3.8 Mangrove community at Hays Inlet, off Moreton Bay, Queensland

Source 3.9 The Great Australian Bight, where sand dunes and limestone cliffs face the relentless swells of the Southern Ocean and no mangroves are found

Source 3.8 shows part of the mangrove community found around the shores of Moreton Bay. If you holiday at Surfers Paradise, you will not see mangroves growing on the beaches there. The coastline is too active, as it is open to strong wind and wave action.

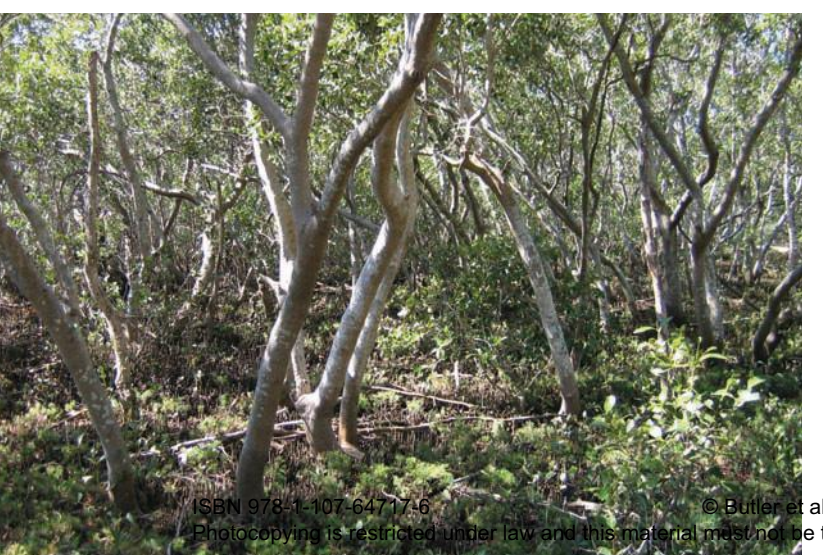
There are no mangroves on the western side of the Great Australian Bight because it is a long stretch of coastline with few bays and the waters are too rough for mangroves to establish there. There are no mangroves in Tasmania because the temperatures are too low even for *Avicennia marina*, the one species of mangrove which can tolerate cooler waters.

Mangrove communities grow in quite calm salty waters. They are very similar to rainforests.

Mangrove communities are very dense, and many have a closed canopy. This cuts out light to the lower layers so that there is no competition from various other species. The mangrove communities drop a lot of litter – leaves and branches – and this decays and provides plant nutrients. The lower layer is usually made up of young seedlings waiting their turn to fill a gap in the canopy. Like the trees in a rainforest, mangrove plants have many **adaptations** which help them survive in their difficult environment: Source 3.11 shows the buttress roots of Queensland's Red Mangrove, which helps support the plant in this muddy environment, and Source 3.12 shows

adaptation an evolutionary trait a plant or animal develops to better suit its environment

Source 3.10 Hays Inlet mangrove community



Source 3.11 Buttress roots of the Red Mangrove in north Queensland

Source 3.12 Breathing roots of the *Avicennia marina* (Gray Mangrove)

Source 3.13 Mangrove roots extend into Deception Bay and trap more silt and mud.

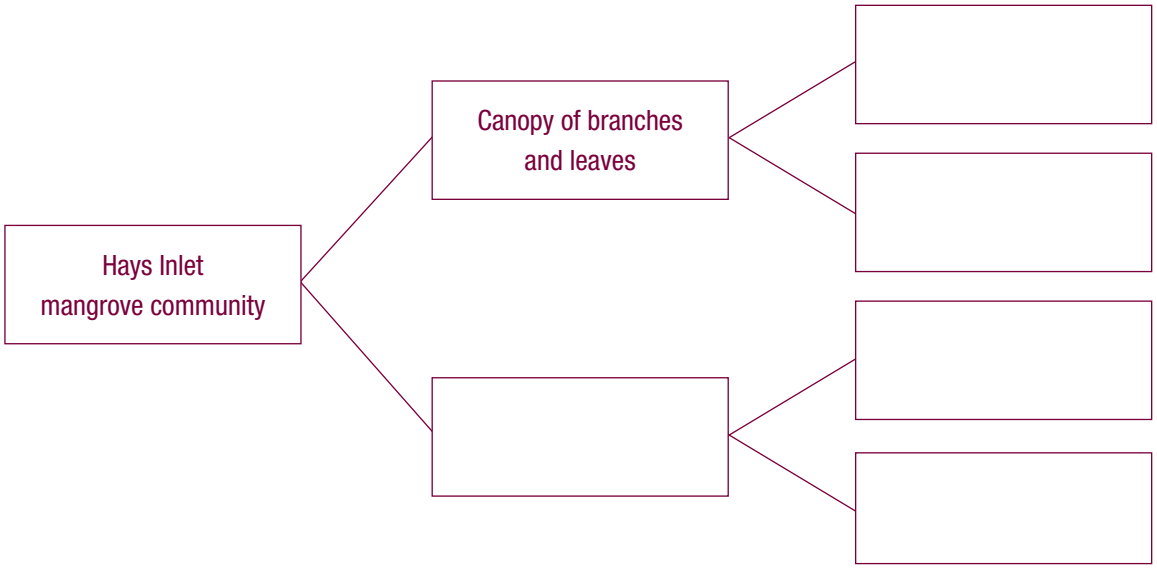
pneumatophore a 'breathing root' that helps mangroves survive at high tide

the special root system that many mangrove plants have developed. These are breathing roots, which assist as the tide comes in and eventually covers the root system completely. These roots are known as **pneumatophores**.

Source 3.12 also shows another important feature of the mangrove plant. The root system traps silt and mud and builds the land up. Source 3.13, taken in Deception Bay, Queensland, shows the mangrove root systems extending into the bay and building the land up.

NOTE THIS DOWN

Copy the graphic organiser below and use the list of rainforest features you noted in Research 3.1, and Sources 3.10–3.14, to explore the Hays Inlet mangrove community.



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As the land is built up, the environment changes. The land is less likely to be inundated by salt water, so other plant species are able to colonise the area. This results in a transition from one biome to another. In this case the transition is to salt marsh plants, which have their own ways of combating salt, then to Casuarina forest, and then to the climax vegetation, Eucalypt forest. These changes can occur in the space of a couple of hundred metres, which means they do not show on the small-scale maps of world biomes.

Geographical fact

Without mangroves many of the seafoods that we enjoy – prawns and many species of fish – would disappear from our shops and our tables.

An interesting factor to add here is the impact of rising sea levels. Examine Sources 3.14 and 3.15.

The king tides only reach this area on a few days of the year. In Redcliffe (Queensland) these tides occur in January and February. Plants growing in this area, including the mangroves, have to adapt to this inundation. Source 3.16 shows the mangrove community at the maximum king tide level.

Source 3.14 Incoming king tide covering the area inland of the Hays Inlet mangroves

Source 3.15 King tide at close to its maximum

ACTIVITY 3.2

1 Suggest what the impact on this plant community would be if the sea level was always as high as shown in Source 3.15.

2 Discuss other possible future scenarios for this plant community.

Source 3.16 King tide on the Hays Inlet mangroves

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ACTIVITY 3.3

1. Explain why the term 'rainforest' should be used more carefully.
2. Analyse why people in places far from the tropics consider their forests 'rainforests'.
3. Describe how mangroves have adapted to growing in salty water.
4. Compare the mangrove communities of South Australia and the mangrove communities of north Queensland.

Deserts

A desert is defined by having one of the following two climate features:

- 250 mm of annual rainfall (or less)
- vegetation covering less than 50% of the ground.

The following research activity will show you how Australia's desert biomes have developed.

Geographical fact

Oceans make up 71% of the Earth's surface. This means 29% of the Earth's surface is land. Deserts make up 33% of the land's surface area. In other words, deserts make up one-third of the land's surface area.

RESEARCH 3.2

Choose one of the following topics:

- the animals that live in desert areas and how they manage to survive
- the plants that live in desert areas and how they manage to survive
- the way of life of the people who live in desert areas and how they manage to survive.

Use the internet and your school library to research one of these topics, then prepare a PowerPoint presentation for the class.

RESEARCH 3.3

Consider the role of people in changing biomes. It is easy to change an ecosystem. It can be catastrophic to change a biome. Many of Australia's biomes are similar to those in other parts of the world – deserts and savanna – but they are also very different. Discuss one of the research topics below and present your research in a short essay.

- Management of Australia's biomes has improved as people have started to learn from the way the Indigenous people managed the environment (focus on Eucalypt forests).
- The 'prickly pear' was introduced to Australia as a garden plant but soon became feral.
- Rabbits were introduced to Australia for sport and once released into the wild soon became feral.
- Australian camels are considered a superior breed to their forebears from the deserts of the Middle East but are often regarded as feral animals in Australia.

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3.3 Factors affecting Australian biomes

Chapter 2 identified climate as the main factor affecting the global distribution of biomes. Examining biomes at a larger scale allows for the closer examination of other factors which affect the distribution of biomes on a more local scale.

Mountain ranges

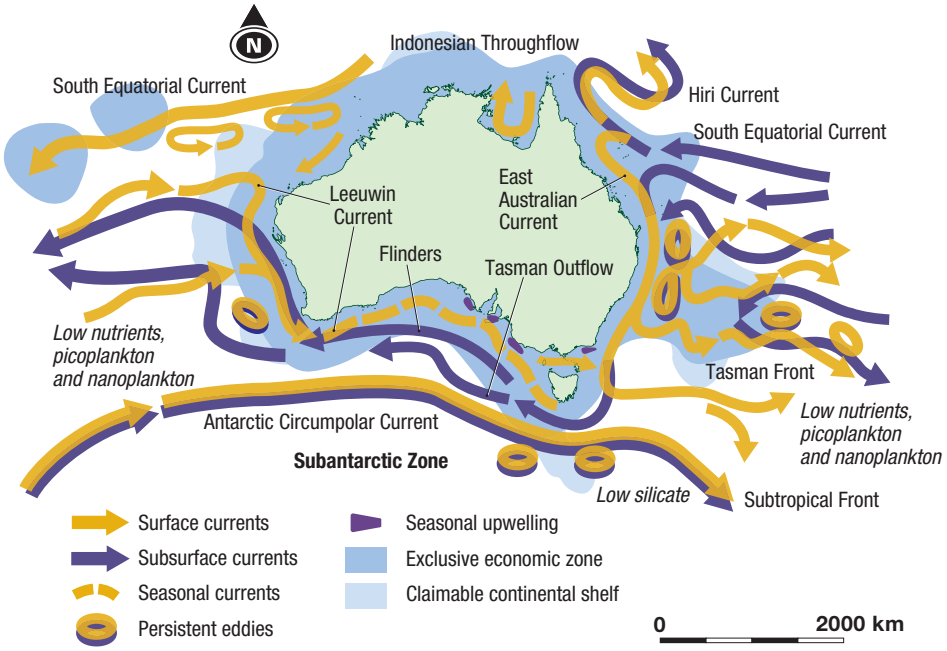
The pattern of biomes along Australia's east coast is influenced by the location of the Eastern Highlands, or the Great Dividing Range. This set of mountains, even though it is not high by world standards, has an orographic impact on the circulation of wind and the accompanying rainfall. Winds blowing in off the ocean are forced to rise, and they drop their moisture on the eastern side of the range. Source 3.2 and Source 3.3 show the effects of this. The sources show a narrow coastal vegetation pattern and a different vegetation pattern immediately to the west of the range.

Ocean currents

ocean current the regular movement of water in the ocean in a particular direction

The other impact on biomes which can be found by examining biomes at a larger scale is that of **ocean currents**. Source 3.17 is a detailed image of Australia's ocean currents. Fans of *Finding Nemo* will immediately see the East Australian Current (EAC) which took Nemo's father, Marlin, south on his adventure.

What needs to be examined is where the currents are coming from, as this affects the temperature of the water and therefore the temperature of the air above them. The EAC is a warm current. It flows from north to south along the east coast of Australia. This warm current will warm the air above it, causing it to expand. As air expands, it can absorb more molecules of water, so the air moving across this current towards the Eastern Highlands holds lots of moisture. This is compressed when the air cools as it rises over the Eastern Highlands. The result is simple: lots of rainfall on the eastern side of the Eastern Highlands and much less on the western side.



Source 3.17 Australia's oceanic currents

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On the other side of the continent the situation is more complex. The western side of Australia does not have a clear annual oceanic flow. The South Equatorial Current (SEC) is blocked by currents flowing north from Antarctica. These waters are much colder, and they also have an impact on the air flowing over them. Cold air does not pick up moisture from the ocean and so is unlikely to bring rain. As the air passes over the land it is warmed, and is therefore able to absorb moisture, making rain even less likely.

ACTIVITY 3.4

1 Using an atlas, locate the following:

- **a** the Atacama Desert
- **b** the Kalahari Desert
- **c** the types of ocean currents that flow off-shore of these areas.

2 What is the relationship between the location of the desert and the type of ocean current flowing along the coast?

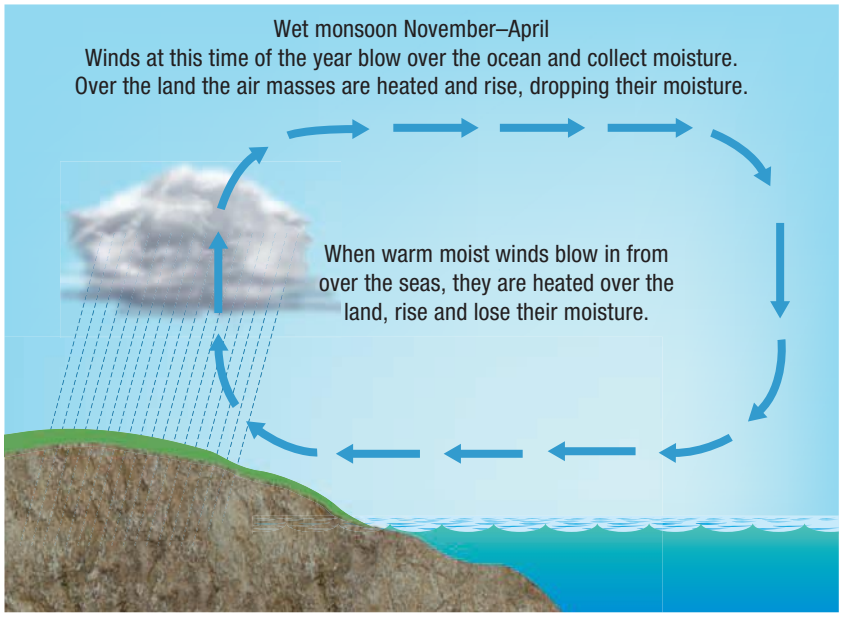
Seasonal air mass movements

Monsoons

Northern Australia experiences a seasonal change in weather as Earth's changing location in relation to the sun makes the sun appear to move north and south of the Equator. Air masses are affected by this: areas of low pressure move north as the sun appears to move north (to the Tropic of Cancer) and south as it appears to move south (to the Tropic of Capricorn). This affects the biomes in this part of Australia.

When the sun appears to be over Australia's Tropic of Capricorn, it warms up the land there and causes the air above it to rise. This rising air draws in moisture from the surrounding sea bodies and rainfall occurs. This promotes growth, especially of the grasses of the savanna areas of northern Australia. This is the time of the 'wet' monsoon.

When the sun appears to be over the Tropic of Cancer, in the northern hemisphere, low



Source 3.18 Wet monsoon season

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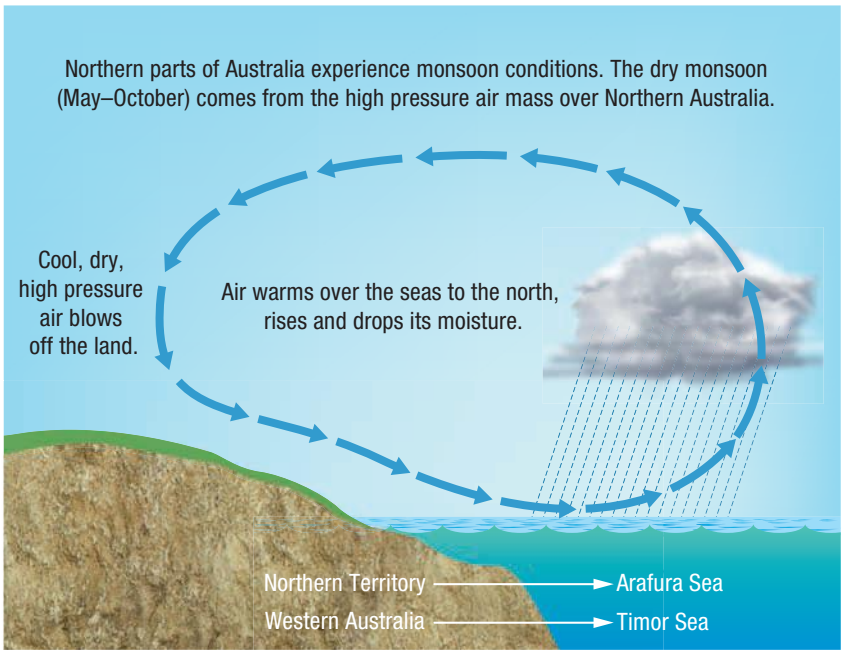

Source 3.19 The dry monsoon

pressure air moves northwards and dry, stable, high pressure air takes its place over the Australian continent. This high pressure air comes from central Australia; it does not contain moisture and is cold, and so it descends. The dry period begins, and continues until the sun again appears to be over the Tropic of Capricorn. Sources 3.18 and 3.19 show how this seasonal change operates.

NOTE THIS DOWN

Copy the graphic organiser below and outline how wet and dry monsoons form.

WET MONSOONS

The sun over Australia's Tropic of Capricorn warms up the land	→		→		→		→		→	

DRY MONSOONS

	→		→		→		→		→	

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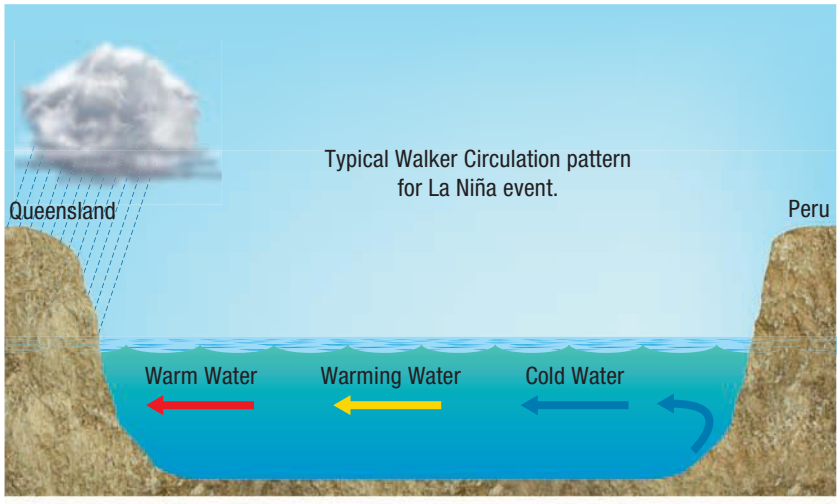
El Niño – La Niña

El Niño extensive warming of the eastern and central Pacific Ocean, leading to an increased possibility of dry conditions in eastern Australia

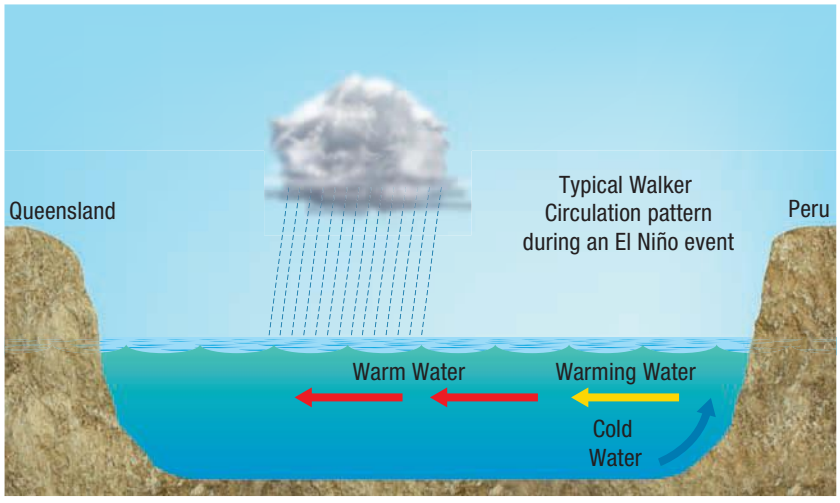
La Niña cooling of the central and eastern Pacific Ocean, leading to an increased possibility of wet conditions in eastern Australia

Weather patterns associated with **El Niño** and **La Niña** events may have more unpredictable impacts on biomes. The monsoons are an annual event, but El Niño and La Niña weather events can last much longer. These events can bring flooding rain, or crippling drought, to northern and eastern Australia. They are predictable, which is of great help to Australian farmers: they can work out when to plant their wheat crop and when to expect rain to start the crop. However, the duration and intensity of these events are not so predictable.

They are driven by air mass movements generated by cold ocean currents flowing north along the coast of South America. If the flow of the current is strong, eastern Australia will experience a La Niña wet weather pattern; if the current is weak, eastern Australia will experience an El Niño dry weather pattern.



The Walker Circulation is named after Sir Gibson Walker, who described relationships between seasonal variations in climate patterns in the Asia-Pacific region.



Source 3.20 El Niño and La Niña weather patterns

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ACTIVITY 3.5

1. Explain why vegetation cover, rather than the amount of rain that falls in a year, should be used as the method of identifying a desert area.
2. Analyse the similarities and differences between how plants and animals cope with desert conditions.
3. Explain how monsoons affect Australia's biomes.
4. Examine how El Niño and La Niña events affect Australia's vegetation patterns.

Case study 3.1

The loss of Australia's rainforests to sugar cane

Australia has for many years been one of the world's major suppliers of sugar. Australia is the third largest raw sugar supplier in the world: it produces $2 billion worth of sugar each year. Sugar cane was brought to Australia with the First Fleet in 1788. Early plantings were in river valleys in New South Wales, but the industry began to flourish once areas along the Queensland coast were opened up. In Queensland the industry's development was helped by cheap labour brought to Australia from neighbouring Pacific Islands. However, many of these Pacific Islanders were brought to Australia against their will, and when the Commonwealth of Australia was proclaimed in 1901, laws were passed to stop the practice. Since that time the industry has undergone many changes.

Rainforests have been cleared for sugar cane; it needs to be grown in high-rainfall or irrigated areas along coastal plains and river valleys. The amount of land used for sugar cane production has increased rapidly and this increase is predicted to continue. Sugar cane production occurs between the Great Barrier Reef and the wet tropics of Queensland. As more land is cleared for production there are risks that areas and habitats will be negatively affected.

Canegrowers is the industry group that represents the majority of cane growers, and supports sustainable sugar cane production to minimise impact on Australia's rainforests. Tactics include leaving more plant residue undisturbed on the surface to reduce surface water runoff and soil erosion, and less frequent tillage, which also reduces the amount of energy farmers use to run tractors, reducing costs and saving resources. Even with these practices, though, some areas of Queensland are still in danger.

There are other practices used in the sugar cane industry that were once thought of as great advances, but that we now recognise as dangerous to parts of our environment. The article opposite, for instance, shows the damage that is being done by one particular pesticide.

Sugar cane production is very important to Australia's economy and agriculture, but it does affect the environment. Canegrowers and other groups strive to educate others about sustainable sugar cane production and to minimise the industry's impact on the environment.

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Pesticides and sugar cane

The Queensland and Federal Government's first report card on water quality in the Great Barrier Reef has found pesticides used in agriculture are causing significant problems for the reef.

The report says some farmers need to be more careful with their chemicals, finding that nearly one-quarter of horticulture producers and 12 per cent of graziers are using practices considered unacceptable by industry and the community.

In the case of the sugar cane industry, roughly one-third face the same criticism. Nick Heath from the World Wildlife Fund Australia says the sugar cane industry in the wet tropics had a 72 per cent rate of 'unacceptable practice'.

Mr Heath says the report shows government needs to further limit the use of chemicals, and he has called for a ban on the weedkiller Diuron.

'Pesticides have been found at toxic concentrations up to 60 kilometres inside the World Heritage area [of the Great Barrier Reef] and at concentrations known to harm coral,' he said.

'And you may be aware that there's a big die-off in turtle and dugong numbers at the moment as a result of the floods. Those floods are carrying these pollutants and they're basically destroying the sea-grass beds of Queensland.'

But the sugar cane industry's peak body, Canegrowers, says the data reflects practices of a few years ago, and says there has been significant change since then.

Source 3.21 Pesticides hurting Great Barrier Reef: report (ABC Online, 15 August 2011).

1. Discuss why the rainforests were cleared to allow for the growth of sugar cane.
2. Explain why Queensland is such a suitable state for sugar cane production.
3. Describe why the production of sugar cane may affect Queensland's Great Barrier Reef.
4. Suggest why it is important for sugar cane producers to leave soil undisturbed as much as possible.

Source 3.22 Sugar cane fields in Australia

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FIELDWORK 3.1 EXPLORING YOUR LOCAL BIOME

The purpose of this exercise is relate your local biome to the larger picture of biomes in Australia.

Aim

To analyse your local biome, link it to the wider Australian scene and examine the human impacts on this biome.

Method

Select an area of parkland, nature reserve or national park in your locality.

Preparation

Find a map of the area and indicate the places that will be visited and studied. You will also need to take a camera, a list of questions based on the 'data collection' section below, paper, a clipboard and a pen. Make sure you are appropriately dressed, with hat, full cover clothing and enclosed shoes, and that you have insect repellent.

Data collection

As you travel along the suggested path on this fieldwork trip, stop at various sites and collect the following information in preparation for your fieldwork report:

1 What is the major biome that this area is part of?

2 What characteristics of this biome can be found in this area? Take photos.

3 List all the ways in which the area is used. Take photos of these activities. Mark the location of these activities on your blank map. Provide a key to display your data collection. Are these activities active or passive? How often would the area be used for these activities? What is the major activity in the area?

4 To what extent does the location of the area being studied influence the types of activities in the area?

5 To what extent is the location of the area being studied influenced by the types of activities in the area?

6 Describe the positive and negative and short-term and long-term impacts of these activities on the area.

7 Sketch or photograph two examples of the ways in which the use of the area has affected the environment. Annotate your sketch with as much information as possible about the use and its impact.

8 Observe the human features surrounding the area. Describe how these are used.

9 List some of the management strategies you observe in the area. Determine whether the strategy is working or not and explain your reasoning. Suggest a new strategy for one of the impacts you identified in item 7.

Fieldwork presentation layout

Front page	Title and name
Contents page	Do this last, once you have numbered the pages
Page 1	Aims and methods
Page 2	Location map
Page 3	Introduction – brief description of the study site
Pages 4–5	Description of uses (and photos)
Page 6	Table of uses: effects of use (positive or negative, short-term and/or long-term)
Pages 7–8	Description of effects of use (and sketches and/or photos)
Page 9	Association between use and effects of use
Page 10	Table or written description of management strategies
Page 11	Photos or sketches of management strategies
Page 12	Evaluation of these strategies
Page 13	Appendix, bibliography, glossary

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Chapter summary

- Because of its isolation from other continents, Australia has developed a unique set of biomes.
- As the Australian continent has drifted northwards over millions of years, the flora and fauna that make up the biomes have adapted to changing environments.
- The pattern of biomes in Australia largely reflects the rainfall distribution map.
- Ocean currents along the western side of the continent affect biomes inland.
- The mountain ranges along the east coast affect the pattern of biomes along Australia's east coast.
- The largest biome in Australia is the desert biome: 18% of Australia's mainland is desert.
- There is only a small area of alpine biome in Australia because Australia does not have very high mountains.
- Mangrove communities are found in many sheltered waters and are very dense communities, often with a closed canopy.

End-of-chapter questions

Multiple choice

1 Which is Australia's largest biome?

A Rainforest
B Alpine
C Desert
D Mangrove

2 Which biome is found in the highest areas?

A Alpine
B Mangrove
C Desert
D Savanna

3 Which biome is found in salty waters?

A Desert
B Savanna
C Mangrove
D Mediterranean

4 What would occur in the northern Australian biomes if the monsoon rains failed?

A Grasslands would die
B Trees would be stressed
C Wildlife would die
D All of the above

5 Which part of Australia is most impacted by La Niña weather patterns?

A Tasmania
B Victoria
C South Australia
D Queensland

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Short answer

1 Describe the biome you would be in if you were walking around Uluru.

2 Explain which biome surrounds the desert biome.

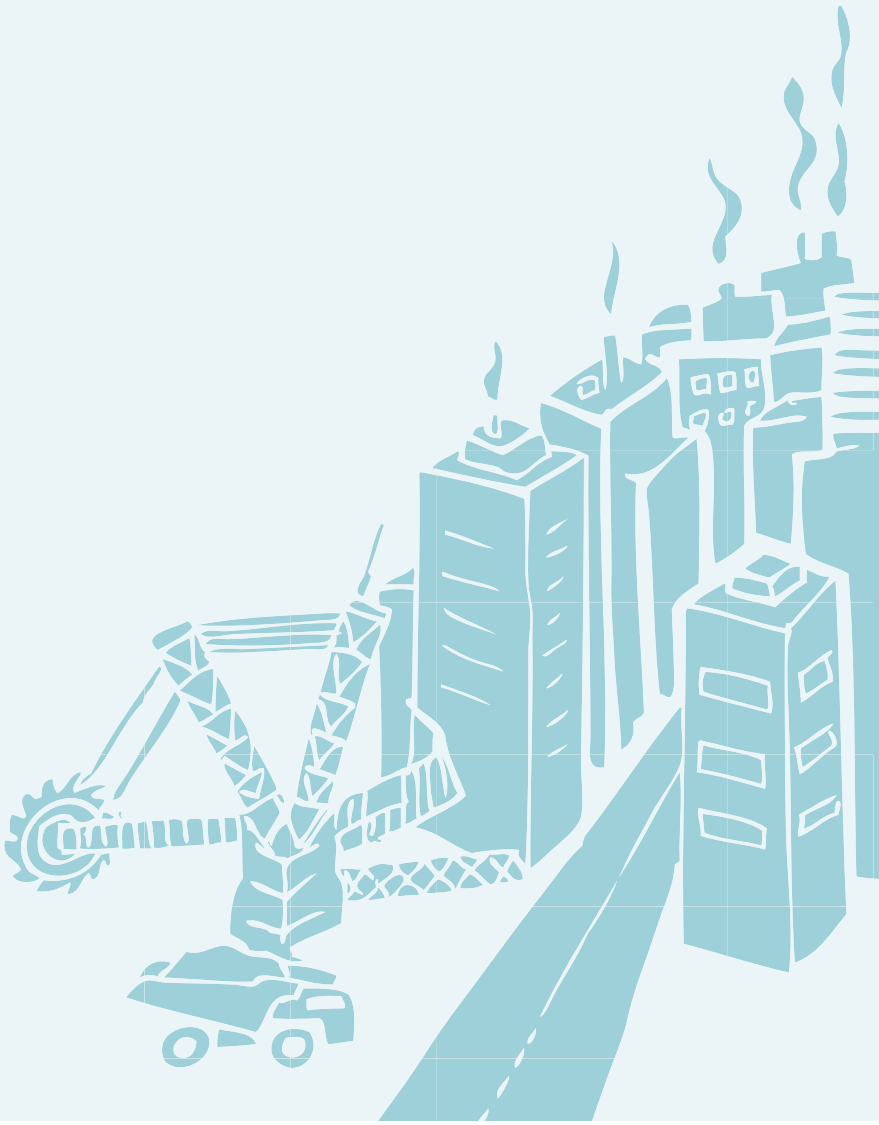
3 Identify which biome is only found in New South Wales and Victoria. Discuss why.

4 Identify which biome extends from the tropical to the cool parts of Australia. Discuss why.

5 Name and describe the mountains in Australia that have the main area of alpine vegetation.

Extended response

Desertification was identified by the United Nations as a cause for international concern in 2006. 'Desertification' is the term used to describe the expansion of desert areas into surrounding savanna regions. It has been linked to both changes in climate and changes in land use. Discuss the situation in relation to desert regions in Australia. Present your discussion in a short essay.



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Source 3.23 An example of desertification caused by soil erosion resulting from overgrazing.

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4 Biomes and food production

Source 4.1 A buffalo herder

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Before we start

Main focus

People depend on biomes for food, clothing and shelter, and a wide range of other products.

Why it's relevant to us

It is important to preserve biomes for future generations.

Inquiry questions

- How do people use biomes?
- What impact do people have on biomes?
- How can biomes be preserved for future generations?
- What is the role of rice production for food and income security in Southeast Asia?
- What are the factors that affect rice yields, and is rice production environmentally sustainable?
- How are changing farming practices, particularly new technologies, positively and negatively affecting rice production and the environments in Southeast Asia?

Key terms

- Extensive agriculture
- Green Revolution
- High-yield varieties (HYVs)
- Hunting and gathering
- Intensive agriculture
- Irrigated rice
- Rain-fed rice
- Rice fields
- Rural–urban migration
- Sequent occupance
- Shifting cultivators
- Soil nutrients
- Staple crop/food
- Sustainability
- Shifting cultivation

Let's begin

The biomes of the Earth's surface provide food, clothing and shelter to all of the Earth's 7 billion inhabitants. These inhabitants – us – make different demands on these biomes. Some people live in harmony with the biome in which they live. Many of us rely on biomes far removed from where we live for our food, clothing and shelter; otherwise there would not be Woolworths, Coles, Myers, David Jones, Harvey Norman and Ikea.

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4.1 World land use

Humans use biomes across the globe to produce goods that can be used for food, clothing and shelter. Humans also adapt and change biomes across the world to produce goods that can be used for food, clothing, shelter and energy. Two sentences, two different outcomes. The key words are 'use' and 'adapt' and 'change'.

How people use biomes

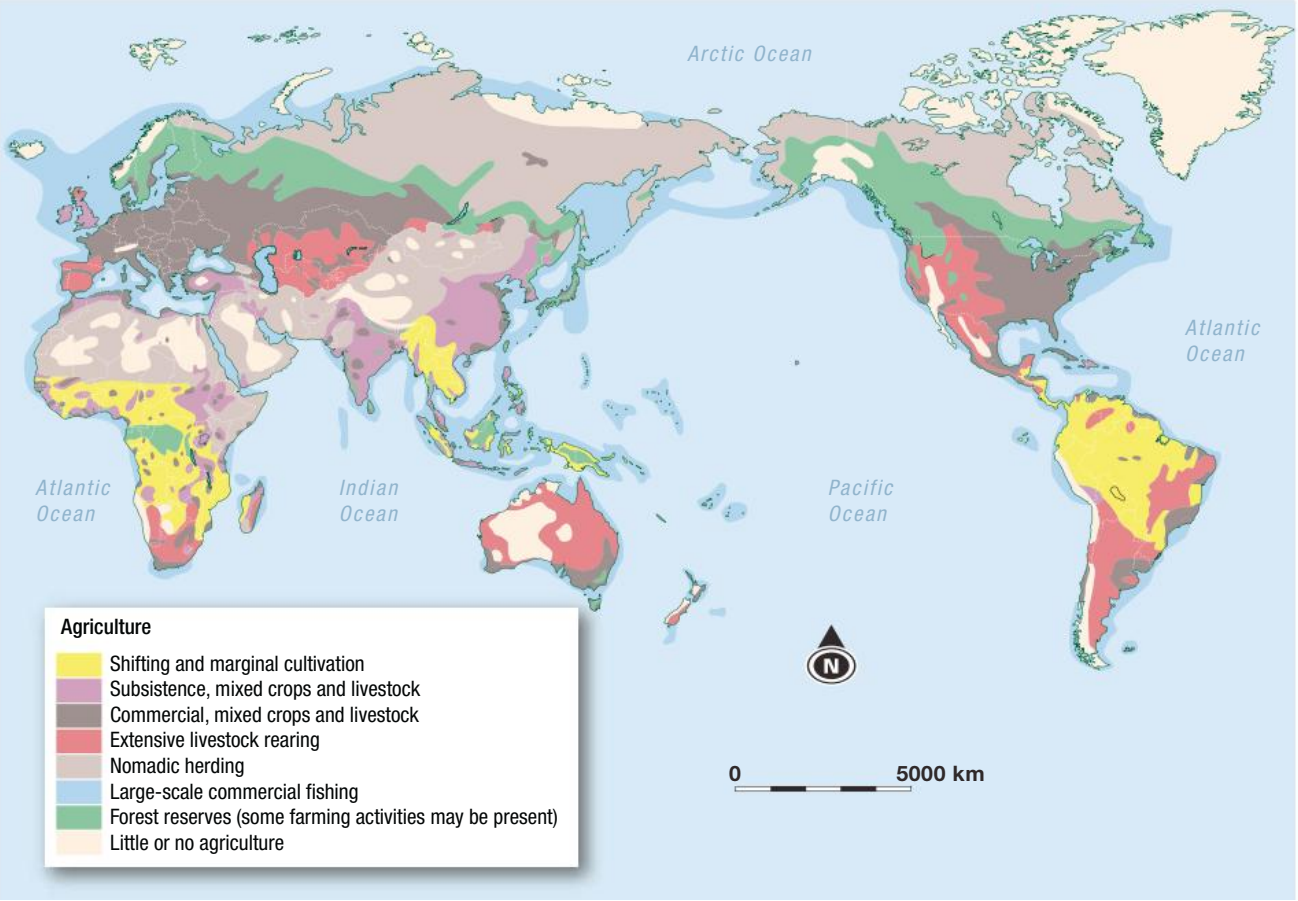
The simplest way to obtain an overview of how people use the world's biomes is to examine a map of the world's economic activity.

It is interesting to compare the map showing the world's biomes in Chapter 2 (Source 2.2) with Source 4.2.

There are some similarities. The **tundra** area in the northern hemisphere is essentially a biome that is used for **nomadic herding**. The taiga, or boreal forest, either remains as forest or is used for nomadic herding. One would think that the desert areas would have little or no agriculture, but even here, though some areas have little or no use, much of the Sahara in Africa is used for nomadic herding and parts of Australia's desert regions are used for extensive livestock rearing. The savanna biomes are dominated by grasses. One would expect to see extensive livestock rearing in these regions. The major savanna areas of the world have a variety of land uses, from subsistence mixed crops and livestock in India to mainly subsistence and marginal cultivation and commercial mixed crops and livestock in Africa.

tundra an area where plant growth is limited by low temperatures and a short growing season; usually found at high latitudes or high altitudes

nomadic herding moving one's cattle or other animals, such as goats or yaks, from place to place as food becomes available and so as not to exhaust the biome



Source 4.2 World economic activity

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ACTIVITY 4.1

1. Commercial mixed crop and livestock activities are carried out over large areas of Europe, North America and Australia. Discuss how these activities may be related to a particular biome.
2. List the economic activities that occur in tropical rainforest biomes.
3. Describe the relationship between mining and biomes. Use bauxite and gold as your examples.
4. Describe how people have made use of the alpine biomes.
5. Explain why the important sugar-producing regions of Australia are not shown on Source 4.2.

The initial examination of the world's economic activity shows that biomes throughout the world are used, and that there is a major division in the way people use them. Some people use biomes for commercial purposes while others use them for subsistence purposes. The people using biomes for commercial purposes are growing crops or raising livestock for sale. They are using biomes for economic benefit. They expect to make a profit and they use the profit they have made to provide the necessities and luxuries of life. The **subsistence** farmers who raise crops in some areas and herd livestock in others are at the other end of the spectrum. They usually have very little **surplus** for sale; their lives are a constant battle to provide food for themselves and their families. The luxuries of life – holidays to Hawaii, a night at the opera, even dinner at a fast-food outlet – are far removed from the way of life of these people.

subsistence (agriculture) producing just enough for the family to survive

surplus excess

There is another division in the way people use biomes which is not clearly shown in Source 4.2. The key of the map uses the words 'extensive' and 'large-scale' in relation to some land uses ('livestock rearing' and 'commercial fishing'). The key doesn't use the opposite terms – '**intensive**' and 'small-scale' – in relation to land uses. '**Extensive**' and 'large-scale' refer to individual agricultural activities that cover a large area. The obvious ones in Australia are the raising of sheep and cattle and the growing of wheat and cotton. In the United States, it is the growing of corn and cotton. These farms cover large areas. 'Intensive' and 'small-scale' land uses refer to activities that cover a small area. In Australia, many land uses fall into this category – sugar cane farming, vegetable production and dairying.

intensive agriculture farming a small area with a crop that has a high monetary value

extensive agriculture crop or livestock production over large areas of land which requires fewer inputs such as labour: one example would be wool production

A key geographic term – 'scale' – has been used here in a way that is different from how it is used in relation to maps. A large-scale map is very different from a small-scale map. Source 4.3 will clarify the differences.

Source 4.3 Differences between the use of 'large' and 'small' scales

Term	Referring to land use	Referring to maps
Large scale	Huge area 1000 km^2	Small ratio or fraction 1:250 000
Small scale	Small area 80 ha	Large ratio or fraction 1:50 000

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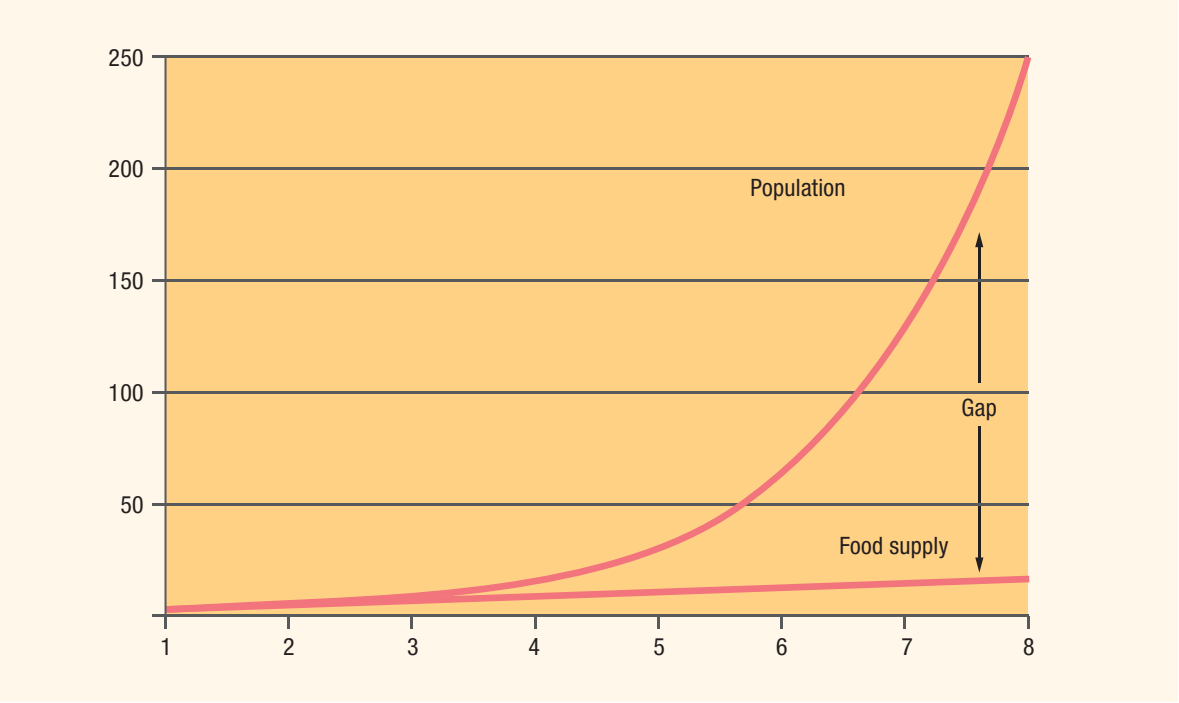
In terms of the use of biomes for food production, there is one global issue to consider before continuing.

Source 4.4 Thomas Malthus

Thomas Robert Malthus, a minister of religion, was born in 1766 and died in 1834. This was long ago, but the ideas he proposed are very relevant to geographers in the modern era. Malthus believed that the world's population growth in the early 1800s would be faster than the growth of world agriculture, and that only disaster could result unless serious action was taken. In Malthus' words:

> The power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction, and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world.

Converting his words into diagrams shows the following.



Source 4.5 Population growth outruns food production.

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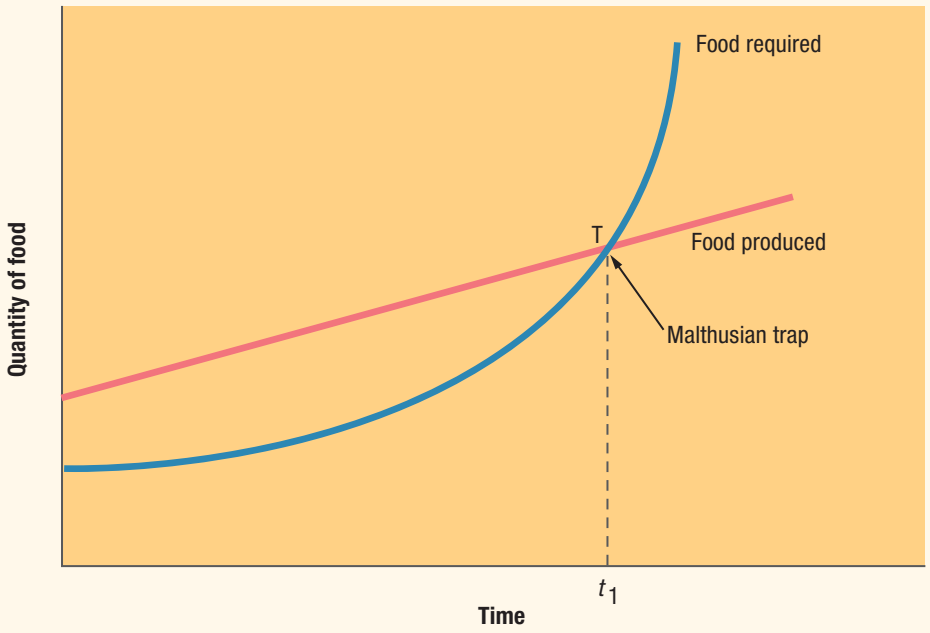

Source 4.6 Crisis point: what would happen?

Malthus believed a disaster or a series of disasters would occur when the crisis point was reached.

RESEARCH 4.1

Geographers may divide the world into the 'haves' and the 'have nots' in relation to food accessibility. At any one time, some regions are in surplus and have enough food for their region and some left over. Other regions are in famine and people are dying because there is not enough food. Divide your class into groups so that some groups examine areas of food shortage and others examine areas of food surplus. When researching your topic, select relevant questions from the list below.

- How are regions identified as being affected by famine?
- Where are these regions?
- Have these regions always been affected by famine?
- Why is famine occurring in these regions?
- Where are the areas of surplus?
- Have these regions always had a surplus?
- Why do these regions have a surplus?
- What is stopping the areas of surplus sending their surplus to areas affected by famine?

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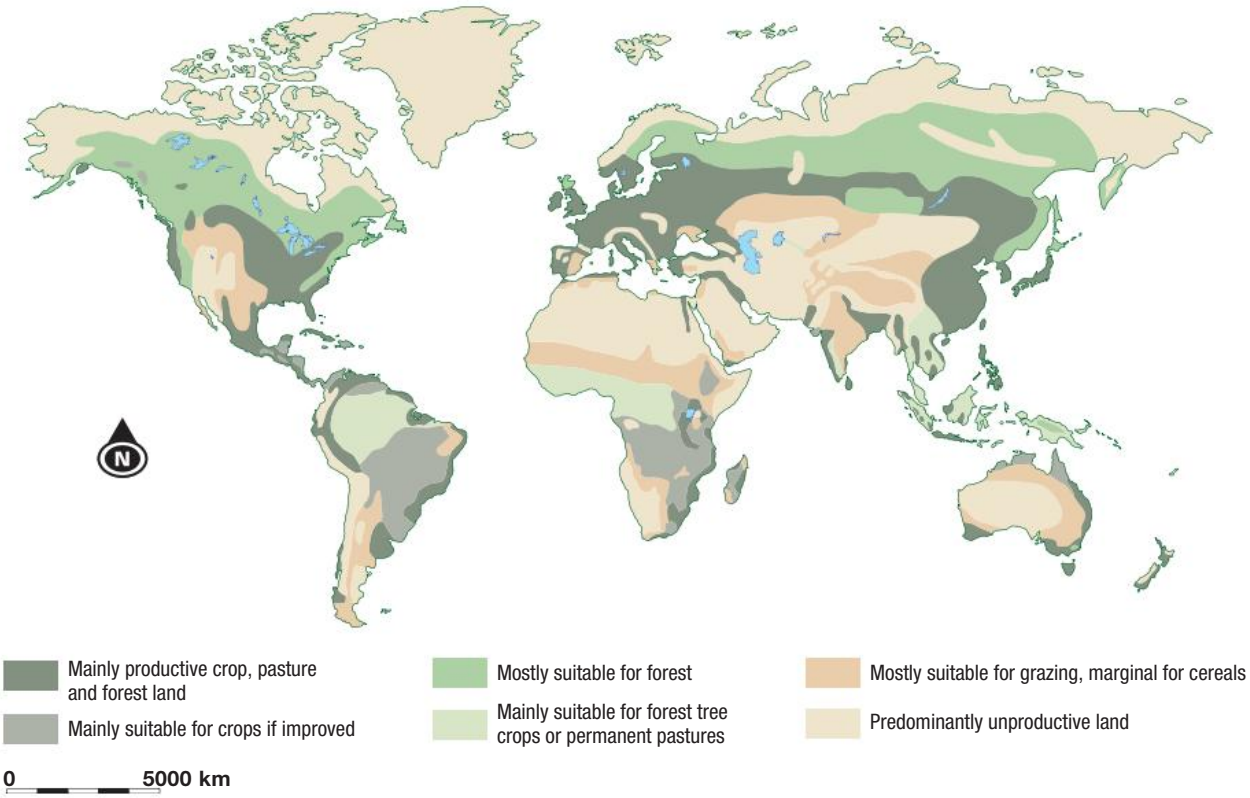

Source 4.7 World potential land use capabilities

Source 4.7 shows the United Nations Food and Agricultural Organization's perception of what the world's current land area could be used for. What would happen to the world's biomes if this became reality?

That is the global scene. It may be frightening, but for a geographer, it should suggest enormous possibilities. In terms of maps, the next sections will take a large-scale focus and examine what could be considered a hierarchy of uses of biomes. This is very similar, as an idea, to the hierarchy of animals in the food chain of the savanna.

Geographical fact

Hunter-gatherers were the first people to domesticate dogs.

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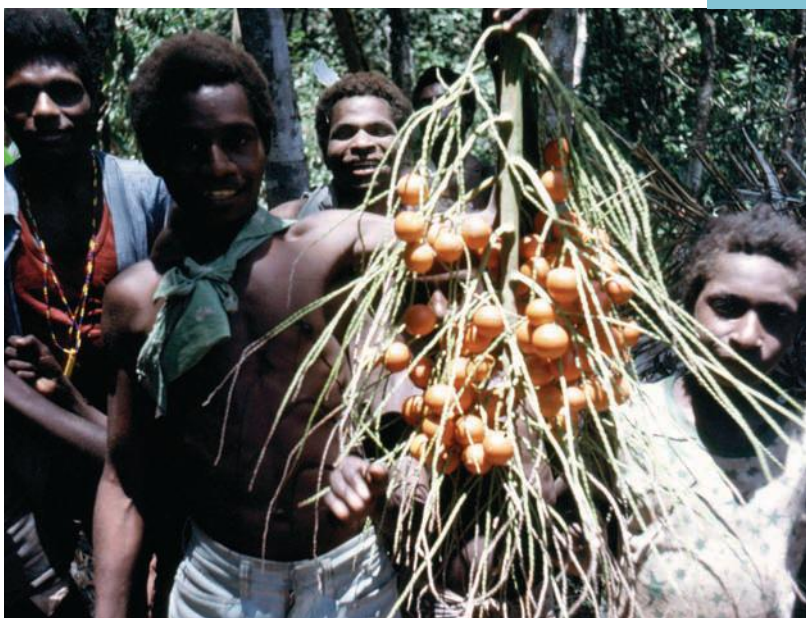
Source 4.8 Crocodile from the Fly River, PNG

Source 4.9 Deer from the forest

Source 4.10 Fish from the Fly River



Source 4.11 Nuts from the palm nut tree

Hunters and gatherers

hunting and gathering the practice of obtaining food requirements through the hunting of wild animals and the collection of naturally growing plants and plant products

The earliest humans **hunted and gathered** food in the forests and plains around them. There are parts of the world where this still happens. The photo set in Sources 4.8–19 shows a group of people living in the forests of the Fly River in Papua New Guinea.

When missionaries first encountered this group of people they lived simply on the fruits of the forest. The missionaries changed these people's way of life, settling the group in a village and therefore transforming their nomadic life in the forest. Evidence of some of the changes can be seen in the pictures above. More evidence can be seen in the pictures following.

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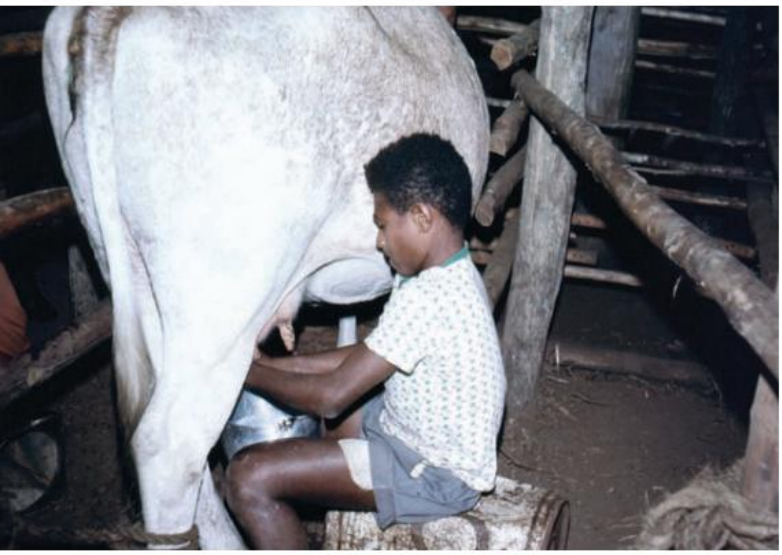
Source 4.12 Cattle were introduced.

Source 4.13 An abattoir was constructed.



Source 4.14 Milk was introduced into the diet.

Source 4.15 The village was linked to the outside world.

Source 4.16 A hospital was constructed.

Source 4.17 A school was built.

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Source 4.18 Areas were converted to farm land.

Source 4.19 Machinery was introduced.

As hunters and gatherers, the people had had a limited impact on the rainforest biome they lived in. They lived off the forest. An animal was killed from time to time, but not all the animals were killed; nor was their habitat destroyed. A sago palm was felled from time to time but not all the sago palms were felled. In short, these people lived in harmony with their environment.

The people are referred to as the Suki: that is the name of the language they speak. The earliest known record of them is when they attacked the explorer Luigi D'Albert in 1877 while he was exploring the Fly River. They were still head hunters as recently as 1931. Missionaries visited the area during World War II, and returned permanently in 1944. The photos above were provided by a student – Richard Gardner – who was a missionary in this area in the 1960s and 1970s. Gardner was proud of his work with the Suki and proud of the fact that one Suki tribesman had actually continued his education and returned to the village as a university graduate.

NOTE THIS DOWN

Copy the graphic organiser below and summarise the positives and negatives that you think would come with living as a hunter-gatherer today. Think about what you would find difficult and what would benefit you.

Hunters and gatherers	
Positives	Negatives

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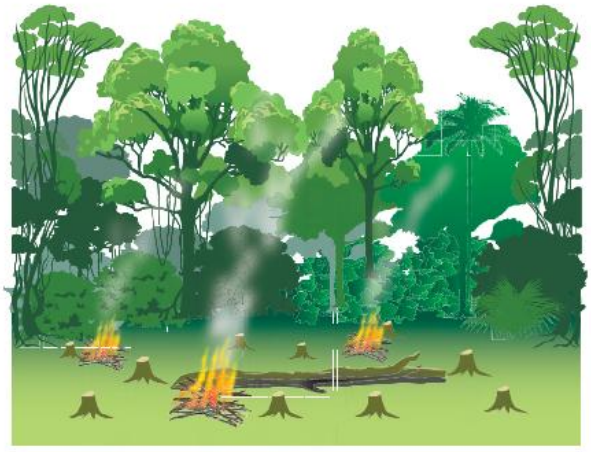
Shifting cultivators

shifting cultivators people who farm a section of land for 2–3 years, then move on to another section to allow the original plot to revitalise itself

If **shifting cultivators** are left undisturbed, they too have a minimal impact on the rainforest environment in which they are usually found. The cycle of shifting cultivation is shown in Sources 4.20 and 4.21.

Source 4.20 The cycle of shifting cultivation

(a) Forest



(b) Slash and burn

(c) First crop

(d) Yield diminishes in second and third year

(e) Bush returns after plot is abandoned

(f) Forest eventually returns

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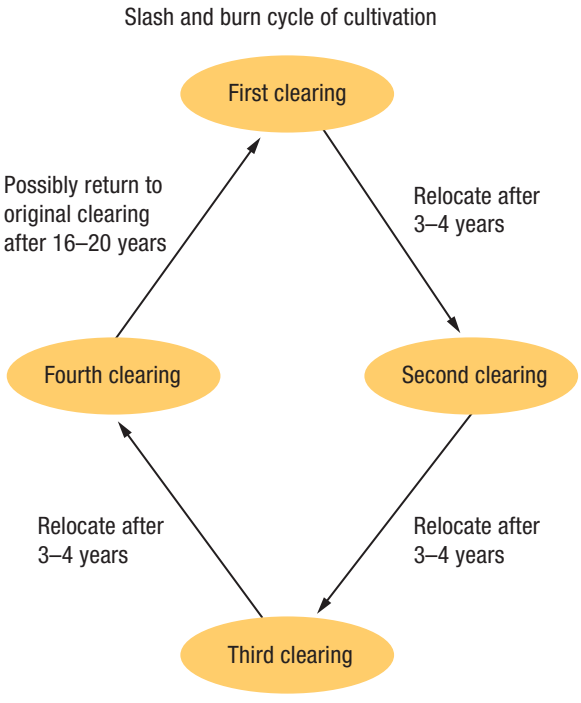
The story of these shifting cultivators is simple. An area of rainforest is selected as a plot and most trees in it are felled. Some are left to hold the soil together if the plot is on a steep slope and some may be left for climbing plants to grow on. Some of the felled trees are burned to provide nutrients for the soil and others are used as a barrier, to protect the plot from wild animals. A variety of crops are planted. This is important because it means the people's diet is varied. It also means that if one crop fails, they will still have food. The first crop is excellent. The plot is only used for around three years, because the yields decrease over time. At that point a new plot is established. Before leaving the old plot, the group will open the barrier around it. Wild animals, usually wild pigs, will enter the plot to forage among the leftovers. These will be killed, making for a variation in the diet of the people.



Source 4.21 Shifting cultivation cycle

The group may move their settlement to the new plot if it is far away. The old plot and old settlement sites are soon reclaimed by the rainforest. Over 16–20 years the humus layer builds up on the floor of the forest and the soil fertility returns. Remember, a rainforest is capable of creating its own fertile soils. When the soil fertility has been restored and a good forest cover has been established, the group can return and use the area again. In this way they shift their plots around, making breaks in the canopy of the forest from time to time, using the fertility of the soil but never completely destroying the biome because they move on once their crops have exhausted the fertility of the soil.

Source 4.22 This plot is on Nguna Island in Vanuatu and shows cassava, bananas and sweet potatoes being grown.

Contact with the outside world has changed the way of life of the shifting cultivators. Missionaries bring medicines, and others may bring axes and chainsaws. The medicines mean that fewer people are dying from the diseases and other threats in the forest. The populations have increased and the axes and chainsaws mean that areas can be cleared more quickly and larger areas can be cleared.

The growth in population means that the shifting cultivator has to return to a plot sooner than the required 16–20 year growth period. The rainforest

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is therefore not well enough established, so the cycle is shortened. In many areas, particularly the northern Philippines, the abandoned plots were being taken over by grass, which does not provide good soil nutrients. Grass encourages more grass, which competes with the young rainforest species. Large areas of rainforest have been converted to grassland, which is useless for agriculture. Also, the grass is not palatable to cattle, which might otherwise have been introduced.

sustainably when a resource is used in such a way as to preserve the resource and its surrounds

Here is a biome which could have been used **sustainably** for years to come, but which is being turned into useless grassland instead. The rainforest is gone and so is the rich diversity of life that lived in it. In many areas the practice of shifting cultivation has been outlawed, but what happens to the people for whom it is a way of life?

Source 4.23 Blady grass (*Imperata cylindrica*) often replaces rainforest in areas where shifting cultivators have overused the land. Blady grass can be found in many parts of Australia.

ACTIVITY 4.2

1. Explain why hunter-gatherers have such a small impact on their biome.
2. Describe how shifting cultivators managed their impact on the biome.
3. List the influences that caused shifting cultivators to increase their impact on the biome.
4. Research current methods of farming that have less impact than shifting cultivation on a biome.

4.2 Adapting biomes

Rice cultivators

Rice cultivators take the use of a biome to a higher level again. More than 500 million hectares (ha) are used for growing rice each year: that is more than 11% of the world's **arable** land. Rice is the main food for more than half of the world's population – for most of those living in China, India and Indonesia. There are two types of rice cultivation: dryland (or upland) rice and wet rice.

arable suitable for farming

Geographical fact

Rice is a subsistence crop. It is grown by the family and consumed by the family. Only 5% of the world's rice crop is exported.

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Dryland (or upland) rice

Here the forest is cleared and the rice is planted. It is often grown on very steep slopes, as shown in Sources 4.24 to 4.27. The crop relies on rainfall.

Source 4.24 Upland rice field in Sabah, Indonesia

Source 4.25 The soil layer is not very deep and the rainfall needed to sustain this crop will wash some of the soil layer away very quickly.

Source 4.26 Abandoned, overgrown field in the same area

Source 4.27 The original rainforest biome is seriously under threat in this area.

The biome has been significantly altered. The original vegetation has been removed. Most of the wildlife associated with that vegetation has gone. A new biome is now in place. This biome is controlled by the people who develop the plots. As the plots are on steep slopes it is highly likely that landslides will occur, because the vegetation which protected the slope and held it together has been removed. Upland rice represents about 13% of the rice area planted annually but only produces around 4% of the rice produced annually. Almost 100 million people in Bangladesh, Cambodia, China, India, Indonesia, Myanmar, Thailand and Vietnam depend on this rice source.

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Source 4.28 Wet rice cultivation in mountainous regions of Bali, Indonesia

Source 4.29 Lowland rice cultivation Singdand Laut, Indonesia

Wet rice

Wet rice cultivation takes the human impact on biomes to a whole new level.

The impacts on the original rainforest biome are easy to identify. The vegetation cover has again been removed, which means the associated wildlife has had to find alternative habitat. Additionally, the land has been sculpted so that fields can be created. The flow of water through this system is precisely managed. Some elements of the original biome remain – those which can provide food – but the rest have been removed.

In terms of humans impacting on rainforest biomes, this would appear to be the top of the pyramid, but it is not.

Commercial farmers

Earlier in the chapter there was a reference to the scale of this. The chapter has followed the increasing impact humans have had on the rainforest biome. There are two uses of this biome which have not yet been addressed. First, it is necessary to move from the global scale to the national scale.

Australia is one of the world's major producers and exporters of sugar. Sugar is extracted from a grass that grows easily in the hot, wet environment of the tropics. Sugar cane growing has already been investigated in Chapter 3. This section will take the investigation further.

Intensive agriculture

The Tweed River valley and the Ord River Scheme have extensive areas of sugar cane, but the areas are still too small to show on a map of Australia. It is interesting that both these areas differ from the main sugar-growing areas. Most sugar-growing areas produce one crop per year using natural rainfall. The crop in New South Wales takes 15 months to mature, because this area is cooler than northern areas. The crop in Western Australia is grown using irrigation from the Ord River Dam.

There are approximately 6000 sugar cane growers in Australia, with the majority on the east coast. Farms are usually small – around 100 ha. This is why sugar cane farming is described as

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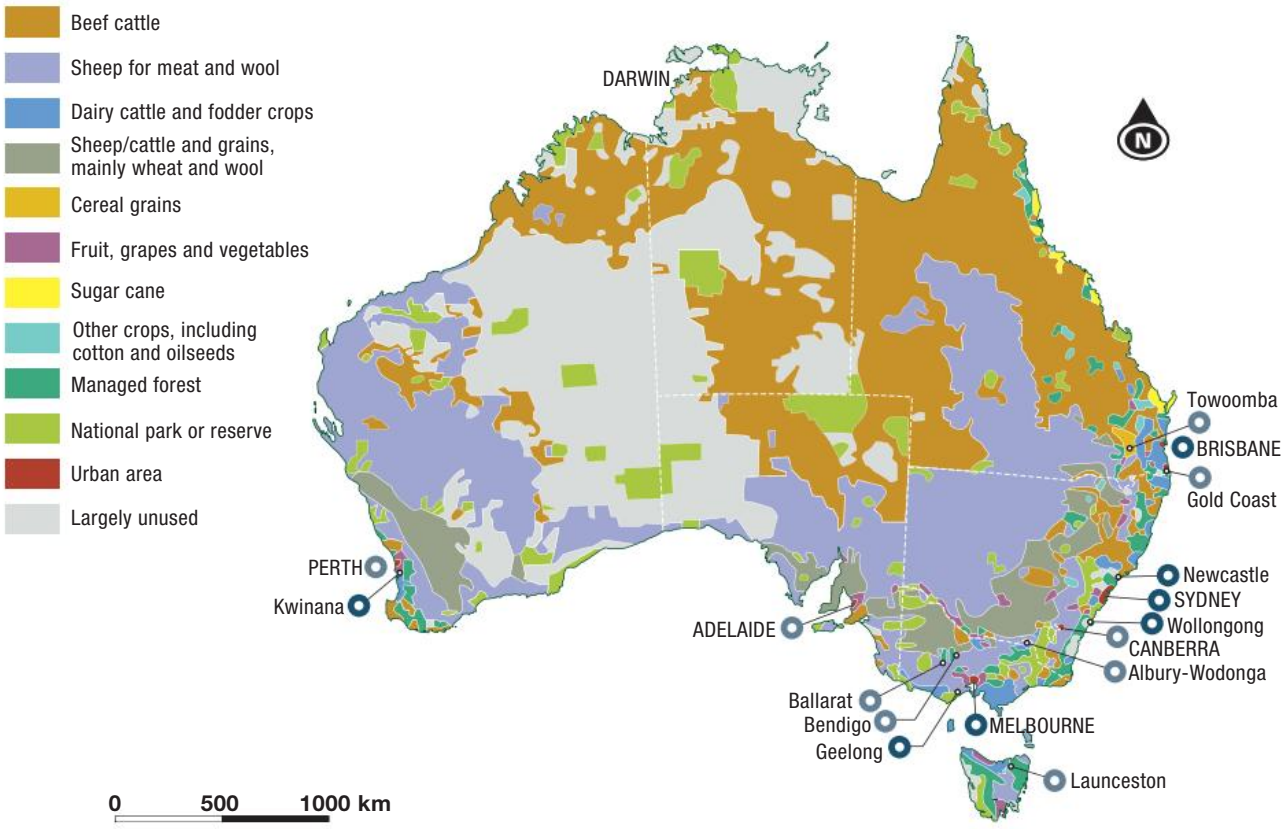

Source 4.30 Australia – economic activity

an 'intensive' industry. The farmer owns a small area of land, and grows a crop which has a high yield and a high value. The farm is often highly mechanised and uses large amounts of fertilisers, pesticides and weedicides.

The impact on the original biome is significant. Source 4.31 shows the sugar cane area around Mackay, Queensland.

Machinery is also used extensively in the industry, to clear the flat land for farming. The hills stand out in the image – they still have remnants of the original biome on them, at least partly because machinery works best on flat land.

Source 4.31 Sugar cane farms west of Mackay show the almost complete loss of the original biome.

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RESEARCH 4.2

Australia has large tracts of extensive agriculture. These farms are huge in area. Some make extensive use of machinery, but others do not. Choose one extensive agriculture activity in Australia and report on the following:

- Where is it located?
- Why is it located where it is?
- What was the original biome?
- How has that biome been affected by the economic activity?
- How might the biome be more sustainably managed in the future?

Present your research in a report.

Geographical fact

The forest of the Amazon provides 20% of the world's oxygen. Wet rice fields contribute between 100 and 500 million tonnes of methane gas (a greenhouse gas) to the atmosphere each year.

Changing biomes over time

Biomes change over time as different people recognise different uses for it. This geographical concept is called **sequent occupance**. One example is the Redcliffe Botanic Gardens.

sequent occupance land use changing over a period of time

Redcliffe Botanic Gardens, Queensland

This tiny 10 ha plot in the centre of Redcliffe has an amazing history.

When the first explorers arrived in Moreton Bay in 1824, the area was a Eucalypt forest at the headwaters of what was to be known as Humpybong Creek. Over time the land use in the area changed. The change occurred in a sequence:

1 The area formed as a result of sediment deposition and volcanic activity.
2 Hunters and gatherers lived in the Eucalypt-dominated forest.
3 Hunters and gatherers were displaced by farmers.
4 Farmers were displaced by the need for a nightsoil dump close to the developing town.
5 The Education Department acquired the site as a possible school development but leased the land for cattle grazing instead.
6 Part of the site was set aside for an education centre.
7 The whole site was set aside as a potential environmental education centre and previous grazing land was converted to examples of local ecosystems.

Source 4.32 Redcliffe Botanic Gardens

8 The area was leased to what was then Redcliffe City Council, to be retained for educational purposes.
9 Today the area is the Redcliffe Botanic Gardens – it stands out clearly as an area of green space to anyone flying across the Peninsula.

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Case study 4.1
The Amazon

The Amazon rainforest biome is one of the most important in the world. It is a huge area, which removes the harmful greenhouse gas, carbon dioxide, from the atmosphere and returns the gas essential for human life on earth: oxygen.

In other parts of the world, such as Southeast Asia, the rainforest in some areas, such as the wet rice terraced areas, was removed generations ago.

The Amazon, however, has only been opened up for 'development' in the past 70 or so years.

The Amazon has been the home to hunters and gatherers – and, to a lesser extent, shifting cultivators – for centuries, but the demands of the outside world are placing enormous pressures on this biome. These demands have also placed enormous pressures on the people who live and have lived sustainably for hundreds of years in this biome.

1 The class needs to separate into groups. Each group needs to select and research one of the following:

- the numbers, location and way of life of the indigenous people of the Amazon
- the numbers, location and way of life of people living in reservations in the Amazon
- the numbers, location and impact of miners on the Amazon biome
- the numbers, location and impact of loggers on the Amazon biome
- the numbers, location and impact of farmers on the Amazon biome
- the numbers, location and impact of dam construction on the Amazon biome
- the numbers, location and impact of tourists on the Amazon.

2 Once each group has completed its research, hold a class discussion in which groups address the class with their findings, to complete their picture of the Amazon basin.

NOTE THIS DOWN

Copy the graphic organiser below and create a Plus, Minus, Interesting Chart (PMI Chart) detailing the different ways in which various types of agriculture impact on biomes.

	Plus	Minus	Interesting
Hunting and gathering	Low impact on resources	Resource availability can be affected by disasters such as flood or fire	Still practised today in some areas

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4.3 Preserving biomes

Studies to date have shown that humans have had significant impacts on the world's biomes. On 1 March 1872, United States President Ulysses S. Grant declared the area of Yellowstone to be a National Park. The objective was to save a part of the Earth's biomes for future generations. Yellowstone is widely believed to be the world's first national park. Australia was not far behind, declaring the world's second national park, now named the Royal National Park, on 26 April 1879. Today over 100 nations have designated national park areas. Australia has just over 4% of the country reserved in its 685 national parks.

When the construction of the Aswan Dam in Egypt threatened the temples of Abu Simbel, nations organised a World Heritage Convention. The outcome was that funds were raised to relocate the temples. A broader outcome was the development of the concept of 'world heritage areas'. These are areas of natural and/or cultural significance which should be managed sustainably so that they are available for future generations to enjoy. Australia has 41 areas on the World Heritage list, including Uluru-Kata Tjuta National Park, Fraser Island and the Great Barrier Reef.

Talk by government and industry has moved from 'how can we develop the resources of an area for maximum profit?' to 'how can we develop and manage the resources sustainably?' This has been a major shift in thinking about biomes and their use. One of the wake-up calls was a book – *Silent Spring*, written by Rachel Carson in 1962 – which described the impact of modern pesticides on the planet's bird life at that time. Finding pesticide residue in Antarctic penguins was another wake-up call. Not all countries are managing their biomes sustainably, but changes for the better are being made.

ACTIVITY 4.3

1 Discuss why national parks are important for the future of biomes.
2 Explain why managing a biome sustainably is important for the future of biomes.

Source 4.33 Royal National Park, New South Wales, Australia

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FIELDWORK 4.1 EXAMINING CHANGING BIOMES IN YOUR LOCAL AREA

Aim

To examine how one section of your local area is being used, has been used in the past, and the impacts of current use. You will also describe the management of this area and evaluate the effectiveness of the strategies used.

Method

Select an area near your school (near enough to walk to from your school) and identify three sites in the area to analyse.

Preparation

Find a map of the area and indicate the areas that will be visited and studied. Plan your path. You will also need to take a camera, a list of questions based on the 'data collection' section below, paper, a clipboard and a pen.

Data collection

As you travel along the planned path, stop at various sites and ensure that you collect all the information you will need for your fieldwork report:

1. List all the ways in which the different areas are used. Take photos of these activities. Mark the location of these activities on your blank map. Provide a key to display your data collection. Are these activities active or passive? How often would the area be used for these activities? What is the major activity in the area?
2. To what extent does the location of the area influence nearby activities?
3. Describe the positive and negative and short-term and/or long-term impacts of these activities on the study area. For example, is there visible rubbish in the area? Is the area being polluted by this activity? How does the area benefit from any protection measures?
4. Sketch two examples of the ways in which the use of the area has affected the environment. Annotate your sketch with as much information as possible about the use and its impact.
5. Observe any human features of the area. Describe them. How do you think the area being examined has influenced, or has been influenced by, these developments? Do these human features differ as you walk through the area? Why?
6. List some of the management strategies you observe. Determine if you think the strategy is working or not and explain your reasoning. Suggest a new strategy for one of the impacts you identified in Item 5.

Fieldwork presentation layout

Front page	Title and name
Contents page	Do this last, once you have numbered the pages
Page 1	Aims and methods
Page 2	Location map
Page 3	Introduction – brief description of the study sites
Pages 4–5	Description of uses and photos
Page 6	Table of uses: effects of use (positive or negative, short-term and/or long-term)
Pages 7–8	Description of effects of use (and sketches and/or photos)
Page 9	Association between use and effects of use
Page 10	Table or written description of management strategies
Page 11	Photos or sketches of management strategies
Page 12	Evaluation of these strategies
Page 13	Appendix, bibliography, glossary

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4.4 A closer look at rice in Southeast Asia

Rice is the staple food of Southeast Asia and contributes significantly to the livelihoods of smallholder farmers, the regional economy and society. Rapidly increasing populations in the countries of Southeast Asia have placed pressure on the rice-farming sector to both increase yields for food and income security and strive towards sustainable practices to protect water, soil and other environmental resources. Rice accounts for two-thirds of the calorie intake of more than 3 billion people in Asia and it is increasingly consumed in Europe, North America and other regions. Approximately 610 million people in Southeast Asia depend on rice as a staple food.

The role of rice

Rice as a staple food

In Southeast Asia, rice is consumed daily and is considered to be the most important **cereal crop** for both food and income security. After **maize**, rice is considered the second most important crop in the world. However, maize is also grown for **biofuel**, and rice has greater importance as a **staple food**.

cereal crop grasses grown to produce edible grains, such as wheat, oats and rice

maize a grain known in most English-speaking countries as 'corn'

biofuel fuel made from natural sources

staple food the most commonly eaten food in a specific region

Rice production is widely considered the reason for populations in Southeast Asian countries continuing to grow with

Source 4.34 Rice farming is a dominant feature in Southeast Asian landscapes.

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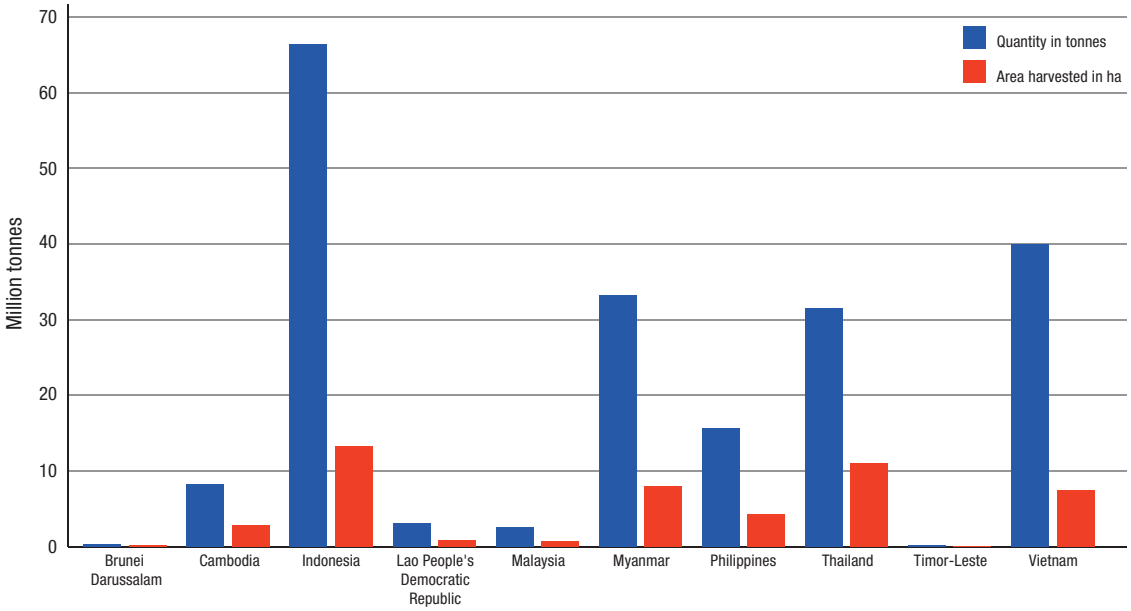
less poverty. Rice is also increasingly consumed in Europe, North America, Australia and New Zealand because of immigration and the increasing interest in food from other regions. Rice is also consumed in Africa, the Middle East and Pacific countries.



Source 4.35 Rice yields and area harvested for Southeast Asian countries in 2010

The Green Revolution

high-yielding varieties (HYVs) varieties developed by selective breeding and cross-breeding to achieve faster growth and to produce more seeds

pesticides substances used to destroy insects and other organisms that can harm or damage plants or animals

Green Revolution a period beginning in the 1940s when new agricultural techniques brought great increases in production and greatly decreased the incidence of hunger worldwide

Rice production increased dramatically in Southeast Asia in the 1960s because of the introduction of **high-yielding varieties (HYVs)** and improvements in fertilisers, **pesticides** and farm machinery. Financial institutions and governments all played a role in financing the uptake of new technologies by providing credit or donating inputs to smallholder farmers. By the 1970s, more than 40% of rice farms involved irrigation, and by the 1980s, HYVs were being widely used. This dramatic, technology-driven increase in rice production was dubbed 'the **Green Revolution**' and was responsible for a decline in poverty and an increase in economic growth.

Rice species and varieties

Asian rice varieties can be traced to a single, wild species of rice (*Oryza rufipogon*). Present-day **domesticated** rice in Asia is classified as *Oryza sativa*. The other domesticated rice species is *Oryza glaberrima*, which is known as African rice. The origin of Asian rice has been traced to China, where it was first domesticated.

domesticated plants plants grown from seeds originally harvested from plants growing wild, which are used to plant areas such as rice fields

Wild rice was collected for food as far back as 12 000 BCE and domestication occurred between 8000 BCE and 10 000 BCE. There are two major sub-species of Asian rice, Japonica and Indica. Japonica is mainly grown in upland areas and is more important for food security. Indica is commonly grown in the lowlands, particularly along the coast; it meets local food requirements and provides a source of income. A third, less common subspecies is Tropical Japonica. All these types of Asian rice are known as 'varieties' because they share a common species status but differ in their physical (appearance, height), biological (growth, disease resistance, number of grains) and culinary (taste, firmness, starchiness) properties. Overall, there are now 40 000 varieties of Asian rice which have been selectively bred and crossbred for qualities such as texture, grain size, starch content, fast growth and high yield.

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Source 4.36 Rice farming in the Philippines utilises rich volcanic soils but is at risk of crop destruction from volcanic eruptions.

Geographical fact

The Cordillera and Banaue terraces in the Philippines are known by the locals as the 'stairway to heaven' because they resemble enormous steps stretching all the way to the mountain tops.

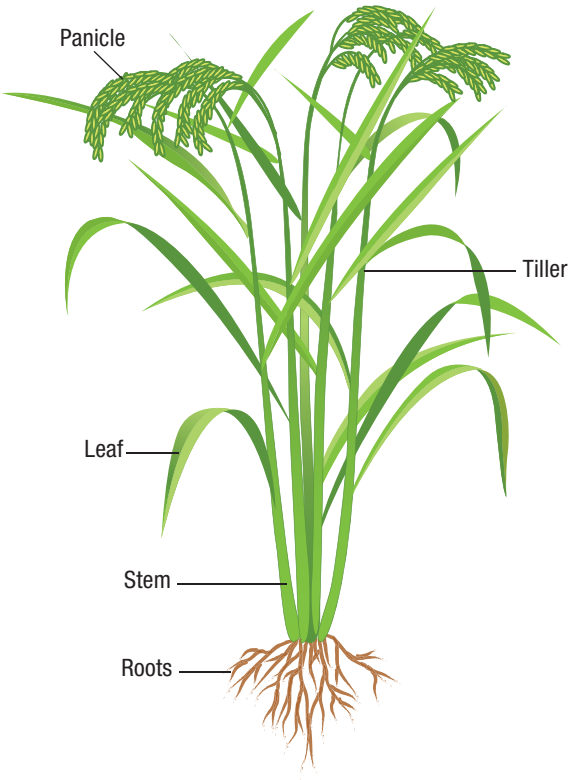
The rice plant

monocot a flowering plant that grows its parts in threes (the number of petals is typically a multiple of three); it only produces one embryonic leaf (cotyledon) in its seeds

vegetative phase the stage at which a plant produces its leaves

The rice plant is a **monocot** grass that can grow to 1.8 m tall. Many varieties are less than 1 m tall. The term 'rice' is used for the seed or grain of the rice plant, but is often used more generally, and incorrectly, to describe the whole plant. A tiller is a shoot made up of the roots, a stem and leaves. The term 'tillering' refers to the division of tillers from the root zone during the **vegetative phase**. A **panicle** is a cluster of rice flowers from which the grain develops. HYVs often have more panicles than older varieties of rice. Panicles form in the reproductive stage and remain present in the ripening stage when the rice grain becomes fully formed.

panicle a cluster of flowers from which the grain develops



Source 4.37 Parts of the rice plant

nitrogen an odourless, colourless, unreactive gas forming about 78% of the atmosphere

phosphate the salt of phosphoric acid, which is commonly used as fertiliser

The rice plant depends on **nitrogen**, **phosphate** and trace nutrients to grow. It also has a high water requirement. Nutrients are supplied by the soil and water the rice grows in, but domesticated varieties of rice must be supplemented with nutrients from fertilisers to produce their maximum yield. There are four main stages in rice plant growth:

- nursery stage – this stage begins with sowing rice seeds in nursery fields. Seedlings are transplanted approximately one month after sowing.

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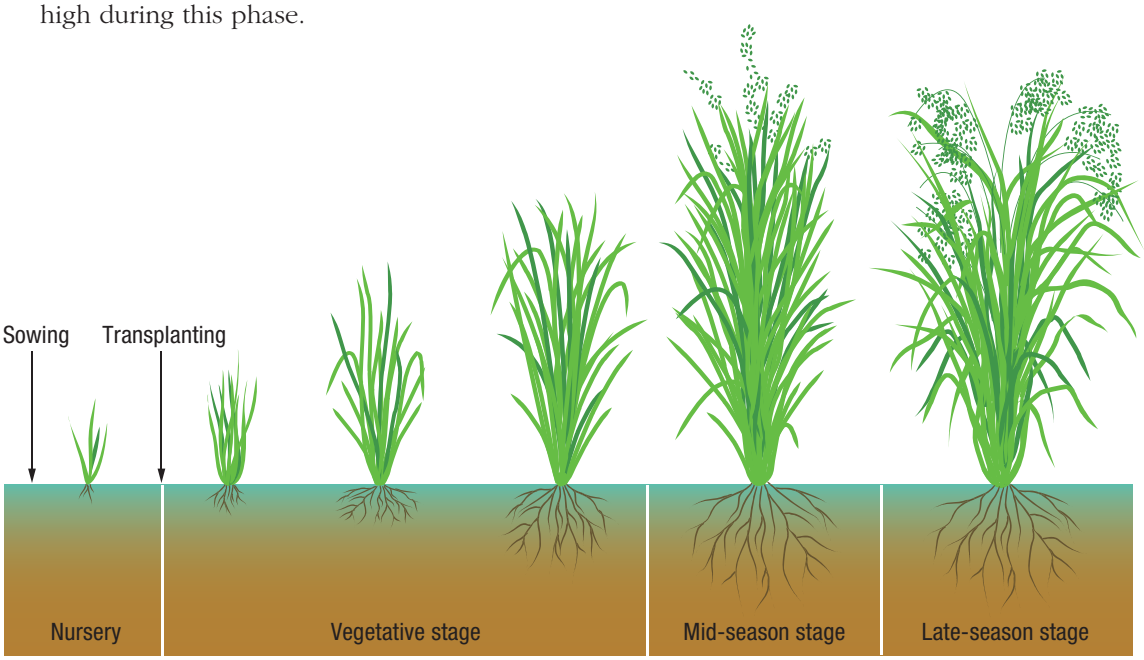
- vegetative stage – following transplanting, the rice plant develops tillers, and later the panicle growth begins.
- mid-season stage – this is a reproductive phase during which the panicle develops flowers. Nutrient and water requirements are high during this phase.
- late-season or maturing stage – this is when seeds develop from fertilised flowers. The seeds are ready for harvest when they are firm. If seeds are not harvested in time, they become 'overripe' and fall from the plant.



Source 4.38 Stages in rice plant growth

(a) (b) (c)

Source 4.39 Seedling showing (a) no panicle, (b) a flowering panicle with seed development, and (c) maturing seeds

Source: Wirastuti Widyatmanti

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ACTIVITY 4.4

1. Identify the three largest producers of rice in Southeast Asia.
2. Describe the four main stages of rice plant growth.
3. Name the two rice varieties commonly grown in Asia.
4. Describe the characteristics of HYVs of rice.

Geographical fact

Rice was once widely used as currency in Southeast Asia and other parts of the world. It was used as currency until World War II in some rural areas.

Significance in culture

In many Southeast Asian societies, rice farming is celebrated through festivals and ceremonies. These events are important because they bring rice-farming communities together and maintain cultural traditions that encourage social cohesion. Many rice festivals and ceremonies have remained relatively unchanged for centuries and help preserve song and dance traditions. Spiritual beliefs that predate current religious practices underpin many of these ceremonies and are accepted as part of the rich cultural history of Southeast Asian countries.

Rice-based food is given as gifts during religious events and on holy days. The end of the Holy Month of Ramadan (Idul Fitri) is celebrated with gifts of rice-sweets and elaborate meals centred around rice. In Malaysia and Indonesia, which are largely Islamic countries, rice has a special place during Ramadan as well: it is prepared for the early morning meal and the 'breaking of fasting' in the evening. Rice-sweets and rice-based foods also feature strongly in Buddhist, Hindu and Christian celebrations. Malay peoples, who live in Indonesia, Brunei, Singapore and Malaysia, celebrate Tepuk Tepung Tawar (patting plain flour ritual) in which different coloured rice grains, along with flowers, vegetables and flour, represent aspects of happiness and prosperity.

Rice-growing systems

Irrigated rice

irrigation the process of supplying water to a crop, typically via channels

topography the surface shape and features of an area, including human-built features

bund a built embankment with two sides

monoculture the growing of a single crop in an area

Over 70% of rice is produced in small (0.5 to 2.0 ha) **irrigated** rice fields. This involves the diversion of water from canals and streams into rice fields where water is maintained at a depth of 5–10 cm. Between 3 and 6 tonnes of rice per hectare (per crop) are produced, but up to 10 tonnes per hectare can be achieved. Most irrigated rice fields are in the lowlands, where the **topography** is better suited to water management. Water is retained in rice fields using small dykes called **bunds**. Farmers remove small sections of these bunds to release water into neighbouring fields or to drain the fields for the rice harvest. Irrigated rice fields are usually used for rice **monoculture** – up to 3 crops can be grown per year in the wet tropics. In temperate areas, only one rice crop is grown per year, and other crops such as wheat are grown in rotation.

Rain-fed rice

Rain-fed rice farming depends on rainfall as its primary source of water. There are two sub-categories of rain-fed rice farming: lowland and upland. Rain-fed lowland farming involves the use of bunds to flood the rice field. The coastal lowlands used for rain-fed rice farming are often subject to prolonged episodes of flooding and drought. During these droughts, salinity can become a problem as saline tidal waters, which

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Source 4.40 Seedlings ready for transplanting into irrigated rice fields, Java, Indonesia

Source: Wirastuti Widyatmanti

have high **evapotranspiration** rates, flow into low-lying fields. Rain-fed lowland rice farming is challenging for farmers because of climatic variability and because the soils are often unsuitable. Because of the risk of crop failure, many farmers are reluctant to invest in farm inputs such as fertiliser and tend to avoid HYVs, which demand more water and nutrients. The risk of economic loss from floods or drought is too high for most farmers. As a result of minimising their investment in farm inputs, they usually produce less than 2 tonnes of rice per hectare.

evapotranspiration the process by which water evaporates from land and water and is expired from plant material and joins the atmosphere

Rain-fed upland rice farming is also known as dryland cropping. In this system, bunds are not used to submerge rice, and lower-yielding rice varieties that require less water are generally used. Because yields are often less than 1 tonne per hectare, rice is only farmed to meet local food requirements. Other crops are grown along with rice to provide cash crop alternatives.

Case study 4.2

Rice farming in the Mekong Delta, Vietnam

Vietnam is the 7th largest consumer of rice in the world and has become a net exporter of rice through improved farming practices. More than 60% of Vietnam's rice is produced in the **Mekong Delta**. Often described as 'a gift from God' or 'White Gold' by Vietnamese, rice is highly valued and yields are often reported on with the same zeal that stockmarkets are reported on in developed countries.

Mekong Delta a region in southwest Vietnam where the Mekong River empties into the sea

Rice farming began in the Mekong Delta in the 18th century. At that time, the Mekong Delta was part of the Khmer Kingdom, controlled from nearby Cambodia. Rice was quickly adopted by the Vietnamese, who eventually acquired political control of the Mekong Delta: they annexed the area, claiming it as part of Vietnam.

The expansive rice fields and complex maze of canals of the Mekong Delta are a legacy of the French colonisation of the area in the 19th century. The French constructed a network of canals to control water flow and drain land for rice farming. The major earthworks were an effort to increase rice production to meet the needs of the French colonies in Asia.

During World War II, the destruction of infrastructure, the traumatisation of rice-farming communities, the disruption of farming activities caused by regular bombing, and catastrophic floods severely affected rice production in the Mekong Delta. Tragically, up to 2 million Vietnamese were thought to have died because of starvation caused by reduced access to this staple crop. Today, Vietnam has regained its position as one of the major rice-growing countries, and the Mekong Delta is widely referred to as Vietnam's 'Rice Bowl'.

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Farmers readily adopt new HYVs developed by Vietnamese research agencies in collaboration with international rice research institutes. The government of Vietnam provides services to facilitate the adoption of new technologies by farmers. Government agencies coordinate workshops to train farmers in how to apply new technologies, and make farm visits to provide advice. Agency officers also work closely with farmer groups and train lead farmers in new farming practices. Lead farmers are farmers who are innovative, trusted, and who have status within the farming community. These officers work with researchers and farmers, and act as facilitators for information exchange.

salinity the level of salt in soil or water

Increasing water and soil **salinity** is a major environmental risk to rice farming in the Mekong Delta. For decades, salinity was largely a problem in the dry season, but changes in the supply of fresh water in the wet season through damming and extraction of waters in the upper catchment, as well as higher evaporation rates and prolonged droughts, have led to saline conditions for longer periods. Crop yields decrease with increasing salinity, and current HYVs of rice are not tolerant of higher salinities. Saline tidal waters also penetrate further inland during droughts and enter canals through leaking tidal (flood) gates, thereby compounding the effects of salinity caused by other factors.

Since the 1990s, rice farmers have attempted to make use of the increasingly saline waters to farm shrimp. Rice fields have been redesigned to create a larger area of water to stock shrimp. During the dry season, shrimp are farmed in ditches, canals and flooded rice platforms. The saline waters are well suited to shrimp, so farmers can produce a valuable crop during a period when rice farming is not possible. At the end of the shrimp farming period farmers prepare the ponds for rice (the rice is grown on an elevated platform) and the monsoon rains help flush salt from the soils and ponds to enable rice to be grown. Erratic and unpredictable rainfall has hindered the success of this new farming method.

Source 4.41 Rice-shrimp pond in the Mekong Delta. Rice is grown on the central platform during the wet season.

1 Briefly describe the factors that have increased soil and water salinity in the Mekong Delta.
2 List the benefits of farming shrimp in the water compartments of a rice field during the dry season.
3 Describe the steps taken by the government of Vietnam to help rice farmers improve their yields.

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Rice production and sustainability

Environmental impacts

Currently, the Intergovernmental Panel for Climate Change (IPCC) estimates that methane emissions from rice farming are approximately 15% of the total emitted by all sources. The release of methane into the atmosphere contributes to the overall human-induced Greenhouse Effect. Methane is mainly produced in rice fields when they are submerged: ponded waters prevent atmospheric oxygen from entering the soil, which leads to an increase in the methane-producing **anaerobic** bacteria that thrive on decomposing plant material, manure and nitrogen-based fertilisers.

anaerobic (organism) an organism that can live without free oxygen (oxygen in the air)

Irrigated rice requires more water than most other cereal crops. This high demand for water reduces the water available to the natural environment and creates competition with other land uses that share water resources. Irrigation canals and bunds are designed to direct fresh water away from natural watercourses and into the rice-farming areas. The impact of water diversion is most significant in the dry season in monsoonal environments. During the wet season, monsoon rains provide abundant water, but during the dry season, water availability can be limited. In temperate rice-growing areas, where annual rainfall is generally lower, there is pressure on water resources year-round.

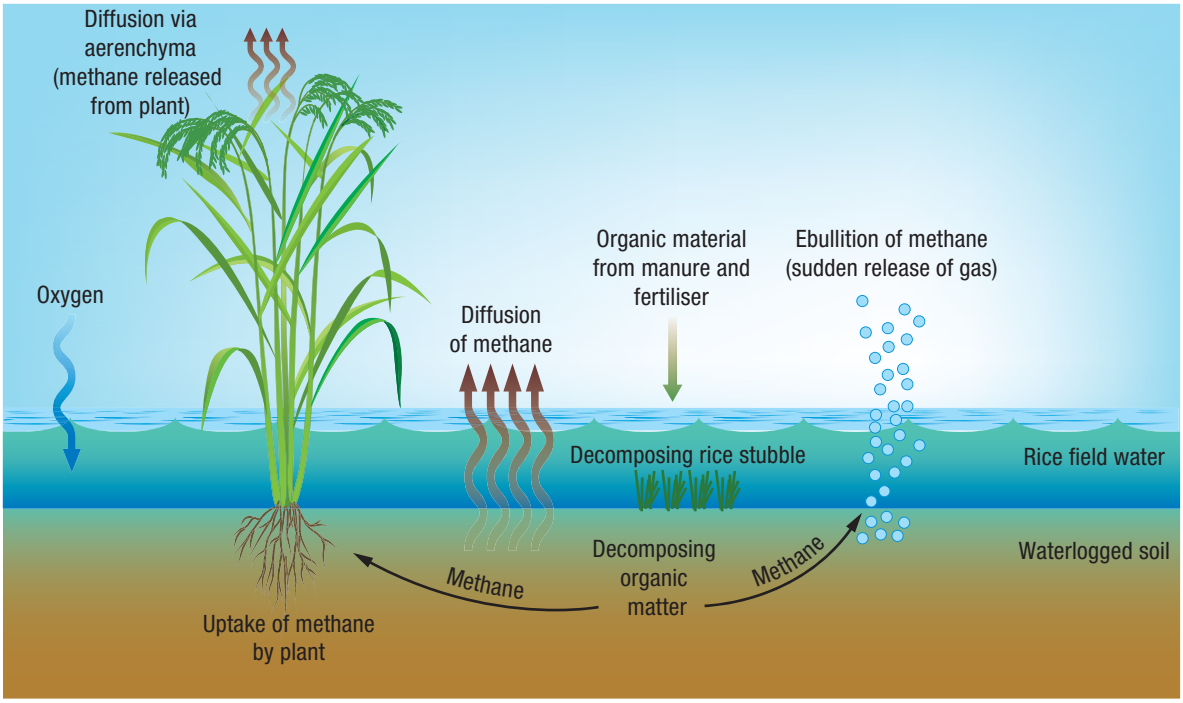
Fertilisers are not fully utilised by rice plants, so any excess is absorbed by the soil, lost into the atmosphere, **leached** into groundwater or transported offsite by runoff or the release of bunded waters. Fertilisers can therefore lead to **eutrophication** of waterways: they can reduce the concentration of dissolved oxygen in the soil, which leads to reduced **biodiversity** and degraded habitat.

leaching the draining of water-soluble compounds out of the soil by the flow of water

eutrophication an excess of nutrients in water, resulting in an increase of algae and bacteria, which leads to the deaths of animals as the oxygen levels in the water decrease

biodiversity the diversity of plant and animal life in a particular habitat

HYVs are more susceptible to insect pests than older rice varieties. The use of pesticides is controversial because of concerns over human health risks, and about their effects on the natural environment. Pesticides may affect insects and other fauna that are important for ecosystem functioning. Pesticides are readily transported by



Source 4.42 Methane gas production in rice fields is enhanced by the use of fertiliser and manure, and by waterlogged conditions.

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water and can affect aquatic ecosystems many kilometres away from their source.

offsite sedimentation the contamination of waterways by accumulated sediments washed from the land

salinisation when salt is deposited on the soil

acidification the process whereby a substance becomes acidic, or is converted into an acid

A great deal of land clearing is done to create more rice fields. Land clearing reduces the size of natural environments and can increase erosion and **offsite sedimentation**. Pressure on land resources from urbanisation, industry and other farming practices has led to the reclamation of coastal wetlands for rice. These reclaimed lands are often not well suited to rice farming because of their low elevation, the presence of acid sulfate soils and their proximity to tidal waters. Reclaimed wetlands can easily be exposed to flooding, and to **salinisation** and **acidification** of soil and water.

Rural–urban migration

rural–urban migration the movement of workers from farmlands to cities and other urban areas

Rural–urban migration is a threat to the supply of labour for rice-producing rural areas. Economic growth in Southeast Asia since the 1980s has attracted rural youth to secure, salaried positions in the cities and the increasingly urbanised regional centres. The migration of young people to urban areas has left behind an ageing labour force in rice-farming communities. Rice farms are often handed down through generations, so a lack of interest in maintaining the family-run farm forces owners to sell their fields or to lease them to others, which means the family tradition of rice farming can cease abruptly.

ACTIVITY 4.5

1 List the key differences between irrigated and rain-fed farming systems.
2 Explain why methane emitted from rice fields is an environmental problem.
3 Explain how the migration of young people affects society in both rural and urban areas.
4 Identify two threats of rice farming to aquatic ecosystems.

RESEARCH 4.3

Investigate rice farming in the Philippines using the internet (start by going to www.cambridge.edu.au/geography9weblinks), then complete the following tasks:

1 Find out the average annual production of rice in the Philippines.
2 Explain the dominant farming system.
3 Describe the economic and environmental factors that have affected yields.
4 Identify two farming practices that were adopted during the Green Revolution.

Environmental constraints

The success of rice farming is inextricably linked to the environment. Without adequate water supply and fertile soil, rice farmers face the challenge of artificially managing the environments they farm. To achieve high yields from HYVs, they have to increase their use of fertilisers, pesticides, water and other inputs.

Rainfall is the primary water source for farmers. Keeping water in upstream areas, in large dams and weirs, and diverting water to other land uses and domestic supply, reduces the availability of

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water in irrigated rice-farming areas. Surface waters (rivers, streams, canals and lakes) are also at risk of contamination from domestic waste and effluent from industry.

Soil fertility is variable across Southeast Asia. Nutrient-rich soils are found in alluvial environments, such as flood plains, and in areas where volcanic activity occurs. Hill slope soils, which are often used for rice terraces, can be shallow and low in nutrients. Sandy soils in coastal areas are often low in nutrients due to leaching. The disturbance of acid sulfate soils in coastal lowlands can release large amounts of acid and toxic metals, which harm the rice plant and can degrade the offsite environment.

Changing consumption trends

Southeast Asian countries can be categorised as net importers or net exporters of rice. **Globalisation** and an increase in the disposable income of young people have led to a shift in food preferences. Urban youth are increasingly adopting western diets and replacing rice with wheat-based staples, such as bread. The health benefits of reducing carbohydrates, which are a major component of rice, are also better known. A change in dietary preferences has reduced the consumption of rice by individuals, but the rising population maintains the demand for rice, particularly in rural areas where incomes are lower and traditional diets remain important.

globalisation the process by which the world is becoming more interconnected, with an increase in social and economic integration between countries (eg an increase in international trade and communication)

Factors that determine whether a country is a net exporter or a net importer include: the number of people who consume rice, the available labour source, the land available for cultivation, the yield of the rice varieties that can be farmed, the farming technology and seasonal controls (such as rainfall) on production. Countries may shift from being net importers to net exporters and vice versa if there is a change in any of these factors.

RESEARCH 4.4

Investigate the role of pests and how they are controlled in rice fields. Information is widely available on the internet (start by going to www.cambridge.edu.au/geography9weblinks). Complete the following tasks:

1. Identify three pests that affect rice fields.
2. Describe how these pests affect rice production.
3. List control measures that are used to manage or eradicate these pests.
4. Identify the environmental risks of the control measures.

Case study 4.3

Rice and Indonesian society

The Dong Son people introduced rice farming to Indonesia from northern Vietnam around 1000 BCE. The Dong Son people brought skills in buffalo husbandry and tool making that enabled Indonesian people to productively farm rice. By 700 BCE, thousands of villages were established around rice fields on fertile volcanic and **alluvial** soils, giving rise to a strong **agrarian** society, which continues to exist today. Indonesia's economic growth is now creating a more highly urbanised society, and decreasing agrarian activities such as rice farming.

alluvial (soils) soils that are rich and fertile and deposited by rivers

agrarian (society) a society that depends on agriculture for its livelihood

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Over 250 million Indonesians consume rice on a daily basis, and over 20 million households participate in rice farming. Most farms are family-based businesses. Approximately 140 kg of rice are consumed per person annually in Indonesia, which is more than double what is consumed in most other countries in Southeast Asia. There are over 13 million ha dedicated to rice farming, more than is used for any other industry in Indonesia. Indonesia is the third largest producer of rice in the world and the largest producer in Southeast Asia. Rice is mostly grown on the islands of Java, Sumatra, Sulawesi, Bali and Kalimantan. Despite its large annual rice production, Indonesia has become a net importer of rice due to declining yields, pressure on land for development and a growing population that continues to depend on rice as a staple food.

Irrigated and rain-fed lowland rice farming are the dominant systems and account for more than 60% and 20% of the area farmed respectively. Irrigated and rain-fed lowland rice fields are locally known as *sawah*. Water management requires cooperation between farmers who share water resources and irrigation canals. Rain-fed upland rice fields are called *lading*; together with tidal swamp rice farming, this accounts for the remaining 20% of cultivated land. Family members, neighbours and villagers work together, particularly during the transplanting and harvest phases of production. Rice farming is labour intensive in Indonesia and increases social cohesion in rural areas.

There is a popular adage in Indonesia: 'If you haven't eaten rice today, you haven't eaten at all.' Clearly, rice is firmly on the menu in Indonesia!

brackish (water) having higher salinity than fresh water, but not as much as seawater

The conversion of rice fields to **brackish** water aquaculture, urban areas and palm oil plantations has reduced the area dedicated to rice production in Indonesia. The higher value of shrimp and some other commodities is attractive to rice farmers who often produce only enough rice to meet their basic needs. Indonesia's efforts to become a net exporter of rice include: education on the health benefits of reducing rice consumption (an excess of carbohydrate leads to obesity), introduction of new HYVs, land zoning to conserve rice-growing areas, government-funded research into development, and government-funded programs that provide farm inputs in order to minimise costs to smallholder farmers.

Source 4.43 Rice fields converted to aquaculture ponds in South Sulawesi, Indonesia

1 List the ways in which rice farming can strengthen village life in Indonesia.
2 Describe how Indonesia has become a net importer of rice.
3 Explain why economic growth is a threat to rice farming in Indonesia.
4 Discuss the impacts of declining rice production on Indonesian society.

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RESEARCH 4.5

Form a group of 3 or 4 and create a poster to communicate historical, cultural and rice production data for one of the following Southeast Asian countries: the Philippines, Cambodia, Myanmar or Thailand.

Make sure to include the following in your poster:

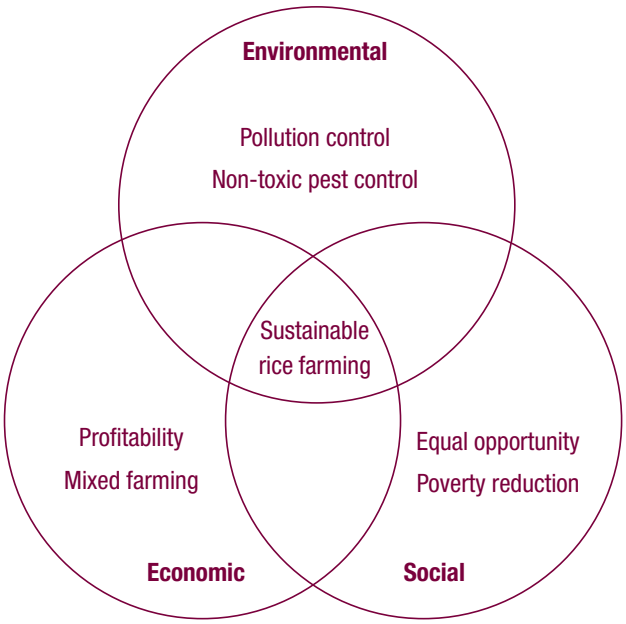
- title and introduction
- the population and any data on consumption of rice
- the annual rice production over the last 10–30 years: using spreadsheet software, enter your production data and generate a graph that best displays the information
- the history of rice farming
- the different farming systems
- the role of rice in the country's society, culture and economy
- the future of rice production
- conclusion or summary.

The UN Food and Agriculture Organisation has relevant data on its FAOSTAT online database.Use the link at www.cambridge.edu.au/geography9weblinks to find the database. Locate a map of your selected country and download images or figures that you can use in your poster.

NOTE THIS DOWN

Copy the graphic organiser and assign the following to their relevant positions:

- soil management
- improved health
- higher income
- water management
- pest control
- farmer cooperation
- export opportunities
- increased educational opportunities
- social cohesion
- employment
- family tradition
- site selection



RESEARCH 4.6

Rice farming is under threat from aquaculture, expanding urban areas, expanding areas of palm oil production and the loss of young people to the city. In a short report, examine the problems these are causing the rice producers and discuss how technology might play a role in maintaining production levels.

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Chapter summary

- People have always used biomes for food, clothing and shelter.
- The impact people have on biomes varies from very little to major.
- Some so-called primitive people are able to manage their biomes quite sustainably.
- Population growth can be harmful to biomes.
- Some subsistence and commercial activities can almost completely remove the original biome.
- National parks are one way to preserve biomes for future generations.
- The public is becoming more aware of the need to manage biomes sustainably.
- Governments are responding to demands by the public to manage resources sustainably.
- Rice is a staple food for all Southeast Asian countries and is important for food and income security.
- Environmental factors, such as soil quality and variable rainfall, and human factors, such as competition for water resources and demand for urban land, are constraints on rice farming.
- An increasing preference for western food has seen a decline in the consumption of rice in younger generations. However, high population growth has maintained demand for rice.

End-of-chapter questions

Multiple choice

1 Which of these biomes are severely threatened by human activity?

A Rainforests
B Deserts
C Alpine
D Coniferous forests

2 Which of these biomes are not severely threatened by human activity?

A Coniferous forests
B Rainforests
C Deserts
D Savanna

3 Which of these is a major factor impacting on the Earth's biomes?

A Soil salinity
B Asteroids
C Humans
D Wildlife

4 Which biomes in Australia are World Heritage listed?

A The Great Barrier Reef
B Fraser Island
C Uluru-Kata Tjuta National Park
D All of the above

5 How many people in Southeast Asia consume rice on a daily basis?

A 20 000 000
B 150 000 000
C 610 000 000
D 340 000 000

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Short answer

1 Explain what shifting cultivation is. How many years does a shifting cultivator use a plot for?

2 Contrast intensive and extensive farming.

3 Contrast subsistence and commercial farming.

4 Discuss the importance of rice to Southeast Asian livelihoods.

5 Describe one way rice farming negatively affects the environment.

Source 4.44 A field in the Usambara Mountains, Tanzania, 'slashed and burned' in preparation for planting maize crop

Extended response

This chapter has shown how people have changed some biomes from natural systems to systems completely dominated by humans. Write a newspaper article about how urban areas depend on rural and natural systems today. When writing your article, consider the following:

- that urban areas use food produced in rural areas
- the history of food production
- what urban areas would be like without rural food production
- the impacts of urbanisation on the economy, the environment and culture.

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5 Agricultural systems in Australia

Source 5.1 Australian farmer yarding sheep

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Before you start

Main focus

Agriculture has been at the centre of Australia's development since European settlement in 1788, and over this time the nature of agricultural practices has changed dramatically. As it looks to the future, agriculture in Australia faces the challenge of providing food and fibre security in a sustainable way for an increasing population with the threat of climate change and environmental degradation placing an enormous burden on the nation's ability to increase production.

Why it's relevant to us

In highly urbanised modern Australia consumers are becoming increasingly alienated from the production of the food they eat and the natural fibres they wear. There needs to be a greater awareness of the vital place that agriculture has in the lives of all Australians and an understanding of the threats that will be faced by the industry in the future.

Inquiry questions

- What role did agriculture have in the development of Australia?
- What is the state of agriculture today?
- How have past agricultural practices impacted on the Australian environment?
- What threats are facing future agricultural production?

Key terms

- Climate change
- Climatic seasonality
- Environmental degradation
- Food security
- Green Revolution
- Sustainable agriculture

Let's begin

As it has been in many other countries, agriculture has been at the forefront of Australia's development. The expression 'riding on the sheep's back' was a reference to the prosperity that Australia derived from the production and export of wool in the 19th century and the first half of the 20th century. Life in the bush and on the farm has featured largely in the history of Australia, mythologised in such works as Banjo Paterson's poem *The Man From Snowy River* and the comical stories of Dad and Dave in *On Our Selection*, shown in some of Australia's earliest films. Agriculture's significance in modern times is still celebrated in the resurgent popularity of annual agricultural shows such as Sydney's Royal Easter Show. Today agriculture remains a major part of the Australian economy, producing a diverse range of products, from sheep, cattle and wheat in Australia's vast inland, to cotton and rice in Australia's irrigation districts, to tropical fruits such as mangoes and bananas in Australia's north.

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5.1 Agriculture in Australia

agriculture the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool and other products

Agricultural Revolution a period of massive change in the way that agriculture is practised

hunting and gathering the practice of obtaining food requirements through the hunting of wild animals and the collection of naturally growing plants and plant products

Sustained **agriculture** first developed over 12000 years ago in various regions around the globe. Archaeologists have found evidence of early farming communities in areas along the Euphrates and Tigris rivers in the Middle East, the Indus River in Pakistan and the Yellow River in China. This first **Agricultural Revolution** marked a monumental shift: from the early **hunting and gathering** societies to communities that domesticated animals and grew crops for food. The advent of sustained agriculture was a relatively recent phenomenon in Australia. Prior to European settlement the Indigenous people of Australia lived a predominantly nomadic hunting and gathering existence and did not farm the land in a systematic way. The arrival of the First Fleet in January 1788 heralded the arrival of agriculture. In May 1788 the livestock in the fledgling colony was listed as 7 horses, 7 cattle, 29 sheep, 74 pigs, 5 rabbits, 18 turkeys, 29 geese, 35 ducks and 209 chickens, and a few acres of land were being cultivated (unsuccessfully) for cereal crops at Farm Cove. (This is now the site of the Royal Botanic Gardens in Sydney.) By 1860 the agricultural revolution had firmly arrived. On the official census there were listed 431525 horses, 3957915 cattle, 20135286 sheep and 351096 pigs, and 48000 hectares of land was devoted to cereal crops.

Today the agricultural industry extends right across the nation, except in the desert areas in Australia's vast inland, and encompasses an enormous range of **commodities**, as shown in the table below.

commodity a raw material, such as an agricultural product, that can be bought and sold

Livestock	Cereal crops	Oil seed crops	Pulse crops	Other crops
sheep	wheat	canola	soybeans	cotton
goats	oats	safflower	lupins	sugar cane
cattle (dairy and beef)	barley	sunflower	mung beans	
pigs	sorghum		peanuts	
poultry	maize		chickpeas	
horses	millet		field peas	
deer	rice		fava beans	
	triticale			

Fruit – tropical	Fruit – general	Berries	Vegetables	Nuts
banana	apple	strawberry	root vegetables (potatoes, carrots, onions)	almond
mango	pear	raspberry	cruciferous vegetables (cabbage, broccoli, cauliflower)	macadamia
pineapple	grape	blackberry	lettuce	cashew
papaya	stone fruit (peach, apricot, plum)	kiwifruit	tomato	
avocado	cherry	passionfruit		
lychee	citrus fruit (orange, lemon, grapefruit)			
	melon (watermelon, rockmelon)			

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peri-urban areas just beyond the boundaries of major urban centres

These industries range in size from the extensive cattle stations – which can be up to 24 000 km² in Australia's arid zone – to fruit and vegetable farms of just a few hectares in the **peri-urban** zones.

Source 5.2 One of the world's major cereal crops is wheat. The wheat in this image has reached maturity and is ready for harvesting.

Source 5.3 Cattle mustering on a Northern Territory cattle station

ACTIVITY 5.1

1. The products in the list on page 114 are only some of the agricultural commodities that are produced in Australia. The list doesn't include silage production for animal feed, for instance. As a class, discuss some of the other agricultural products that you are familiar with that are grown in Australia.
2. Some of the commodities on the list, such as cattle, can be produced in most Australian regions, but some have specific growing or production conditions. As a class, make a list of some of the major factors that may have an influence on where agricultural production can take place and what types of commodities can be produced.
3. As a class, discuss the importance of agriculture to the Australian economy relative to other sectors of the economy, such as mining, manufacturing or services. Which is the more important, and why?

RESEARCH 5.1

Have any of the class answers for question 1 above included native foods or 'bush tucker'? Research some of Australia's native foods and discuss their potential as agricultural commodities.

Despite its overall success, agriculture did not have an easy start in Australia. In the first few years of settlement, the fledgling British colony almost starved and had to import food from other colonies – the sandstone soils around Sydney Harbour were too infertile to sustain crops, and the unfamiliar climate proved confusing to those used to European conditions and farming techniques, so they didn't know how to time their planting cycles correctly.

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Within two years of settlement, however, more fertile soils were discovered further inland, and in 1789 the governor of the fledgling colony, Captain Arthur Phillip, assigned the first land grant in Australia: to the ex-convict James Ruse at Rose Hill (now Parramatta) for the purpose of establishing farming on a larger scale. The 30 acre (12.15 ha) 'Experiment Farm', as it was known, was Australia's first wheat farm and proved that the colony could be self-sufficient.

Source 5.4 The cottage at Experiment Farm, now surrounded by suburban Sydney

Agricultural productivity in Australia is constrained by significant geological and climatic factors, as well as pressures from alternative land uses such as urban development. Of all the inhabited continents, Australia is the driest. It also has some of the Earth's oldest, shallowest and most weathered and infertile soils, making vast areas of Australia unsuitable for **intensive agriculture**. Over 70% of Australia's land area receives low amounts of rainfall and is classed as either semi-arid or arid: of the 7.6 million km^2 of total land area barely a tenth is suitable for sown crops and pastures, and much of that only after the addition of fertilisers or the use of other soil-improving practices such as the planting of pasture **legumes** (which fixes essential nitrogen to the soil). Australia does have areas of naturally fertile soil, such as in the Wimmera area of Victoria and the Darling Downs region of Queensland, but these are not extensive compared with the deep, fertile soils of the North American prairies or the Ukraine in Eastern Europe.

intensive agriculture farming a small area with a crop that has a high monetary value

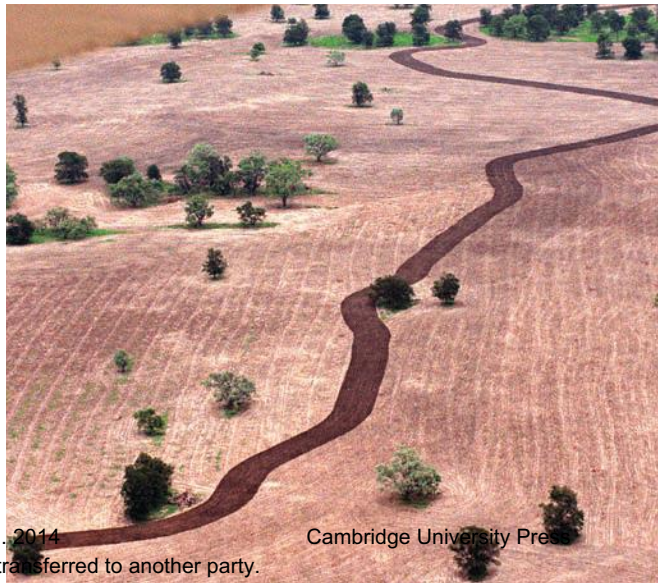
legume a type of plant, such as clover, soybeans and lupins, that carries nodules on its roots; working with certain bacteria, legumes are responsible for the fixing of nitrogen in the soil

Source 5.5 Harvesting wheat in Victoria's fertile Wimmera region

Australia is also one of the most urbanised countries in the world, with almost 90% of the population living in towns and cities and most of these within 100 km of the coast along the southwestern, southern and eastern regions of the continent, where the soils are more fertile and rainfall is more abundant. The continual spread of urbanisation is one of the pressures that agriculture is facing in Australia, as more and more land is being claimed for urban development.

Land and water are essential for agriculture and the Australian landscape and water catchments have changed significantly since European settlement. Agriculture is the largest

Source 5.6 A tractor ploughing a paddock recently cleared of vegetation near Moree, New South Wales



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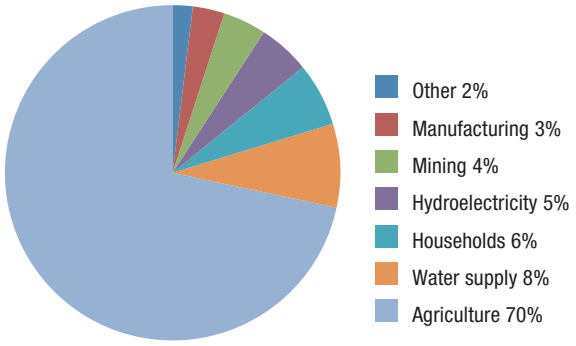

Source 5.7 Water use in Australia

hectare 10 000 square metres

erosion the wearing away of the surface of the Earth by the action of water and wind

salinity the level of salt in soil and water

consumer of water in Australia – on average, it represents 50–70% of total water use – and since settlement around 100 million **hectares** (ha) of forest and woodland have been cleared, mostly for agricultural production. Even today land continues to be cleared for agriculture. In 2013 around 456 million ha, or 59% of land in Australia, is used for agriculture, making it the dominant form of land use.

Agricultural land use has also had other significant impacts on the Australian environment. The alteration of vegetation cover has led to increased **erosion** and **salinity**; land clearing has caused a reduction in biodiversity and increased extinction rates; the cultivation of food plants and the grazing of domestic animals have changed the nutrient balance of the soil; and the addition of fertilisers has increased the rates of **soil acidification**.

soil acidification a gradual increase in the acidity of a soil, which reduces crop productivity

Historically, despite the difficulties faced in establishing and adapting agriculture to Australian conditions, and in managing the impacts agriculture has had on the environment, it has been a successful enterprise. Australian farmers are innovative. They are constantly adopting new ideas and practices to increase productivity while also looking after the land. They have been able to produce enough food and natural fibre (such as wool and cotton) to meet the needs of several times our own population.

Agricultural enterprises are also successful for the Australian economy. Until the 1970s agricultural products made up a substantial percentage of world trade. In 1876–80, food and natural fibre accounted for about 58% of the value of world trade. This made Australian farmers some of the wealthiest in the world and this wealth showed in the grandeur of some of the houses built at the time. One of these, Werribee Park Mansion in Melbourne's west, was built by the pastoralists Andrew and Thomas Chirnside in the 1870s and reflected the immense wealth the family had made from sheep production.

Today agriculture makes up less than 10% of world trade and farm profits have decreased significantly. Today's Australian farmers need to produce more than four times the volume to earn, in real terms, just over half of what farmers earned in 1951–52.

Source 5.8 Early photograph of the Chirnside property near Werribee, Victoria

Geographical fact

Some of the longest fences in the world have been created in Australia to protect farming land and livestock from pests and predators. The Dingo Fence, which is 5400 km long – 2.5 times the length of the Great Wall of China – stretches from South Australia to Queensland to protect sheep from dingo attack. Rabbits, which were released in Victoria in 1859 and soon grew to plague proportions, have had a devastating impact on the natural environment and agricultural production. To protect their crops from rabbits, farmers in Western Australia erected three rabbit-proof fences. Rabbits managed to cross the first one, so two more had to be constructed. The total length of all three fences is more than 3000 km.

ACTIVITY 5.2

1. Explain the meaning of the expression 'Australia rode on the sheep's back.'
2. Describe the major limiting climate factor for agriculture in Australia.
3. Suggest some of the ways that agriculture in Australia has dealt with the lack of natural rainfall.

Agriculture and the spread of settlement in Australia

The spread of settlement in Australia was closely linked to the expansion of agriculture. This was not always an easy process. For the first 150 years of settlement the establishment of agriculture was hampered by the vastness of the continent, the unfavourable climate and rainfall, the poor soil, the lack of agricultural experience and knowledge of those settling the land and poor decision-making by farmers and Australian governments. Despite being a nation that has largely settled the coast, the bush has always been a feature of the Australian collective consciousness, and dreams of making a living from the land have had a strong attraction for many people.

fragmented broken up into smaller or separate parts

In the process of settlement the landscape was **fragmented**. Before the arrival of Europeans in 1788, the Indigenous peoples were intimately bound to the land; it was – and still is – an essential part of their spiritual and physical being. European notions of land ownership didn't exist and territorial boundaries between peoples were based on cultural identification with land features such as rivers and mountains. Aboriginal people could move freely over the landscape.

European notions of land ownership were based on the principle of private ownership, and land was allocated with geometrical precision, based on units such as acres. The fragmentation of the landscape begun by the Europeans was consolidated with the establishment of boundary fences and roads which clearly marked out territory and restricted the free passage of people and animals through the landscape. Widespread land clearing was an integral part of this process.

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Source 5.9 An early style of chock and log fence in Tasmania

ACTIVITY 5.3

1. Explain what 'a landscape becoming fragmented' means.
2. Explain how perceptions of the land differed between Indigenous Australians and the early settlers.
3. Discuss how you think Indigenous people might have reacted as the landscape was becoming fragmented.

RESEARCH 5.2

In a recent book by the historian Bill Gammage, called *The Biggest Estate on Earth*, he claimed that the Indigenous people of Australia were the first to create widespread landscape change on the continent and were adept managers of the land who intimately understood the life cycles of native plants and the importance of fire in the management of the landscape. Gammage's conclusions imply that contemporary Australian land managers have a lot to learn from Indigenous land management techniques.

Research what some of these Indigenous land management techniques were and how they might be useful in contemporary land management practices.

Settlement and expansion 1788–1860

From early in the history of the Australian colonies the colonists eagerly sought new land for growing cereal crops and for sheep and cattle production. The period from 1788 to 1820 was a period of limited agricultural expansion because of low population growth and geographical impediments such as the impenetrability of the mountain ranges west of Sydney. Most of the agricultural settlement was taking place within 50 km of Sydney in New South Wales and Hobart and Launceston in what was then called Van Diemen's Land. Wheat and maize were the major crops and wool was only beginning to be recognised as having economic potential.

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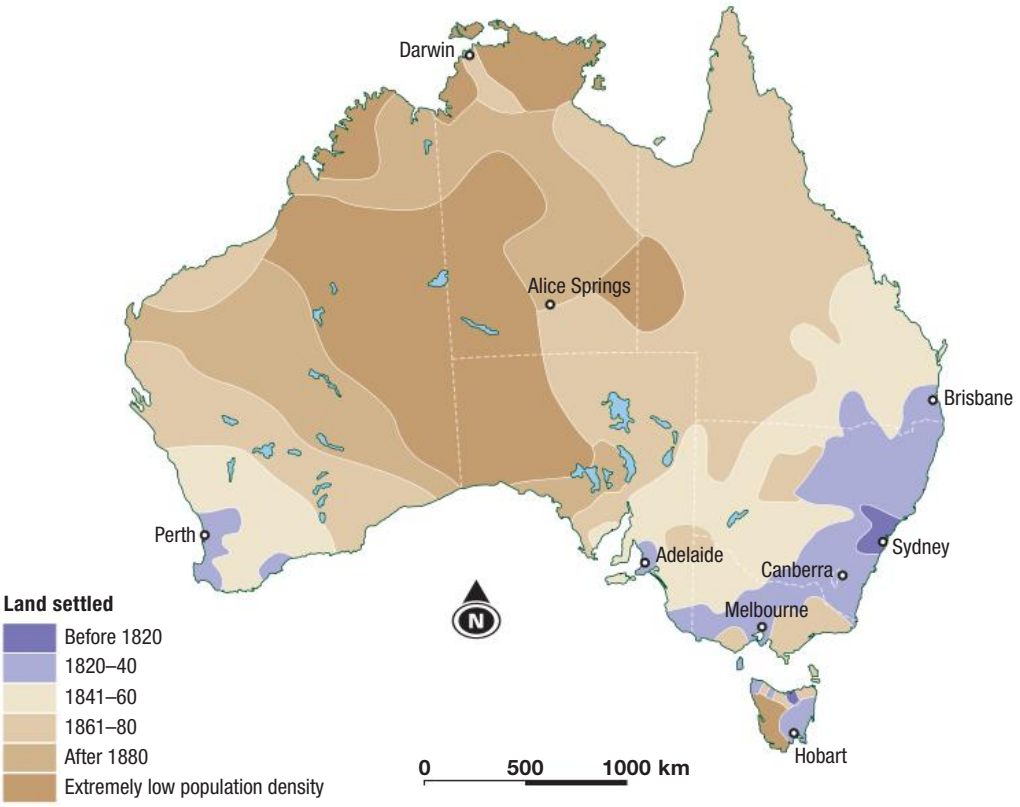

Source 5.10 Pattern of land settlement in Australia

Once a crossing had been found through the Blue Mountains west of Sydney in 1813, settlers who were eager for fertile land for agricultural development spread through the inland. The same thing was happening in Victoria. In 1836, Sir Thomas Mitchell, who was exploring the western district, wrote of the richness of the land:

> Towards the south coast on the south and adjacent to the open downs between the Grampians and Port Phillip, there is a low tract consisting of very rich black soil, apparently the best imaginable for the cultivation of grain in such a climate.

squatter a farmer who in colonial Australia occupied large tracts of Crown land in order to raise sheep or cattle

Agricultural settlement of the vast interior of the continent during the next 40 years was led by the **squatters**, who were seeking land for sheep and cattle grazing. The growing of cereal crops was still largely restricted to the high rainfall coastal zones on Australia's eastern and southeastern coasts.

The squatters were farmers who had, during the early years of European settlement, illegally occupied large areas of **Crown land**. So vast was the country and so small was the population that there was little the colonial authorities could do to keep the squatters in check.

Crown land land owned by the government

The vast sheep and cattle runs the squatters acquired – they averaged about 12 000 ha – were so financially successful that these men became wealthy and powerful members of Australian society: the squattocracy. By the 1830s, colonial governments no longer regarded the squatters as acting illegally and began granting them licences or leases for the territory that they had occupied. Many of these squatters are remembered in place names that still exist in the areas that they occupied. The establishment of the rural town of Kyneton in central Victoria is one example of the importance of the early squatters. Its streets are also named for people such as Charles Ebden and William Yaldwin, who settled the area in the late 1830s.

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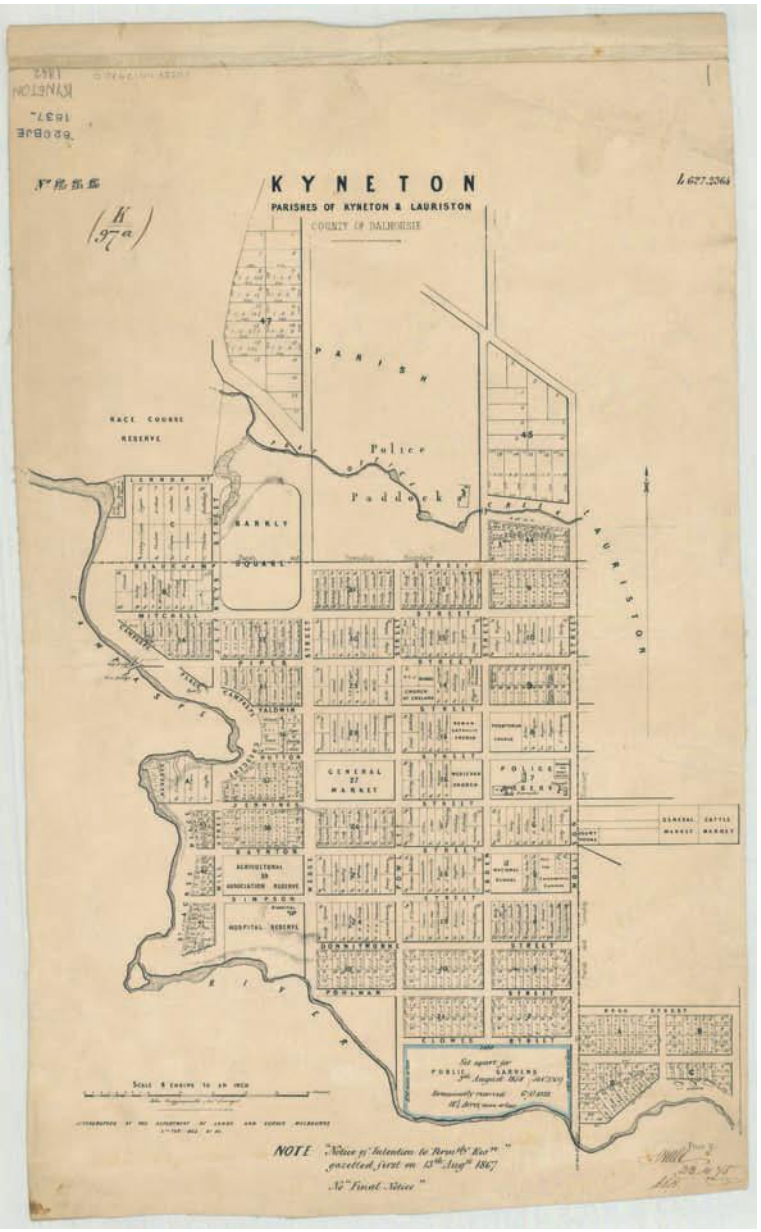

Source 5.11 Early map of the Victorian town of Kyneton

ACTIVITY 5.4

1. Explain why the development of agricultural settlement in Australia was so limited in the first 20 years of European settlement.
2. Discuss whether or not it was in the interests of the squatters to ignore the government restrictions on taking up land to run sheep and cattle.
3. Suggest ways in which the success of the wool industry might have promoted greater migration to the Australian colonies.
4. Referring to Source 5.11, investigate the settlement of your own region.

RESEARCH 5.3

1. The export of wool created enormous wealth for Australia and the development of the merino sheep was one of Australia's success stories. Write a research report detailing the development of the merino sheep in Australia and how it has been adapted to Australian conditions. Examine some of the important figures in its development, such as John and Elizabeth Macarthur, and explain why merino wool was such a valued commodity.
2. Many local historical societies have museums that document the history of the region. Visit one of these museums and take note of the number and types of artefacts that relate to the agricultural history of the area. Write a research report on the agricultural history of your region.

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Unlocking the land – turning the bush into farms, 1860 to 1900

By the 1860s the colonial governments were under pressure to 'unlock' the land that had been occupied by the squatters and break it up into farming allotments. A number of factors were encouraging this change:

- large numbers of immigrants had swelled the population of the colonies following the gold rushes of the 1850s and there was pressure on governments to allocate land to these new settlers
- the governments of the colonies also believed that Australia's fortunes could not be tied predominantly to the export of wool and decided that the rapidly growing population needed to be self-sufficient in food
- there was a general (but inaccurate) belief that the European tradition of intensive farming of smaller parcels of land could be transplanted to Australian conditions.

Colonial governments introduced a number of Land Acts (laws) which broke up the land holdings of the squatters and promoted schemes aimed to help people farm a variety of produce on their land, with a particular emphasis on intensive agriculture such as wheat rather than **extensive agriculture** such as wool production. There was great enthusiasm for these schemes: it was hoped they would revolutionise agricultural production in Australia. One government land agent in Echuca in Victoria even enthusiastically wrote in 1872 that the Victorian Land Act had somehow affected the climate:

extensive agriculture crop or livestock production over large areas of land which requires fewer inputs such as labour: one example would be wool production

> With the Land Act 1869 a great improvement in the seasons took place, the rainfall increased, the grass became abundant, steady and increasing settlement took place, which has now amounted to a rush, and … still they come. (quoted in Charles Fahey, *John Sweeney and the making of an Australian farming landscape: a micro-level study of Baulkamaugh and Katunga, 1877–1955*)

Large areas of land which had previously been licensed to squatters was divided into selections of 16–130 ha and sold. In Victoria, the Land Act of 1862 reserved 4 million ha of land for selection. In many cases the wealthy squatters, through various means, were able to buy back much of their land, often selecting the most productive allotments. Many of the blocks that were not good quality agricultural land or did not have characteristics essential for viable farming, such as creeks and rivers, were rejected by the squatters and were bought by small farmers known as **selectors**, many of whom ended up not having enough money, resources or knowledge of farming to do anything but struggle to survive on their land.

selector a farmer, often with few resources, who bought a small parcel of land following the land reforms in Australia in the 1860s

Source 5.12 A selector's hut in Gippsland, Victoria, in the 1880s

Nicholas Caire, Selector's hut, Gippsland c.1886
National Gallery of Australia, Canberra
Purchased 1983

The selectors who purchased these land parcels brought their families to live and work on the farms, and for a great number of these families extreme hardship ensued. Many of these blocks were too small to sustain a family, let alone produce a surplus, and a great number of them had no access to a reliable water source. Drought and flood caused heartbreak for many, and attempts to get the land to produce enough to sustain a family often had adverse environmental consequences. Large numbers of these farms were doomed to failure and over time many were deserted by the

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farmers, who just walked off the land. The land parcels were then often incorporated back into larger land holdings.

It was during this period that the agricultural landscape of Australia started to change dramatically. Close to the major settlements of Melbourne and Sydney, which had been settled for a number of years, smaller agricultural holdings were well established – land had been cleared and fenced and roads had been built. Large parts of the interior, however, had not been substantially changed. The squatters had had little need to clear the land of vegetation and fence it. The boundaries of their land holdings were creeks and rivers or other prominent landscape features.

The various Land Acts of the 1860s brought about a significant change in land use to areas that had previously been open **pastoral** land. The Land Acts generally required the selectors to clear and fence their land, and this and other provisions in the Acts were beginning to change the characteristics of land use in Australia.

pastoral land used for the grazing of cattle or sheep

ACTIVITY 5.5

1. List the ways in which the Land Acts of the 1860s were a failure.
2. Describe how the Land Acts of the 1860s promoted change in the landscape of Australia's inland.
3. One of the underlying beliefs driving agricultural settlement in Australia in the first 150 years was a belief in the ideal of the yeoman farmer. The yeoman farmer was a European small farmer who, with intensive labour, could work a small plot of land and make it productive. Many people came to Australia from Europe with the belief that they could make a similar living from the land here. In what ways did this belief not quite fit the reality of Australian conditions and circumstances?

RESEARCH 5.4

The history of the Kelly Gang, who were bushrangers in Victoria's northeast in the 1870s, is closely associated with the experiences of selectors in Victoria following the gold rushes of the 1850s. The Kelly family were poor Irish settlers who struggled to eke out a living on unproductive farming land and felt marginalised and persecuted by the wealthy squatters. Research the history of the Kellys and other families who were small farmers in Victoria's northeast and discuss their experiences of life on the land following the Land Acts of the 1860s.

Consolidation of agricultural settlement, 1900–70

By the first decades of the 20th century virtually the whole of the Australian continent had been opened up to agriculture and agriculture was a major employer. In 1910 agricultural industries employed about 26% of the Australian workforce. The only areas which didn't have an agricultural presence were the deserts in central Australia. Agricultural activity was widespread and varied. While the **dryland** production of wool and wheat were the mainstays of the Australian agricultural industry, irrigation schemes had also been established, mostly along the Murray River and its tributaries, to support more intensive agricultural practices such as fruit growing and dairying.

dryland agriculture farming that depends only on natural rainfall and soil moisture to water crops

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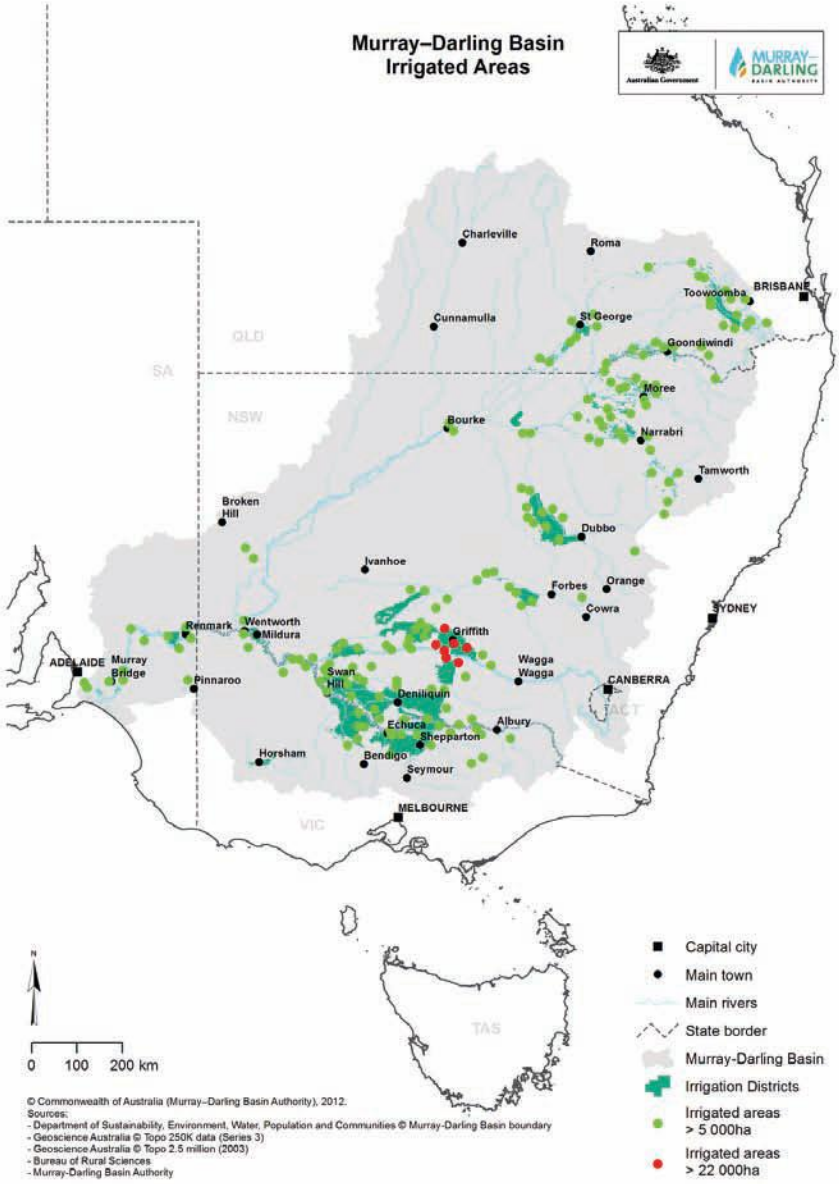

Source 5.13 Irrigation districts along the Murray and Darling rivers and their tributaries

A pastoral industry based on cattle grazing had been established across Australia's northern regions, from the Kimberley Ranges in Western Australia to the Gulf of Carpentaria in Queensland. Sugar cane and bananas were being harvested along Queensland's tropical coast. Tasmania was producing quality apples and a dairy industry was established in the high-rainfall zones along Australia's southeast and southern coasts.

Systematic agricultural settlement in Australia was further developed in the first half of the 20th century through the establishment of 'soldier settlement schemes' to repatriate men returning from World Wars I and II.

Australian governments, faced with having to provide for tens of thousands of men returning from war, developed various land settlement schemes to place these men and their families on farming allotments. These schemes served a number of purposes:

- they rewarded men for their war service
- they solved the problem of finding employment for these men
- they were seen as a means of boosting agricultural production through intensive farming practices.

Like the Land Acts of the 1860s, the 'soldier settlement schemes' broke up the bigger landholdings and opened up various tracts of Crown land for settlement. State governments also spent substantial amounts of money buying land that was already privately owned.

The table opposite shows the amount of land acquired by each of the state governments for their soldier settlement schemes, how much was allotted and how much the acquisition of private land cost.

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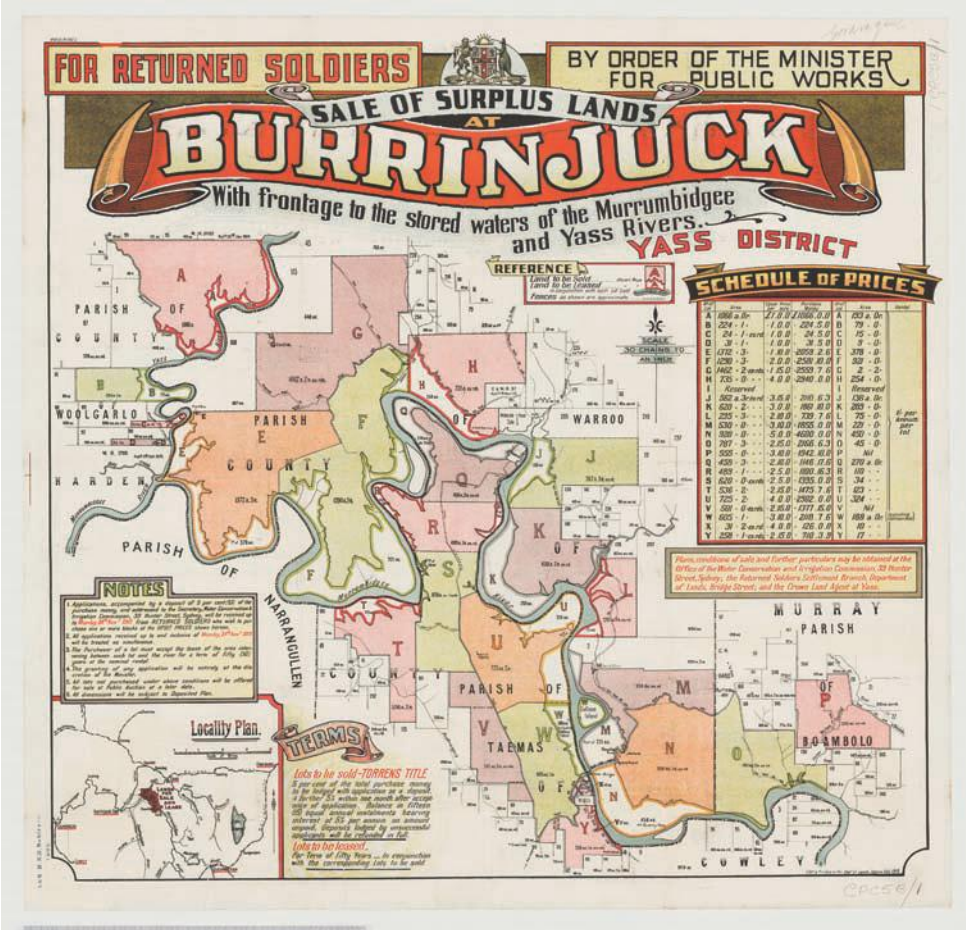

Source 5.14
Brochure advertising the sale of land near Yass, New South Wales, to returned soldiers

Soldier Settlement – Areas Acquired and Allotted 1924							
Particulars	**NSW**	**Vic**	**QLD**	**SA**	**WA**	**Tas**	**Total**
Private land acquired in acres	1 843 869	1 744 111	41 101	2 106 937	253 478	268 209	6 257 705
Crown land set aside for settlement	7 166 991	528 239	699 723	693 140	8 841 233	61 373	17 990 699
No of farms allotted	8 819	8 640	2000	3 249	1 095	1 935	25 738
Total number of acres eventually allotted	8 134 009	2 290 489	705 565	2 779 078	9 094 711	271 537	23 275 380
Price paid by government for land acquired £	8 060 002	13 214 902	270 480	4 302 942	607 215	2 010 255	28 465 766

From ABS Year Book Australia 1925

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ACTIVITY 5.6

1. Which government spent the most money in purchasing privately owned land?
2. The Victorian government acquired less privately owned land than the New South Wales government, yet spent more than New South Wales on buying privately owned land. Suggest reasons for the difference in the price paid for land.
3. Which two states set aside greater areas of Crown land than the other states? Suggest reasons for this difference.

Like many of the government rural settlement schemes that had come before it, the 'soldier settlement scheme' set up following World War I, in 1918, was also generally regarded as unsuccessful, and many of these soldier settlers had left the land within 20 years. In Victoria, 60% of the settlers had left their blocks by 1939. There were a number of reasons for the failure of these farms:

- many of the soldiers were inexperienced as farmers
- the soldiers did not have enough money or resources to develop their farms
- many of the blocks were too small to generate sufficient income and a number of them were situated in areas that were not suited to intensive agriculture
- the prices farmers were getting for their produce fell.

The 'soldier settlement schemes' which followed World War II, in 1945, were generally regarded as more successful. By the middle of the century the conditions required for successful agricultural enterprises in Australia were better understood, so soldiers were allocated blocks of land of an appropriate size, and the type of agriculture that took place on them was more in accordance with what the land could sustain.

By the last decades of the 20th century the large pastoral estates of the 19th century squatters throughout southern Australia had largely been broken up. The modern equivalents of these enormous pastoral stations are now found across the arid and semi-arid regions of Australia, where cattle and sheep grazing over large areas is the only viable form of agricultural production.

The unproductive blocks of land that had brought such hardship to settlers following the Land Acts of the 1860s and the soldier settlement schemes of the early 20th century were by then bought and incorporated into larger, more productive farms or incorporated into nature reserves.

Source 5.15 The 35 000 ha Langidoon Station – a sheep grazing property near Broken Hill, in western New South Wales

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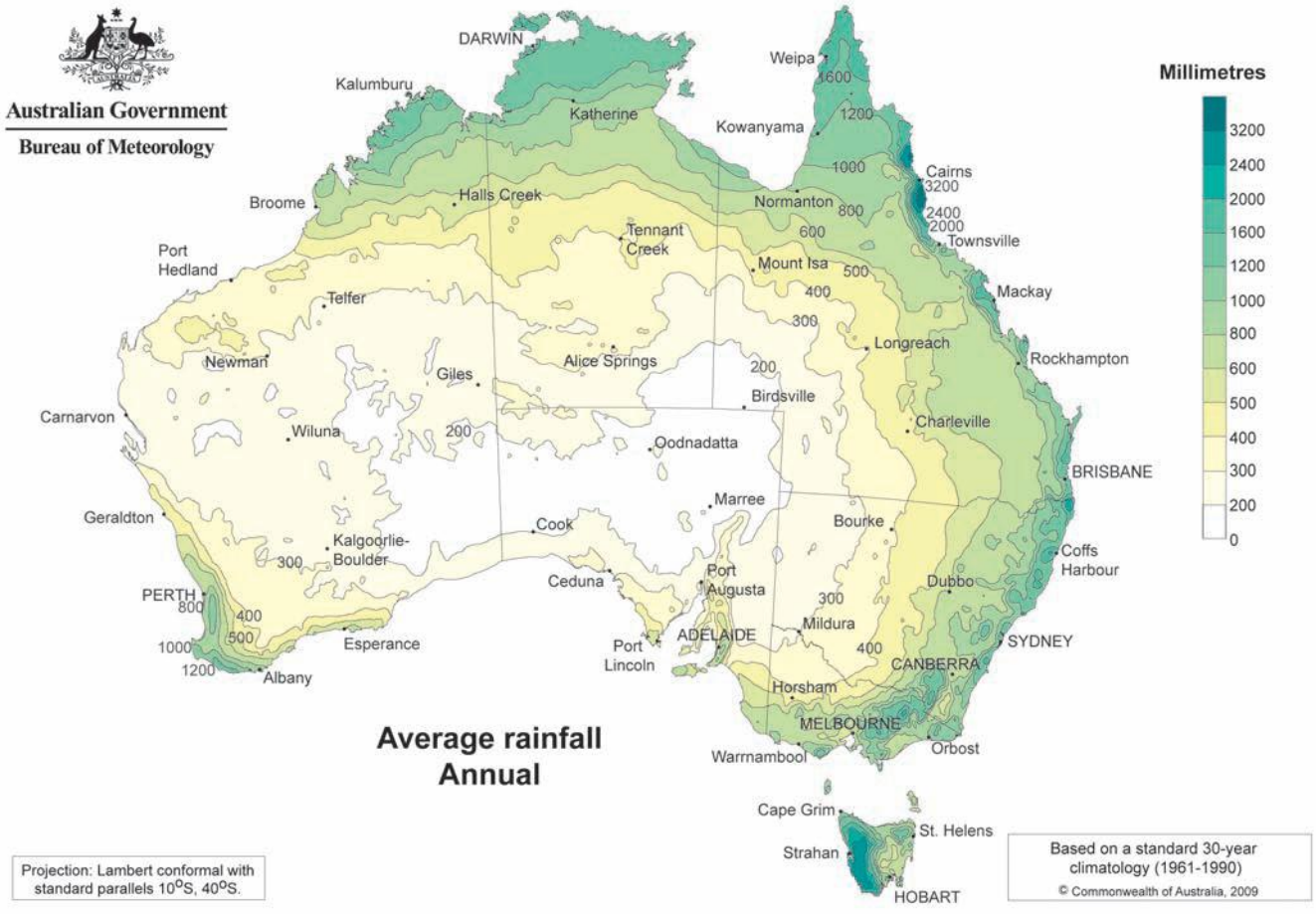
ACTIVITY 5.7

1 Discuss the extent to which agricultural settlement occupied the Australian landmass by the beginning of the 20th century.

2 Explain why the soldier settlement schemes following World War I were regarded as a failure and the ways in which they repeated the mistakes of the earlier Land Acts.

The limits of agricultural production in Australia

One of the major factors influencing the history of agricultural settlement in Australia for over 150 years after 1788 was a lack of understanding of the climatic and geological limitations on agricultural production here. Agricultural knowledge and practices imported from European and other agricultural regions of the world did not suit Australia's conditions, and agricultural adaptations to Australian conditions were often learned through harsh trial and error. The social impacts of some of these ill-suited beliefs and practices were disastrous for farming families, and they have also caused long-term damage to Australia's environment, damage that will affect future food production.



Source 5.16 Map of average annual rainfall for Australia

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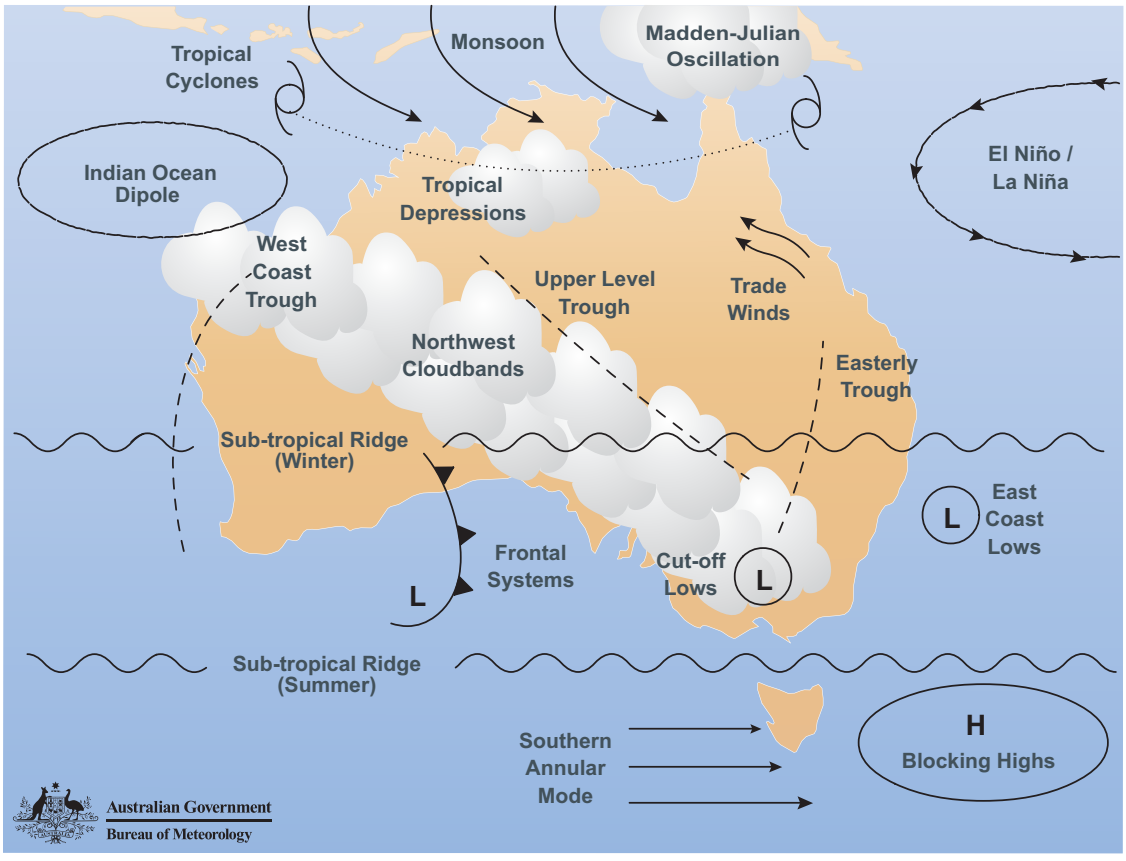
Australia's unique climate

Rainfall, or the lack of it, is the most important single factor determining agricultural land use in Australia, but knowledge about how Australian rainfall patterns impact on agricultural land use was accumulated only over time.

The Australian continent experiences a high degree of climatic seasonality: it fluctuates between periods of rain and periods of dry conditions. Vast areas of the continent receive limited rainfall, and even across large areas that do receive good rainfall, high rates of evaporation cause the ground to quickly dry out, depriving plants of moisture. Much of Australia's interior receives little rainfall in either winter or summer, and experiences high evaporation rates. Many of these areas are only suitable for extensive livestock grazing.

Even the northern half of Australia, which receives higher rainfall rates than the arid interior, receives this rain in the summer months when evaporation is at its greatest, limiting the type of agriculture than can be practised there. In the Kimberley region in northern Western Australia, for example, the number of livestock that the land is capable of sustaining is only one head of cattle for every 25–30 ha. Agricultural production in these arid and semi-arid areas in the past has at times exceeded the land's capacity, causing serious land degradation. Erosion and destruction of fragile habitats have resulted from overgrazing and poor crop choices. In some areas government decrees limited the types of agricultural practices that could be used. The Goyder Line in South Australia, for example, was drawn up in 1865 to limit the extent of wheat production in the north of the state.

The southern portion of the continent, through New South Wales, Victoria, Tasmania, South Australia and Western Australia, receives most of its rainfall during the cooler winter months, when evaporation rates are lower. This makes these areas more suitable for a greater variety of agricultural enterprises, as soil moisture is generally sufficient to grow cereal crops even in relatively dry land such as the Mallee area of northern Victoria. This region also includes most of Australia's sheep belt.



Source 5.17 Diagram of the climate influences on the Australian continent

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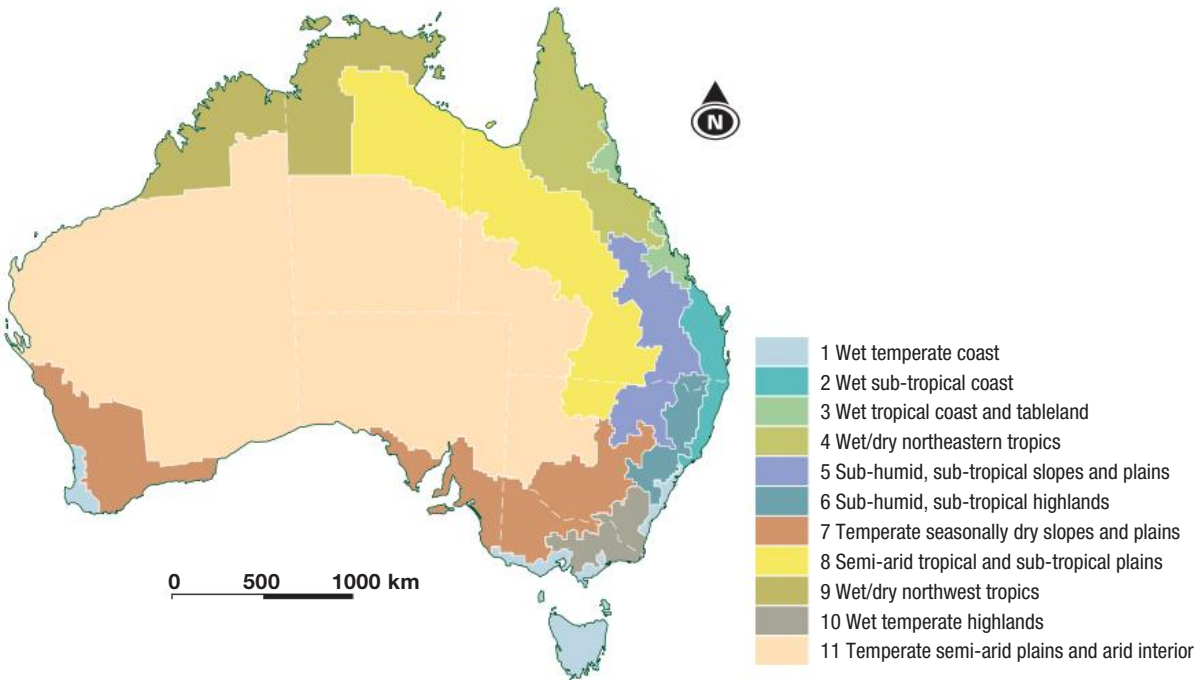
RESEARCH 5.5

1. Source 5.17 shows the climate influences that affect the Australian continent. Use the links at www.cambridge.edu.au/geography9weblinks to go to the Australian Bureau of Meteorology website and detail how each of these influences affects the weather.
2. Research the historical climate and rainfall data for your area. Starting at www.cambridge.edu.au/geography9weblinks again, link to the Australian Bureau of Meteorology website. Along the left-hand side of the home page is a series of links. Go to Climate and Past Weather. On this page you need to click on the link for weather and climate data. To get information for your area you need to:
   - select Monthly Rainfall or Monthly Temperature
   - select a weather station in the area of interest (by typing in the name of your location).
3. Describe the climate in your area: i.e. hot summer/cold winter; mild summer/mild winter; winter rainfall/dry summer; uniform rainfall all year round.
4. Investigate the Goyder Line. What factors were used to determine it?

Australia's agricultural zones

The CSIRO has identified 11 agricultural regions in Australia, based on soil type, land features, climate and ecology, as shown in Source 5.18.



Source 5.18 The 11 agricultural ecological zones as defined by the CSIRO

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1 *Wet temperate coast*. The climate is predominantly wet and cool to warm. The primary agriculture is dairying, intensive cropping, beef grazing and horticulture.
2 *Wet sub-tropical coast*. The climate is warm and wet with rainfall throughout the year, but more dominant over summer. The principal agricultural activities are dairying, beef grazing, intensive cropping (including sugar cane) and horticulture.
3 *Wet tropical coast and tableland*. The climate is hot and wet with temperatures generally consistent. Rainfall over most of the year with occasionally a short dry period over summer. Agricultural production is beef grazing, intensive cropping and sugar cane.
4 *Wet/dry northeastern tropics*. The climate is hot and rainfall is summer dominant, with the winter dry. The whole region is used for beef production, but sugar cane, rice and other intensive agricultural production occur in the Burdekin River irrigation area.
5 *Sub-humid, sub-tropical coasts and plains*. The climate is characterised by hot summers and mild winters with uniform rainfall throughout the year tending to summer rainfall in the north of the zone. The eastern areas which are more elevated are noted for mixed wheat/sheep/cattle farming and large areas of irrigated cotton. Oil seed and summer cropping increases in the north, while grazing is the major land use in the west. The area is a valuable wheat production area, noted for the high quality of its grain.
6 *Sub-humid, sub-tropical highlands*. The climate is warm, with cool winters. Rainfall is uniform throughout the year, but tends to be summer dominant in the northern areas. There are large areas of land cultivated for pasture for sheep and cattle. The Hunter and Peel river valley irrigation areas support agricultural and horticultural industries.
7 *Temperate seasonally dry slopes and plains*. This area is the heartland of Australian agriculture because of the diversity of its agricultural industries and its high level of production. The climate is characterised by hot summers, cool winters and good winter-dominant rainfall. It has extensive areas of land cultivated for cereal crops and pasture, and is a major wheat/sheep/cattle production zone. Throughout the eastern region extensive irrigation areas, particularly along the Murray, Murrumbidgee and Goulburn rivers, support a wide range of intensive agricultural production, including fruit and rice growing and dairy production.
8 *Semi-arid tropical and sub-tropical plains*. The climate varies between hot with a wet summer/dry winter in the north and warm to hot with low rainfall in the centre. Extensive cattle and sheep grazing are the predominant land uses.
9 *Wet/dry northwest tropics*. The climate is characterised by hot, wet summers and very dry, warm winters. Extensive cattle grazing is the dominant agricultural industry, but the Ord, Katherine and Daly rivers provide irrigation for some intensive agricultural production.
10 *Wet temperate highlands*. This is a high-rainfall zone with the elevated areas cool and wet, tending to dry and hot summers towards the inland. In the lower elevation areas and the mountain tablelands forests have been cleared for pasture. Sheep and cattle for wool, lamb, beef and dairy production are extensively grazed on the improved pastures.
11 *Temperate semi-arid plains and arid interior*. The climate is warm to hot with minimal rainfall. Extensive sheep and cattle grazing takes place on native grasslands.

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ACTIVITY 5.8

1 Each of the towns and cities in the table below is representative of one of the agricultural regions in Australia. You will be creating an Annotated Visual Display (AVD).

a On a blank A4 outline map of Australia shade all the agricultural regions. Your colour code does not have to match Source 5.18. Indicate in your legend what each region is.

b On your map show the towns and cities listed in the table below and label them. Paste your map into the top left corner of an A3 sheet of paper. (An alternative is to have an A3 sheet of paper with a blank outline map already printed into its top left corner.)

c On the right-hand side of the A3 sheet, copy the graphic organiser below and label the agricultural region the city or town is located in and add in the rainfall and temperature data. The first set has been done for you. To find the information, you need to source historical climate records from the Australian Bureau of Meteorology. Go to www.cambridge.edu.au/geography9weblinks and link to the BOM website. Then go to Climate and Past Weather and click on the link for weather and climate data. To get information for each city and town:

1 select Monthly Rainfall or Monthly Temperature

2 select a weather station in the area of interest. (Find the weather station that has the most extensive records for the region.)

3 get the data.

Town/city	Agricultural region	Mean annual rainfall (mm)	Mean temperature January (^{0}C)	Mean temperature July (^{0}C)
Launceston TAS	Wet temperate coast	674.9	24.3	12.6
Canberra ACT				
Swan Hill VIC				
Bunbury WA				
Newman WA				
Murray Bridge SA				
Bourke NSW				
Kununurra WA				
Cairns QLD				
Cloncurry QLD				
Warrnambool VIC				
Barcaldine QLD				
Gympie QLD				
Armidale NSW				
Narrabri NSW				
Wagga Wagga NSW				
Myrtleford VIC				
Bendigo VIC				

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ACTIVITY 5.8 *continued*

2 Identify the regions where the more intensive agricultural industries, those which need fertile soils and good rainfall – such as vegetable growing – are more likely to take place.
3 Which regions are most suited to wheat production?
4 What are the climatic requirements for sugar cane production?
5 Along what river system is irrigated agriculture most intensive?
6 What is the distribution of beef production in Australia?
7 Imagine you were a farmer seeking to set up an agricultural enterprise in one of these regions listed in the table:
   a In what ways would the climate data help you decide what sort of production and type of agricultural activity could take place?
   b What other information might you need to help you make your decision?

5.2 Environmental impacts

Agricultural land use puts pressure on the environment.

The results include erosion, salinity, loss of biodiversity and a decline in water quality. The term used to describe the impacts on natural systems that are additional to those which occur naturally is **environmental degradation**. Erosion, for instance, is a natural process, but agricultural practices which expose the soil to wind and rain, such as cattle grazing, are not – they are a result of human behaviour. Today, much is being done in Australia to try to address some of these issues, but some of the damage that has been created by past agricultural practices is substantial and costly to fix.

environmental degradation a change or disturbance to the environment perceived as harmful or undesirable

About two-thirds of Australia's agricultural land is degraded to some degree, and in places the degradation is expected to continue because of the extent of the deterioration and the continued pressure of land use.

Much land degradation is directly linked to the replacement of native vegetation with introduced shallow-rooted pastures and cereal crops. Land degradation has also been a result of poor farming practices. The expansion of grain production throughout the 19th and early 20th centuries in Australia left the land degraded. As each new wave of settlers occupied virgin land for wheat cropping, for instance, many of the farmers had little understanding of the need for crop rotation and resting of paddocks, so they would plant the same crop every year, until the soil was exhausted and fertility declined.

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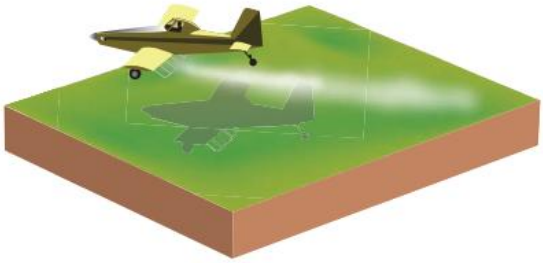
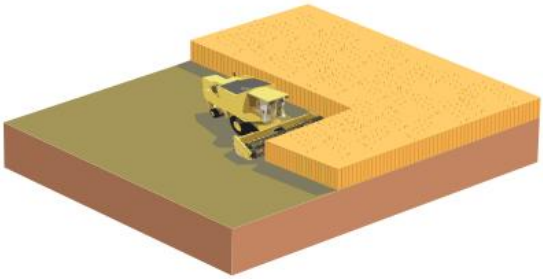
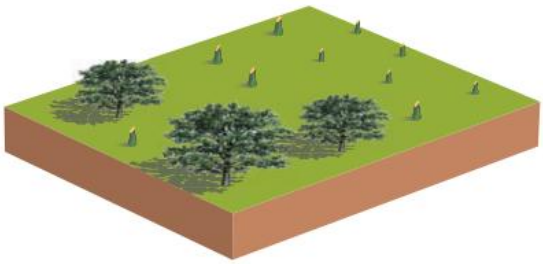
Mechanised farming with heavy use of fertiliser, using finite fossil fuels and generating pollution and CO_2



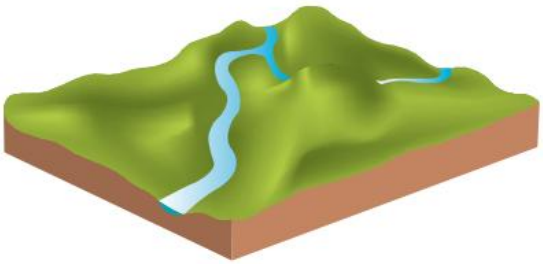
Intensive use of chemicals to control resistant pests



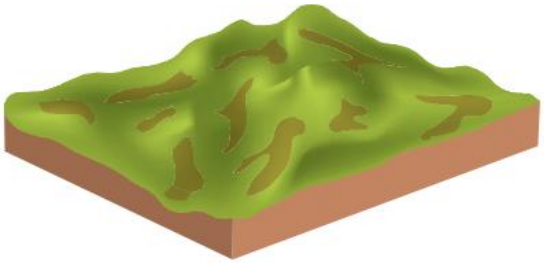
Monocrop cultivation, leading to loss of diversity



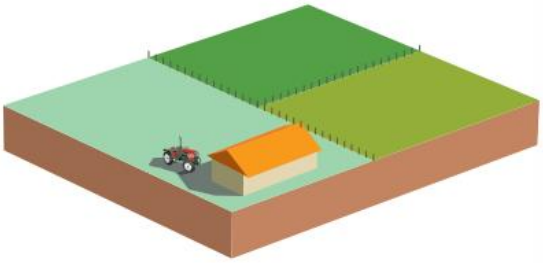
Deforestation, leading to shortages of wood for fuel



Demands on water resources for irrigation, which can destroy soil by salinisation



Overcropping, overgrazing, leading to soil erosion



Population growth, leading to smaller plots and more intensive farming

Loss of plant and animal genetic diversity caused by large-scale farming

Source 5.19 The environmental costs of modern agriculture

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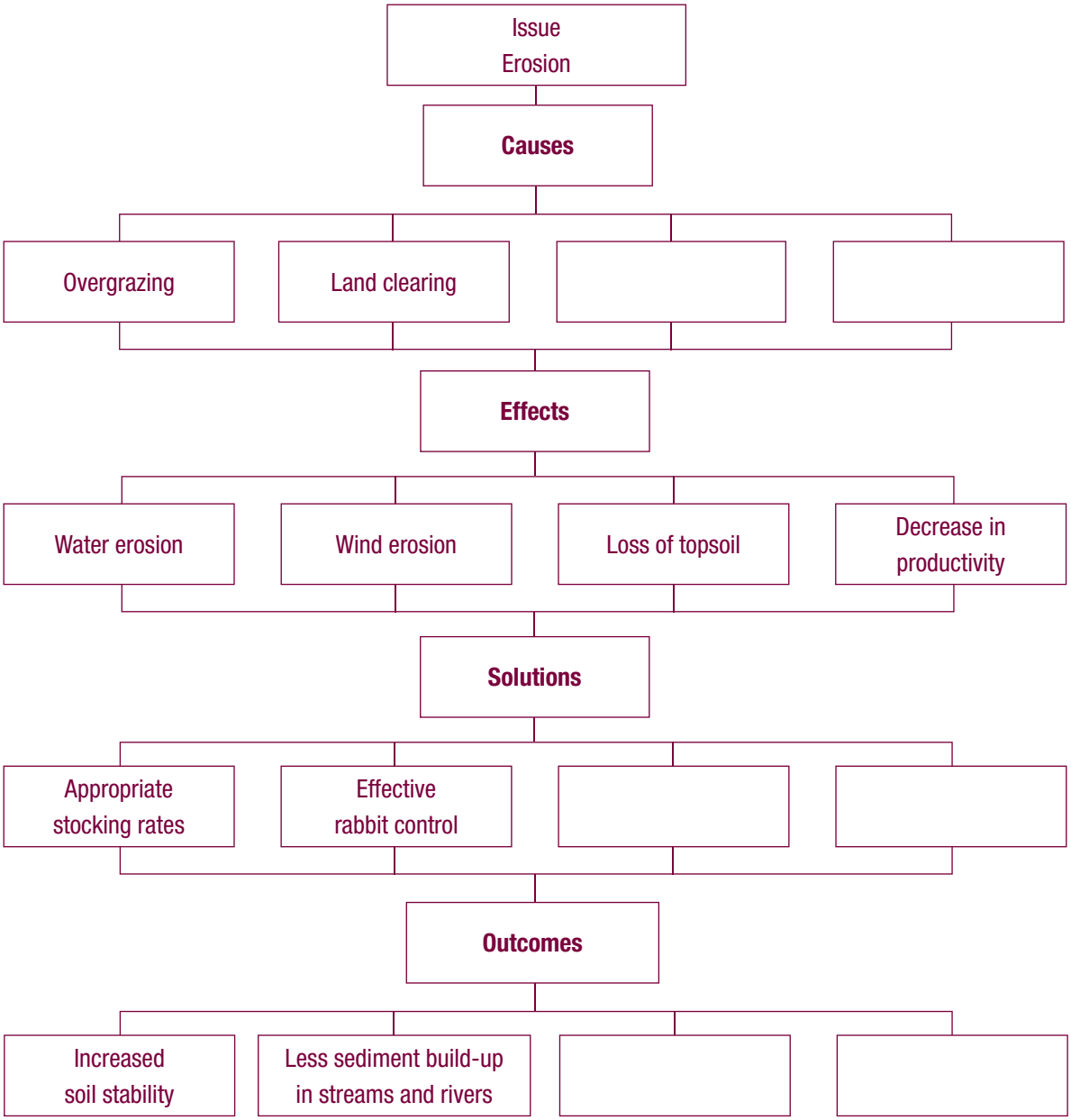
NOTE THIS DOWN

Copy the graphic organiser below and research and develop a problem and solution map outlining the five main environmental problems occurring as a result of agricultural activity. These are erosion, salinity, soil acidification, biodiversity loss and water quality decline. An example has been partially done for you.



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Source 5.20 Severe stream bank erosion along Castle Creek near Euroa, northeast Victoria

Source 5.21 Sydney Harbour Bridge almost obscured by a severe dust storm in September 2009. The storm carried thousands of tonnes of precious topsoil into the atmosphere.

Soil erosion

Soil erosion is the result of wind and water removing soil from one place and depositing it in another. While soil erosion is a natural process, disturbance of the land by various agricultural practices has increased the rate of erosion. On sloping lands that have been converted to cereal crops the rate of erosion has increased by a factor of 50 in some instances. Agricultural practices which accelerate the process of soil erosion include land clearing, replacement of native grasses with introduced species, overgrazing and soil disturbance (through soil tillage such as ploughing or harrowing).

There are a number of ways in which erosion occurs. These vary according to the vegetation cover, the soil type and structure, the slope of the land and land disturbances or the activities of burrowing animals (such as rabbits and wombats). In water erosion, the severity of the rainfall – severe rainfall is a large amount of rain falling in a short space of time – is a major factor in the degree of erosion and the amount of soil that is transported. In wind erosion the velocity of the wind is a major factor.

The types of erosion that occur on agricultural land are:

1 *Sheet erosion*: when the topsoil is removed as a thin layer through the action of water flowing uniformly over an area of bare soil, such as land that has been cultivated for planting crops or has been overgrazed by livestock or pest animals such as rabbits
2 *Rill erosion*: where little rivulets of running water gather and cut small channels in the soil; also linked to farming practices such as cultivation or overgrazing
3 *Gully erosion*: when water follows drainage lines and washes away soil, cutting deep channels in the earth; under natural conditions vegetation moderates the effects of water flow by holding the soil together and protecting the ground from the direct impact of rainfall, but farming practices often remove much of the vegetation that slows down erosion
4 *Stream bank erosion*: stream banks erode as a natural process, but this process is accelerated by agricultural practices such as vegetation removal and damage caused by livestock going to the water to drink

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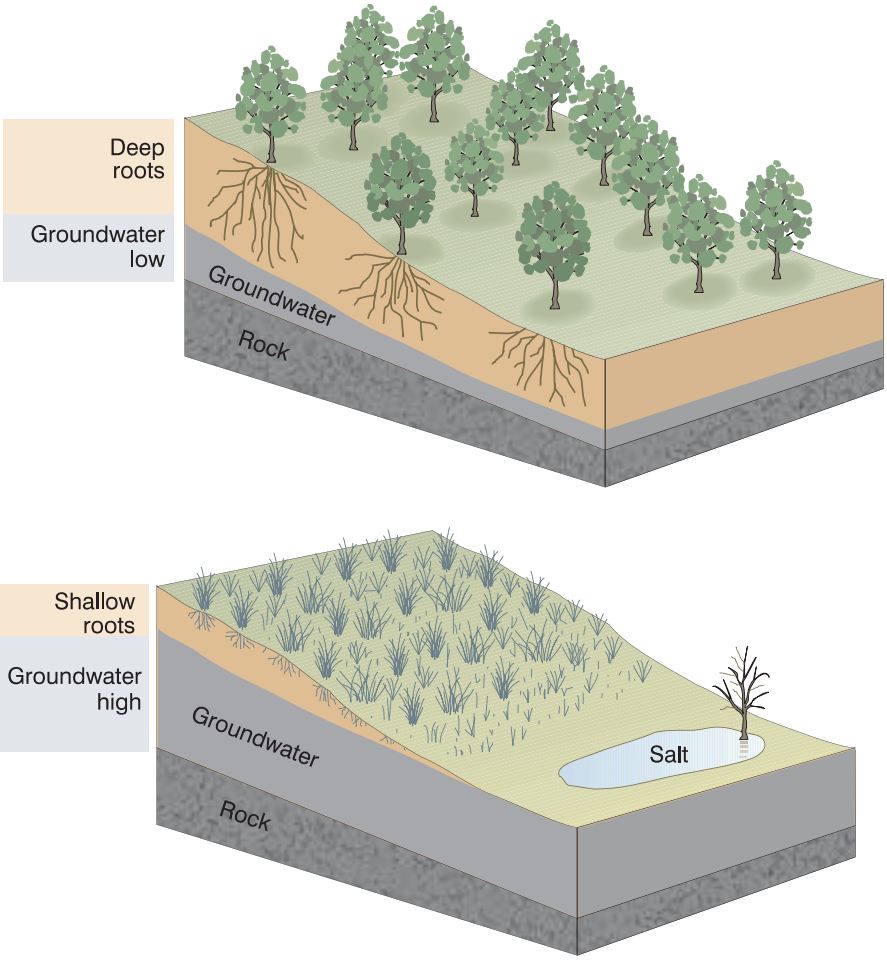
5 *Wind erosion*: when land is left bare the soil is exposed to the actions of wind; when the wind reaches a particular velocity the process sorts the soil particles, removing the finer material containing the organic matter, clay and silt and leaving the coarser, less fertile material behind. The resulting dust storms can carry soil hundreds of kilometres, as the dust storms that engulfed Sydney in 2009 did, when soil from western New South Wales, an area which had been experiencing drought, was removed by strong westerly winds.

Soil acidity

Soil acidity is a major problem for Australian agriculture. It is estimated that approximately 50 million ha of surface soil and 23 million ha of subsoil is affected in Australia's agricultural zone. In 2001 the estimated annual value of lost agricultural production due to soil acidity was about $1.6 billion. Soil acidification, like erosion, is a natural process, but it is intensified by agricultural practices such as the use of nitrogen fertilisers and nitrogen-fixing pasture plants (such as clover or lucerne) – these change the chemical composition of the soil, leading to a decline in the ability of the soil to support enough vegetation to prevent soil erosion. These practices also limit crop and pasture growth because they affect the availability of nutrients that plants need, such as calcium magnesium, boron and molybdenum. Acidification can also lead to an increase in toxic levels of aluminium, iron or manganese.

Salinity

Salinity is another widespread problem which affects agricultural production in Australia.



Source 5.22 Replacing deep-rooted native vegetation with shallow-rooted introduced species for crops and pastures has caused increased infiltration of water into the soil and the rising of the water table, which then causes dryland salinity.

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Over 2.5 million ha of agricultural land in Australia is affected by salinity; this is expected to grow to 12 million ha in the next 50–100 years. This represents about 4.5% of currently cultivated land. The presence of salt in agricultural land either kills the vegetation or causes a reduction in plant productivity.

Salt is a naturally occurring substance in Australian landscapes. Stores of salt are found in rocks and the soil, and much is locked away in underground water storages. These stores have been built up over millions of years from ocean salt spray, the weathering of rocks and the deposition of ancient ocean sediments when areas of the Australian landmass were below the sea. Low rainfall and the relative flatness of the Australian landscape have meant that this salt does not get flushed away through the river systems – it has accumulated in the **water table**.

water table the level below which the ground is saturated with water

Australia's deep-rooted native plants, as they have adapted to the harsh Australian environment, have kept these underground salt stores in balance. They have adapted so that they use all available water above the ground, intercepting much of the water before it enters the water table. This has kept the water table from increasing in size and rising – it needs to stay below the level of the root zone, because it can cause damage to the plants if it reaches the root zone.

With European settlement the water balance has changed. Land clearing for agriculture has replaced woodland and forest with shallow-rooted plants such as cereal crops and pasture grasses. This has meant that less above-ground water is being taken up by plants, and so more water is getting through to the water table, raising it and bringing salt to the surface. Where this occurs in non-irrigated land it is known as dryland salinity. In irrigated areas, where excessive water usage is bringing the water table to the surface, it is known as irrigated salinity.

The signs of a salt-affected landscape are sick or dying trees, a decline in vegetation, **colonisation** by salt-tolerant weeds, salty bare patches on the earth and saline pools in creek beds. Water quality is affected as the salt is washed into rivers and streams; in extreme cases the water is made too salty for animals and humans to drink.

colonisation the process by which a species enters a new area and dominates it

Source 5.23 Salinity in the wheat belt of Western Australia is affecting grain production; this salinity is expected to increase.

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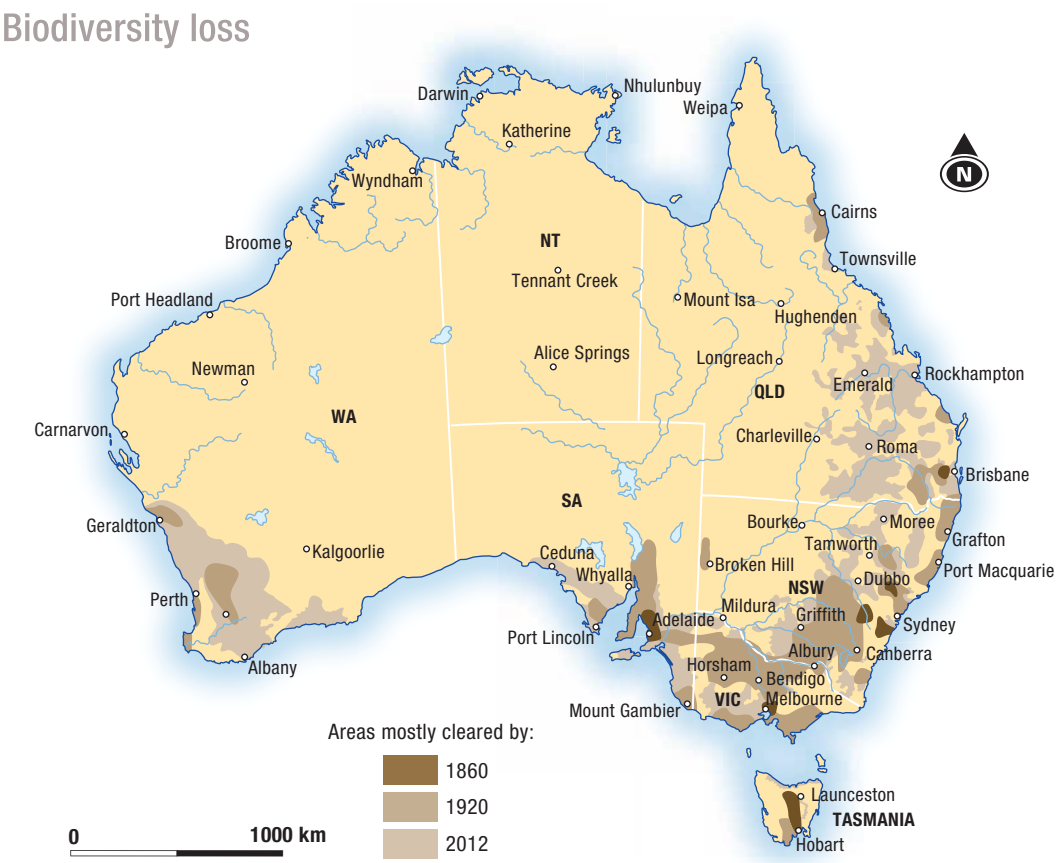

Source 5.24 Areas of vegetation cleared in Australia since 1788. Land clearing has led to loss of biodiversity and increased potential for erosion. The increase in the workforce following the gold rushes of the 1850s and mechanisation in the 20th century substantially increased land clearing rates.

The loss of biodiversity in Australia is another factor affecting the productivity of agricultural land. Australian farmers have over generations contributed to biodiversity loss through soil disturbance, land clearing and the fragmentation of landscapes, monoculture farming practices, pesticide and herbicide use, the introduction of feral animals such as pigs and goats, the introduction of weed species and the depletion of water resources such as wetlands. Australian farmers have come to realise the importance of having a diversity of organisms (both plant and animal) to support agricultural ecosystems. Healthy natural ecosystems have evolved to do what they do best:

- process and recycle nutrients and wastes
- provide insect pollinators for plants
- provide natural predators for pest species
- balance the water cycle and provide clean water
- stabilise the land and soil
- provide shelter and food for a multitude of organisms.

Without a healthy supporting ecosystem, agricultural systems become vulnerable to pressures we have discussed, such as soil erosion, salinity and pest and disease invasion.

In the past a lack of understanding about how healthy natural ecosystems help keep environmental systems in balance led to the increasing reliance by farmers on **synthetic pesticides** for pest control.

synthetic pesticide a pesticide in which the active ingredient has been manufactured (as opposed to a natural pesticide, in which the active ingredient occurs naturally)

The unfortunate side-effect of this reliance is what is known as the pesticide treadmill. This is where insect pests develop immunity to the pesticide and the farmer is forced to use greater concentrations or more powerful variants of it, and this continues in a cycle as the pests develop greater tolerance to the new regime. It is a cycle which increases the likelihood of soil and water contamination over time.

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Source 5.25 A farmer spraying herbicide in a paddock of the previous year's wheat stubble to suppress weed growth prior to reseeding

Water quality decline

The decline in water quality as a consequence of agricultural practices and environmental degradation is a major issue in Australia. One of its most immediate impacts is a decline in the quality of water used for human and livestock consumption. Intensive land use along the Murray River is creating significant issues for the people of Adelaide in South Australia, who rely on water from the Murray River for personal consumption. The increasing salinity of the river system is not only making the water unpleasant for drinking; it also speeds up the deterioration of infrastructure such as water pipes.

Other things that lead to a decline in water quality include increased sediment flows into rivers and streams as a result of erosion, and fertilisers, herbicides and pesticides flowing into waterways from agricultural runoff.

Two of the main fertilisers that are entering Australian waterways as runoff are nitrogen and phosphorus. Australia's ancient soils are naturally deficient in these two elements and the discovery in the early 20th century that the addition of phosphorus and nitrogen to pastures and crops could significantly boost agricultural production was seen as a revolution in farming in Australia. It was later discovered, however, that the entry of these fertilisers into Australian waterways through runoff from farms was having major environmental consequences.

One of these is algal blooms (growth) in rivers and lakes. Algae are naturally occurring microscopic organisms, and in low numbers they are important contributors to the ecology of water bodies. Increased nutrient loads from farm fertilisers, however, are causing these organisms to multiply to levels, in some species, at which they can produce toxins that are fatal to humans and animals. Unchecked algae growth also reduces oxygen levels, causing widespread fish deaths. Other consequences include increased **turbidity** and unsightly scums which affect the smell and taste of the water.

turbidity cloudiness in the water due to the presence of extremely fine particles of matter that are held in suspension

Source 5.26 A farmer paddling through an outbreak of blue-green algae on the Darling River, New South Wales

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Increased research into land and plant science is now helping farmers deal with excess fertiliser loads. Farmers now use a balance sheet approach to fertiliser applications, and apply them much more effectively. They have a greater understanding of nutrient inputs (fertilisers, soil conditioners, legume nitrogen fixation) and nutrient exports (such as how much fertiliser is harvested with the crops, losses to groundwater, rivers and atmosphere), so they can develop an appropriate management plan. This is much more environmentally effective, ensures optimal productivity and saves the farmer money.

ACTIVITY 5.9

1 Describe how the widespread removal of native vegetation for agricultural production has contributed to dryland salinity.

2 Explain how increased acidity of the soil inhibits agricultural production.

3 List the positive and negative impacts of the use of fertilisers in Australian agriculture.

4 Summarise the pesticide treadmill.

5 Discuss how the 'balance sheet' for fertiliser application works and the benefits of this strategy to the farmer and the environment.

6 In the left-hand column of the table below are a number of activities that farmers could use to address environmental issues on their farms. Match these with the reasons why these activities might be carried out.

Strategy	Reason
Plant native trees in paddocks.	Encourage biodiversity.
Build fences around areas of salinity and along creeks and rivers.	Promote a natural filter to intercept sediment and fertiliser runoff.
Use a balance sheet approach to fertiliser application.	Reduce the level of the water table.
Restore wetland areas.	Prevent livestock trampling the land, thus reducing erosion and stabilising the soil.
Match animal numbers to the availability of feed.	Reduce the amount of pesticide needed.
Set aside areas of land for nature reserves.	Minimise the amount of fertiliser entering waterways.
Encourage natural insect predators.	Avoid overworking the land.

7 Go to www.cambridge.edu.au/geography9weblinks and follow the link to the website Australian Screen. Type 'superphosphate' into the search facility. It will take you to a documentary made in 1965 about life on an Australian sheep farm. It shows superphosphate being applied by plane. The narrator says that this is the most efficient method of spreading superphosphate. Comment on what the environmental effects of this method might be and why it is not widely used now.

8 Explain how the practices of the selectors and the soldier settlers, as they tried to make unproductive land sustain a living, had a greater negative impact on the environment than the vast sheep and cattle runs of the squatters.

9 Suggest how issues of environmental degradation might affect future agricultural production in Australia.

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Agricultural innovation and agricultural productivity in Australia

Australian farmers have been very successful at finding innovative solutions to problems and maximising agricultural productivity. The early development of agriculture was derivative – the crops, livestock, technology and concepts of agricultural production were all imported from overseas – so a lengthy process of adaptation and innovation had to take place before successful systems of Australian agriculture evolved.

Australia has a rich history of agricultural inventions and technological adaptations to suit Australian conditions and increase productivity. Some of the more notable ones came around the end of the 19th century:

- The stump jump plough allowed a farmer to plough areas from which stumps and roots had not been fully cleared. This invention was especially important in the opening up of the mallee country in Victoria and South Australia.
- The combine harvester stripped, threshed and winnowed wheat. This invention, which was pioneered by H.V. McKay, an agricultural engineer from Victoria, allowed farmers to harvest wheat crops on a large scale.

Source 5.27 A crude scrub roller used by farmers to clear light scrub in Victoria's Mallee region in 1927

- The scrub roller, which is dragged through the bush to flatten the vegetation, opened up vast tracts of light bush country.
- Large-scale irrigation, developed by the Chaffey brothers around Mildura, allowed intensive agriculture to be expanded into Australia's dryland agricultural zone.
- William Farrer, in the late 1800s, bred a number of new wheat varieties, the most notable of which was an early-maturing wheat strain named 'Federation', which was drought and disease resistant.

The Green Revolution

However, it was during the 20th century that the most widespread impacts of agricultural innovation and adaptation occurred. Across the world this period became known as the **Green Revolution**, and it was driven by advances in agricultural science and technology leading to a greater understanding of efficient land, soil and water management practices. Coupled with this were advances in the understanding of plant and animal genetics and dramatic improvements in the science of **animal husbandry**. The technological advances in agricultural science were driving dramatic productivity improvements, and these were being supported by other factors, such as:

Green Revolution a period beginning in the 1940s when new agricultural techniques brought great increases in production and greatly decreased the incidence of hunger worldwide

animal husbandry the agricultural practice of breeding and raising livestock

factory farm a farm where many animals are raised together in a small space

- mechanisation and the development of specialised agricultural machinery
- technological advances such as the use of computers and the internet
- the development of pesticides, herbicides and fertilisers and their increased use
- the development of specialised agricultural production enterprises such as **factory farms** for production of livestock such as pork and poultry
- the development of intensive agriculture infrastructure such as greenhouses for fruit and vegetables
- the involvement of big business in agricultural enterprises

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Source 5.28 Chickens on a commercial poultry farm

- the development of multinational companies that support agricultural production, such as the global agricultural giant Monsanto, which has invested hundreds of millions of dollars into seed and agricultural chemical research and development
- government investment in agricultural infrastructure such as irrigation schemes and railway and other transport networks
- government policies that favour maximising production, such as diesel fuel rebates for farmers, reducing the cost of fuel.

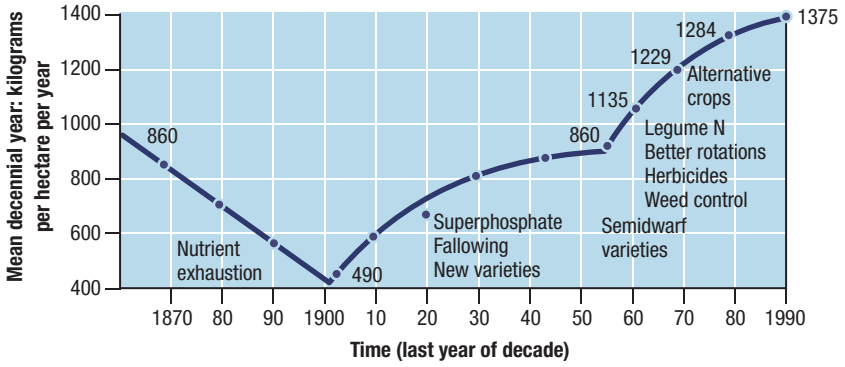
ACTIVITY 5.10

1 Suggest how the invention of the scrub roller might have had a negative environmental impact.

2 Examine how mechanisation increased agricultural production.

3 Describe the difference between scientific agriculture and earlier agricultural practices.

Wheat production in Australia



Source 5.29 Trends in wheat yields in Australia since the 1870s, showing declining production towards the end of the 19th century

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One of the outcomes of the Green Revolution was the development of higher-yielding strains of cereal crops; these have allowed increased food production, to meet the demands of an increased population. One measure of these improvements is wheat crop yields.

By the end of the 19th century inefficient agricultural practices such as continuous planting of crops on the same land were having a clear effect on crop yields in Australia: they were declining significantly because of a reduction in soil fertility.

By the end of the 20th century crop yields had almost quadrupled. In the case of wheat, the introduction of practices which increased nitrogen levels in the soil, and the use of superphosphate from the 1950s onwards, resulted in substantial improvements in crop yields through improved soil fertility. A better understanding of land management resulted in the widespread adoption of the ley or rotational farming system in dryland agricultural areas. This system involves resting and rejuvenating land through cycles of crop planting alternated with turning the land out to pasture. When the land is under pasture, farmers can graze sheep or cattle and maintain the profitability of the land. This system replaced earlier farming techniques where crops were planted year after year until the soil was exhausted. The rotation of crops with pasture grasses or legumes helps improve soil stability, increases the amount of organic matter in the soil, fixes nitrogen into the soil and improves weed and pest control.

Continued research throughout the 20th century further assisted wheat production with the breeding of higher-yielding disease-resistant wheat strains, the development of chemicals to control pests and weeds and greater understanding of the role of **trace elements** in plant growth. The wheat industry was also improved by increased mechanisation and technological progress. The introduction of tractors in the 1940s greatly assisted production, as did the development of the self-propelled combine harvester, which didn't require horses to pull it. These harvesters became widespread across the Australian wheat belt after the 1950s. Just as society moved into the digital age, so did farming. Farmers now use GPS to map out the planting of crops, so they can minimise soil compaction by tractors travelling over the same ground again and again, and there are sophisticated computer software programs that allow them to measure crop yields based on nutrient balances in the soil.

trace element a chemical element required in only minute amounts by living organisms for normal growth

Source 5.30 A farmer using a GPS in his tractor to track the cultivation pattern in his paddock. This system allows the farmer to more accurately plant seed and administer fertiliser.

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ACTIVITY 5.11

1. Go to www.cambridge.edu.au/geography9weblinks and follow the link to the website Australian Screen. Type in 'wheat harvesting with a reaper and binder' in the search facility. It will take you a documentary made in 1899 on wheat harvesting in Australia. Comment on the amount of human labour required to harvest wheat in 1899. In 1910 agricultural industries employed about 26% of the workforce. Today it is about 5%. Describe how mechanisation has changed the nature of agricultural practices in Australia and how it has impacted on the rural workforce.
2. Referring to Source 5.29 and what you have read, discuss the reasons for declining wheat yields during the 19th century:
   - What were some of the factors that resulted in an increase in wheat yield during the 20th century?
   - What is the ley method of farming and how did it improve soil nutrition?

Case study 5.1

Conventional cultivation and no tillage planting

One of the most fundamental of farming practices for crop production is tillage. Tillage is the practice of getting the soil ready for planting crops. Traditionally this practice involved using a plough to turn the soil to both suppress weeds and to break up and loosen the soil for the planting of seed. The use of a plough for preparing land for crops has a long history. Its use was often mentioned in the Bible.

In its modern form tillage usually involved an initial breaking up of the soil and turning it with a mould-board plough pulled behind a tractor (or horse or oxen) to a depth of about 25 cm. This initial ploughing produces large clods of earth which then have to be ploughed at least twice, with ploughs that have large round discs on them, to further break up the soil and create a finer-textured bed for planting the seed. Fertiliser is then spread onto the soil.

Once the seed was placed, harrows (large implements that rake the soil) were dragged across the field to cover the seed.

In the no-till or direct-drilling method, which has become increasingly popular since the 1970s, machinery that cuts a narrow slot into the undisturbed soil is used to place the seed and fertiliser directly into the ground.

1. Explain why the no-till method of cultivation is an improvement on traditional methods.
2. Describe why the maintenance of the soil structure is important.
3. List the biggest negative impact of the no-till method and suggest how it might affect the environment.
4. Discuss why traditional cultivation methods are more likely than no-till methods to be practised in developing countries.

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Source 5.31 A farmer ploughing a field with oxen in northern Vietnam

Source 5.32 A farmer using a minimal-till cultivation system where the stubble from the previous year's crops is left in the soil

Benefits of conventional tillage	Benefits of no-till method
• Breaks up the soil, allowing water and oxygen to penetrate. • Machinery required is not as specialised as for the no-till method and is less expensive. • Buries organic matter such as dead plants and animal manure to fertilise the soil. • Controls weeds by burying them and interrupting the growing cycle rather than relying on heavy use of herbicides. • Ploughs along the contours of the land, reducing erosion.	• Protects the soil from erosion by maintaining the soil structure. • Maintains the soil structure and so protects the habitat of beneficial soil organisms such as earthworms. • Enhances water infiltration of the soil as water follows the pathways opened up by worms and decayed plant roots. • Retains crop and pasture residues from the previous year/s on the soil surface, which protects the soil from erosion. • Reduces the release of CO_2 into the atmosphere because the organic matter in the soil is left undisturbed. • Requires less use of heavy machinery, which reduces energy costs. • Reduces time needed to prepare the soil.
Disadvantages of conventional tillage	**Disadvantages of no-till method**
• Increases erosion by exposing the top soil. • Interferes with the soil structure. • Requires high labour and energy costs to prepare the soil. • Leaches fertilisers into rivers and streams. • Breaks up the soil and increases the release of organic matter as CO_2 into the atmosphere.	• Increases the use of herbicides to control weeds. • Requires specialised machinery that is relatively more expensive than conventional tillage equipment.

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5.3 The changing nature of Australian agriculture: 1970 until the present

Since the beginning of European settlement, agriculture has dramatically changed both the Australian landscape and people's relationship with the land. The first 180 years of agriculture in Australia was a period of expansion and consolidation, and patterns of land use became firmly established.

By the 1970s the general pattern of Australian agriculture was predominantly the family-owned farm, which was passed on from generation to generation. The family lived and worked on the farm, and bringing up a family 'on the land' was seen as a healthy and attractive lifestyle – money was good, the work was hard but rewarding, and children could be brought up in a healthy environment. Government support for agriculture during most of the 20th century was strong, and state and federal governments provided incentives for farmers to produce more. They spent vast amounts on agricultural infrastructure such as irrigation schemes and set up trade barriers to protect Australian farmers from offshore competition. The world demand for Australian farm produce was high and farmers got good prices for staple commodities such as wool and wheat. Within Australia food processing factories such as Rosella, SPC and Arnott's Biscuits were processing Australian farm produce into a variety of goods – tinned soup, fruit and biscuits – and Australian consumers were really only offered 'Australian made'.

Throughout Australia the fresh produce and processed foods of Australian farmers were sold through small businesses – grocery stores, butchers, greengrocers, dairies and corner shops – rather than through the big supermarket chains that we have today. This was a period when there was a much closer relationship along the food and fibre chain between the farmer, the storekeeper and the consumer.

From the 1970s onwards the nature of agriculture in Australia changed significantly and farming became more complex. Changes

Source 5.33 Australian food processing companies such as Rosella process the products of Australian farmers.

Source 5.34 Along a 1 km stretch of suburban road in Coburg, in Melbourne's north, which was developed in the 1920s and 1930s, there were about a dozen of these small shops that serviced the local community with fresh produce such as milk, eggs, fruit and vegetables sourced from the local region. Now these shops have been converted to housing.

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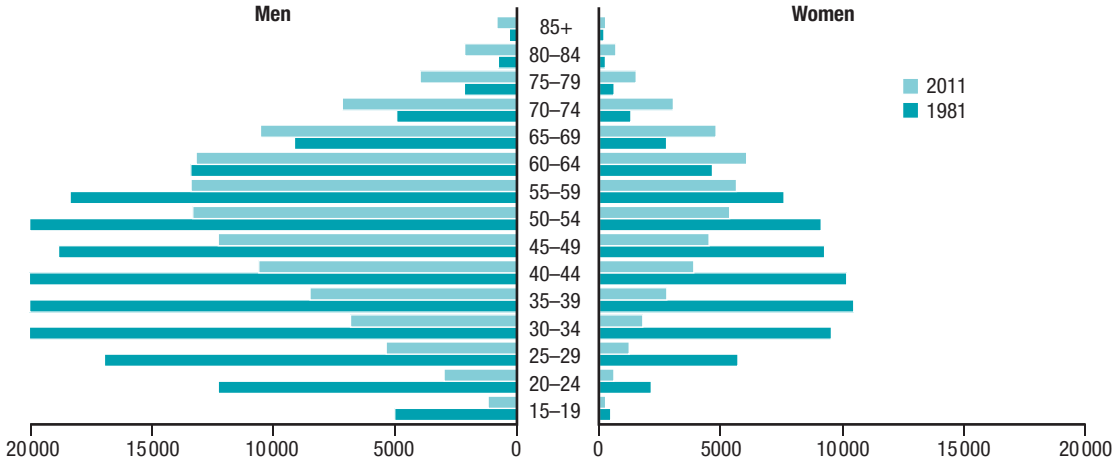
in national and global economies put pressure on farmers to become more competitive. Today, farmers compete more with overseas producers than they ever did before. The costs of running a farm have soared. Fuel and other farm input costs – such as fertilisers and labour – have risen and competition for limited resources such as water have forced the introduction of such things as water trading, which means farmers have to buy and sell water for their farms.

In the last 40 years Australian cities have expanded dramatically, and increasing numbers of people seeking a 'tree change' are moving away from cities into the country, encroaching on farming land and forcing significant change on traditional farming communities within 100 km of the major urban centres, such as by driving up land prices. Other pressures being felt by farmers come from competing land users such as the mining and coal seam gas industries, which are threatening the viability of a number of farming communities – farming land is either being used for the extraction of minerals or is under threat from pollution, such as groundwater contamination associated with coal seam gas production.

The changing nature of agriculture in Australia is changing the business structure of farming. While the family-owned farm is still the dominant form of ownership in Australia, particularly in industries such as dairying and horticulture, the structure of farms is changing. Since the 1970s the declining profitability of farming has meant that the traditional pattern of farm ownership is no longer economically sustainable. Studies have shown that in some regions of Australia only 28% of farms are of a sufficient size and profitability to support the families owning them. Over the last four decades Australian farmers have faced a decline in the average **terms of trade** of about 2% per year. What this meant was that farmers had to increase their output by 2% each year just to be able to buy the same bundle of goods and services from year to year. In this environment small farmers are finding it hard to compete and are either leaving the land or being forced to supplement their farm income through employment off the farm. Compared with 1980, there are now 100 000 fewer farmers and the average age of farmers is increasing; many children of farmers decide not to take over the farm when they reach adulthood, so their parents stay working the farm. The sons and daughters of farmers are increasingly leaving the land to find employment in the larger urban centres and the capital cities.

terms of trade the price farmers receive for their products divided by the price paid for inputs such as fuel, labour and/or fertiliser



Source 5.35 The average age of farmers is increasing as their children decide not to take up life on the land, meaning that farmers are forced to stay working their properties.

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ACTIVITY 5.12

1 Explain how buying 'Australian made' produce assists Australian farmers.
2 Suggest why Australian governments might have put **tariffs** on food imported from other countries to make them more expensive.
3 Discuss how 'tree-changers' – people moving out of urban areas to live on small rural properties – have affected farming in the areas they are moving into.

tariff a government tax on imports and exports

FIELDWORK 5.1 FROM PADDOCK TO PLATE

Aim

Understanding the process of agricultural production from the paddock to the plate is an important way of understanding the role of agriculture in our lives. The aim of this investigation is to understand the processes involved, right from growing the produce, until it ends up on our dinner tables.

Preparation

One of the best ways of understanding this process is to speak to people involved along the production chain, from the farmers to the people at the wholesale fruit and vegetable markets.

There are a number of ways of accessing information to assist with this fieldwork:

- Most capital cities have a fruit and vegetable wholesale market that runs education sessions.
- Organise a fieldwork trip to a farm in your local area.
- Plan a trip to a farmers' market.
- Visit a livestock saleyard.

Data collection

The type of data collection you do will depend on where the fieldwork is conducted and what sort of commodity is being investigated. Here is a list of basic questions you need to ask:

- What sorts of inputs (such as fertiliser and cultivation practices) are needed to produce the commodity? (If you are going to a fruit and vegetable market, choose a few commodities.)
- How is the produce harvested or prepeared for sale?
- Is the commodity processed after leaving the farm? If so, what is that process?
- How far did the commodity have to travel to get to market?
- How does the commodity get from the wholesale market to the consumer?
- What is the price of the commodity at each stage of the process?

Presentation

Your fieldwork can be presented as a written report or visually, using a flow chart on a poster. Online programs such as Glogster can be powerful tools for representing information visually.

Evaluation

As part of your understanding of how agricultural production works, provide an evaluation of the processes involved. Some of the questions worth considering are:

- How much energy has gone into getting the produce from the farm to the consumer? This is especially important now, when consumers need to be carbon conscious.
- How has the price of the commodity changed from the farm gate to the dinner table?
- How far did that commodity travel to get to the market? What is your opinion of the argument that people should be eating only food that is in season and grown in their regional area rather than using precious resources to have food shipped from interstate or overseas?

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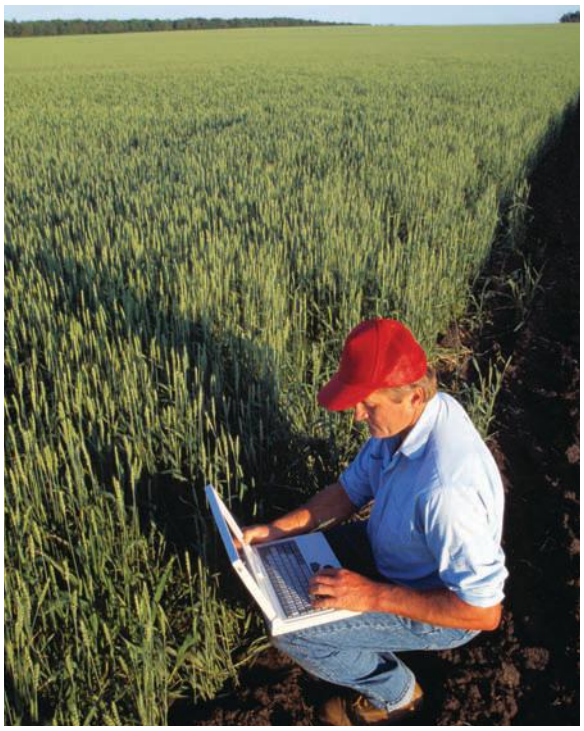
The changing nature of rural communities

Rural society is changing. Where once country towns were thriving communities with strong populations and profitable businesses that served the farming sector, many are becoming more like ghost towns, as businesses have closed down and people have left to find work in urban centres.

Source 5.36 The rural town of Terowie in South Australia's mid north has suffered a dwindling population since rural industries and services went into decline.



Source 5.37 A farmer using a laptop to input data relating to his wheat crop

demographic related to the structure of a population

One such measure of the changing **demographic** profile of these towns is the death of sporting clubs such as Australian Rules, rugby, cricket and netball – there are just not enough young people to field teams.

Since the 1970s farming operations have become increasingly less geographically and demographically defined as a block of land on which the family has a home and everybody in the family is involved in the running of the farm. Farmers have become more sophisticated in their approach to the business of farming. The image of the lone farmer working the field on his tractor or rounding up the sheep with a couple of sheep dogs and then trucking the produce off to the local railway siding to be sold is now outdated. Today's farmer is more likely to be studying the internet for weather reports, programming the GPS in the tractor to ensure optimum crop planting, or negotiating the purchase of seeds for the following year's crop on a mobile phone.

Agriculture in Australia today

Modern farming requires an understanding of the whole business of agriculture, from balancing the nutrient levels in the soil to buying and selling water and monitoring international market prices for agricultural commodities. One way for farmers to remain profitable is to set up smaller-scale corporate enterprises where farming families join together as a cooperative. These enterprises use **economies of scale** to deal with rising costs.

economy of scale the advantage that a larger producer or consumer has over a smaller one because of costs that do not increase proportionately with size or amount purchased

The benefits of a cooperative are:

- it can share resources such as farming machinery
- it is more able to buy resources such as seed and fertiliser in bulk quantities and thus negotiate for a reduction in the price

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- it is better able to negotiate with buyers for optimum return on their products
- it can more easily afford the services of agricultural consultants who can provide the members of the cooperative with specialist advice.

Another feature of modern agriculture in Australia is the increasing number of large corporations and multinational companies that are investing in agricultural and food processing enterprises. Agricultural companies are not new to Australian agriculture; they have been involved since the early period of European settlement.

The Australian Agricultural Company, which today is a major beef producer in northern Australia, was first formed in 1824 by an Act of the British Parliament in order to purchase 1 million acres of land in New South Wales for agricultural production. Its investors included members of the British Parliament and prominent English bankers.

Modern agricultural corporations include large family-run farming businesses that produce a diverse range of commodities on multiple sites. One such family enterprise in Queensland has 11 farms, stretching 1500 km across a region. This business produces a range of vegetables which it sells to the major supermarket chains. The benefit of this type of business over other farms that are geographically limited and only focus on a few commodities is that, if one commodity is affected by localised weather conditions such as flood or drought, or a downturn in the market price, other parts of the business that are not similarly affected can maintain profitability.

Other enterprises that are becoming more established in Australia are large companies made up of shareholders who are not necessarily farmers. Some of these companies, such as Timbercorp, take advantage of government tax incentives to buy up substantial areas of land to produce a single crop, such as almonds. These companies have large amounts of money to invest, and have at times dominated the water trading market in irrigation zones, to the detriment of smaller farmers who miss out on their water allocations. These investment companies are also driving up land prices, so they are seen by many people in the country as not really caring about farming communities and being driven only by profit.

Source 5.38 A Timbercorp sign on one of the company's Eucalypt plantations advising people to keep out

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Case study 5.2

The Age, 24 November 2007

The end of the family farm?

Up around Wemen in far northwestern Victoria they say the Murray River has taken to running backwards. Such is the force of suction, they say, when agricultural giant Timbercorp opens its irrigation pipes to water its monster almond estates. It's one of the yarns doing the rounds about the corporate farmer which, according to locals, is sucking life not only out of the embattled river but also out of the community that depends on it.

True? Sorting fact from fiction is tricky when the rumour mill is running full tilt in the bush. Even more so when the subject is managed investment schemes – Timbercorp is one – and drought is driving people to mob-like thinking.

Such schemes are investment vehicles that allow well-off city professionals and business high-flyers to slash their tax burden by investing in products such as timber, fruit, nuts and olives, without leaving public transport zone 1. They make up a small, but increasingly controversial, part of Australian agriculture, attracting about $300 million in annual investment.

To many small farmers and their allies in the towns dotted through the parched north of the state, the schemes are threatening traditional farming, killing off jobs and communities and flooding and undermining markets. Yet for a curious, if accidental, alliance of big business, economists, environmentalists and some farmers wanting change, things are not nearly so simple.

Managed investment schemes have their problems, they say, but they bring science and sophistication to an agricultural sector overdue for a shake-up and shake-out. They are at the forefront of an agricultural revolution made all the more urgent by drought and **climate change**.

climate change the shifting or change in the world's climate/weather

A study this year by economic consultants Econtech (partly financed by managed investment scheme companies) of the social and economic impacts of such schemes concluded that the sector had had a positive impact on rural employment, creating about 2200 jobs in 2005–06.

But try telling that to some of the small citrus, grape and dairy irrigators who are finding it increasingly difficult to keep their farms afloat. For many, this year is the first they have not been allowed their full water allocation under the entitlement granted to them decades ago. Many are on 20% or less and have had to decide between trying to grow a crop, keeping the trees and vines alive but not producing, or tearing them out. In such a climate, there is one option that has become attractive, and lucrative: selling water rights.

In the new world of water trading, farmers are now free to sell their permanent water entitlements and their annual allocations. The cutting of this year's allocation has driven their value close to record highs: about $2500 a megalitre for permanent rights, and temporary rights up to $1300.

With its city-backed capital base, Timbercorp has been able to buy water rights from drought-stricken farmers across the state's northern river system, consolidating them at Boundary Bend [near Wemen]. But communities upstream, in the Goulburn area around Shepparton, fear that the export of water from a region built on irrigation will gut centres such as Shepparton.

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1 List some of the reasons for Timbercorp being treated with hostility by people in the rural community.
2 Summarise some of the benefits discussed in the article of involving large corporations in agriculture.
3 Timbercorp has a negative image in the bush. Suggest ways the company might change that image.

Another feature of modern Australian agriculture is the increasing numbers of foreign companies that are investing in agricultural properties, businesses and food processing companies. This increase is fuelling anxiety in the bush that Australia is 'selling off the farm' and thus undermining its capacity to feed itself if the country hits troubled times. As Barnaby Joyce, a federal National Party politician, put it in 2009:

> Overseas interests are targeting our mining and agricultural industries because they have long-term strategic value and we should be mindful of that. We are not going to be able to sustain ourselves in the long term through service industries; that is the economic form of trying to make a living by taking in someone else's washing.
>
> (*The Australian*, 24 April 2009)

The other concern for farmers in Australia is that foreign companies that have bought food-processing factories in Australia have been shutting down these factories because of the cost of production in Australia. Rising labour costs and the fluctuating value of the Australian dollar have meant that for many of these businesses, which have factories all over the world, it is cheaper to close their Australian factories and produce their goods in other countries. These decisions impact on farmers when they are no longer able to sell their produce to the local processors, and they have a flow-on effect on the economic health of rural communities. Places like Shepparton, in Victoria, have been hit hard by such closures – when the SPC Ardmona factory in Mooroopna, northern Victoria, which was owned by the Coca-Cola Company, closed down in 2011, for instance. SPC Ardmona processed fruit such as peaches and apricots from local growers. Its closure meant not only that people in the factory lost their jobs, which impacted on the regional economy, but also that the local growers had to find other markets for their produce.

ACTIVITY 5.13

1 Explain how economies of scale might be applied in modern farming.
2 It has been claimed that the demise of rural sporting clubs has heralded the death of the soul of rural communities. Explain what you think this means.
3 Source 5.35 indicates that there were substantially more people involved in farming in the age group 15–29 in 1981 than in 2011. List some of the reasons for this decrease.
4 Explain why the average age of farmers is increasing.
5 Explain what the expression 'selling off the farm' means.
6 Analyse why the buying of Australian farms by foreign companies is such a contested political issue in Australia. List some of the benefits of foreign investment in Australian agriculture.

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RESEARCH 5.6

Research some of the ways digital technologies have assisted agricultural production over the last 25 years and create an annotated visual display.

The power of the major supermarket chains – Coles and Woolworths

One of the features of the changing nature of modern agricultural enterprises in Australia is the growing power of the two major supermarket chains, Coles and Woolworths, to influence the prices of agricultural produce. The two chains have been involved in a price war to capture customer loyalty. Each is trying to sell its produce at the lowest prices – this is good for the customers, but is it good for the farmer as well? For farmers who have a guaranteed contract with the supermarkets to supply the produce it could be seen as a good thing, because they are assured of a market for their produce. In the short term the supermarket customers are also benefiting through lower prices for basic food items such as bread and milk.

However, there are growing concerns about the effects this dominance has on Australian agriculture.

- Growers are forced to bid against one another and the successful ones are often the corporate farmers with better economies of scale. This pushes the smaller producers out of the market.
- The farmers who are under contract to the supermarkets have their profit margins reduced. In the case of some dairy farmers, the pressure to ensure that the cost of milk to consumers remains low means that the price they receive for their milk barely covers the cost of producing it.
- Farmers lose autonomy and flexibility over their operations as they are forced to respond to the terms of their contracts with the supermarkets. One of the concerns is that the supermarkets may be making the decisions about how the commodities are produced and what is grown.
- The high quality requirements of the supermarkets for the produce, such as having fruit of an even size and colour, can mean a high use of agri-chemicals.
- Over the longer term, forcing some growers out of the industry could lead to reduced competition pressures, so the supermarkets could in the future start charging higher prices for produce while still keeping their costs low. This would increase the profits for the supermarkets.
- Supermarkets, in favouring certain types of produce over others, reduce choice and thus may make some types of produce uncommon or not available, leading to a loss in agricultural diversity.
- Supermarkets trying to ensure year-round supply of fruit and vegetables encourage the greater energy expenditure needed to either grow food in artificial conditions or to transport food over great distances.

Source 5.39 The two big supermarket chains, Coles and Woolworths, have been involved in a price war, bringing down the price of staple food items such as milk and bread.

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NOTE THIS DOWN

Does your family buy meat and fresh fruit and vegetables from a supermarket, or from another source, such as a greengrocer, butcher or a fresh food market (such as a farmers' market) or one of the larger markets (such as the Queen Victoria Market in Melbourne)? Copy the graphic organiser below and list some of the reasons why people might favour one over the other.

Supermarket	Other
Convenience of having all groceries in the one building	Supporting small business and smaller farmers.

Sustainable agriculture

Agriculture in Australia has changed dramatically, particularly in the last 60 years. Some of the drivers of this change have been a real need for increased production because of population growth and an ideology that says that progress and productivity are intrinsically good things. In basic terms, for farmers this means making two blades of grass grow where one grew before. As we have seen, food and fibre production and distribution soared through most of the 20th century, through technological and scientific developments, the expansion of agricultural enterprises and supporting industries, such as the chemical and seed industries, and increased land clearing.

These developments have allowed farmers – and there are now fewer of them – to maximise productivity and reduce their labour costs (by getting more machines to do the work) at the same time.

Although these changes have had many positive effects, including the almost quadrupling of crop yields in some cases, and have reduced many risks in farming, such as dealing with the unpredictability of Australia's variable climate, there have also been significant environmental costs and social costs.

Environmental costs:

- land and water degradation
- pollution
- biodiversity loss
- increased energy consumption of non-renewable sources such as oil.

Social costs:

- economic decline of rural communities; greater unemployment means less money being spent in country towns
- reduction in the rural workforce as people leave the country to work in the cities
- relative decline in the wages of farm workers
- ageing population of the farming community.

Coupled with these costs are the threats that a changing climate poses to future agricultural productivity. There is a possibility that current agricultural regions will become unsuitable for the type of farming that is currently being practised there.

Over the past 20 years there has been increasing concern that current forms of agriculture are not going to be sustainable over the longer term. As a result, there is a movement towards more sustainable agriculture. This is based on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their needs.

Sustainable agriculture requires an understanding of the relationship between agriculture and natural **ecology** and the management of that relationship. Sustainable agriculture will:

sustainable agriculture farming that is conducted in a way that preserves resources

ecology the way in which everything living interacts with the world around it

- satisfy human needs for food and fibre
- enhance the quality of the environment so that it supports natural and agricultural processes, leading to healthy soil, stable landforms, clean water and greater biodiversity

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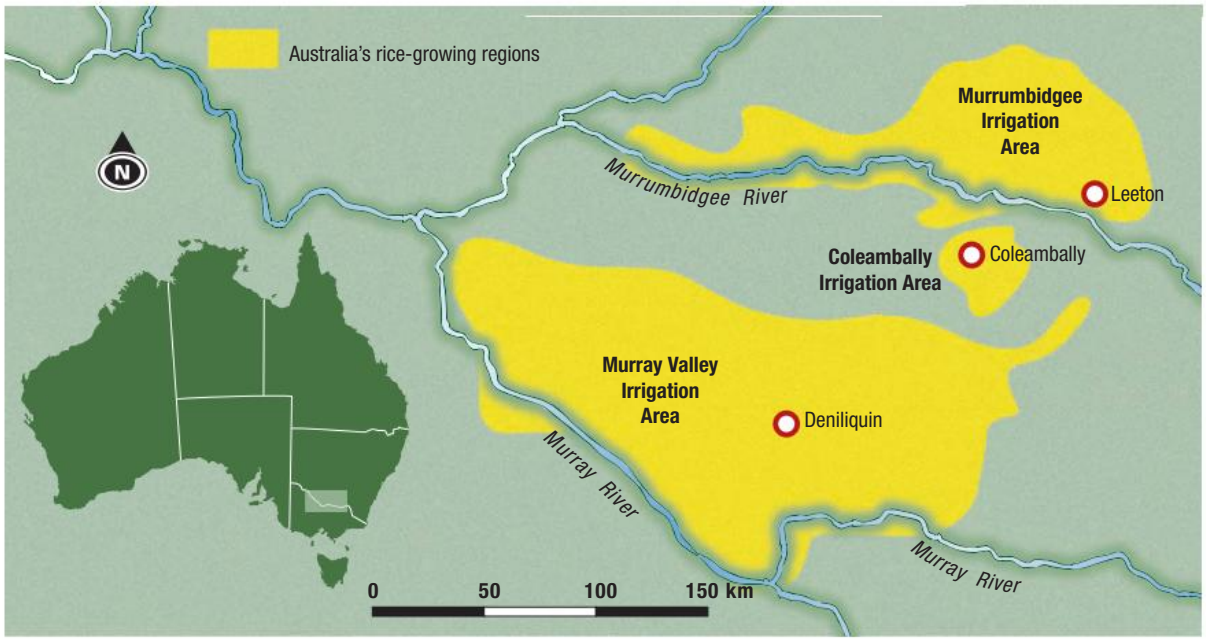
- make the most efficient use of non-renewable resources such as oil
- reduce chemical use and integrate natural biological cycles and controls into agricultural practices (such as using farm-friendly insects to control pests)
- ensure that farming operations are economically viable and support prosperous rural communities
- encourage the ethical treatment of animals and abandon high-density practices such as cage-breeding chickens
- enhance the quality of life for farmers and society as a whole.

Source 5.40 There is increasing consumer demand for free-range chickens because of concerns about the inhuman treatment of caged birds.

Case study 5.3

The case for rice in Australia



Source 5.41 Australia's rice-growing regions

The two crops that most often come under question in debates about sustainable agriculture in Australia are cotton and rice. Both are water-intensive industries which, on the face of it, don't suit Australia's climatic and geographical conditions.

Rice is grown in the Murrumbidgee, Coleambally and Murray irrigation districts in New South Wales

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and uses waters extracted from the Murray and Murrumbidgee rivers system for irrigation. The issue of whether or not to grow rice is a complex one. Australian rice production is one of the most water efficient in the world, yet it still requires significant quantities of water. Rice production in Australia uses approximately 1200 litres of water for every kilogram of rice produced. While this compares favourably with beef – it takes about 7000 litres of water to produce a kilogram of beef – the difference is that beef can be produced on non-irrigated pastures and needs only natural rainfall. Rice, on the other hand, relies on irrigation systems, which puts a burden on river systems and artificially introduces more water into the water table, which increases the threat of salinity.

One of the methods of evaluating the viability of farming rice and cotton in Australia is to create a SWOT analysis. One has been done for rice cultivation in Australia.

Rice production in Australia

Strengths	Weaknesses
• Innovative farmers use modern techniques to increase the efficiency of production and water management. • The Australian rice-growing region has a good climate for growing temperate varieties of rice. • Low disease and pest problems compared with other rice-growing areas in the world. • Brings in export income for Australia. • Reduces the reliance on imported rice in Australia.	• Heavy consumer of water. • Is not naturally suited to the Australian climate and conditions. • Is reliant on varieties of rice that are susceptible to cold weather and disease. • The geographical concentration of rice-growing districts makes rice production vulnerable to outbreak of disease or natural disaster such as flood. • A relatively small player on world markets.
Opportunities	**Threats**
• High-quality product that is in demand overseas. • Can limit production during periods of drought or water shortage and cultivate other crops. • Water use efficiency and reduction of environmental impact through increased research and development. • Industry's strong environmental record can provide a positive image to Australians.	• Climate change. • Increased salinity and biodiversity loss. • Negative image for the industry because of sustainability issues. • Reduced competitiveness against cheaper overseas production. • Pest and disease resistance to herbicides and pesticides.

1 Investigate the Australian cotton industry and complete a SWOT analysis for cotton production in Australia.

2 Write an essay making a case for abandoning cotton farming in Australia, or for maintaining it, or for limiting it, or for expanding existing production, or find a possible alternative region for production in Australia.

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Responding to the need for sustainable agricultural practices

Australian farmers and rural communities have always been resilient, resourceful and innovative. Today's Australian farmers are dealing with the environmental consequences of 220 years of Australian agriculture and the impact of restructuring in the agricultural sector over the last 40 years in a number of ways:

- Farmers are now taking steps to rehabilitate the land through the assistance of organisations such as Landcare Australia, which provides advice and assistance to farmers. One of the ways to rehabilitate the land is to return areas of properties to natural habitats. This promotes biodiversity, and the natural vegetation helps return the water table to manageable levels so that salinity can be kept in check.
- There is better management of irrigation water allocations in river systems such as the Murray–Darling, which helps ensure that there is adequate water for environmental flows which keep the river system and the wetlands healthy.
- Natural wetlands are being restored: they act as buffers, intercepting sediment and nutrient flows in the rivers and streams so that water quality is maintained.
- There is a growing awareness of the value of the native food or 'bush tucker' industry as a sustainable industry.
- There is a growing understanding of the use of fire to keep native grassland areas in Australia's arid and semi-arid zones healthy and provide sustainable fodder for the cattle industry in these regions. These were practices developed by Indigenous Australians over thousands of years prior to European settlement.
- There is increased development and use of organic farming methods – such as crop rotation and recycling of nutrients such as compost – in which no synthetic chemicals are used.
- Farmers' markets, where smaller producers sell their products, are growing in number and popularity. These markets offer consumers the opportunity to have closer contact with the producers of the foods they eat.

Source 5.42 Australian native forest foods from the Daintree rainforest in north Queensland

Source 5.43 Farmers' markets, like this one near Cohuna in Victoria, are increasing in popularity in Australia.

- Rural towns are becoming more resourceful in attracting people into their communities by promoting them as tourism destinations, and through niche industries. For example, Clunes, a rural community in central Victoria, promotes itself as a destination for book lovers, and its annual book fair attracts hundreds of visitors.

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Geographical fact

Thomas Malthus was an 18th-century economist who predicted that human population increase would eventually outstrip food production and lead to a natural check on population growth through famine, disease or war. Malthus's argument, which he put forward in his *Essay on the Principle of Population* in 1798, was that population growth increases exponentially, so it doubles with each cycle (1,2,4,8,16,32 … and so on) while agricultural production increases arithmetically over time (1,2,3,4,5,6,7 … and so on).

Malthus's theory is just one of many about the relationship between human growth rates and the ability of agriculture to sustain human populations. His gloomy projections haven't been fulfilled – yet, at least – even though the world population reached 7 billion in 2011.

ACTIVITY 5.14

1. Define organic farming and describe how it differs from conventional agricultural practices.
2. Rural communities need to be more diversified than they have been in the past, when they relied on agriculture for their success. Do you agree? Why or why not?

Food security

Apart from the early period of European settlement at the end of the 18th century, when the colony almost starved, Australia has managed to provide the food and fibre requirements of its population and have a surplus to export. Today Australian farmers produce over 90% of Australia's daily domestic food requirements and approximately 60% of their total agricultural production is exported. In the global market Australia contributes 1% of all food consumed in the world and feeds about 40 million people outside Australia each day.

RESEARCH 5.7

1. Investigate the role of Landcare and other conservation organisations in Australia that assist farmers in managing land and water.
2. Research genetically modified crops. Analyse whether or not they have a place in sustainable agricultural practices; list some of the arguments for and against them.

Present your findings to the class in a PowerPoint or Prezi presentation.

Source 5.44 Logo of the United Nations Food and Agriculture Organisation, which is leading world efforts to provide food security. The Latin phrase *fiat panis* means 'let there be bread'.

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Australian agriculture has always been at the leading edge of innovative practices and technological advances and it must maintain this position if it is to continue to provide **food security** for both Australian and global communities. The population of Australia is projected to grow from almost 23 million in 2013 to 35 million in 2050, and the global population is projected to grow from 7 billion in 2011 to 9 billion in 2050, so the pressure to increase agricultural productivity is enormous. This will also be impacted by the predicted effects of climate change.

food security the knowledge that enough food will be provided for the population now and in the future

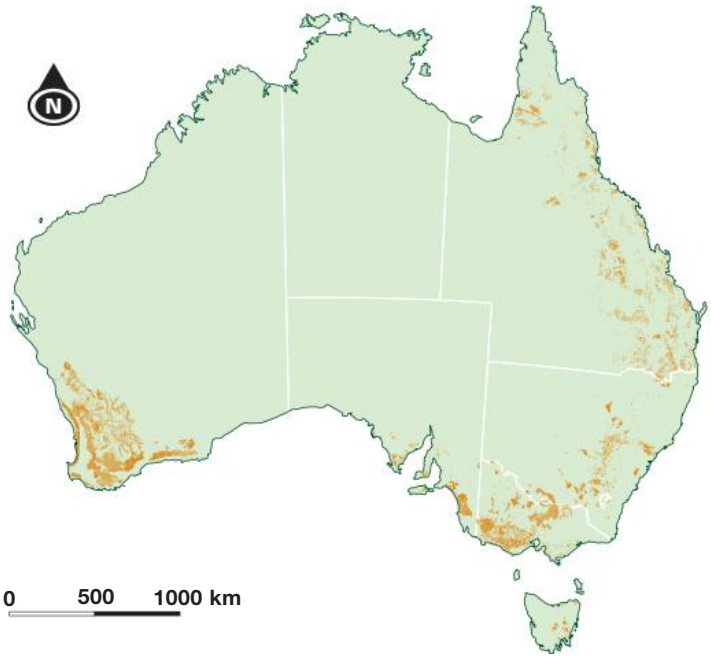
Until now, Australia's food security has been maintained by the availability of:

- arable farming land
- affordable energy resources
- water
- nutrients
- effective farming and trade practices
- efficient transport networks
- sufficient storage capacity for agricultural products.

Climate change is expected to have a significant impact on everything on the list above. Current projections are that in Australia we can expect changes in both the distribution of water available for agriculture (such as river flows) and the timing and duration of rainfall events. Higher average temperatures will increase evaporation rates and reduce moisture levels in the soil. If rainfall, water distribution and temperature patterns are altered, land use patterns will change – production may decline in existing agricultural areas.

Climate change projections also point to an increase in the frequency and intensity of adverse weather conditions such as flood and drought, and suggest changes in the geographical distribution of pests and diseases. This combination will make the production of some cereal crops and livestock unsustainable at some locations. Widespread adaptation, including the relocation of existing agricultural regions, will be required. Also, many existing farming practices will need to change to meet the requirements of reducing carbon emissions and restoring land and water health.

The capacity of the world's natural resources to deal with increasing human population is going to be stretched to the limit in the next 40 years. Currently, human activities use one-third to one-half of the global ecosystem's production: that is, looking at all the things that the Earth's processes produce, such as fresh water and biomass (crops, for instance), humans are taking 30–50% of it for their own use. To extend this beyond 50% is going to put enormous pressure on the biosphere.



Source 5.45 Areas of Australia forecast to have high levels of salinity in 2050. This increase is going to significantly impact on crop production in the next 40 years unless strategies to deal with it are implemented.

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A roadmap for the future of agriculture

Greater management of both natural and agricultural resources is going to be needed if we are to secure food production over the next 40 years. Some of the strategies required are:

- protection of existing natural ecosystems to ensure the health of natural processes and maintain biodiversity: this means reducing the current rate of land clearing
- restoration of degraded land and water resources
- widespread development of more sustainable agricultural practices
- reduction of carbon emissions from human activities
- greater environmental and resource management of other land use industries, such as mining
- greater control over urban development and the spread of cities that are encroaching onto farming land.

These challenges are going to be difficult in light of present trends in both industry and human development. Some of these trends are the increasing demand for biofuel production in the developed economies of the world as they seek alternative (renewable) sources of fuel. The biofuel industry, which converts organic products such as corn or sugar cane to fuel, is competing with food agriculture for the use of arable land. The demand is being driven by the increasing cost of oil and the need for countries to secure energy resources while there is political instability in the oil-producing nations of the world.

Another trend that is going to put enormous pressure on global agriculture is the growth of the middle class in places such as China and India. As these nations become more prosperous, the demands on food production change. In the past, the levels of calorie consumption in these countries have been well below the levels of western nations such as Australia and the United States, and their diets have been based on staple foods such as rice. However, as prosperity increases dietary habits change, and levels of consumption increase. One of the areas of consumption increase is animal protein products such as meat and dairy. As it takes much more energy and resources to produce a kilogram of meat than it does to produce a kilogram of rice, the extra demands on agricultural production are going to be enormous.

ACTIVITY 5.15

1. Examine how successful Australian agriculture has been in meeting the food and fibre requirements of its population.
2. Explain what 'food security' means.
3. Referring to Source 5.45, identify the areas of Australia that will be prone to severe salinity in 2050.
4. Explain how this distribution corresponds to existing areas of agricultural production.
5. Summarise the impact salinity may have on future Australian food production.

RESEARCH 5.8

1. Research biofuel and how it is impacting on agricultural food production.
2. The UN Food and Agriculture Organisation was set up to deal with issues of world hunger. The logo of the FAO is instantly recognisable. Inset in a circle which represents the globe are the letters of the organisation and the image of a stalk of wheat. It also has the Latin phrase *fiat panis*, meaning 'Let there be bread.' Create a logo for an organisation that has been set up to deal with issues of food security in Australia over the next 40 years. Annotate your logo, explaining your choice of words, phrases and images. Have a class vote on which one best represents the future of Australian agriculture.

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Chapter summary

- Agriculture has been practised for thousands of years all over the world.
- In Australia, the arrival of the First Fleet brought with it the agricultural practices of Europe.
- By 1860, the Australian agricultural revolution was in place, with a boom in breeding livestock and land cultivation.
- The spread of settlement in Australia can be linked to the expansion of agriculture. Landscapes were fragmented, and were based on the European notion of ownership.
- By the late 1700s, agricultural settlements and colonies began to appear.
- By the mid-1860s, governments were under pressure to 'unlock' the land, and break the areas previously settled by squatters into small farming allotments.
- During the second half of the 19th century Australian governments recognised that Australia needed to be self-sufficient, and could not rely solely on the export of wool.
- Australia's unique climate placed limits on early agricultural practices. Australia's dryness was a problem because many of the agricultural practices used were brought from Europe, which is not dry.
- Australia's agricultural zones all need specific practices to deal with their climate and ecology.
- By the early 20th century, agricultural production was a large part of the Australian economy.
- Systematic agricultural settlement in Australia was further developed with the establishment of 'soldier settlement' schemes for men returning from World Wars I and II.
- The Green Revolution that began in the 1950s was driven by advances in agricultural science and technology that led to a greater understanding by farmers of efficient land, soil and water management practices.
- Agricultural land use places pressure on the environment: the effects include erosion, salinity, loss of biodiversity and a decline in water quality.
- Australian farmers have been very successful at providing innovative solutions to problems and maximising agricultural productivity. They have also had to deal with the country's vastness and relative remoteness from the rest of the world.
- From the 1970s onwards, changes in the national and global economies have put pressure on farmers to become more competitive.
- Today farming requires an understanding of the whole business of agriculture, from balancing the nutrient levels in the soil to buying and selling water and monitoring international prices.
- Agriculture in Australia has changed dramatically, particularly in the last 60 years: there has been a real need for increased production because of population growth, and also an ideology that progress and productivity are intrinsically good things.

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End-of-chapter questions

Multiple choice

1 When did systematic agriculture arrive in Australia?

- **A** 10 000 years ago
- **B** 1788
- **C** 1820
- **D** 1950

2 Which of the following commodities is a cereal crop?

- **A** Sheep
- **B** Legumes
- **C** Wheat
- **D** Apricots

3 Which of the following is the primary cause of dryland salinity?

- **A** Rising water table
- **B** Overgrazing of sheep and cattle
- **C** Increased rainfall
- **D** Erosion

4 The Green Revolution occurred in which century?

- **A** 18th
- **B** 19th
- **C** 20th
- **D** 21st

5 On the back of what animal was Australia's economic prosperity riding for much of the 19th and the first half of the 20th century?

- **A** Cattle
- **B** Rabbits
- **C** Pigs
- **D** Sheep

Short answer

1 Analyse how a lack of understanding about Australia's climate and geology and its limitation in the first 150 years of settlement led to increased environmental degradation.

2 Discuss the Green Revolution and how it changed agriculture.

3 List some of the changes experienced by Australian agriculture in the last 40 years.

4 Describe sustainable agriculture.

5 List the challenges facing the future of food security in Australia and overseas.

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Source 5.46 Local produce on display at New York City farmers' market.

Extended response

Problem solving for sustainable development: finding a compromise between Australia's energy needs and those of agriculture, the environment and the economy

Securing energy sources such as gas in Australia is vital for the economy. Food and fibre security is also vital to Australia's future prosperity. The question is how to balance the interests of industries such as mining and energy with those of agriculture, the environment and the economy.

Divide into small groups. Use a problem-solving model to explore the issues involved with coal seam gas exploration and production and evaluate solutions that would be acceptable to all stakeholders. Each group should represent the interests of one of the following stakeholders in the debate:

- coal seam gas industry
- farmers
- environmentalists
- politicians.

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Step 1 – Fact finding

1. List the facts relating to coal seam gas production.
2. Identify where your group stands on the issue: negative, positive or somewhere in between?
3. List the information you need in order to develop solutions.
4. Create a list of sources where that information can be found.

Step 2 – Problem finding

1. Identify all the underlying problems and issues related to coal seam gas production.
2. Analyse the information and identify a major problem/s which, if solved, would provide a solution for farmers and environmentalists and the coal seam gas industry.

Step 3 – Idea finding

1. List as many ideas as you can for solving the problem/s.
2. Brainstorm ideas, focusing on quantity rather than quality of ideas. (Evaluation of the ideas can take place at a later stage.)

Step 4 – Solution finding

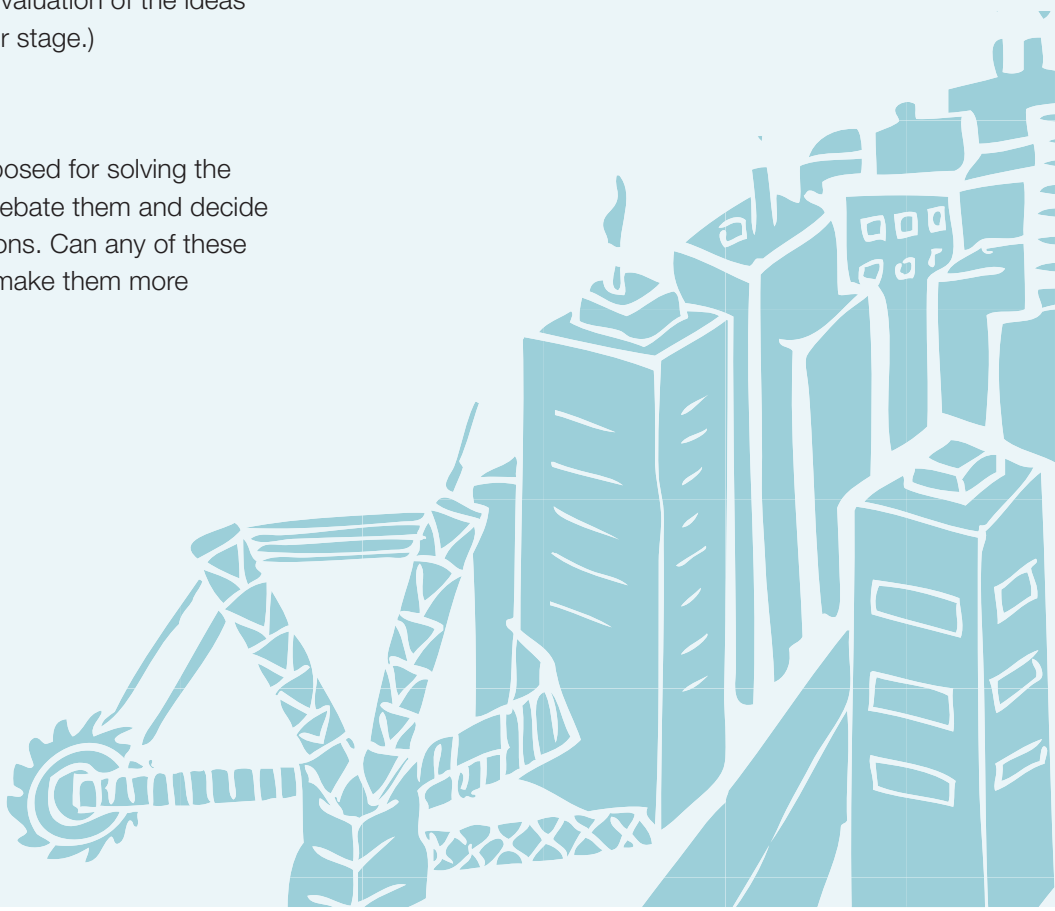
1. Evaluate the ideas proposed for solving the problem. As a group, debate them and decide on a hierarchy of solutions. Can any of these ideas be combined to make them more suitable?

Step 5 – Acceptance finding

1. Develop a plan for implementing your chosen solution. Consider all those who must accept the solution, plan for answering their questions and decide how to convince them that the solution is appropriate.
2. Present your arguments to the class and answer any questions they raise.
3. Class members from each stakeholder group should ask questions of the group presenting that reflect the interests of their group.

Step 6 – Evaluation

1. Were there any solutions that all stakeholders came up with?
2. What were some of the disagreements between the stakeholders and why were there disagreements?
3. What are some of the ways solutions to these types of issues that are acceptable to all stakeholders can be found? Suggest some strategies for managing the interests of all groups.



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UNIT 2
Geographies of interconnections

ISBN 978-1-107-64717-6

Cambridge University Press

6 Places and spaces

Source 6.1 Camels on Cable Beach in Broome, Western Australia

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Before you start

Main focus

How place and space, as major geographical concepts, or organising ideas, help us to better understand how we, other people and cultures see and connect with places that are important to who we are.

Why it's relevant to us

The way we see, understand and connect with places that are significant in our lives, as well as other people's and other cultures' futures, has a big influence on how we live today.

Inquiry questions

- What factors influence how we perceive and engage with places in our local area?
- Why do we see some places as safe and/or inclusive and other places as unsafe and/or exclusive?
- What can our community do to improve people's access to places, activities and services and ensure that public places in our local community are safe?
- How do the activities and interests of Australians shape places?
- What are the challenges and opportunities this presents for designing more sustainable futures?

Key terms

- City
- Consensus
- Domestic tourism
- Geographical concept
- Identity
- International tourism
- Perspectives
- Place
- Population
- Refugees
- Space
- Town
- Worldviews

Let's begin

Place and space are major geographical concepts, or organising ideas, that help us see, understand and connect with our local area and other places, spaces, cultures and environments. They provide important ways for us to gather and interpret information to make informed decisions about the use of places, connecting places over space and time and understanding the environmental, cultural, social and economic consequences of these decisions.

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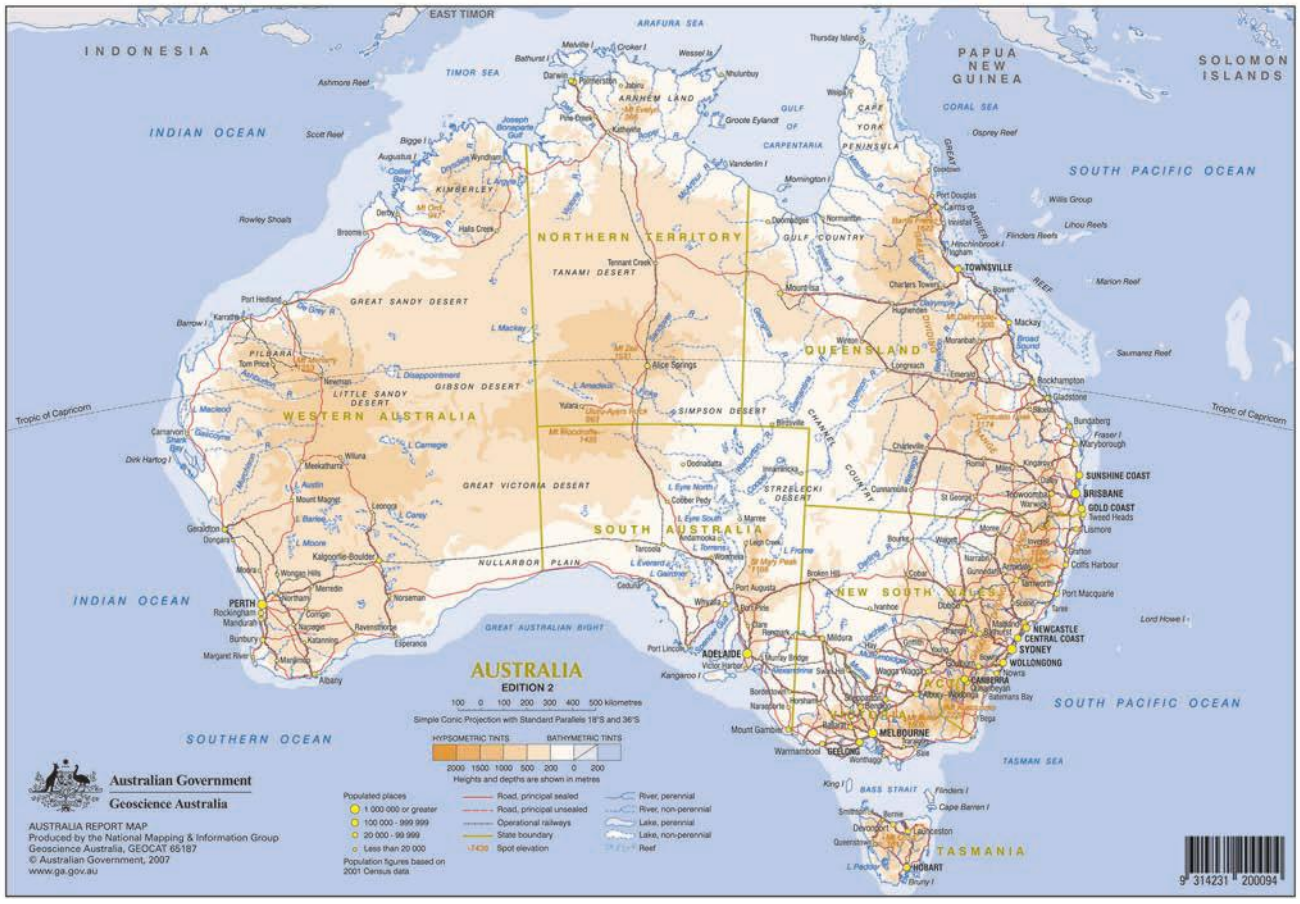
6.1 Place and space

Places are parts of the Earth's surface that have specific meaning for some people. A place can range in size from a comfortable chair in a room to a national park to a country to the whole world. A place can be a natural feature, such as an old-growth forest, or a human construction, such as a house. It could also be a place where natural and human features and human constructions interconnect, such as a farm.

geographical concept
a key notion or idea that helps us to explore, understand and explain features, patterns and relationships on the Earth's surface

In geography we use the **geographical concept** of space to better understand where, how and why places are located and connected over the Earth's surface. As we move, or send something, from one place to another place, we are using our understanding of space. For example, the form of transport you use and the route you take to go from your home to your school is informed by your understanding of how your home and school are connected across space.

Often maps are used to show the location, distribution and reasons for the pattern of places over space.



Source 6.2 Australian settlement and transport

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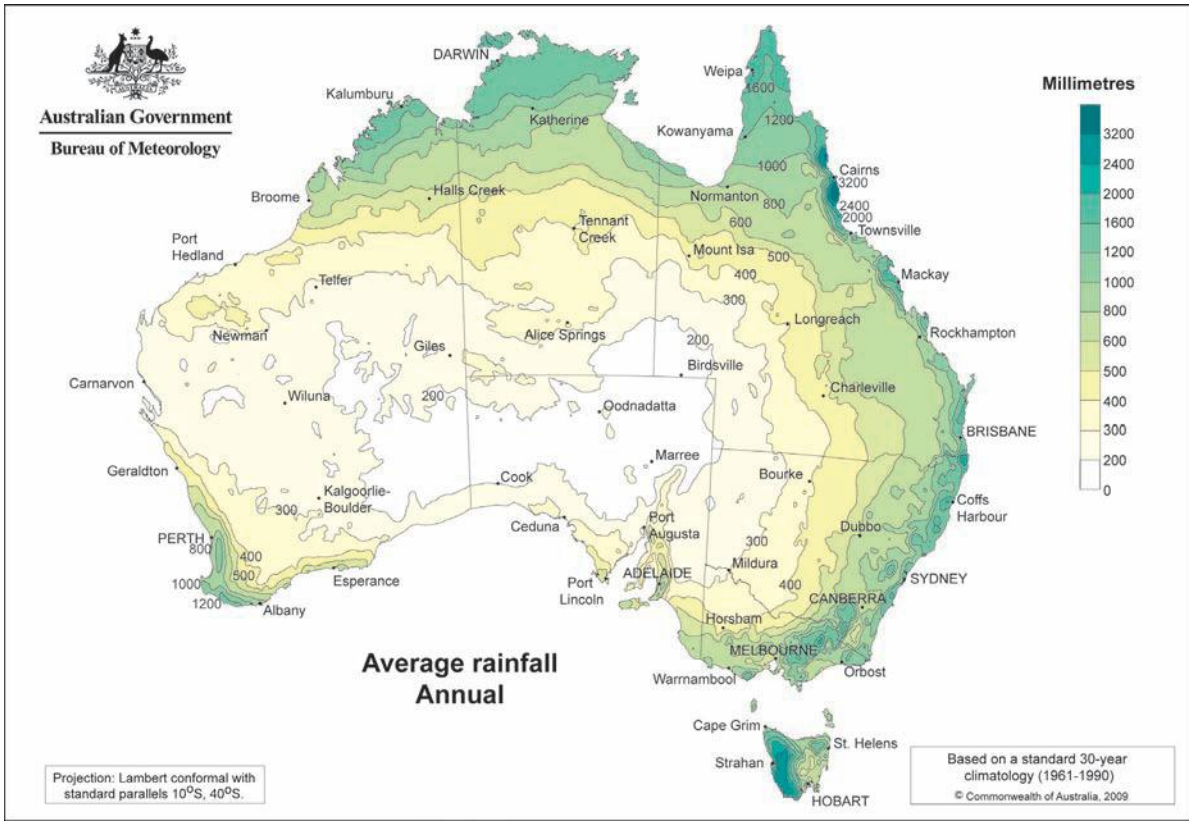
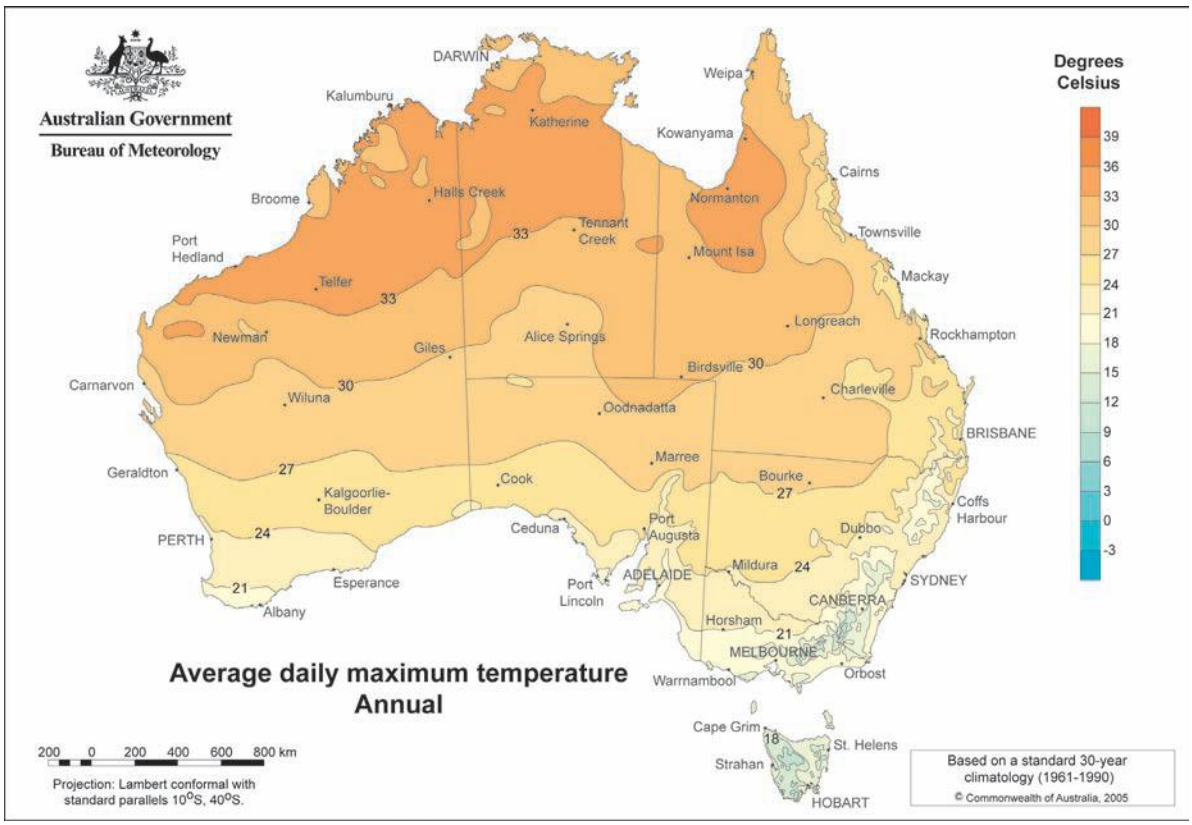


Source 6.3 Australian average rainfall



Source 6.4 Australian maximum daily temperature

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ACTIVITY 6.1

1 Use the three maps to describe the approximate:
   - **a** height above sea level
   - **b** average annual rainfall
   - **c** average annual daily maximum temperature

   of the place where you live.

2 Describe the region of Australia where:
   - **a** the majority of Australians live: provide evidence from the map to support your conclusion
   - **b** there are very few people living: provide evidence from the map to support your conclusion.

3 Use information provided on all three maps to suggest reasons why:
   - **a** the majority of Australians live in the region you have identified
   - **b** large areas of Australia have a very low population density.

Stories of place

How we identify and interact with a place and its spatial features depends on our personal and cultural **perspectives**: on the relationship we have with the place and its natural and human environmental features and why it is important for us, our culture, our people and our future.

perspectives the ways in which people view the world around them

NOTE THIS DOWN

Copy the graphic organiser below and identify and describe the places you and other students find important.

Important places		
Think	**Pair**	**Share**
Choose a place that is important to you.	In a pair, discuss and compare your important places.	Join with one or two other pairs to share your discussion outcomes.
Describe the place and write down 3 reasons why it is an important place for you.	How are the places similar and different? How are the reasons for their being important similar and different?	Identify common reasons for the places you identified as being important.

Discuss with the class any common reasons you found for why places are important.

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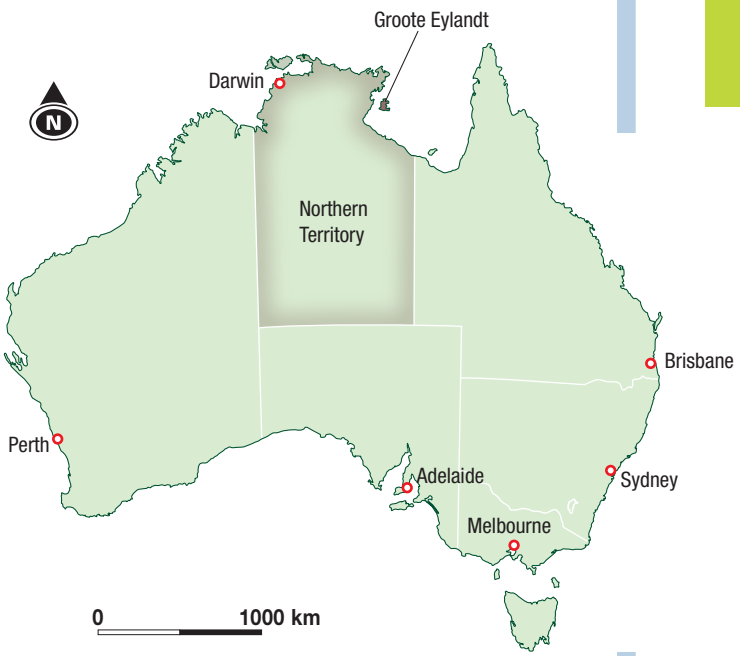
Case study 6.1

Elma Yantarrnga's story

Elma Yantarrnga is an Anindilyakwa-speaking person from Groote Eylandt in the Northern Territory. Elma is the senior female ranger with the Anindilyakwa Land and Sea Rangers. She represents the Anindilyakwa Land and Sea Rangers at land management conferences right across Australia, as well as being actively involved in training and in conversations with such organisations as the Northern Territory Department of Fisheries and the Australian Quarantine and Inspection Service (AQIS). When Elma thinks of her land and place and her work, she says:

> I do this for my people and my land. I am a ranger so that I can look after our land the best way. Some people think that we are out here having fun, that we aren't working. But we are working; we are working to look after our land. I know, as a ranger, that I need to learn different ways of looking after land and that is why I am always learning and training and showing people what I do. When you are a ranger you are looking after your land all the time. It is a new way of seeing land and our place and it is important. We listen and tell stories about our land with our people and then we go to work and we remember those stories and we think of those stories when we are doing our ranger work and it makes me a better ranger. When we are talking to the people that come and look at our land, like the Fisheries people and the AQIS people, we listen to what they have to say about our land and we tell them what we have to say about our land and then we all work together to look after this land. Some people get their brains washed like a lollipop when they don't listen to the people and what our people tell us about our land. This is my land and I look after my land for my people.

Source 6.5 Anindilyakwa Land and Sea Rangers retrieve a ghost net from the waters surrounding the Groote Eylandt archipelago



Source 6.6 Location of Groote Eylandt

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Source 6.7 Groote Eylandt

1 Describe the geographic location of Groote Eylandt.

2 Explain why telling and sharing stories of land and sea are an essential part of life and culture for Elma Yantarrnga as a traditional landowner and as a ranger.

3 Suggest what may happen if the stories of the people who have a deep spiritual connection with land and sea are not listened to when decisions are being made about that land and sea.

Remember Elma Yantarrnga's story about the importance of including, sharing and listening to stories about connection and care of land and place as you read through this chapter.

Case study 6.2
Tala's story

Tala was born and grew up in Jordan. Her family is Palestinian and she now lives in Australia.

Since coming to live in Australia, Tala has thought and written about why place is so important to migrants' **identity**.

Tala says that before she left Jordan, she believed that people were more important than place because people bring meaning to the places around them. She now believes that it is our

identity the ways in which we define ourselves

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Source 6.8 Jordan

connection to place that brings meaning to who we are. Place connects with people, culture and spirituality; it lives in the person and travels with them as a 'sense of home, sense of place, sense of dwelling as a mobile habitat'.

Tala found coming to a foreign country where she did not speak the language very difficult, as language connects us with a place and its culture. When migrants leave their countries and come to Australia they face language – and **nostalgia** – problems as they try to assimilate to Australian ways of living and find an identity in this new place. Migrants find ways to assimilate to Australian life while keeping connections with their past life.

nostalgia remembering good things about the past

Many migrants' homes have become private museums of cultural objects they have brought with them. 'Middle Eastern migrants always surround ourselves with socially and culturally pleasing objects,' says Tala. These are more than just objects: they connect migrants with their life experiences of their former place – 'They represent my history, my culture'– and help them deal with all the changes in their new lives.

Tala says that holding festivals and celebrating cultural days in the new place is important. It 'brings meaning to this new place by celebrating culture'. Connecting with people of your culture, speaking your language and buying, cooking and sharing your culture's food is also part of establishing your sense of identity, place and belonging.

Childhood memories and stories of places are very important. Tala says that she has never lived in the Palestinian territories. However, through listening to her grandmother and grandfather's stories about living in Jerusalem, Tala has a very strong sense of connection with Jerusalem: it is part of who she is and of her culture.

Tala says that the senses are also important in connecting with place and culture. The cooking, smell and taste of Middle Eastern food brings back fond memories of experiences in Jordan with family and friends. 'When I go to a new place I keep the smell in my mind, and that connects me with a certain place.'

Music and musical instruments are also important connections to culture and identity. Tala downloaded Omar Bashir playing the oud – go to www.cambridge.edu.au/geography9weblinks for a link to this YouTube video – to demonstrate the significance of Middle Eastern music being played on authentic Middle Eastern instruments.

Tala loves her life in Australia, in part because she keeps her connections with her past as she assimilates to Australian life and her new identity.

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Source 6.9 The oud

Geographical fact

The oud, a string instrument, is considered one of the most central instruments in the Middle Eastern music tradition. It dates back over 3500 years.

1 Describe and explain the importance of the relationship between place and identity for Tala: write a 300–400 word essay or create a poster, or a PowerPoint or other electronic display.

2 In a small group discuss how your connection with a special place, or places, is important to your identity. List the reasons.

3 One of Tala's fondest memories of Jordan was visiting Petra. Go to www.cambridge.edu.au/geography9weblinks for a link to a site that will help you research and describe where Petra is and why it is such a significant place. Suggest a place in Australia that has a similar significance to you.

RESEARCH 6.1

Your task is to interview a person to gain an insight into why a particular place is important to who they are.

1 Before you start:
- Identify a person who can share a story with you about a particular place and why it is important to them. It may be a place from their past or a place they connect with today.
- The place could be a house or building, a national park or waterway, a town or farm, a state or country.
- Remember, people may connect with a place for many reasons: family, cultural, spiritual, as a safe place and as a place of opportunity, for example.
- Also, everyone sees and remembers places in different ways, including through sight, hearing, taste, smell and touch.

2 Identify your task to your interviewee and show them the questions you will use to guide the talk.

3 Get the person's permission to share their place story with others. Make sure you are aware of, and respect, their wishes about any information they do not want disclosed to others.

4 Decide how you will keep a record of the interview.

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RESEARCH 6.1 *continued*

5 Hold and record the interview.

6 Prepare a written, or recorded, or poster description of where the place is and why it is important for your storyteller.

7 In groups of up to 4 people, share these place stories. Identify any common reasons – and any different reasons – for why the places are important to the people whose stories you shared.

8 Share these reasons with the whole class: you could collate them into a book or e-book.

6.2 Worldviews

How we identify and interact with a place depends on our individual and cultural perspectives on the relationship we have with the place and its natural and human environmental features.

Perspectives explain how we see the world and our place in it. They include spiritual connections, the values placed on the interdependence of the natural and human environment, our sense of belonging to the place, and the place's importance through time. The major perspectives and beliefs that determine how we see the world around us and live in it can be called our **worldviews**.

worldviews the collection of ideas, beliefs and spiritual connections through which we – personally, as groups and as cultures – understand, connect with and interact with the world

It is very difficult to fully understand our worldviews because they are so much part of who we are. We usually think, say and do things without realising that we are following our worldview. In a sense our worldview is to our personal, social and cultural being as our lungs and heart are to our physical being.

It is important to be aware of our and other people's worldviews – where they come from and how they influence our thinking. Through understanding our and other people's worldviews we are more able to positively connect with other people and cultures.

An understanding of our own worldview also helps us to better appreciate how we see the relationship between humans and the environment. For example, is it a relationship based on seeing humans controlling environments for human needs, or is it a relationship based on seeing humans' needs and the environment's needs as interconnected?

ACTIVITY 6.2

1 In groups of 3, identify a geographical issue to share your views on. It may be a local issue (such as building a skate park) or a regional issue (such as building dams on your local rivers) or a world issue (such as how to reduce poverty in the world).

2 Spend 5 to 10 minutes individually, thinking, and maybe recording notes, about your ideas and beliefs on the issue.

3 Take turns explaining your ideas and beliefs to the other people in your group – take 3 minutes each. Rotate the roles of speaker, timekeeper/questioner (if needed), and recorder.

4 After each person has spoken, the recorder will lead a discussion on the views expressed by the person they recorded.

5 Discuss how your views were similar and different and reasons why this may be so.

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Uluru – how worldviews coexist

governance the set of rules, organising processes and structures that groups, societies and countries follow to make decisions and maintain order in their day-to-day living

Uluru is an example of how the coming of Anglo/European culture, **governance** and worldviews to Australia impacted on Aboriginal and Torres Strait Islander peoples' connections with country.

The Uluru experience also illustrates how Aboriginal and Torres Strait Islander and Anglo/European cultures and worldviews can coexist. We all have choices about how we do this.

Source 6.10 Location of Uluru

Uluru is recognised worldwide as an iconic symbol of Australia. Uluru and Kata Tjuta have extraordinary cultural, spiritual and geological significance. The Anangu people, the traditional owners of country including Uluru and Kata Tjuta, have lived in deep spiritual and cultural interdependence with this country for tens of thousands of years. They are part of the oldest cultural–country interrelationship still existing on Earth.

Uluru and Kata Tjuta are among the oldest landforms on Earth. Rocks there have been dated at around 550 million years old. Their cultural and geological significance is recognised: Uluru-Kata Tjuta National Park was listed as a natural World Heritage site in 1987. In 1994 Uluru-Kata Tjuta was re-nominated under cultural criteria, and it is now recognised as a mixed natural and cultural World Heritage site. It is one of only 29 sites worldwide with this joint listing.

Geographical fact

World Heritage listing is managed through the United Nations Educational, Scientific and Cultural Organization (UNESCO) as part of an international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage, adopted by UNESCO in 1972. The treaty aims to identify, protect and preserve sites of cultural and natural heritage around the world that are considered to be of outstanding value to humanity.

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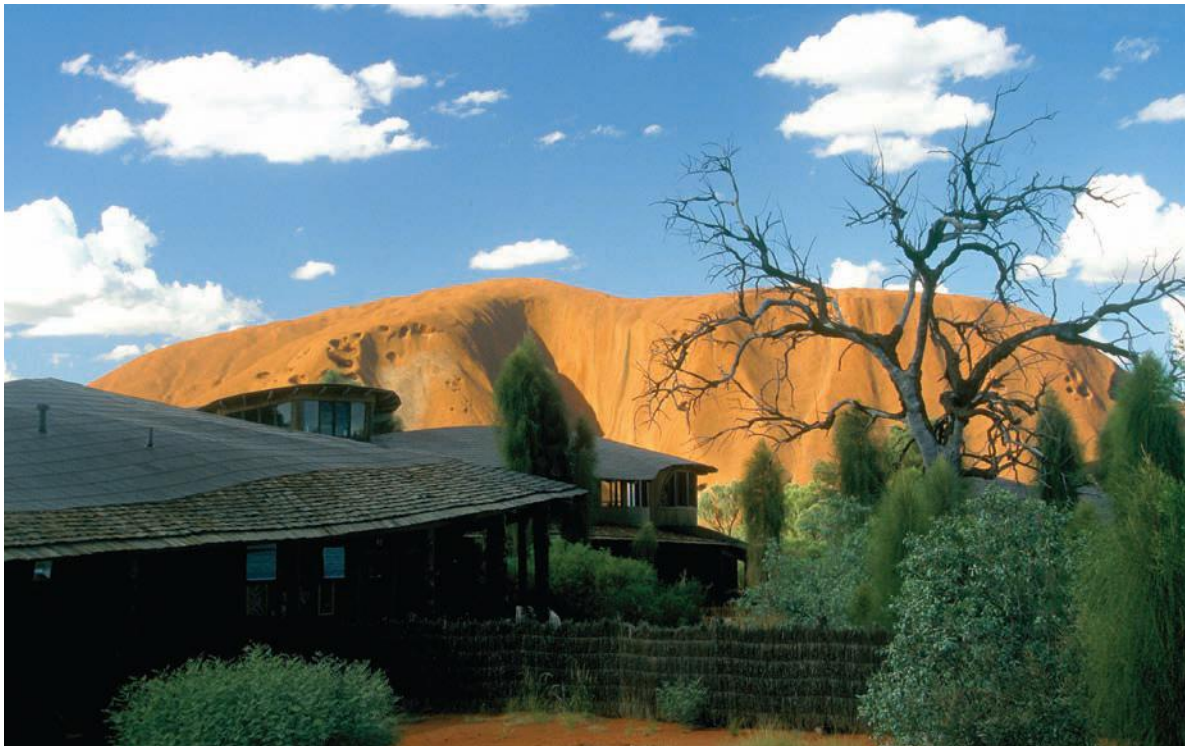

Source 6.11 Uluru-Kata Tjuta Cultural centre, in the Uluru Kata Tjuta National Park

The recent management of Uluru-Kata Tjuta country and of tourism in the Uluru-Kata Tjuta National Park illustrates how people's different worldviews can coexist.

At a ceremony at the Uluru-Kata Tjuta National Park on 26 October 1985, Sir Ninian Stephen, Australia's Governor-General, handed the **title deeds** of Uluru-Kata Tjuta to the Anangu traditional owners under the *Aboriginal Land Rights Act 1976* (NT) (ALRA). At the same time a lease agreement was signed by the newly formed Uluru-Kata Tjuta Aboriginal Land Trust and the Director of National Parks – it leased the land back to the federal government for 99 years. The agreement formally acknowledged Anangu ownership of the park, and recognised the value of Uluru-Kata Tjuta as a park of national and international importance.

title deed a legal document that shows ownership of a piece of land

The park is now jointly managed by a board made up of Anangu and *piranpa* (non-Aboriginal people) members, with their roles and responsibilities set out in both the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and the ALRA. The EPBC Act ensures that visitors to the park respect its natural and cultural values, while the ALRA protects the property rights of the Anangu. This process of working together has come to be known as 'joint management'.

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ACTIVITY 6.3

Read the Northern Territory government's advertisement THE ROCK BELONGS TO ALL AUSTRALIANS! (AND ALWAYS HAS).

THE ROCK BELONGS TO ALL AUSTRALIANS!

(AND ALWAYS HAS)

On October 26 without consultation or mandate, the Federal Labor Government will hand over Ayers Rock and the whole of the Uluru National Park to fewer than 100 Australians. They will then pay these special Australians $75,000 a year to lease it back from them. All Australians visiting Ayers Rock will pay to see it, and the new owners will get 20% of that fee as well.

The Northern Territory Government is adamantly opposed to this action:

- It is contrary to accepted procedures under which land claims have been made — until now.
- It shows an arrogant disregard by the Hawke Labor Government of the interests of the Northern Territory and of all Australians.
- It is another misuse of Commonwealth power in an area which has always been regarded as a State responsibility.
- It places in the hands of just a few that which belongs to all Australians: Ayers Rock, the heart of this country.

The Northern Territory Government seeks support from the Australian community to prevent this act of gross irresponsibility. The Hawke Labor Government must be reminded that it is elected to respect the wishes of the majority of Australians, not to serve the narrow factional interest of its own left wing.

Will Katherine Gorge (already under claim) be next? Perhaps the Great Barrier Reef will follow.

Australians did not give the Hawke Government a mandate to divide this country.

They were given custody of our heritage, not the right to give it away.

NORTHERN TERRITORY GOVT.

The Midweek Territorian, October 23, 1985, Page 5

Source 6.12 *Midweek Territorian*, 23 October 1985

1. Identify the two main purposes of the 26 October 1985 agreements.
2. Explain what the main concern of the Northern Territory government was.
3. Identify and justify your point of view on 'who owns' Uluru.
4. Share your opinions with the class.

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Geographical fact

Over 400 000 Australian and overseas people visit the Uluru-Kata Tjuta National Park each year.

NOTE THIS DOWN

Copy and complete the graphic organiser below about whether or not it is appropriate for tourists to walk on Uluru. Discuss what other class members wrote. Go to www.cambridge.edu.au/geography9weblinks to find links to useful websites.

Cultural reasons for not walking on Uluru	Reasons why tourists walk on Uluru

consensus an agreement reached by a group as a whole

Aboriginal and Torres Strait Islander people make decisions through **consensus**. The process is very important. The leader of the conversation is chosen by the community because of their knowledge and skills in the issue being discussed. The people identify the issue and talk about ideas on how to move forward. Every person tells their story (one story) on the matter. The conversation continues until there is agreement on what will happen.

Non-Aboriginal and Torres Strait Islander people usually start by looking at the 'for' and 'against' arguments of a proposal. The result is often an argument rather than a conversation, and many times a few people dominate the argument. For many people, the outcome is more important than the process.

ACTIVITY 6.4

In small groups, or as a whole class, conduct a consensus decision-making process in relation to walking on Uluru. Identify the issues and continue talking until you reach agreement on the issue.

World heritage sites

UNESCO has listed over 900 locations as World Heritage sites. They are places that have special cultural or physical significance, not just for the local community or the nation where they are located, but for all of humanity.

RESEARCH 6.2

In pairs, go to the UNESCO World Heritage Centre site (there is a link at www.cambridge.edu.au/geography9weblinks) and click on The List tab. There are 29 sites, including Uluru-Kata Tjuta National Park, listed as sites (both cultural and natural).

Select and click on one of the 29 sites listed. Use the Description, Maps, Gallery and video tags to complete the following tasks:

1. Describe the location of the site.
2. Describe the special cultural features of the site.
3. Explain the special natural features of the site.

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6.3 Safety and inclusion

How we see and connect with places often depends on whether or not we feel safe and included there. What makes a place safe or threatening, including or excluding, for you?

Being safe and included in the community and country they live in is a major day-to-day concern for millions of people around the world. When people cannot feel safe where their home is they often flee that place. Some flee to safer regions in their country and many flee to other countries. The people who flee from their country are refugees.

Article 1 of the 1951 United Nations Refugee Convention defines a 'refugee' as:

- a person who is outside his/her country of nationality or habitual residence and
- has a well-founded fear of persecution because of his/her race, religion, nationality, membership of a particular social group or political opinion, and
- is unable or unwilling to avail themselves of the protection of that country, or to return there, for fear of persecution.

There are more people who move within the borders of their own country than move out of their country as refugees. For example, in 2011, while there were more than 800 000 people who were newly displaced as refugees across international borders, there were 3.5 million people who were newly displaced within their own country.

Geographical fact

Afghanistan is the leading 'country of origin' of refugees. In 2011 there were close to 2.7 million refugees who had left Afghanistan: that is around 1 out of every 4 refugees in the world. They were spread across 79 countries, but 95 per cent of them were in Pakistan and the Islamic Republic of Iran.

NOTE THIS DOWN

Copy the graphic organiser below and discuss the places you and other students might feel safe and included or unsafe and excluded.

Safe and unsafe in places / Included and excluded in places		
Think	**Pair**	**Share**
What makes places: • safe or unsafe? • including or excluding?	In a pair, discuss and compare your thinking about: • safe or unsafe • including or excluding.	Join with one or two other pairs to share your discussion outcomes and identify common reasons.
Safe or unsafe		
1 2 3		
Including or excluding		
1 2 3		

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Case study 6.3
Ali's story

Source 6.13 Location of Khuzestan province

Ali's story is very much about safety, respect and opportunities.

At the beginning of the interview, Ali said that to talk about his story of place he needed to 'speak my own language, as I am thinking about place in Arabic'. So Farouk, Ali's young teenage son, played an important part in the interview. Both Farouk and Ali have good English-speaking skills.

Ali and his family are Ahwazi Arabs who lived in the Khuzestan (al-Ahwaz) province in Iran. The province borders Iraq. Khuzestan province is divided into two geographical regions, the western fertile plains region irrigated by the Karun, Karkheh and Jarahi rivers, and the eastern mountainous region.

Ali experienced war and conflict all his life before coming to Australia. He was born in a small village very close to the border with Iraq. When he was a small child, the village was one of the first places to be attacked at the start of the Iran/Iraq war, on 22 September 1980.

During the 8 years of the war Ali's family moved over 300 km – from the fertile flat floodplains, where most of the fighting was occurring, to

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the mountainous southeast Behbehan area of Khuzestan province.

The end of the war did not bring safety or opportunities for Ahwazi Arabs. Ali says that the Iranian government in Tehran has a policy of 'Persianisation' – it aims to impose the religious beliefs, practices, language and way of life of the dominant Persian ethnic group on all the ethnic and religious minority groups in Iran.

'Persianisation' has included the adoption of *gozinesh* (selection) laws (from the mid-1980s) that restrict most non-Persian nationalist and ethnic groups' access to education, and to employment in military and government services and other positions. These groups have to pass rigorous tests to show that they follow and practise Iran's official state view of Islam before they can access these opportunities. Many Iranian groups, such as the Ahwazi Arabs, the Baloch and the Kurds, have come to see themselves as nationalist groups with their own culture, clothes, religious faith, and flags – a small Ahwazi Arab flag flies in a corner of Ali's lounge room. The nationalist groups want to have their own separate country (the Kurds, for example, want their own nation of Kurdistan) or at least political recognition and rights in the region of the country they live in.

The Ahwazi Arabs owned areas of fertile floodplain land. When they were forced to flee during the Iran/Iraq war, this land was taken and sold at very low prices to ethnic Persians and other non-Arab people. The Ahwazi Arabs therefore had little land and very limited education and work opportunities. When the Ahwazi Arabs protested about these conditions, many were arrested and some were executed. Ali spent four years in jail for helping other Ahwazi Arabs by giving them money. Ali says, 'I lived in Iran, but Iran did not live inside me.'

Because of Ali's fear for his family's safety, the inability of his children to get formal education and the lack of work opportunities for him and his family, he left Iran, to try to find a place where there would be good opportunities, and respect, for his family. He spent six months in Iraq living with cousins. Then he and his family moved to Syria for one-and-a-half years. They then moved to Lebanon and lived there for a further two years. In each of these places, although he was with people who shared his Arabic culture, Ali found neither respect nor

Source 6.14 Distribution of ethnic and nationalist groups in Iran

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opportunities. In Lebanon he applied to the United States and Australia as a refugee. Ali and his family were accepted as refugees to come to Australia:

> So we came to Australia. It is totally different but it has safety and freedom and respect that people need to have. So we stayed here.
>
> Place for me is very important. If you live in any place for a time it becomes part of your mind. Australia is a new place for me so I must learn new language. If you live long in Australia it will become part of your mind.
>
> Most people, immigrants, who come to Australia, keep thinking of old place and culture – even when asleep I have dreams about old country.
>
> Most people who come from different countries have difficulties in Australia. They didn't have much education in their country and culture different and have difficulties interacting. Therefore they keep looking for their own kind.
>
> When we came here we became quickly attached to our place. When African and Middle Eastern people come here we like to get attached and interact with other people as quickly as possible to learn their ways and get jobs and learn.

1. Explain why place and, safety, respect (including cultural heritage) and opportunities are so important to Ali and his family.
2. In a small group, discuss how safety and respect are important to how you connect with and move through places. Note down the main points from the discussion.
3. Describe, in three or four paragraphs, the reasons why refugees can feel either safe or unsafe and respected or disrespected in places. Include suggestions for what we, as citizens, can do to ensure that all people feel safe and respected in all places all the time.

Source 6.15 The Ahwazi Arab flag

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Making public spaces safer places

Safety in public spaces is an important concern in all communities.

Safety has been one of the main reasons for children carrying mobile phones. Now we are all being told to download personal safety apps (applications) on our smartphones so we can instantly get help when we are in trouble.

Closed-circuit television (CCTV) – a surveillance system that sends television signals from cameras to monitors and/or recorders – is another way electronics are being used for public safety.

Read the following opinion piece from the *Newcastle Herald*.

Are we ready for CCTV?

Damon Cronshaw, *Newcastle Herald*, 25 October 2012

'Every time we have a shoplifting incident, we catch it on camera. CCTV is a great tool for apprehending offenders.' Frontline Hobbies owner Colin Scott.

Newcastle mayor Jeff McCloy has no doubt about the benefits of CCTV.

McCloy has used it successfully at his properties. Once, he caught a graffiti offender spraying a tag on a wall in Hunter Street. The image made the *Newcastle Herald*'s front page and police soon caught the offender.

'It's imperative that we have CCTV in Newcastle,' McCloy said. 'Every modern city in the world has it and it's a tremendous deterrent for crime.

'I can't understand why there would be any resistance to it.'

A push for CCTV in Newcastle's trouble spots is back on the city's political agenda, amid plans to combat and reduce alcohol-related violence.

CCTV rose to national prominence last month when it was used to catch the alleged killer of Melbourne ABC radio employee Jill Meagher.

Newcastle City Council staff remain interested in CCTV, despite a decision this year from the previous elected council not to proceed with a trial.

For some, CCTV is a step on the slippery slope towards a surveillance society and a restriction of civil liberties.

It's a concept that invokes Big Brother, the ever-present eye of a totalitarian dictator, made famous in George Orwell's novel *Nineteen Eighty-Four*.

But many who want the CBD and other public areas to be safer welcome CCTV, considering it a practical aspect of crime fighting.

Newcastle MP Tim Owen said he would 'like to see more CCTV in areas of high concern for street violence'.

'I would be encouraging the council to look very closely at it,' Owen said.

'I think there is a general consensus in the council that they would like to introduce CCTV, but it depends on the new council.'

Bond University Adjunct Professor of Criminology Paul Wilson said he was concerned about the proliferation of CCTV as a crime prevention method.

'Other methods, such as better street lighting, more police patrols and environmental changes, may be more cost effective and less likely to invade privacy,' Professor Wilson said.

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NOTE THIS DOWN

Copy the graphic organiser below and summarise some reasons for and against using CCTV in public places.

Reasons for and against using CCTV in public places	
For	**Against**

ACTIVITY 6.5

1. Identify three main arguments for using CCTV in public spaces and three main arguments against it.
2. Explain and justify your opinion on the use of CCTV in public spaces.
3. As a member of your local government's (shire or council) advisory committee you have been asked to identify five actions you would take to improve public safety. List and describe each of the five things.

6.4 Transport

Where we live and the types of transport available to us have a major influence on how we live and connect with other places: people who live in a capital city obviously have different transport choices and access to services, such as specialist doctors and universities, from people living in remote areas of Australia.

Geographical fact

The 2011 Australian census showed that 66% of Australia's population lived in the capital cities – just over 20% live in the Greater Sydney area and just under 20% live in the Greater Melbourne area.

The Australian Bureau of Statistics (ABS), with the Adelaide University Australian Population and Migration Research Centre, has developed the Accessibility and Remoteness Index Australia (ARIA) map to show the levels of accessibility to and remoteness from **service centres** in Australia. Access and remoteness are determined by the physical road distance from the settlement to the nearest service centre – there are five service centre categories, based on population size. The index ranges from 0 (high accessibility to largest service centre) to 15 (high remoteness from small and large service centres): an inner regional zone has larger service centres, of between 48000 and 249999 people, and an outer regional zone has service centres of between 18000 and 47999 people.

service centres settlements (villages, towns and cities) that have shops and services such as education, health and banking. Larger service centres (cities) have a greater range of services than smaller service centres.

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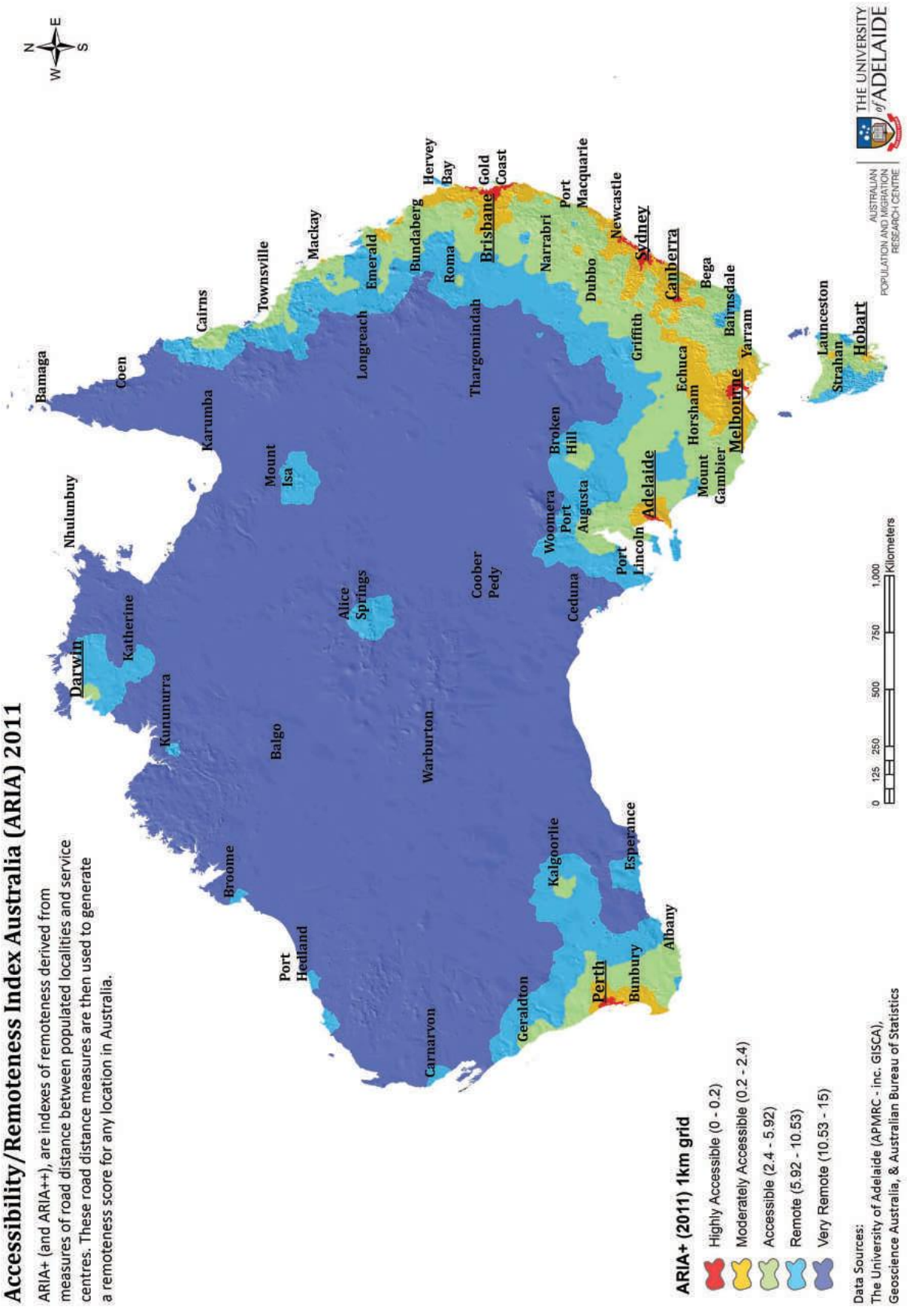

Source 6.16 Accessibility and Remoteness Index Australia (ARIA) map

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As members of our community we have a right and responsibility to be involved in planning for the future of our community and its connection with other places.

Source 6.17 The distribution of the Australian population according to ARIA

Area	People (millions)
Major cities	15.1
Inner regional	4.3
Outer regional	2.1
Remote	0.324
Very remote	0.17

ACTIVITY 6.6

1 Suggest why settlements such as Broome and Mt Isa are identified as remote rather than very remote, even though they are located in very remote regions of Australia.

2 Use the Accessibility Remoteness Index map, an atlas or your own experience to identify 3 places – a capital city, an outer regional settlement and a remote or very remote settlement – in Australia. Use your knowledge and research from the web and other sources (for example, you could contact a school) to complete the following table on transport choices and issues.

	Capital city	Outer region	Remote/very remote region
Transport choices			
Major transport and access to services issues			

3 Provide an argument to either support or reject the statement that 'the internet has reduced the isolation of remoteness'. Hold a class discussion on this topic.

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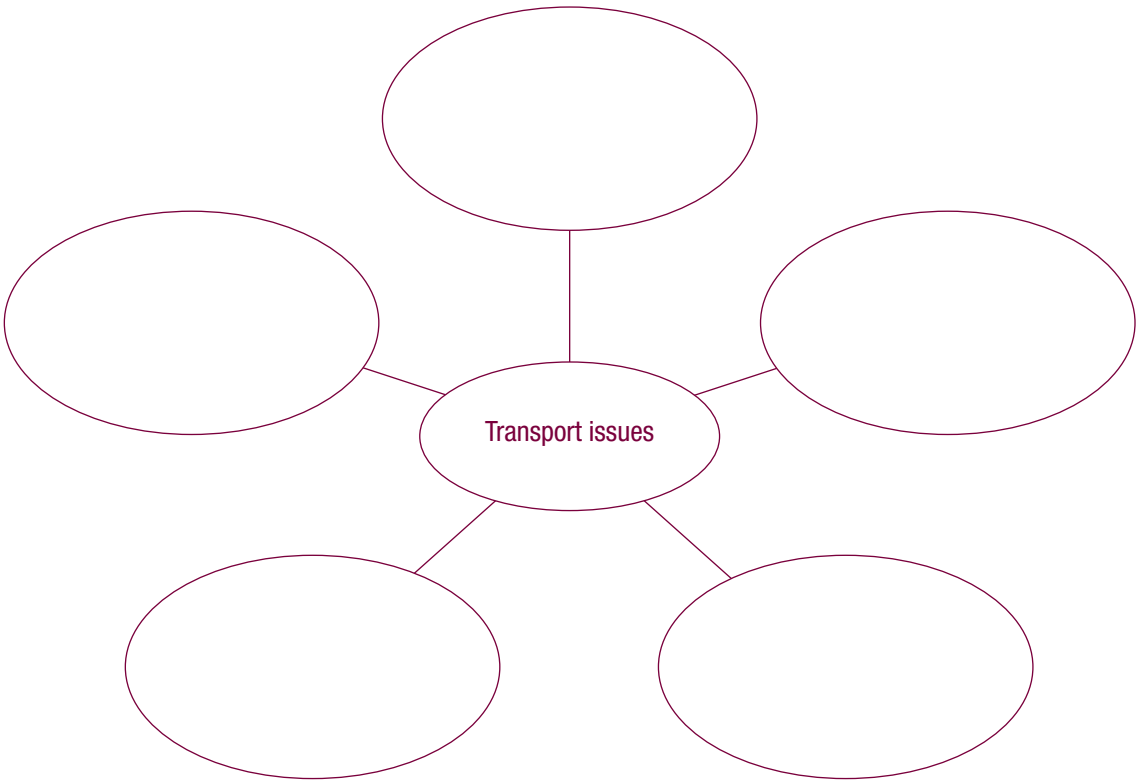
NOTE THIS DOWN

Copy the graphic organiser below and work in small groups to identify up to 5 transport issues that affect your local area. They could be about distance, congestion, lack of choice, safety, future needs, people with special transport needs and so on. Name and briefly explain each of the issues in the mind map bubbles.



RESEARCH 6.3

Your group has taken your transport issues to your local shire (council) planning committee. The chair of the committee thanks the group and invites you all to be members of a subcommittee developing a process for including the community's ideas in planning for transport in your local area for the year 2030 and beyond.

Your group's tasks are to:

1 Make written recommendations on:

- **a** How the community should be involved in the planning discussions and decision making.
- **b** Who the people with special interests, needs and knowledge are who need to be included in the planning discussions.

2 Provide detailed reasons to support each of your recommendations.

Websites for the Toowoomba Regional Council Sustainable Transport Strategy and the City of Stonningham Sustainable Transport Policy will provide additional ideas: go to www.cambridge.edu.au/geography9weblinks to link to them for links to these websites.

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FIELDWORK 6.1 RESEARCHING PEOPLE'S VIEWS ON A LOCAL GEOGRAPHICAL ISSUE

Aim

- To collect people's stories about and views on a local geographical issue.
- To present a report on your findings and suggest what could be done to resolve the issue in the best interests of the community now and in the future.

Method

Do your research and report as a small group of two or three people. First, consider what information you are looking for and the best way to collect it.

It is also important to know who you will report to and decide how your report will be presented: a talk to your class or to all Year 9 students, a letter to your local paper, a presentation to your local council (shire), a film? You may also want to report back to the people you spoke with.

Preparation

Identify a local geographic issue to research. Choose an issue that relates to community involvement in suggested changes to a place or space: it could be planting or removing trees, or a tree, in the main street; building a transport bypass around your town; damming your local river; building classrooms on a school oval; the need for better public transport; or establishing a wetland in your district.

Write down what the issue is about. Draw a sketch map and/or take pictures of the place.

Then identify who in your community could have stories/views on the issue. It is important to include as many people and views as possible.

Preparation for information gathering

Whatever method of information gathering you use, you will need to clearly inform every person you interview of the purpose of the interview, what you will ask them to do and how their stories/views will be used in your report.

You also need people's permission (preferably in writing) if you intend to refer to their identity, or use an image of them, in your report.

The next task is to decide on your method of research, and prepare for it. Whichever method you choose, you will need a list of questions to ask:

- As you are seeking people's views, you need to ask open-ended questions; for example, 'What are your views on having more CCTV cameras installed on Main Street? Why do you think this?'
- Have a list of five questions; you may only need to use two or three questions, and then they will tell their stories.
- Be prepared to ask follow-up questions to seek further information.

Survey

- Will you use a written survey or take notes as you interview people?

Film

- Decide what format to use; it could be a short documentary on the issue and people's stories, or a news report, or another film genre.
- Decide where each interview will take place and the order of the interviews. For ideas on how to do this, follow the link at www.cambridge.edu.au/geography9weblinks and do a search on 'storyboard'.
- Determine the best way to edit your film to show the main points.

Public meeting

- Where will the meeting be?
- How will you organise seating: in rows, or in a large circle, or some other way?
- How will the information be recorded?
- Who will chair the meeting?
- Will there be refreshments? Who will organise that? Who will pay for it?
- Remember, the purpose of the meeting is to hear people's stories or views, not to debate the issue. You could say that each person gets to speak once, with a possible clarifying question from the chair.
- Make sure the people at the meeting know the purpose of the meeting, and how the meeting will work.

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Data collection

Send out invitations for community members to be involved in your information gathering – whether it is by survey, filming, public meeting or another process – explaining what it is about, how it will be done and what they can contribute. Then do your information gathering.

Read, or view, the information you have gathered and list the range of positions people have on the issue. Using the listed positions as the headings for your report, summarise the main points for each position.

Decide how to present your summary of the community's positions on the issue.

Research work presentation layout – if the presentation is to be done digitally, use a similar layout sequence

Front page	Title and names
Contents page	Do this last, once you have numbered the pages
Page 1	Aims
Pages 2–3	Name the geographic issue you have researched and use maps and/or photographs to show its geographic location or locations. Explain why it is an issue and how the community is involved in deciding what should happen.
Pages 4–5	Describe the process – survey or filming or public meeting or another process – you used to collect the community's views. Explain why you chose this process – advantages and challenges. Describe how the people who spoke were invited to be involved. Comment on how successful you felt your process was in gathering the information you were seeking.
Pages 6–9	Present your summary of main positions (views) of the people who spoke to you or completed the survey.
Page 10	Use your summary of the community's positions on the issue to list the options the community has for settling the issue. Describe and explain the action you recommend the community take. Consider how to include all people's views, and the probable present and future social and environmental impacts of the action you recommend.
Page 11	Concluding comments, including who will receive your report on the issue.

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6.5 Australian places

While a few Australians live on remote properties and farms, the vast majority of us live in either a town or a city. Life in cities and towns can be the same in a lot of ways, and very different in others.

It's not just a question of size; there are other important differences. Cities can face unique challenges, such as the environmental impact of both the stable population and of any large events that take place there. Towns have their own issues, such as access to services and resources. Also, both towns and cities can be tourist destinations, but the impacts of tourism – both positive and negative – can be very different in the two kinds of places.

6.6 Characteristics of towns and cities

Definition of a town and a city

There are some key differences between a **town** and a **city**. A town is defined as a built-up area with a name, defined boundaries and local government; it is larger than a village and generally smaller than a city. A city is defined as a large town.

town a built-up area somewhere between a city and a village in size

city a larger town; in Australia this is generally defined as being a metropolitan area

Source 6.18 The Opera House and Harbour Bridge lit up for New Year's Eve celebrations

population the number of people residing in an area

metropolitan pertaining to a large city, its surrounding suburbs, and other neighbouring communities

exurbia a residential area beyond the suburbs

These definitions provide an overview of a town and a city, but they don't provide exact size characteristics for either. In Australia, there is no clear statistical definition between a town and a city. The Australian Bureau of Statistics (ABS) defines an 'urban centre' as a '**population** cluster of 1000 or more people'. Therefore we can suggest that the minimum population for a town is 1000 people, but there is still no clear population division between a town and a city.

To understand the difference between a town and a city you would have identify the characteristics of a city. In Australia, a city is characterised as a **metropolitan** area, which includes the historic core area, the continuously developed suburbs that surround the historic core and the **exurbia** that surrounds the city; the exurbia is the region beyond the connected suburbs of a city. For example, Camden is classified as being in the exurbia of Sydney.

A city is also characterised by the diverse range of products, services and employment opportunities it is able to offer. The greater concentration of services – banking, government services, law, health, education and recreational services – within cities attracts people. As a result of the location of these services, other businesses build up around them; this in turn creates demand for people to work in these businesses. This leads to the populations of the cities growing, which attracts more services. For example, Bendigo in Victoria grew into a city as a result of the discovery of gold in the 19th century and the demand for services by the miners.

Source 6.19 Australia's largest 25 cities

	CITY, STATE	POPULATION (2011)
1	Sydney, NSW	4 605 992
2	Melbourne, VIC	4 169 163
3	Brisbane, QLD	2 146 577
4	Perth, WA	1 832 116
5	Adelaide, SA	1 262 940
6	Gold Coast, QLD	576 747
7	Newcastle, NSW	540 002
8	Canberra, ACT	367 752
9	Wollongong, NSW	288 102
10	Sunshine Coast, QLD	241 683
11	Hobart, TAS	216 276
12	Geelong, VIC	174 086
13	Townsville, QLD	167 636
14	Cairns, QLD	146 477
15	Darwin, NT	129 062
16	Toowoomba, QLD	125 265
17	Launceston, TAS	107 746
18	Albury-Wodonga, NSW/VIC	103 209
19	Ballarat, VIC	95 007
20	Bendigo, VIC	89 665
21	Mandurah, WA	88 305
22	Burnie/Devonport, TAS	84 217
23	Mackay, QLD	83 350
24	La Trobe Valley, VIC	78 614
25	Rockhampton, QLD	75 648

Source 6.20 Hobart is the largest city in Tasmania and the 11th largest city in Australia.

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ACTIVITY 6.7

1. Construct a column graph that illustrates the information in the table opposite.
2. Using a blank map of Australia and an atlas or online map, find all the major cities and label them on the map.
3. Suggest a trend in the distribution of major cities in Australia. Explain your suggestion.

Features of large cities

Large cities are places of diverse activities and interests. Towns and cities provide various activities for the people who live in them: culture, leisure and sport, shopping and celebrations.

Culture

Australia is one of the most multicultural countries in the world. Throughout its history since 1788, Australia has received influxes of migrants from countries all around the world, from the early migration of British and Irish settlers to the mass immigration of British and European people after World War II.

According to the ABS 2011 census, 27% of the resident population were born overseas (6.0 million people). This was an increase from 10 years earlier – the figure then was 23.1% (4.5 million people). People born in the United Kingdom are the largest group of overseas-born residents, accounting for 5.3% of Australia's total population at 30 June 2011. This is followed by people born in New Zealand (2.5%), China (1.8%), India (1.5%) and Vietnam and Italy (0.9% each).

When migrants come to Australia, many of them congregate and live in areas or suburbs where other migrants from their country live. There are a number of examples of how migrants have influenced the culture of an area. In Jindalee in Perth, 43% of the residents were born in Britain. Harris Park in Sydney has 43% of its population born in India. In Adelaide, the suburb of Hectorville has 16% of its population born in Italy. Pacific Pines and Upper Coomera on the Gold Coast in Queensland have 15% of their residents born in New Zealand.

When large concentrations of people from the same nationalities and cultures live in an area they tend to have an impact on the built environment. For example, in the western Sydney suburb of Cabramatta, 35% of the population were born in Vietnam. As a result of this, there have been changes in the built environment that reflect their culture, such as mall gates, which reflect and symbolise Vietnamese heritage and beliefs. Similarly, there are many specialty shops in Cabramatta – such as grocery stores, bakeries, seafood stores and spice stores – that cater to the Vietnamese community.

Source 6.21 Ceremonial gates in the mall area of Cabramatta

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Source 6.22 Melbourne Park precinct

Source 6.23 Sydney's Olympic stadium

Source 6.24 Brisbane's Suncorp Stadium

Leisure/sport

Australia's warm, sunny climate is ideal for a range of leisure and sporting activities. The demand for facilities to provide and cater for these activities has shaped many of our cities. Governments and councils have to provide sports facilities from the amateur up to the professional levels. An example of a major sporting precinct is Melbourne Park in Melbourne. Within this complex are the Melbourne Cricket Ground, which is used for cricket and AFL, the Melbourne Tennis Centre, which hosts the Australian Open Tennis Tournament, and Olympic Park Stadium, which is the home ground for the Melbourne Storm rugby league team, the Melbourne Rebels rugby union team and the Melbourne Victory soccer team.

Sydney and Brisbane have also developed world-class sporting facilities. Sydney hosted the 2000 Olympic Games and as a result of this has a wide range of sporting facilities. The centrepiece of this is the main Olympic stadium, which held 110 000 people during the Olympics. Since that time, rebuilding and redevelopment has reduced the seating to 80 000. This stadium plays host to a range of sporting events, from rugby league, rugby union, soccer and AFL to cricket. The Sydney Cricket Ground and Sydney Football Stadium are other major sporting locations in Sydney.

Brisbane has also developed major sporting facilities, the most significant of which is Suncorp Stadium. It is a 52 500 seat stadium that is the home ground for the Brisbane Broncos rugby league team, the Queensland Reds rugby union team and the Brisbane Roar soccer team.

A range of other places within cities and towns allow people to enjoy recreation and leisure activities. Australia has some of the most famous beaches and coastal areas in the world. Many Australians live by the coast and it is also a major attraction for international tourists. An example of this is Sydney's Bondi Beach, 7 km east of the city's Central Business District (CBD). It is around 1 km long, and during the peak time in summer it can attract up to 40 000 visitors per day.

The Gold Coast in Queensland is another area whose beaches have an international reputation. The Gold Coast is a very strong tourist destination for both domestic and international tourists, with

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Source 6.25 Sydney's Bondi Beach

Source 6.26 The Gold Coast coastline and beaches, one of Australia's major tourist destinations

Source 6.27 Chapel Street in Melbourne

around 11.5 million visitors going there in 2012. Those tourists generated $4.6 billion in revenue for the local economy. This demonstrates how a city can generate income from its natural resources.

Shopping

Over the past 20 years, shopping in cities and towns has changed from shops in suburbs that service the local community to large regional shopping centres. These shopping centres allow shoppers to go to one location and find a variety of stores and services, including many specialty stores. The company that has been a driving force in the development of these large shopping centres is the Westfield Group. Westfield has 44 shopping centres in Australia, covering every major metropolitan area in five states, and those centres are home to more than 11 000 retail outlets. Westfield's shopping centres attract more than 500 million visits each year. This demonstrates how dominant this company has become: it both creates demand and responds to changes in demand for shopping over the past 20 years.

The development of large shopping centres has also led to the development of other areas within cities that cater for 'boutique shopping'. These are usually populated by smaller shops owned by independent retailers or designer labels. These areas cater for those who want specialised items that cannot be found in major shopping stores and centres. Examples of these include Oxford Street in Sydney, Chapel Street in Melbourne, Rundle Mall in Adelaide, King Street in Perth and Queen Street in Brisbane.

Celebrations and nightlife

Within cities there are also areas that attract people who go out for their recreational and social activities to cafes, restaurants, bars and clubs. They tend to be located in central and/or CBD areas of the cities, such as George Street and The Rocks in Sydney, Southbank in Melbourne and Fortitude Valley in Brisbane. These areas also provide a range of employment opportunities for people. The hospitality industry employs almost a million people in Australia and is a vital industry in terms of employment and services for the community.

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Source 6.28 The Rocks area of Sydney, with restaurants and views of the harbour

Source 6.29 Thousands of people line the harbour shores early to watch the New Year's Eve fireworks in Sydney.

Cities are also the location for many major celebrations and events, such as New Year's Eve celebrations and cultural festivals. These celebrations contribute both economically and socially to the cities. For example, the New Year's Eve celebrations in Sydney contribute $156 million to the local economy, with around 1.5 million people going into the city to watch the fireworks and celebrate the New Year. This demonstrates the vast economic impact that one celebration has on a city.

Another example of this is the annual Gay and Lesbian Mardi Gras in Sydney. This parade started in 1978 when several hundred people marched down Oxford Street in support of gay rights. The Mardi Gras is now a festival, much bigger, longer and broader than just the parade, and it is one of Australia's largest tourist attractions, drawing many international and domestic tourists to Sydney. It generates around $30 million for the local economy, and around 200 000 people go to watch the parade. This is another example of how celebrations generate economic benefits, but it also provides a social celebration of – and for – the diverse communities in our cities.

ACTIVITY 6.8

1. List the reasons you visit your capital city.
2. Explain why the city is an ideal place for your needs.
3. Discuss the benefits of attracting large numbers of people to metropolitan areas.
4. Identify any negatives to having so many people in the one place.

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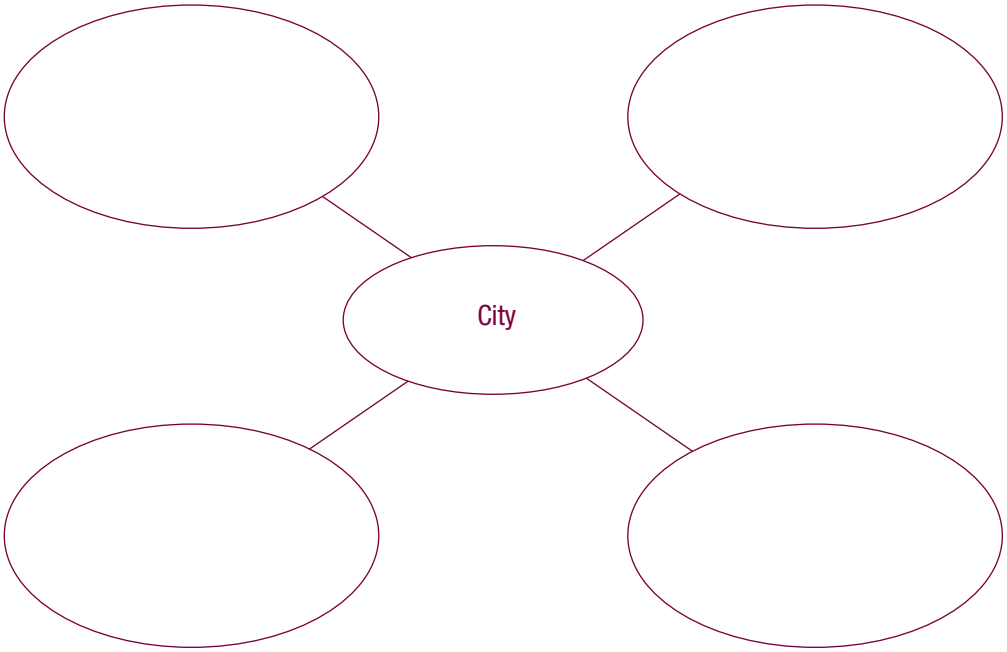
NOTE THIS DOWN

Copy the graphic organiser below and outline the known features of one Australian capital city, including celebrations, festivals and businesses that attract visitors.



6.7 Major events in Australian cities

Cities have infrastructure and facilities that allow them to host certain large events that towns cannot support. These events can bring economic, social and cultural benefits to the city. Many large cities in Australia host major events, from food and wine festivals to global events such as the 2000 Summer Olympic Games. These events are important for cities because they bring people, goods, services and investment into the cities and their communities.

The benefits of hosting events has seen the New South Wales and Victorian governments set up organisations to attract major events into their cities and regional areas. This has seen many international sporting and cultural events come to New South Wales and Victoria. These have provided economic benefits for the local economy via tourism and hospitality. For example, an exhibition of artefacts from the tomb of the ancient pharaoh of Egypt, Tutankhamen, was brought to Melbourne, and international football (soccer) team Manchester United played 2013 pre-season games in Sydney. These events provided national and global exposure that promoted both Melbourne and Sydney as major cities in Australia.

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Case study 6.4
The 2000 Sydney Olympics

In 1993 Sydney put in a bid to host the 2000 Summer Olympics, and the International Olympic Committee selected Sydney to host the Games. (Sydney beat Beijing by just two votes.) One of the key principles behind Sydney's Olympic Games bid was the notion of being the 'Green Games'. Sydney's aim was to set a new standard of environmental excellence in the organising and staging of the Olympic and Paralympic Games. The goal was to leave a legacy of improved environmental standards for the third millennium.

Source 6.30 Sydney 2000 Olympics logo

remediation the removal of pollution or contaminants from the environment

The first major environmental challenge for the Sydney Olympics was the **remediation** of the Olympic site, Homebush Bay. The area's industrial history – which included brickworks, abattoirs, rubbish dumps and paint/chemical factories – had left the area with 9 million tonnes of domestic, commercial and industrial waste, which contaminated over 20% of the 760 ha site. The government invested $137 million in remediating the area; at the time, this was the largest remediation project ever undertaken in Australia. Once completed, the site was transformed into parklands, wetlands, waterways and international sporting facilities.

One of the other key components of the environmentally sustainable approach for the Sydney Olympics was energy use. A major element of the energy plan was to maximise the use of renewable forms of energy, particularly solar energy. All 665 houses in the Athletes' Village were fitted with solar energy panels, solar-powered carts were used to transport athletes, equipment and sponsors around the Olympic site, and solar cells powered 19 lighting towers along the Olympic Boulevard as well as the Superdome, which has Australia's largest solar energy system.

Minimising waste throughout the construction period and during the Olympic Games was another major consideration for the Organising Committee.

Source 6.31 Solar-powered lights along Olympic Boulevard, part of the 'Green Games'

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By limiting waste, the event could decrease the pressure on landfill sites, and recycling products would place less pressure on the production of new resources. Sydney achieved this by recycling or composting 80% of litter generated during the Games – this was made possible by the use of biodegradable plates, cutlery, bin liners and bags. In addition to this, the water reclamation and management scheme on the Olympic site reduced the demand for drinkable water by 50%. Recycled water from the site was used for flushing toilets and for irrigating gardens and parks.

Source 6.32 Waste recycling was a major component of the Sydney Games

The final part of the environmental approach to the Sydney Olympic Games was the protection of the area's biodiversity. Within any area, protection of biodiversity is crucial for the ecosystem's functioning and the maintenance of healthy habitats for flora and fauna. The initial environmental impact study of the Homebush site discovered that the rare green and gold bell frog had habitats within the park. The main habitat was found in the large excavation (called the Brickpit) on the site that had been the brickworks.

To protect the frogs, the Brickpit was converted into a protected habitat. Frog ponds were established, special vegetation was planted, and underpasses were developed so the frogs could pass under roads without being endangered by traffic. Frog fencing was installed to direct frogs into the underpasses and away from roadways and traffic. This protection program was so successful that not only was the original population conserved, but two new self-sustaining subpopulations emerged in newly built habitats. The frog is now found at the Brickpit, Narawang Wetland, Kronos Hill and Wentworth Common, and can also be seen in other parts of the park and the surrounding community.

Source 6.33 Circular walkway over the Brickpit

Source 6.34 The habitat of the green and gold bell frog

Holding the Olympic Games requires significant development of venues. Sydney held the events for the 2000 Olympics across 13 venues. Most of these venues were built new for the Olympics (the Homebush Olympic Site, Rowing Centre and Equestrian Centre, for example). Some existing sites, such as the Ryde Aquatic Centre, which hosted the water polo, were upgraded. Other sports used existing sites that did not require upgrading

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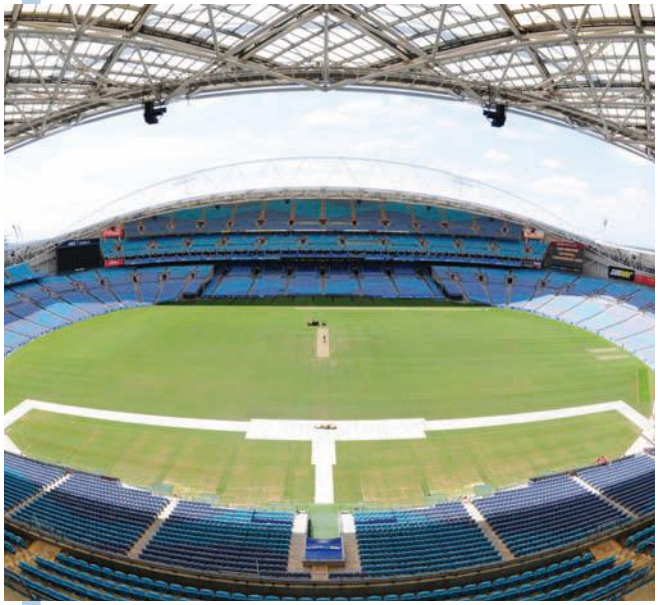
(such as Darling Harbour, which hosted the wrestling, judo, boxing, fencing and weightlifting competitions) and some, such as sailing, just used the natural physical environment – Sydney Harbour.



Source 6.35 The main Olympic Stadium

One of the most contentious events was the beach volleyball competition conducted on Bondi Beach. This involved building a temporary 10 000-seat stadium on the beach that would be dismantled after the Olympics. This led to protests from some local residents, who didn't want such a huge structure built on the beach and were concerned about the extra traffic and people coming to the area. They believed that it would interfere with their recreational activities on the beach. There were also arguments that there would be negative environmental effects. However, the stand was built, the competition was held and was a great success, and the stand was then removed.

1 List the ways in which the design of Homebush reduced its environmental impact.
2 Discuss the short- and long-term benefits of planning for conservation.
3 Explain why preservation of local species is important, even within a city.
4 Suggest ways in which venues – those to be built and those already built – could reduce their environmental impact.

ACTIVITY 6.9

1 List five major features of your local city.
2 Identify the various events your city hosts.
3 Discuss the pros and cons of these events.
4 Suggest events you feel would benefit your local city.

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The legacy of the Sydney Olympics

> To me, the legacy lies in those intangible qualities such as the stories that people have to tell now because of the Olympic Games.
>
> Cathy Freeman, 400 m Gold Medallist, Sydney 2000

Source 6.36 Cathy Freeman lighting the Olympic flame at the Sydney Olympics

The legacy of an Olympic Games is a very complex issue: how do we measure a legacy?

One way to look at the legacy of the Olympics is from an economic perspective. When Sydney bid for the 2000 Games, the bid committee estimated a total cost of $3 billion, of which just $363.5 million would be borne by the public. By 1998, however, when the New South Wales Auditor-General was called in to review the Games' budget, it became clear that this figure was a huge underestimate. He calculated that the true cost of the Games was more like $5.9 billion, of which the public would be paying $2.3 billion. In 2002 the New South Wales Auditor-General undertook a further audit, confirming that the Sydney Games had ended up costing $6.6 billion, and had cost the public purse somewhere between $1.7 and $2.4 billion. So if you look at the legacy of the Olympic Games from an economic perspective, it wasn't a sound investment for New South Wales and Australia.

The built and physical environment is another legacy that needs to be examined. Sydney now has world-class sporting venues: ANZ Stadium (Olympic Stadium), the Olympic Park Aquatic Centre, the Equestrian Centre, the Tennis Centre and the International Regatta Centre. These sporting areas have become training grounds for the next generation of athletes, with many schools and organisations, such as the New South Wales Institute of Sport, using them to train young athletes. By having these world-class facilities, Australia's young athletes can develop their talents, which may allow them to achieve their goals of competing at a global level and even in future Olympics.

Source 6.37 Sydney Olympic Athletics Track, where young athletes can train in world-class facilities

Another contentious issue in hosting an Olympics is what to do with the built environment (other than the sporting venues) once the Games have finished. Having developed such specific infrastructure and sites for the Olympics, there need to be ways to adapt and/or redevelop the

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area afterwards. One of the key reuses of the Olympic site was the conversion of the Athletes' Village into a residential suburb called Newington. This was very successful, with many of the houses being purchased straight after the Olympics.

Another major reuse was the relocation of the Royal Easter Show from Moore Park to the Olympic site. The Royal Easter Show is an annual two-week event that showcases agricultural products and livestock, and it attracts over 800 000 people. This move has been very successful: it has new, modern facilities for all exhibitors, and a more central and accessible location, so there are now increased attendances.

Source 6.38 The Royal Easter Show now uses the Olympic site.

However, while these reuses are in effect now, the Olympics site was underutilised for a long period after the Games, with governments and authorities debating what to do with it. There were many debates as to the best model to use, but they eventually settled on a 'mixed use' philosophy. This approach promotes the integration of recreational, educational, residential and commercial activities in the one area.

The recreation aspect was achieved by using the Olympics sporting facilities and by providing green space in the form of parks. Education has been included through the development of an education centre that runs fieldwork activities; these look at the land remediation process on the Homebush site. The centre also runs activities that look at the regeneration of the **intertidal wetlands**, which were once under severe threat.

intertidal wetlands the part of a shore between the high water and the low water marks

Residential development was seen as a crucial part of the reuse of the Olympic site. The residential living on the site currently consists of two high-rise towers, named the Australia Towers, with a further two towers in the planning or construction phase. Having a permanent population changed the dynamic of the area; people who lived there permanently needed a range of services, such as cafes, restaurants, retail and supermarkets, all of which had to be built.

Source 6.39 One of the Australia Towers high-rise apartment towers in Olympic Park

The commercial sector was slow to move to the Olympic site, but over the past 4–5 years there has been an increase in the amount of commercial activity. The most notable commercial activity on the site was the building of three office blocks by the Commonwealth Bank. These blocks house around 5000 employees who have been relocated from the Sydney CBD. There has also been an increase in the number of hotels on the site, with three permanent hotels catering for tourists and for those attending events (such as music and sporting events) held at the site.

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The 'Green Games' left many unique and significant benefits for the physical environment. It regenerated ecologically sensitive wetlands, protected and enhanced the biodiversity of sites, established vast areas of green space within a built environment and remediated land. This has had dramatic impact on the environment. Areas that were once sites for residential and industrial waste dumping are now areas of unique environmental significance: the Brickpit (where clay was extracted to make bricks), as noted, is now home to a colony of the green and gold bell frog.

NOTE THIS DOWN

Copy the graphic organiser below and summarise the positive and negative legacy of the Sydney Olympics.

The legacy of the 2000 Sydney Olympics

Positive	Negative

RESEARCH 6.4

Use the internet to gather information about the Sydney and London Olympic Games. Compare and contrast the legacies of the Sydney Olympics (2000) and the London Olympics (2012). In your answer you should look at:

- built environment
- economic costs
- sporting facilities
- environmental impacts
- reuse of the Olympic sites.

ACTIVITY 6.10

Imagine that your home city or town is chosen to host the next Olympic Games, then complete the following tasks:

1. Identify an area in your home city/town that would be the centre of the Games and suggest what kinds of changes to buildings, facilities and infrastructure would be required to host the events.
2. Suggest the economic effects the Games would have on your town while they are being held, and their possible economic legacy.
3. Suggest what changes to the built environment would remain in place after the Games and how those places could be repurposed for ongoing use.
4. Explain the environmental impact the Games would have on your home city/town and what could be done to protect the local environment.

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6.8 Tourism

domestic tourism where people travel within their own country for recreation

international tourism where people travel outside their own country for recreation

Tourism is a valued and important industry in Australia. It contributes around $34 billion per year to the Australian economy, and employs 500 000 people directly. There are two types of tourism: **domestic tourism** and **international tourism**.

Domestic travel by Australians

Domestic travel within Australia is an important part of tourism. It accounts for three-quarters of the tourism spend in Australia annually: $25 billion a year. According to Tourism Australia, the domestic overnight leisure market is a key segment of the Australian tourism industry. The core target is families, with parents who are 30–54 years old: this represents 35% of Australia's population.

The locations most visited by domestic tourists are the major capital cities – Sydney, Melbourne and Brisbane. Outside these, the most popular locations are the Gold Coast, the Whitsundays, tropical North Queensland, the Hunter Valley and the Blue Mountains.

In 2011–12 the most common state for domestic tourists to go to was New South Wales, which had 33% of all visitors from outside the state. This was followed by Queensland, with 25%, and Victoria, with 24%. These three states dominated domestic tourism, with a total of 82% of all visitors. The main reasons domestic tourists gave for their travel during this period were going on a holiday (43%), visiting friends and relatives (34%) and business (19%).

International travel by Australians

The numbers of Australians travelling overseas have increased dramatically in the last 10 years. According to the ABS, 3.5 million residents departed Australia in 2002. By 2011 this number had increased to 7.8 million and in 2012 it was 8.2 million. That is an 134% increase in that 10-year period.

Source 6.40 Whitehaven Beach in the Whitsundays, a major domestic tourist destination

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Source 6.41 Short-term resident departures for Australia from 2002 to 2012

	2002		2007		2012	
	Number (000s)	Proportion (%)	Number (000s)	Proportion (%)	Number (000s)	Proportion (%)
Country of destination						
New Zealand	597.3	17.3	902.0	16.5	1 103.3	13.4
Indonesia	241.7	7.0	282.5	5.2	911.8	11.1
United States of America	299.1	8.6	479.0	8.8	863.6	10.5
Thailand	168.9	4.9	374.5	6.9	622.3	7.6
United Kingdom	318.3	9.2	428.4	7.8	489.1	6.0
China	136.9	4.0	284.5	5.2	381.1	4.6
Fiji	128.3	3.7	200.4	3.7	332.5	4.0
Singapore	149.2	4.3	221.5	4.1	306.5	3.7
Malaysia	109.5	3.2	181.2	3.3	259.4	3.2
Hong Kong	140.5	4.1	206.5	3.8	229.4	2.8
All other countries	1 171.3	33.8	1 901.8	34.8	2 720.9	33.1
Total	**3 461.0**	**100.0**	**5 462.3**	**100.0**	**8 219.8**	**100.0**

There are some key trends and facts that can be seen in Source 6.41 above. The first is that New Zealand is the most visited country by Australians. However, from 2007 to 2012 there was an overall increase in the number of people going (an additional 201 300 people) but a 3.1% decrease in the overall proportion of people going to New Zealand. In other words, more people went to New Zealand than ever, but the overall number of people going overseas increased so much that those New Zealand trips were a smaller proportion of the amount than before.

The second key trend is the dramatic increase in the number of Australians going to Indonesia. In 2007 there were 282 500 people going to Indonesia. By 2012 there were 911 800 people, or 11% of all Australians going overseas as tourists.

Source 6.42 Auckland, New Zealand: Australia's most popular international destination.

Source 6.43 Kuta, Bali: Australians like Bali for a beach holiday because it is very cheap.

There are a number of factors that have led to the increase in Australian residents travelling overseas. The main one has been the emergence of low-cost airlines such as Jetstar, Pacific Blue, Air Asia and Scoot. This has increased the number of flights and lowered airfares to close international destinations such as Indonesia, Thailand, Singapore and Fiji.

Another factor is the value of the Australian dollar. With the Australian dollar strong against most other major currencies (meaning that instead of, say, getting US80c for A$1, you get US$1 for A$1, which is called parity), it is very attractive for Australian residents to take an overseas holiday, especially to places like the United States, where the exchange rate is around parity. Natural hazards in Australia have also contributed to residents going overseas for holidays. Cyclones and floods, especially in Queensland, have led people to look for other places to holiday.

Source 6.44 Jetstar Airways is a low-cost airline that operates on domestic and international air routes.

ACTIVITY 6.11

1. Explain why tourists would be drawn to major cities.
2. Suggest why Australians travel overseas.
3. List factors that would deter Australians from travelling overseas.
4. Discuss the tourism appeal of each state for both domestic and international tourists.

RESEARCH 6.5

Select a town or area and evaluate the impact of tourism on it. In a short report, refer to tourism's:

- economic impact
- environmental impact
- cultural impact.

Popular Australian tourist destinations

There are many tourist destinations in Australia that appeal to both domestic and international tourists. This section looks at different destinations. These destinations have very different appeals and are popular with different groups of tourists – and face different challenges as a consequence of tourism. By looking at several locations, we can build up a picture of Australian tourism that is more complete than if we just looked at a single place.

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Hunter Valley, New South Wales

The Hunter Valley is 155 km northwest of Sydney. It is the second most visited area in New South Wales (after Sydney); 7.6 million people visited the Hunter Valley in 2012. The Hunter Valley is most famous for wine-making, and there are many **vineyards** and **wineries** in the area. The wineries range in size from small boutique wineries up to large, internationally recognised wineries.

vineyard a plantation where grapes are grown, usually for use in wine-making

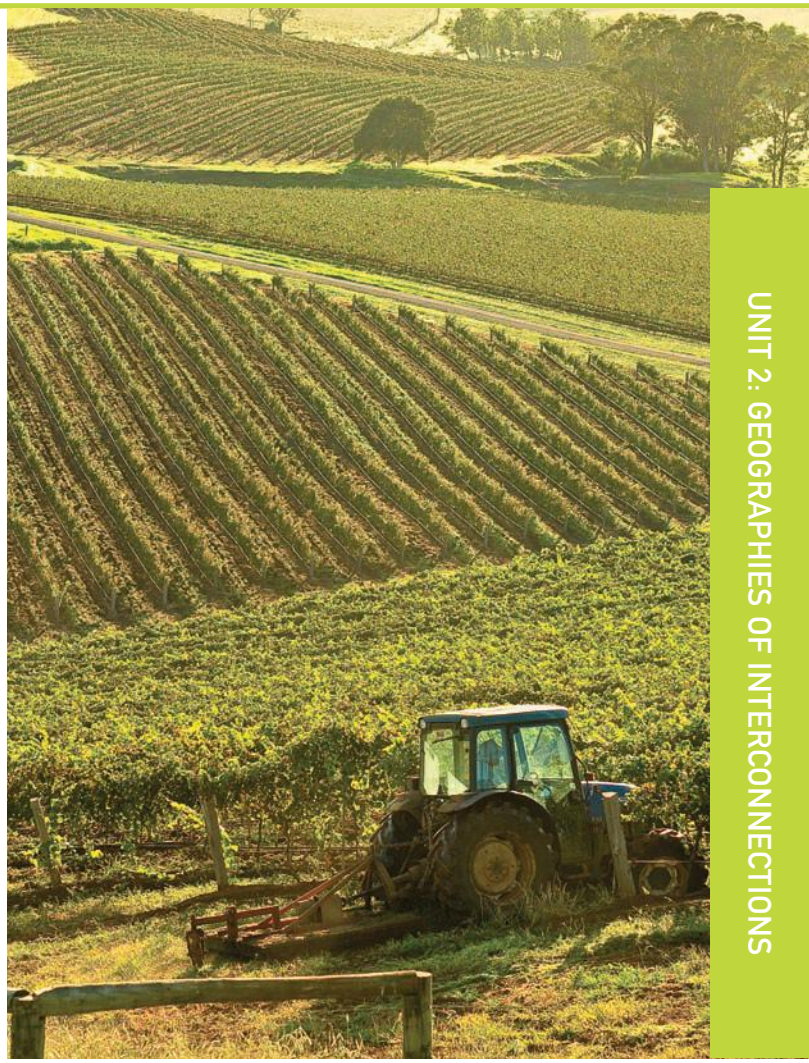
winery a place where wine is made

bed and breakfast a guest house that supplies sleeping accommodation and a meal in the morning

With such a large number of tourists going to the area, facilities are needed to cater for them. This has seen the development of accommodation for those staying for weekends or longer periods. Small-scale **bed and breakfast** venues cater for couples, while 5-star resorts such as Cypress Lakes Resort and the Hunter Valley Country Club accommodate wealthy families.

Other tourist attractions have developed in the area. There are three golf courses (Cypress Lakes, the Vintage and the Hunter Valley Golf Club), as well as hot air ballooning, historic sites, horse riding and shopping.

This tourist industry has been of tremendous economic benefit to the Hunter Valley. In 2012 tourism contributed an estimated $1.6 billion to the local economy. Tourism also employs thousands of people in the area, especially in restaurants and accommodation.



Source 6.45 Grape growing and wine production is the biggest industry in the Hunter Valley.

Source 6.46 Wine tasting is a major tourist attraction in the Hunter Valley.

Longreach, Queensland

Longreach is a town in the central west of Queensland, around 1200 km northwest of Brisbane. It is a small town – 4189 people – that has a number of tourist attractions. The main one is the Australian Stockman's Hall of Fame. The Hall of Fame was built in 1988 to recognise the contributions that various people have made to life in outback Australia. It displays the history of famous explorers, stockmen, pastoralists and Indigenous Australians who explored and worked in the outback. It also houses a vast collection of archival material, including photographs, artworks

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Source 6.47 Stockman's Hall of Fame in Longreach

Source 6.48 Qantas Founders Museum in Longreach

and other items. Since it opened, over 1 million people have visited the Hall of Fame, which indicates how popular it is.

Another major attraction in Longreach is the Qantas Founders Museum. The Queensland and Northern Territory Air Service (QANTAS) was started in Longreach, where a hangar and a runway were built in the 1920s. Since then, Qantas has grown to be one of Australia's biggest companies, and this museum is dedicated to preserving the humble beginnings of this Australian icon.

Each year around 120 000 visitors go to Longreach, which has tremendous economic benefit to the town. On average these visitors stay for 4–5 nights.

Phillip Island, Victoria

Phillip Island is 140 km south-southeast of Melbourne. The island is 26 km long and 9 km wide, and it has a population of 9406 people. There are two major tourist attractions, and they bring 3.5 million visitors to the island each year. The first is the area's natural and wildlife features, such as the Little Penguin colony, Seal Rocks and the Koala Conservation Centre.

One unique and very popular wildlife feature of Phillip Island is the Penguin Parade. The little penguins of the colony (formerly known as 'fairy penguins') go out to sea each day to catch food (mostly pilchards and other small fish) for themselves and their young. Just on dusk every evening they return and make their way up the beach to their burrows in the sand dunes. Tourists can sit and watch the penguins come up onto the beach and into their burrows; Phillip Island is one of the few places in the world where you can watch such an event.

Source 6.49 A Little penguin nesting on Phillip Island

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Source 6.50 Phillip Island's Grand Prix circuit

Source 6.51 View across Mason Cove to the penitentiary and ruins at the Port Arthur Historic Site

The second major tourist event is the island's program of motor sport. The Phillip Island Grand Prix Circuit is home to major motor racing events each year, including events for the MotoGP series (motorcycles), the World Superbike Championship and the V8 Supercar Series. The events attract thousands of people; for example, the 2012 MotoGP attracted a 3-day record of 122 465 people.

With both the motor sports and wildlife features attracting such a large number of visitors, Phillip Island faces major issues in protecting the environment from the tourists. A special visitor centre had to be built to cater for the large numbers of people going to the Penguin Parade. Governments and local authorities have to ensure that environment and wildlife tourism remains ecologically sustainable and is not exploited for purely economic reasons.

Port Arthur, Tasmania

penal colony an institution where prisoners are held (often located on an island or an isolated location from which escape is difficult, or impossible)

Port Arthur is 61 km southeast of Hobart, and has a population of 366 people. The British established Port Arthur as a **penal colony** in 1830. Port Arthur continued as a convict settlement up to 1877, when it ceased operation. After its closure, tourists started coming to the site to see and try to understand what the convicts had gone through. People come from all over the world to view this historic site, so tourism is a stable source of income for the area.

In 2012 around 220 000 people visited Port Arthur, making it the most popular tourist destination in Tasmania. In recognition of this, the Tasmanian government has put a lot of resources into preserving and protecting the site, which is now listed as a World Heritage site. As part of the preservation program, the Port Arthur Historical Sites Management Authority, which runs the site, has developed extensive educational and archaeological programs. The aim of these programs is to educate people while preserving an important part of Australian history.

Source 6.52 Ruins of the convict hospital at Port Arthur

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Source 6.53 Underground house in Coober Pedy

Source 6.54 Tourists come to fossick for opals in Coober Pedy.

Coober Pedy, South Australia

Coober Pedy is a town in the far north of South Australia, 850 km north of Adelaide and 700 km south of Alice Springs. Opal was discovered in the region in 1915, and a wave of European migrants came to the area in the 1960s to seek their fortune. Opal mining developed into a multi-million dollar industry and Coober Pedy slowly developed into a modern mining town, the 'Opal Capital of the World'.

The town is widely known for its underground housing, an effective and environmentally friendly response to the area's searing summer heat and chilly desert evenings. This is one of the main tourist attractions of the town, as it offers visitors an experience that isn't found anywhere else in the world. These underground houses, called **dugouts**, attract thousands of tourists each year, providing valuable economic stimulus to what is now a small mining town. The constant influx of tourists has also created employment for locals in the hospitality industry and led to the development of many tourism-based small businesses, such as outback tours and mine tours.

dugout a shelter that is dug into the ground and roofed over

Monkey Mia, Western Australia

Monkey Mia is located in the Shark Bay World Heritage Area, around 800 km north of Perth. It is famous for its bottlenose dolphins; for the past 40 years, the dolphins have come in to the shallow waters and allowed humans to feed fish to them. The amazing thing about this is that it has been a completely natural behaviour; humans have not trained these bottlenose dolphins to come in – the dolphins do so by themselves.

Around 100 000 tourists go to Monkey Mia each year to see and feed the dolphins. The large number of tourists has created some major concerns about the management and protection of the dolphins and the environment of the area. The Western Australia Department of Conservation and Environment manages the dolphin experience by:

- regulating dolphin feeding
- maintaining a dolphin interaction area
- careful recruitment of new dolphins into the interaction program
- regulation of boat encounters.

The government is hoping to protect the dolphins and maintain an ecologically sustainable tourism industry here, ensuring that Monkey Mia can be enjoyed by future generations.

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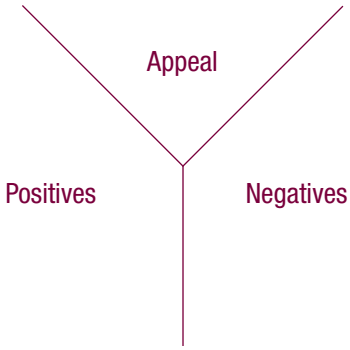
Source 6.55 Dolphin feeding in Monkey Mia

Source 6.56 The bottlenose dolphins found at Monkey Mia

NOTE THIS DOWN

Copy the graphic organiser and look at the positives, negatives and appeal of one of the Australian tourist destinations discussed in this chapter.



RESEARCH 6.6

1. Use the internet to gather information about another popular tourist destination in your home state.
2. Use the information you have gathered to plan a five-day family holiday to that destination. Your plan should include:
   - transportation costs to and from the destination
   - details of where you will stay for five nights, and the costs of the accommodation and meals
   - details on activities for each day of your stay – what you will be doing, how much it will cost and how much time it will take.

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Chapter summary

- Places are parts of the Earth's surface that have specific meaning for the people who identify with them.
- We use the concept of space to better understand where, how and why places are located and connected over the Earth's surface.
- How we identify and interact with a place and its spatial features depends on our personal and cultural perspectives on the relationship we have with the place and its natural and human environmental features, and why it is important for us, our culture, our people and our future.
- Through understanding our and other people's worldviews – the collection of ideas, beliefs and spiritual connections through which people personally, as groups and cultures, understand, connect with and interact with the world – we are more able to positively connect with other people and cultures.
- How we see and connect with places includes whether or not we feel safe and included in the place.
- Where we live and the types of transport available to us have a major influence on how we live and connect with other places.
- Through including and listening to people's stories about the importance of place to them we are better able to be part of positive, inclusive and caring communities.
- A town is defined as a built-up area with a name, defined boundaries and local government, that is larger than a village and generally smaller than a city.
- A city is defined as a large town.
- Cities host major events that play an important role: they bring people, goods, services and investment into the cities, which leads to economic benefits for the cities.
- There are many tourist destinations in Australia, providing a wide range of experiences and appealing to different groups of visitors.

End-of-chapter questions

Multiple choice

1 A person's perspective on a place is influenced by:

A a sense of safety.

B country of origin.

C connectedness to a location.

D all of the above.

2 Worldviews are:

A a collection of ideas, beliefs and values.

B your opinion of life.

C photos of Earth.

D none of the above.

3 Refugees are:

A people who have fled their country.

B people who have travelled from their country by boat.

C people seeking asylum because their own home is unsafe.

D both A and C.

4 Your sense of space is influenced by:

A the stars.

B transport.

C how long it takes for someone to receive an email.

D fences.

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5 How much money does tourism contribute to the Australian economy each year?

- **A** $23 million
- **B** $43 million
- **C** $10 billion
- **D** $34 billion

Short answer

1 List the influences on one's sense of place and space.

2 Discuss why people might move locally or internationally.

3 Suggest why consensus is important when managing places like Uluru.

4 Describe the value of transport in an area.

5 Evaluate the importance of tourism to the Australian economy.

Extended response

Everyone has a sense of place, space and belonging. Imagine you are a person with a disability or from a different culture. In a diary entry, explore your perceptions and use of places and spaces in your local area. How does your perception of place and accessibility affect how you engage with and connect to this place?

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7 Patterns of consumption

Source 7.1 The seaport at Hong Kong, which transports millions of containers of goods from China every year

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Before you start

Main focus

What we consume and where it is produced link places around the world.

Why it's relevant to us

Over the last 20 years there have been sizeable shifts in patterns of production and consumption. As technology becomes more advanced, there have been changes in what we buy and where it is produced. Manufacturing is shifting to China and other countries, while industry in developed countries is changing.

Inquiry questions

- What do we mean by the 'Industrial Revolution', 'industrialism' and 'capitalism'?
- How have traditional centres of production changed?
- How is technology shifting patterns of production?

Key terms

- Capitalism
- Footloose
- Hi-tech
- Industrialisation
- Manufacturing
- Outsource
- Redevelopment
- Regeneration
- Special Economic Zone

Let's begin

The city of Pittsburgh was changed by rapid industrialisation and by the challenges it faced after many industries left the area. Technology plays a key role in the changing patterns of production, and Silicon Valley is now an important place. The region of Pudong in China has also changed dramatically through the rise of manufacturing in the region, with significant environmental impacts. The laptop provides an interesting example of the way production and consumption cross national borders.

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7.1 The Industrial Revolution

Before 1750 most of the world's population lived in rural areas, working the land, often in extremely tough conditions. Skilled craftspeople produced **manufactured** goods in small quantities in these rural areas. While cities existed, their populations were smaller and they were fewer in number. The Industrial Revolution changed this situation forever. This shift started in Britain but quickly spread through Europe, and North America and from there to the rest of the world. As cities developed, new large-scale **industries** were set up.

manufactured produced on a large scale

industry a type of commerce or business, such as the metal industry or the tourism industry

Geographical fact

In 1800 there were 22 cities worldwide with more than 100 000 inhabitants. By 1895 there were 100 cities with more than 100 000 inhabitants.

RESEARCH 7.1

Which cities had more than 100 000 inhabitants in 1895? Using the internet and other resources, see what information you can find to help you answer this question. Use this information as the basis for a research report. Complete the following tasks in relation to the cities you have found:

1. Using a current world map, find as many of these cities as you can.
2. Create a table with information about the state of the industrialised world in 1895. Consider the following:
   - **a** the location of the cities (continent, proximity to other industrialising cities)
   - **b** the industries developed in these cities (if you can't find this out, speculate on the basis of geographical location)
   - **c** any relationships you can identify between location and industry.
3. Write a one-page report about the changes in day-to-day life in a newly industrialising environment, based on the information you have found.

Causes of the Industrial Revolution

Population growth

In the 18th and 19th centuries the population of the world began to grow. This led to a need to produce more food and more goods. People looked for ways to improve the efficiency of farming and manufacturing.

Invention of machinery

A number of vital inventions in this period allowed significant changes to the way people lived their lives. Among the most important was the steam engine. The power the engine produced revolutionised transport, manufacturing and mining and was a major factor in the growth of many new industries. New machines, such as mechanical weaving looms, were also invented, allowing for mass production of goods such as cotton cloth.

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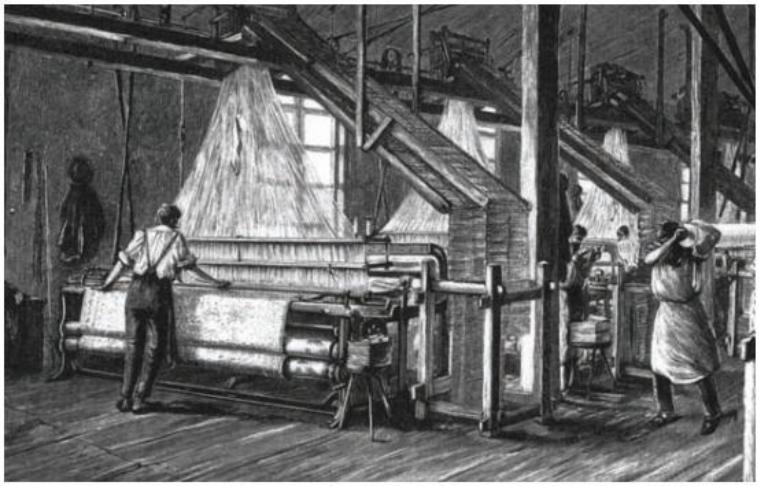


Source 7.2 A steam-powered weaving mill in Lancashire, England

Increase in global trade and colonisation

The 18th and 19th centuries were also a period when European countries were colonising large parts of the world. This made large supplies of raw materials available, as well as new trading partners. The new factories manufactured goods from these raw materials and sold them back to the colonies at a profit.

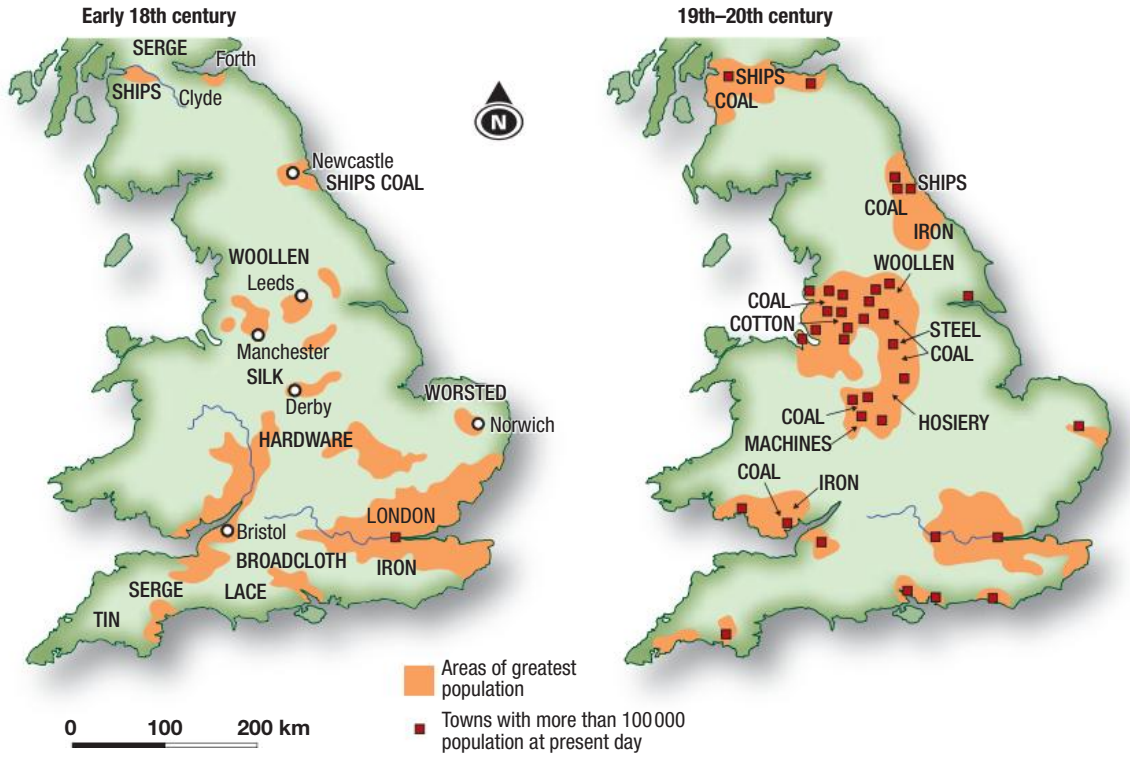
Effects of the Industrial Revolution

Growth of new industrial areas

The most significant change related to the Industrial Revolution was a shift in populations from rural to urban areas. Many of these urban areas did not exist prior to this. New towns and cities developed around raw materials such as coal, iron and tin, as it was cheaper to manufacture goods from these materials close to their source. Industrialisation saw previously rural areas become densely populated.

Changes to social structure

The Industrial Revolution led to the development of what became known as the 'working class'. The workers in factories were often poorly paid and



Source 7.3 Map of Britain before and after the Industrial Revolution

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lived in extremely cramped and squalid conditions. Many of those moving to work in these cities were women and children, who were employed in a range of industries, including the textile factories. Over time, workers formed unions to campaign for better conditions and safer work practices.

Increased wealth

The process of manufacturing produced large amounts of money for factory owners. This money was invested in other businesses and ventures, which in turn created yet more wealth. Over time, as wages increased, the populations of industrial areas also became better off, and were able to purchase more manufactured products, thus driving further production. Governments benefited through the collection of more taxes, leading to the construction of public buildings and infrastructure such as railways and piped water.

The Industrial Revolution and Australia

As a British colony, Australia was influenced considerably by the Industrial Revolution. Indeed, many of Australia's first immigrants came from Britain's rapidly expanding industrial areas. Much of the technology associated with the Industrial Revolution was exported into Australia by the British. Cities such as Newcastle were established around coal deposits, leading to the creation of steelworks and other heavy industries.

Source 7.4 BHP steelworks is still in operation in New South Wales.

Industrialism across the world

Although the Industrial Revolution led to **industrialism** in Europe, North America and Australia in the 19th century, this shift occurred much later in many regions. Countries such as India, South Africa and Thailand are currently shifting from agricultural to industrial production, at an extremely rapid rate.

industrialism when a country's economic and social systems become based on the production of goods through mechanised industries in urban centres, rather than through agriculture

As Source 7.5 illustrates, the world can be divided according to levels of industrialisation. The extent to which a country is industrialised can be influenced by a range of factors, including the growth of population, access to technology and the amount and types of raw materials that are available for use by industry.

Industrialisation is closely related to the level of development in a country. Industrialised countries tend to be richer, have higher levels of education and longer life expectancy.

As countries become established as centres of industry and populations grow richer, their ability to produce goods at a competitive price can start to reduce, as wages increase, making it difficult to compete with companies that operate in countries that are poorer and pay lower wages, countries where industrialisation is in its earlier stages. What happens then in the established industrialised countries is often the emergence of service industries, such as financial services, health care and information technology.

Geographical fact

Over 60% of those employed in Australia work in service industries.

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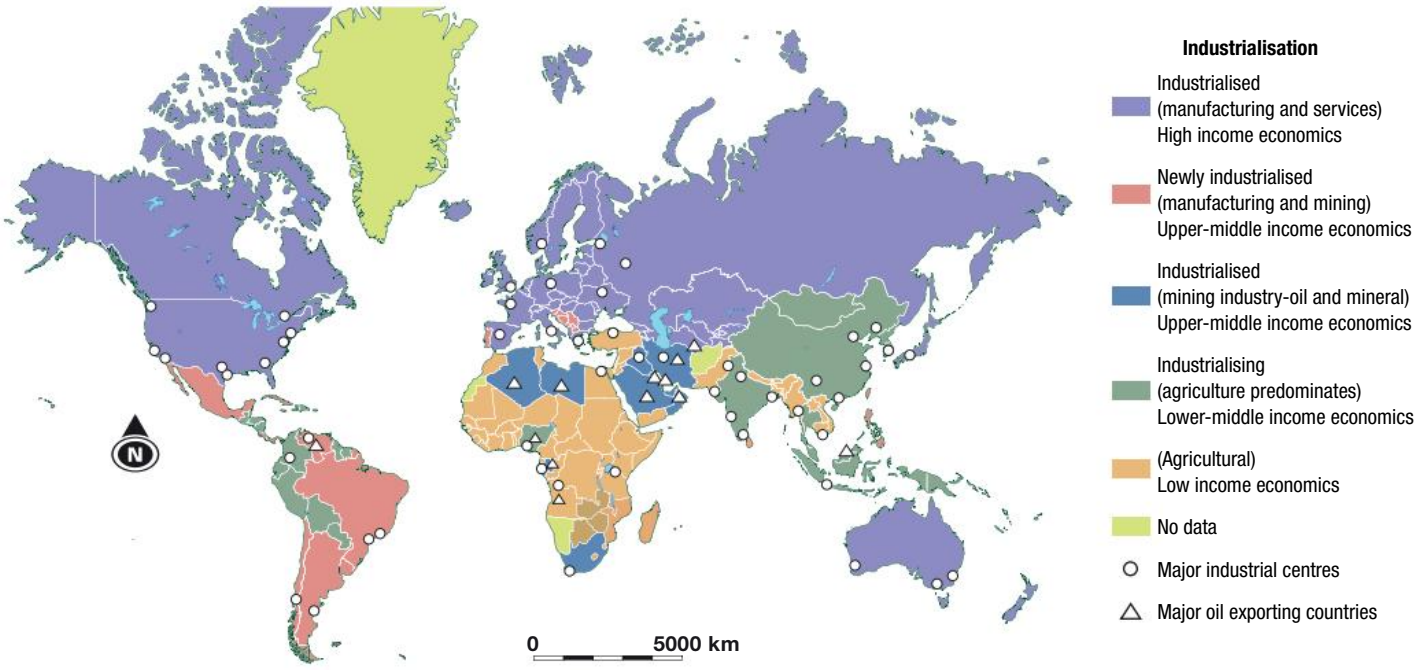

Source 7.5 World map showing level of industrialisation in different regions

ACTIVITY 7.1

1 Explain how population growth was related to the Industrial Revolution.
2 Describe two ways in which industry and agriculture were improved by new mechanical technology.
3 Using Australian wool as an example, explain the vital role colonies played in industrialisation.
4 Using Source 7.5, describe the extent to which industrialisation has occurred in the following regions: Africa, Southeast Asia and South America.

Capitalism

Industrialisation has led to most nations in the world adopting, to a greater or lesser extent, what is known as a capitalist economic system.

capitalism an economic system in which resources and means of production are privately owned and prices, production and the distribution of goods are determined mainly by competition in a free market

Throughout the 20th century **capitalist** principles led to huge industrial growth in developed nations. Capitalists argue that by letting private industry run the economy, rather than relying on governments to intervene by planning economic growth, setting high taxes and redistributing wealth, the population will become wealthier in a shorter period of time. They also suggest that the system rewards hard work and innovation and is equitable in that anyone with these qualities can succeed.

Many argue, though, that this type of system exploits poor workers while maximising money made by rich shareholders and factory owners. This is now an issue in developing countries as companies from developed nations set up

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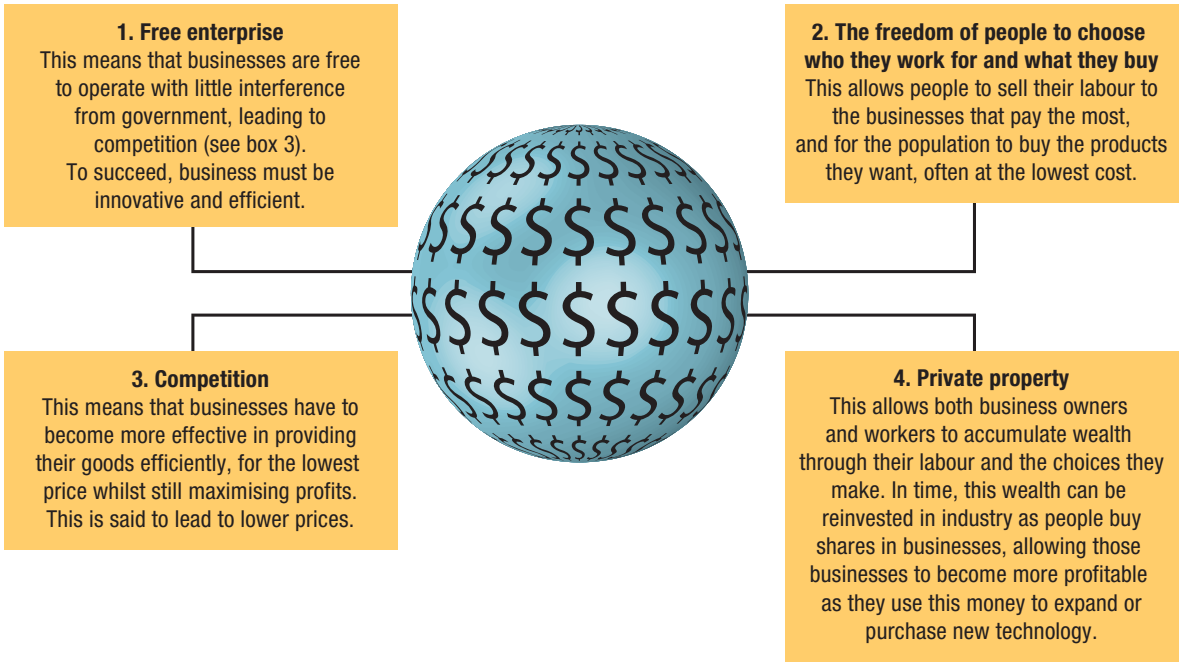

Source 7.6 Understanding what capitalism is

factories overseas – this helps them maximise their profits because they pay less for labour. Others suggest that the system is vulnerable in times of economic instability, as share market collapses can lead to mass unemployment and a drop in standard of living. Environmentalists argue that capitalism often overlooks environmental damage, as companies focus on making a profit, not on sustainability.

NOTE THIS DOWN

Copy the graphic organiser below and analyse the positives and negatives of capitalism. As an extension task, find examples of each of these points through research. Conclude by stating whether or not you think capitalism is a good system.

Capitalism	
Positives	**Negatives**
• Increased wealth • •	• Exploited workers • •

Goods and services

As more factories were built and more products were manufactured, there was a range of benefits, all of which fed the economy and allowed the population to become wealthier and have a higher standard of living.

Fordism

Factories provided employment, which meant people were earning a steady income. This is a significant shift from rural economies, where much of the population is likely to live off the products they grow or tend. As income increased, the

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Source 7.7 Ford Model T, the first mass-produced affordable car

general population, for the first time, had money to spend. Henry Ford, in the 1920s, made sure he paid his workers enough money to, over time, be able to buy his cars. This was known as 'Fordism': if the workers were able to buy the product they were making, there would be more of the product needed, thus increasing the profitability of the company.

This approach was extremely successful in postwar America, during the period known as the baby boom, when employment was high and the economy was expanding.

Savings and investments

As workers accumulated money over time, they had the opportunity to save considerable sums. This allowed the working class to buy their own homes, for the first time. This, in turn, generated more wealth – as the economy grew there was a need for more construction workers, and a need for more factories to produce building materials.

The money accumulated by workers was also invested in shares in companies. Many businesses gave workers special discounts to buy shares in the company they worked for. This ensured that the company would maximise its productivity and provided more money to be invested in equipment.

The rise and fall of heavy industry in developed countries

During the 19th and early 20th centuries, industrial centres across the United States and Europe followed a similar pattern of rapid growth and gradual decline. The reasons for this pattern are almost universal and can be seen through the example of Pittsburgh, US.

Source 7.8 Location map of Pittsburgh, US

Pittsburgh is in the state of Pennsylvania, in the northeast of the country. During the early 1800s its position at a **confluence** of two rivers – which then become the Ohio River – led to its development as a trading post. Between 1850 and 1950 the population of the city rose from around 60 000 to over 650 000 as heavy industry developed in the region.

confluence the point at which rivers meet

The rise of Pittsburgh as an industrial hub was due to a range of physical and human factors, as set out on the next page.

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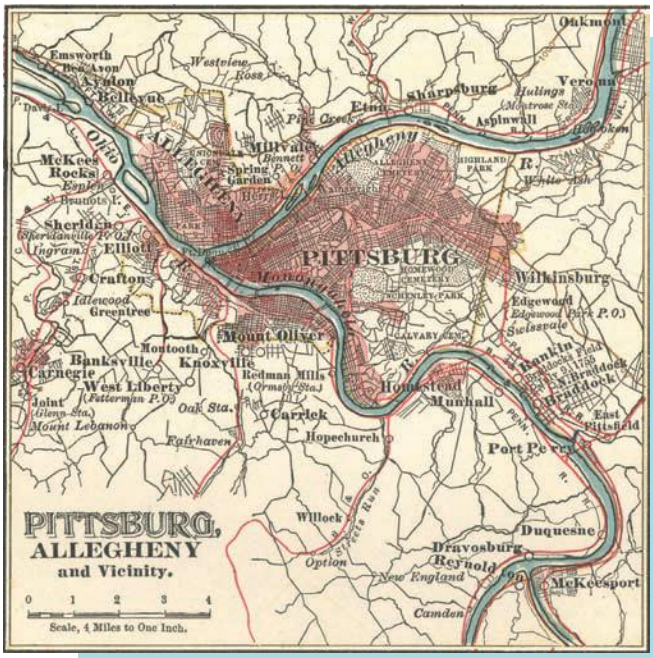
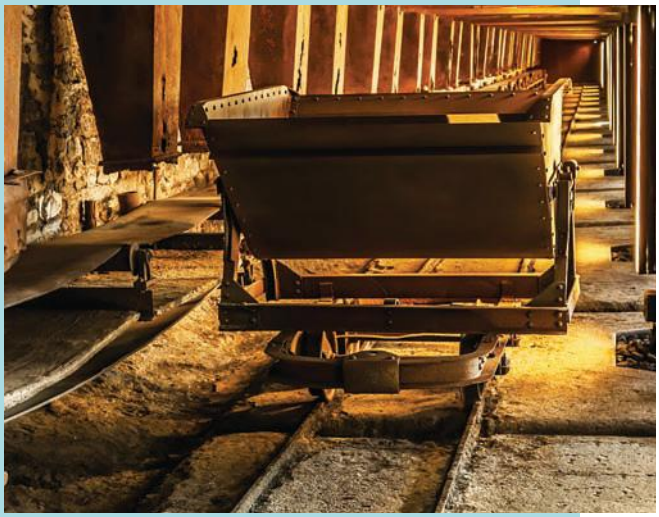


Position on two rivers

Pittsburgh's two major rivers provided a means to transport heavy goods all around the eastern and central US, and north to Canada. Water was also a vital resource for the steel and glass industries, as millions of litres are required for the production of these goods.

Close proximity of coal deposits and other raw materials

A reliable supply of coal was vital for the development of heavy industry. It provided energy for the iron-smelting process that produces steel. As coal is expensive to transport, heavy industry developed around the coal fields close to Pittsburgh. In 1914, 82 000 people were employed in coal mines around Pittsburgh.



Cheap labour

High levels of immigration to the area from Europe and other regions led to a cheap labour force, willing to work in the unskilled jobs associated with the new iron mills. When slavery was abolished many African-Americans also headed north looking for work.

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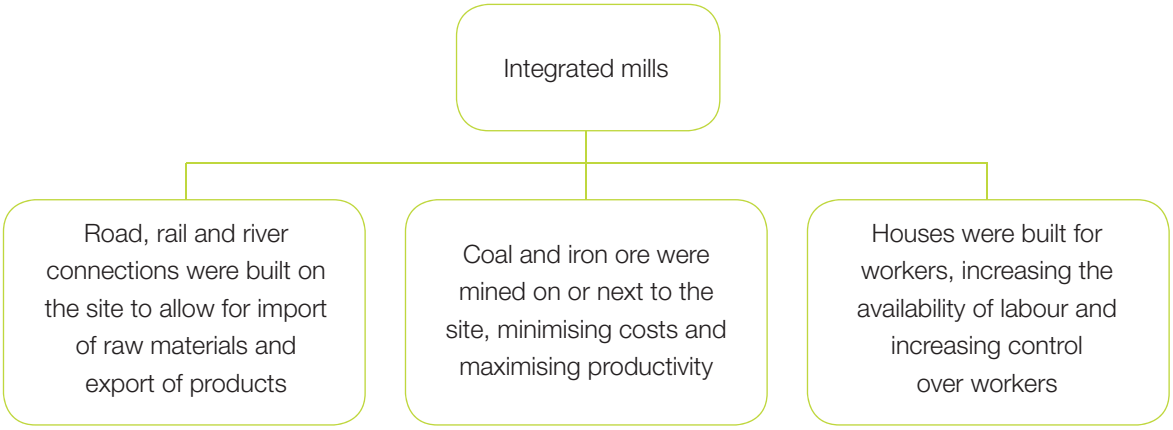
Pittsburgh: City of Steel

By 1870, with industrialisation well under way, heavy industry had developed from lots of small businesses to huge factories, employing thousands, built outside the city – there was more land there and it was closer to the raw materials required. These sites were known as integrated mills and were hugely significant in increasing production.



At Pittsburgh's peak over 90 000 people were employed in these steel mills, and many hundreds of thousands were employed in supporting industries. The city was the 12th largest in the US in 1950, with a population of almost 700 000. By 2000 its population was half that and Pittsburgh was the 51st largest city in the US. What had sparked this decline in Pittsburgh's fortunes?

Decline of steel production in Pittsburgh

There are currently only two functioning steelworks in the region, and none in the city of Pittsburgh. In the 1980s, over 150 000 industrial workers were laid off. This decline was caused by a number of factors:

- higher labour costs of American workers
- coal and iron ore supplies in the Pittsburgh region running out, making raw materials more expensive (in extraction and transport)
- competition from cheaper steel from abroad, from countries such as Japan and South Korea
- outdated technology in the factories, where there had been no innovation
- an overdependence on one type of industry, in this case steel.

This decline also caused a range of social problems. In 1990 male unemployment in Pittsburgh was 40%. There was migration, particularly of the white population, out of the city and into the suburbs.

Vandalism and crime rates rose as abandoned buildings within the city were vandalised. Environmental issues were a factor in this continued decline, as many of the sites of old steelworks were too polluted to be redeveloped.

Source 7.9 An abandoned factory in Pittsburgh

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Responses to industrial decline in Pittsburgh

Since the 1980s Pittsburgh has reinvented itself as a centre for technology and tourism. Companies such as Google have taken advantage of the workforce emerging from Pittsburgh's universities and the abundance of available land to create large campuses in the city.

Pittsburgh's industrial past has also been at the heart of much of the **redevelopment**. Historic buildings have been restored and are now apartment blocks and hotels, bringing people back into the city centre.

redevelopment when an area is rebuilt, redesigned or renewed

Industrial sites along the city's river have been cleaned up and are now recreational facilities, attracting both visitors and tourists.

Tourist numbers have increased, with many coming to visit the rich industrial history in the area. Tours of former steel mills are popular. The city's riverside location is also attractive to tourists, with river cruises highlighting the city's beauty. Pittsburgh's **regeneration** has been particularly impressive in that much of it has been initiated and run by locals. While the city population is unlikely to reach 1950 levels, Pittsburgh now has a diverse range of employment opportunities, improved environmental quality and a rich culture and identity.

regeneration new life coming from something old or obsolete

Source 7.10 Pittsburgh's historic Heinz factory has been restored and converted into apartments.

Source 7.11 A former industrial site has been converted into recreational facilities.

Geographical fact

The SoHo (SOuth of HOuston Street) neighbourhood of lower Manhattan, New York City, now renowned for its blend of galleries, artists' lofts and fashionable shopping boutiques, was in the 1950s an industrial wasteland, after having gone through a succession of residential, commercial and industrial reincarnations. Artists began moving into the abandoned warehouses of SoHo during the 1960s and 70s, commencing its evolution into the more upscale district it has become today. The surrounding neighbourhoods of TriBeCa (TRIangle BElow CAnal Street), NoHo (NOrth of HOuston Street) and NoLita (NOrth of Little ITAly) have gone through a similar process of gentrification.

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RESEARCH 7.2

1 Choose one of the cities listed below:
   - Newcastle, New South Wales
   - Sheffield, England
   - Detroit, US

2 Use books, journals and the internet to create an 8-slide PowerPoint presentation explaining why these cities became centres of heavy industry, how they grew during periods of industrialisation, why they underwent a decline and how the cities have since undergone regeneration. Slides must include:
   - maps and images
   - an explanation of the role physical and human geography have played in the rise and fall of heavy industry in the area
   - an analysis of how successful responses to urban decline have been.

Other cities regenerating old industrial areas

Emscher Park, Germany

The area around Essen in the Ruhr Valley was once a coalmining centre. As the coal ran out, the area went into decline. The response was Emscher Park, an 800 km^2 area of recreational facilities, cultural attractions and restored buildings. At its heart is the River Ruhr, once among the most polluted rivers in Germany. The scheme has improved the health of the river through the introduction of new wastewater facilities. At its heart is a theme park based around old industrial facilities. The ferris wheel allows visitors to look into the old coking plant.

Melbourne Docklands, Australia

In the 1990s the area around Melbourne's docks was a wasteland as ships moved out to the new containerised port. The Docklands stadium was built in 1996 to kickstart the area's redevelopment. Since then large numbers of firms have set up in the area, enjoying its close proximity to Melbourne's CBD and its spectacular waterfront setting.

Source 7.12 Emscher Park, Germany

Source 7.13 Docklands in Melbourne, Australia

Olympic Park, East London

The site for the 2012 London Olympics was once a disused industrial site located between railway lines. The site was heavily polluted as a result of chemical waste. It was cleaned for the Games, and the Olympic Village has now been converted into housing. Development in the surrounding area has continued and includes Europe's largest shopping centre, in nearby Stratford. Many major sporting events, including the Barcelona and Sydney Olympics, have been used to kickstart regeneration in old urban districts.

Source 7.14 Olympic Park, East London

7.2 From heavy to hi-tech

As most developed countries have experienced a decline in heavy industry in the last 25 years, new industries, with vastly different requirements in terms of location and workforce, have sprung up. Jobs in heavy industry have been replaced by employment in **hi-tech** companies, including information technology, specialised electronic and advanced manufacturing, and in other sorts of industries, such as financial services and communication-based businesses.

hi-tech products and technology that are complex, and that use or produce the latest advances in computers and electronics

footloose an industry that can relocate easily

These hi-tech industries are known as **footloose**. While heavy industry was tied to a particular location as a result of the need for raw materials such as coal, modern hi-tech industries, such as software development companies, can be far more flexible in their choice of location. There are, moreover, several key factors that are attractive to these types of industries as shown opposite:

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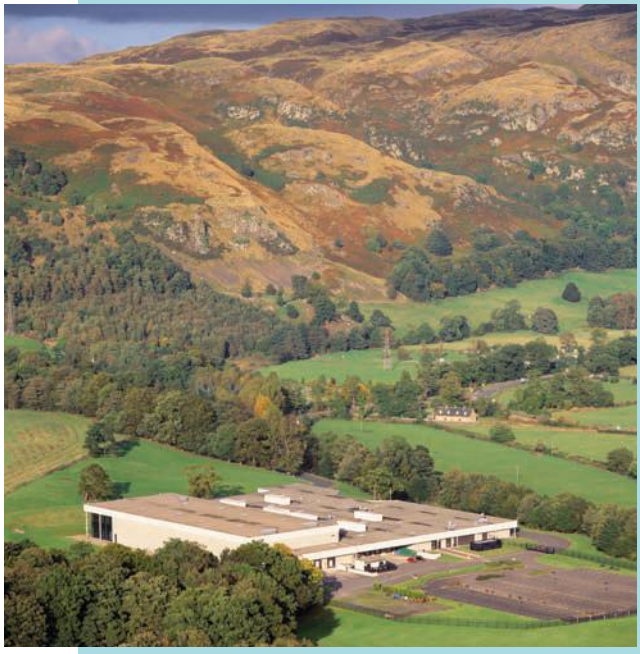
Communication

Many hi-tech industry hubs are established along communication routes that allow quick and easy movement of workers and goods. Close proximity to airports is also considered important as many of these companies are global businesses. Fast and available broadband and cable networks are also a necessity for this type of business.

Close to a skilled workforce

Hi-tech businesses are only successful if a suitable workforce of highly qualified employees is available. As a result, these businesses are often located close to major universities.



In or near attractive natural environments

Because attracting the right skilled workers is vital to these businesses, offering the chance to work and live in an attractive environment is also important.

Close to other hi-tech businesses

This allows the sharing of services, greater exchanges of ideas and innovations, and reduced transport costs for components.

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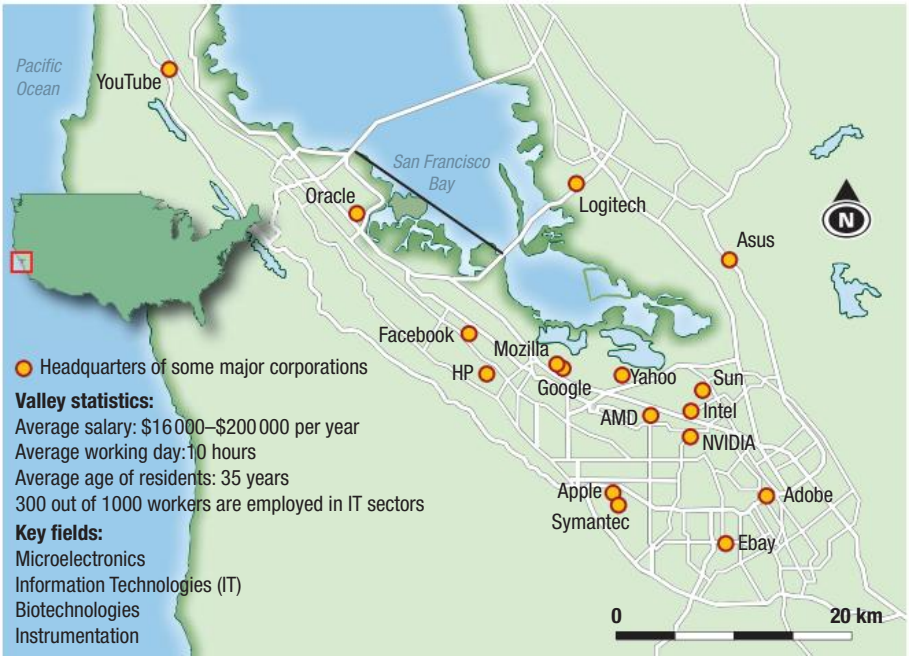
Hi-tech industry in Silicon Valley

The area now known as Silicon Valley is the biggest and most famous example of an area dominated by hi-tech industry. With around 300 000 workers in these industries generating $200 billion in turnover each year, this region is vital to the US economy.



Source 7.15 Map of Silicon Valley

Silicon Valley has been a key centre of the computer industry since the late 1970s, and the explosion in home computer ownership can be linked directly to its growth. In 1975 around 3000 computers were sold to the public. In 2012 around 330 million were sold worldwide. Most of these were produced by companies with roots in Silicon Valley.

The massive increase in access to and use of the internet has benefited the region, with many hundreds of companies providing online services, servers and software. But why is this region so attractive to these companies?

Causes of its success

Stanford University, located nearby, is considered one of the main factors in the success of the region. The university, backed by government funding in the 1950s and 1960s for defence research, founded a research park in the grounds of the university that attracted hi-tech companies. Many of the graduates went on to form highly successful companies in the region. In the 1970s and 1980s, research on computers and the initial development of the internet took place at the university, leading to a large skilled workforce living locally.

The Bay region of California has an attractive climate and interesting natural scenery and is well known for its laid-back lifestyle. Many of the companies adopted such a culture, and firms such as Apple and Google became renowned as model employers, attracting the most talented workers from across the globe. Highway 101, running through the valley, provides a fast and direct communication link between the area and San Francisco.

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Source 7.16 Headquarters of Oracle, in Silicon Valley – all the buildings are Oracle buildings.

While a number of the companies located in the valley are huge, most are small businesses with few employees. This has led to a culture of sharing and collaboration between companies, and this has helped make this region home to many leaders in innovative technology. It has given them the edge over other regions that are characterised by larger, more secretive business operations.

venture capitalists companies or individuals that invest large sums of money in small companies to help them start up and grow

With the success of companies such as Apple, Silicon Valley became home to a large number of **venture capitalists**. Because 40% of all venture capital in the US is invested in the region, small businesses are attracted to the area – the chances of attracting investment are higher there than elsewhere.

Effects of hi-tech industry in Silicon Valley

Impact on regional and national economies

GDP (Gross Domestic Product) the total value of all goods and services produced in a particular country; often used to compare the size of national economies

If California were a country, it would have the 8th highest **GDP (Gross Domestic Product)** in the world. This illustrates the size and importance of California's economy both to the US and globally. The technology companies of Silicon Valley are a hugely important sector, contributing roughly $40 billion of the state's $140 billion in exports. This huge sum of money, combined with the fact that the area is home to most businesses attempting to start up, makes its success vital at both a regional and a national level.

Living in the area

Hi-tech industries have had many positive effects on Silicon Valley. Employment rates are higher, and local governments collect large amounts of tax from industries in the area. As Silicon Valley has developed, the area has become home to a large number of the super-rich. The recent **floating** of Facebook instantly created 1000 millionaires in the valley. The demand for skilled workers has also pushed average wages up. While this attracts workers, demand for housing also pushes prices up. The price of rental accommodation is 78% higher here than the US average, and the purchase price of a typical house is up to three times the country's average. This makes it hard for those not working in these high-paying sectors to live in the area.

floating (a company) letting the public buy shares in it; this gives the company money to invest or spend

Traffic congestion and loss of farmland as companies continue to expand in the region are other concerns – this changes the pristine environment that attracted many to live in the area in the first place.

Source 7.17 Aerial view of 'Googleplex', Google headquarters, Mountain View, California.

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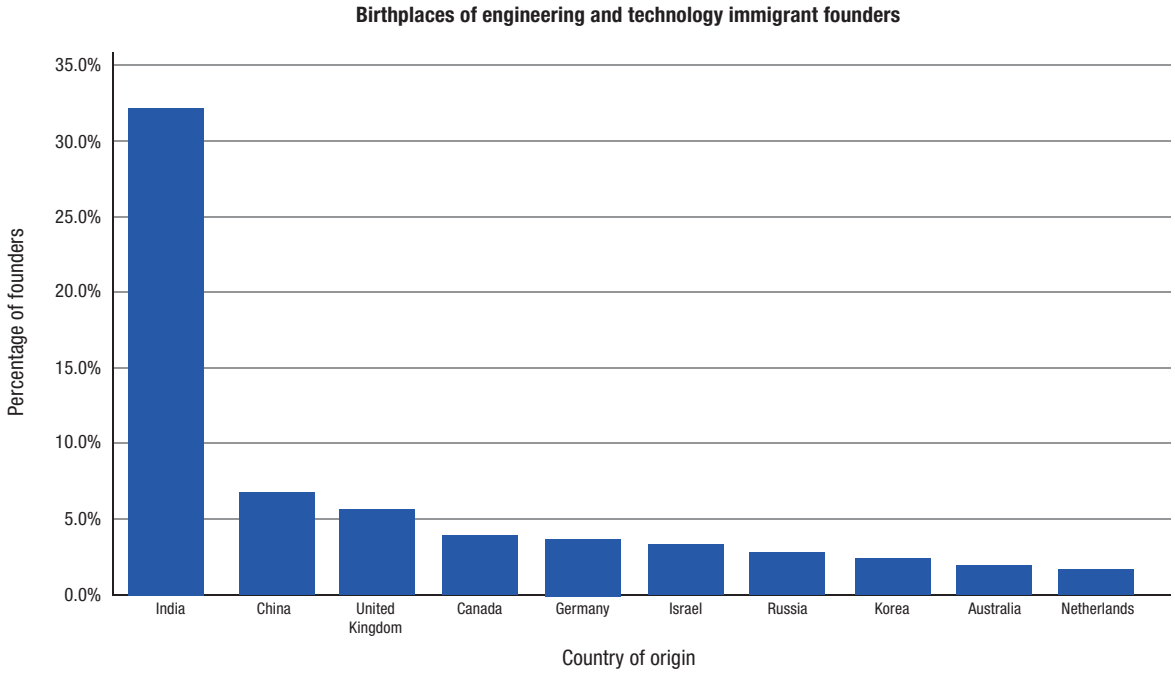
Migration to Silicon Valley

As technology companies continue to hand-pick the best and brightest graduates from around the world, Silicon Valley has become amongst the most multicultural regions in the US.



Source 7.18 The birthplaces of scientists and engineers in Silicon Valley

Over half of the scientists and engineers working in the region come from overseas. This has given the region a unique cultural identity, as well as a competitive advantage in terms of the level of innovation occurring. However, these workers are more mobile than workforces associated with traditional industries, and they are now moving to other locations, including Pittsburgh, where the cost of living is low.

Silicon Valley and globalisation

Migration is an important element of the success of Silicon Valley, but the region's relationship with other countries is more complex than just the movement of workers. Many of the larger companies within the area, such as Apple and IBM, are **transnational companies**. This means that, as wages in the area and the price of land continue to rise, some operations can be shifted overseas. Apple, for example, made all its products in the US until 2002. It has since shifted production to countries such as China. Apple still employs over 18 000 in the US, but up to 700 000 workers in factories in other countries, subcontracted by Apple, are taking on its manufacturing.

transnational companies (or corporations) companies that operate their businesses in and across more than one country; also called multinational companies

Also, highly skilled engineers and software workers are heading back to their native countries to use the skills learned in Silicon Valley. Companies in countries such as India are now employing these workers to lead their own hi-tech operations. Conversely, Europeans are coming to Silicon Valley to try to start up operations, taking advantage of the infrastructure and venture capital – they leave the region later.

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ACTIVITY 7.2

1. Summarise the difference between heavy industry and footloose industries.
2. Describe and explain two factors that influence the location of footloose industries.
3. List key factors for the success of Silicon Valley as a centre of hi-tech industry.
4. Explain why Silicon Valley is one of the most multicultural regions in the US.
5. Create a digital map, using Google Earth, that highlights the geographical features that play a role in Silicon Valley's success. Label Stanford University, Highway 101, distance to the CBD of San Francisco, headquarters of Google, Facebook and Hewlett Packard. Write your own description of the relevance of each of these.

The future of hi-tech industry in the US

Export of hi-tech jobs

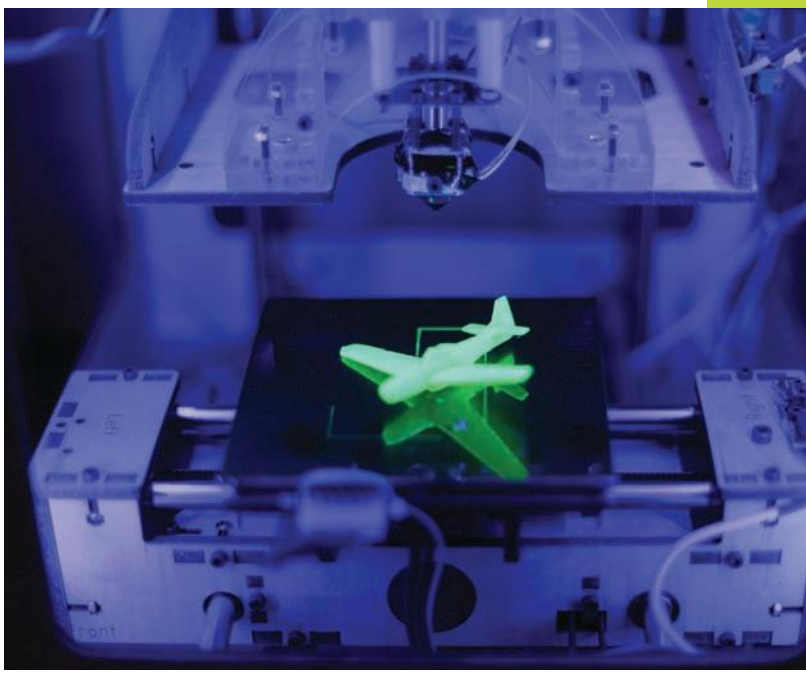
Many are concerned that the trend of computer-based industry heading overseas will continue, particularly as cities such as Bangalore in India continue to attract investment in these areas. Also, there are millions of graduates emerging from India's and China's universities, which is adding to the concern, as wages and costs are lower in both those countries. Others argue that Silicon Valley's culture of innovation will create new opportunities and markets in America. They use the example of social networking websites that didn't exist 10 years ago and now employ tens of thousands of people.

Footloose employees

Advances in technology have increased the ability of people in a variety of jobs in a huge range of sectors to work from home. As fibre optic technology improves communication, this may well make the physical location of a workforce less important. This is particularly relevant in the IT industry, where many of the jobs revolve around the use of computers and the internet anyway. Global companies may have employees in India, the US and China collaborating on projects in real time.

Advanced manufacturing

Hi-tech and sophisticated manufacturing still exists in the US and it is expected to continue to grow. One of the most exciting developments is the emergence of 3D printers.



Source 7.19 A 3D printer creates a model plane.

These machines can 'print' products, and as they increase in sophistication many feel this type of manufacturing may replace traditional factories. These machines are already being used to make tools for existing factories, so it is possible that they will one day replace the factories.

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China: rising giant of industry

In 2011 China took over from the US as the country with the largest industrial output, producing over 20% of all manufactured goods globally. Its rise in this sector of the economy has been rapid, with spectacular growth in a wide range of industries, most notably in the last 20 years.

Reasons for the growth of Chinese industry

With a population of around 2 billion, China has both a large available workforce and a significant domestic market for manufactured goods. Also, China's position in the centre of Asia means it is close to a large number of strong economies, such as Japan and India, which are valuable trading partners.

Developments in agriculture have reduced the need for large numbers of rural workers, which has led to rural–urban migration.

China is a one-party communist state with a very high degree of central control and, until recently, no private ownership of property or companies. It has planned its industrial growth carefully, with all large investments in technology and infrastructure being made by the state. In the last two decades the government has taken a different approach, trying to attract investment from foreign companies through the establishment of Special Economic Zones (SEZ) where taxes and restrictions on import and export are removed. Wages are lower in China than in western countries, and laws regarding the conditions of workers and environmental regulations are generally weaker. These combine to reduce the cost of goods produced, which has made those goods very competitive on the world market.

NOTE THIS DOWN

Copy the graphic organiser below and categorise the factors behind the growth of industry in China. An example has been provided for you:

Categories	Factors behind industrial growth
Physical geography	Abundance of natural resources
Human geography	
Government	
Working conditions	
Technological advances	

China's economy

Prior to 1975 China's economy was dominated by agriculture, although there was some manufacturing, with an emphasis on heavy industry such as chemicals – these were used to make fertilisers, which increased agricultural production. In the last 20 years manufacturing has become the dominant force, as a result of government plans to increase this sector.

China now manufactures a huge variety of goods, including clothing, cars and trucks, electronics and, increasingly, advanced technology such as computers and mobile phones.

Geographical fact

China produces 50% of all the cameras made in the world.

While a lot of goods produced are exported, China's huge population and growing wealth mean there is also a large domestic market now able to afford an increasing range of products.

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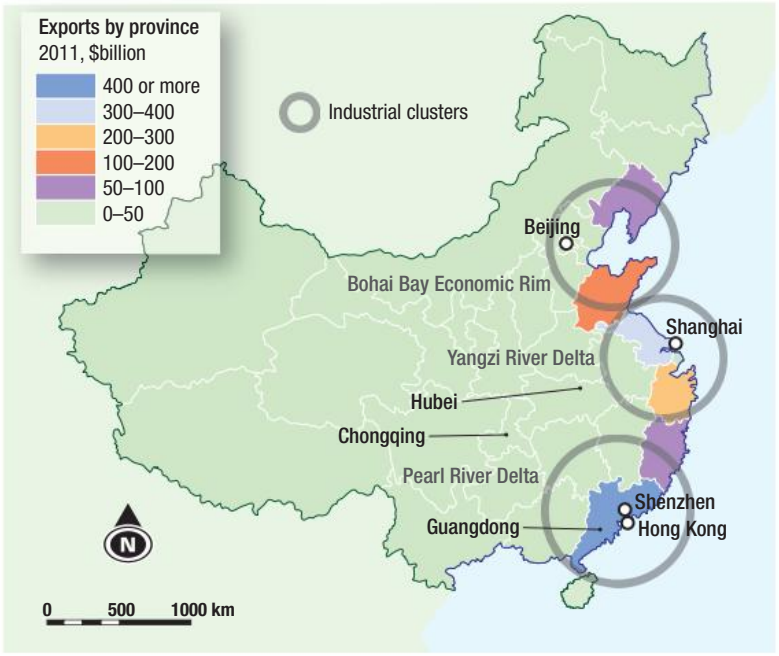
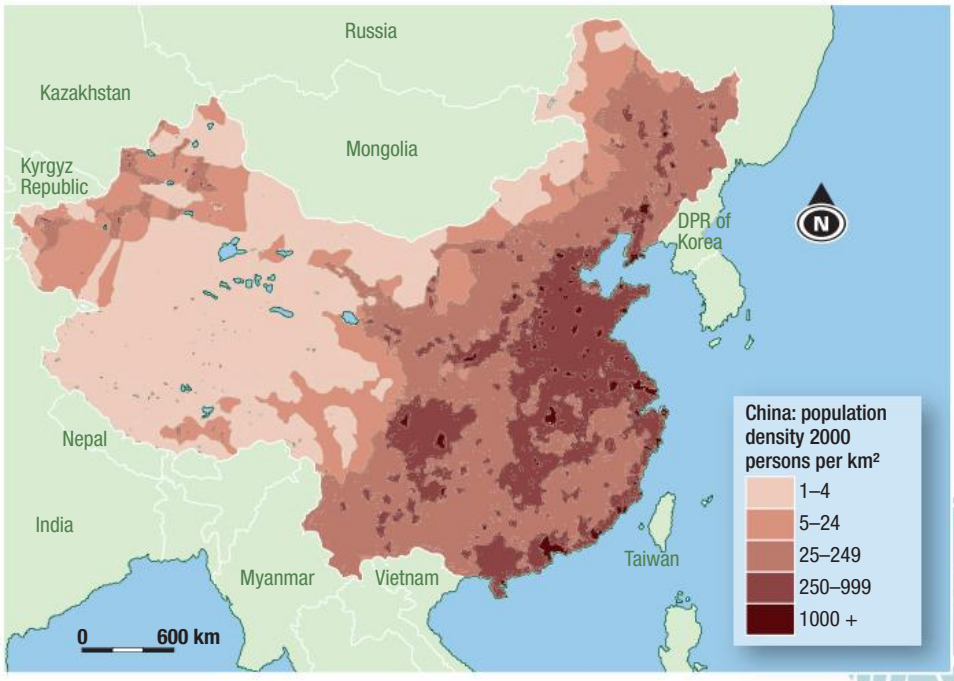
Manufacturing goods



Source 7.20 China's industrial clusters



Source 7.21 Population density map of China

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Most of China's industry is based in the coastal regions. This, unsurprisingly, is where most of the population is to be found. These areas were settled early, before industrialisation, as they provided trading links, fertile soils and a ready water supply. These regions are also attractive to industry, because:

- coasts provide ports to import raw materials and export goods
- the east cost is close to major markets such as Japan, and is the start of shipping routes to the US
- there are large local populations that provide both a workforce and a market
- the area has a good water supply for industry and domestic use through major river catchments
- there is flat land suitable for building factories.

These areas were also targeted in the setting up of Special Economic Zones, largely as a result of the factors outlined above.

Inside a Chinese factory

While conditions in factories vary considerably, depending on the location, owners and the type of goods being made, there are certain characteristics that many of the factories share.

Large numbers of workers

Many factories have thousands of workers, with some huge plants, such as the Foxconn plant in Shenzen that makes goods for Apple, having in excess of 300 000. These numbers illustrate both the scale of manufacturing that takes place and how cheap labour is. In China it is still often cheaper to employ humans than to purchase the machinery to replace them.

Geographical fact

Over 150 million Chinese people work in manufacturing factories.

Contracted by Chinese or western companies

Unlike in Australia and the US, most of these factories are not owned by the companies that they manufacture goods for. They are owned by other, smaller companies, and compete for short-term contracts, which reduces both the risk and the costs for the company offering the contract. It also allows the factories to operate several contracts at once. For example, one American computer company may want 300 000 screens for monitors, and another may order 100 000 laptop screens. These may all be produced in the same factory at the same time. The downside for the factories is that they have to be extremely competitive, which always means increased pressure on workers – longer working hours and low wages.

Source 7.22 A factory in Donguan contracted to make toys for McDonald's meals

Highly flexible practices

One key reason for the success of Chinese manufacturing is the rate at which they can change their methods of production. Because it is easier to tell humans to change what they are doing than to re-engineer computerised production lines, companies can change the products, and increase or decrease rates of production extremely quickly. When demand for the iPad soared in 2010 the factory contracted to produce parts for them simply increased the number of workers on shifts to meet that demand.

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Conditions inside Chinese factories

Compared with what we expect in an Australian factory, conditions in many Chinese factories are extremely hard. Workers do not have the same rights in terms of maximum working hours and safety conditions. They are sometimes made to work overtime, having to sign agreements with the factory that may lead to up to 100-hour working weeks. There have been cases of workers being forced to stand on production lines for up to 11 hours without a break. One factory was caught fining workers for going to the toilet.

Source 7.23 A dormitory at a factory in Beijing: 6 workers share this space.

Many factories have dormitories and free or cheap meals, with workers effectively sleeping and working at the factory. This is because even now many of the workers come from rural areas, and so need somewhere to live.

While the Chinese government has made efforts to improve the working conditions in factories and carry out more rigorous inspections, the factories themselves are often highly secretive about their practices. Some companies from developed countries that produce their goods in these factories also try to conceal where their products are being made, partly so that the buying public do not find out about the working conditions in those factories. Although the conditions are tough, many workers stay because they feel the conditions and pay are still better than those in rural areas.

Geographical fact

In 2012, 2000 workers at a Chinese electronics factory rioted over working conditions, requiring 5000 police to restore order at the factory.

ACTIVITY 7.3

1. Describe how China's economy has changed in the last 20 years.
2. State 2 physical and 2 human factors that affect the location of China's industry.
3. Explain how the working conditions in Chinese factories increase profits for western companies.
4. Discuss the ethics of western businesses using Chinese labour.

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Case study 7.1

Pudong New Area: the Chinese economy in the 21st century

Pudong is a newly established zone within Shanghai. Before 1990 Pudong was a rural area close to the city of Shanghai, providing food for the residents of the city. In 1990 the government announced plans to turn Pudong into an international centre of finance, industry and trade. By 2010 around 6000 businesses had relocated in the area, investing almost $30 billion.

Source 7.24 Pudong before development

Source 7.25 Pudong is now a world centre for finance and trade.

How did Pudong develop?

Pudong's success can be attributed to three main factors:

1. Location

Pudong's close proximity to the established city of Shanghai meant the area already had 74 million people living close by, with all the benefits in terms of communications, labour market and infrastructure this brings. The government also invested heavily in roads and bridges in the area, as well as constructing an airport. The area's position on the Yangtze River, close to the South China Sea, also made it ideal for the building of port facilities and for trade with nations such as South Korea and Japan.

2. Its status within a Special Economic Zone

China's policy of granting certain regions SEZ status has been highly successful in attracting investment. This meant that foreign companies gained significant tax benefits in setting up in the region, increasing their profitability. Foreign companies arrived in huge numbers. The government also looked to attract particular high-value industries, such as hi-tech manufacturing, by offering even more benefits and tax breaks. This led to innovative companies from China and overseas setting up in the area.

3. Strict planning and zoning in the region

Careful planning by the government has led to the creation of specific zones for different types of industry. This has been successful in increasing connectivity between companies, providing an attractive urban area and ensuring efficient transportation.

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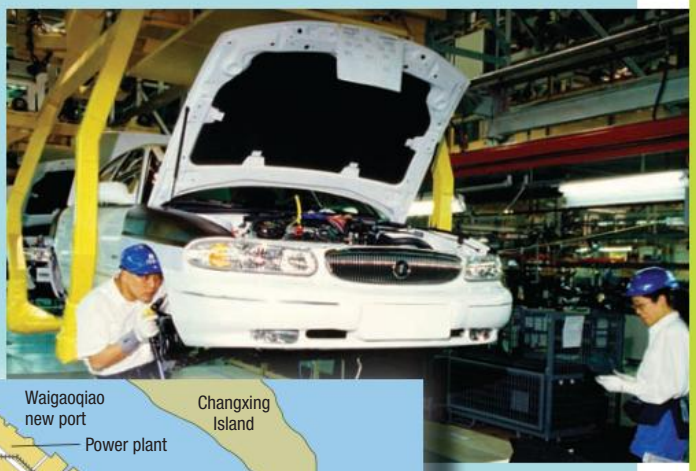
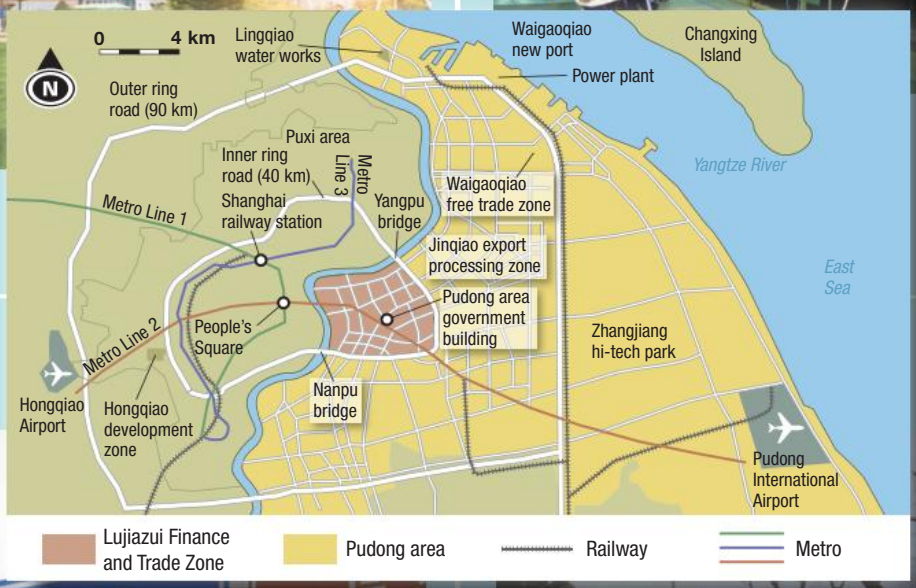
This area is home to over 600 domestic and foreign finance and insurance companies. These provide employment, and capital to businesses wanting to start in the area, and add prestige to the region. Real estate here is now more expensive than in Manhattan, New York.

This region is focused on heavy industry, particularly car manufacturing, as well as some higher-tech industries. General Motors (GM) built a $1.5 billion factory here in 2001, to sell cars to the rapidly increasing numbers of Chinese who can afford them. It now also exports cars from this facility to the US.





This area is a centre for trade and logistics, and includes a large port. Many international businesses, along with electronics facilities including Intel and IBM, have also set up in the area.

The park provides more than 100 000 jobs in 3600 companies. Their main focus is research and development of electronics and other products, information technology and biomedicine. Much of the research development in this area is aimed at businesses operating in the Pudong region.

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Pudong and globalisation

Pudong, and indeed all of China's new industrial regions, are influenced greatly by globalisation. It could be argued that these cities would not even exist without the new interconnectedness of countries. The influence of globalisation on Pudong can be seen in a range of ways.

Global demand for goods made in the region

Regions across the world demand goods made in these regions, and many workers in Pudong rely on this for their employment. Industry in many of these sectors can, as a result, be affected by **recessions** occurring in other countries, when people may be less likely to buy products.

recession a period of economic downturn: many businesses close and people lose their jobs

Influence of foreign companies

Foreign companies have a variety of influences in the city, because they set up their own factories and contract locally owned factories in the area. This means a large portion of economic growth in the area is reliant on foreign investment. These firms also send workers from their native countries to Pudong, so there are significant **expat** communities in the Pudong area.

expat a worker from overseas

Cultural influences

The Chinese government planned Pudong so that it would look like a modern international city, so it has huge skyscrapers in the riverside financial district. Much of the traditional architecture has been knocked down. This process has also occurred in other Chinese cities, most notably Beijing.

Source 7.26 Historic buildings such as this were knocked down in the reconstruction.

1 List 3 products that are manufactured in China.
2 Describe and explain the location of China's population.
3 Imagine you were setting up a factory in the Waigaqiao free trade zone. Explain how the other 3 zones within Pudong could benefit your business.
4 Discuss how China's planning and building of factories differs from that of western countries.

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Effects of the growth of manufacturing in China

The rapid and sustained growth of China's economy has had a range of economic, social and environmental impacts on the country.

Rapid increase in wealth of the population

Despite cheap labour being one of the main factors behind China's economic growth, wages paid to manufacturers are roughly 3 times what they were in 2005. This has led to a rise in living standards for all those working in factories. At the other end of the scale, China is now producing a class of 'super-rich', as owners of businesses profit from the strong performance of Chinese companies.

Geographical fact

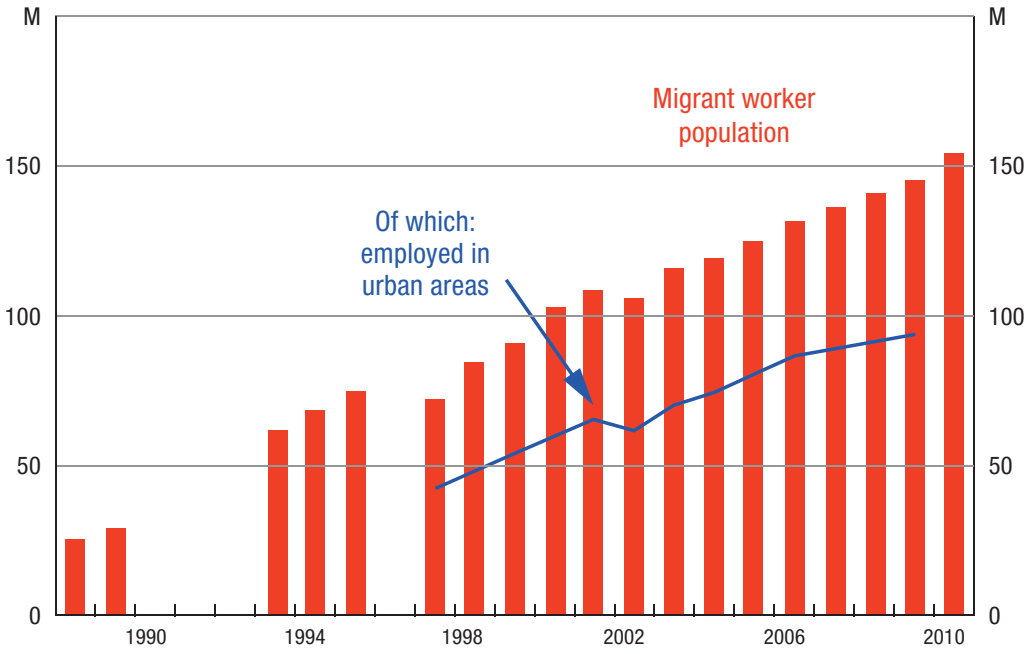
1 in 175 people in Shanghai is a millionaire and there are 7000 billionaires living in the city.

As the population gets richer their demand for goods such as cars and electronics, along with real estate, also increases. Factories and workers are needed to supply this demand, and this increase in production, which means more money is being paid and being spent, makes the economy grow yet stronger.

This increase in wealth does not affect the whole of the population, however. Those still in rural areas earn on average less than $500 per year.

Rura–urban migration

The movement of people from poor rural areas to cities is perhaps the most dramatic effect of China's economic transformation. In China in 2010 there were around 150 million migrants from rural areas living in urban areas – around 7 times Australia's total population!



Source 7.27 Number of rural migrants in urban areas

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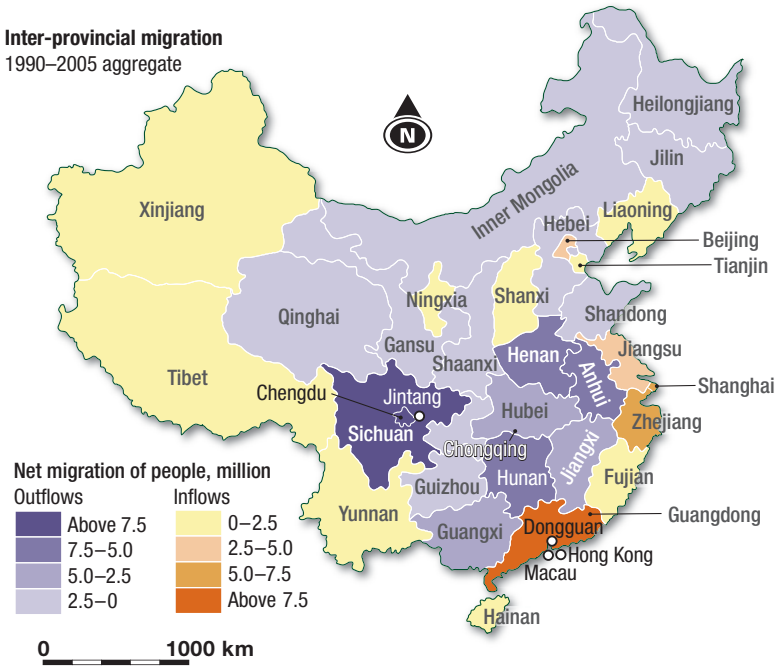
This has a range of effects. As the Source 7.27 graph shows, a significant number of these migrants are unable to find work, which leads to an increase in the number of urban poor. Most of these migrants are young, between 18 and 35, and may be granted only temporary status to stay in the cities. The government sometimes limits them to stays of between 1 and 3 years: the plan is to manage growth and ensure that there are not too many workers for the jobs available.

The map below illustrates how dramatic this shift in population can be, with provinces such as Chengdu losing over 10% of its population in 10 years, while regions such as Donguan increased at a similar rate.



Source 7.28 Internal migration within China

Source 7.29 Street person in Beijing, China. Twelve per cent of China's population live in extreme poverty (subsisting on less than $1.25 per day).

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Case study 7.2
Rural–urban migration stories

Liang is 62. He lives in a village in Guangxi province in southern China, where he tends to crops on steep terraces. Liang has two children, but both have headed to cities to work, one to Hong Kong and one to Shenzhen. Although they said they would return, they are now earning 3 times what he earns. He is worried that there will be no-one to take over the land, or look after him and his wife when he gets too old to work. Almost all the young people in the village have left, although a few have returned with money. His home has no running water and it is a 20 km trip to the nearest doctor.

Jiao is Liang's daughter. She is 37. Jiao works in a clothing factory in Shenzhen, and her husband works collecting recycled bottles around the city. They have a son, Hui, who is 17. Most of their spare money goes on school fees for Hui, who they hope will study and become an accountant. Their apartment is cramped, only 15 m^2, and rents have risen a lot in the last few years. Jiao's husband suffers from respiratory diseases as a result of working outside in the pollution. Although Jiao works long hours she thinks she will stay in Shenzen as the money is better. However, if she saves enough she may return to her village.

1 From the two accounts make a list of 'push factors' (things pushing people away) from rural areas and 'pull factors' (things attracting people) to urban areas.
2 From Jiao's account, make a list of advantages and disadvantages of living in the city.
3 Suggest why young people should stay in their villages.
4 List the benefits of migrating to urban areas.

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ACTIVITY 7.4

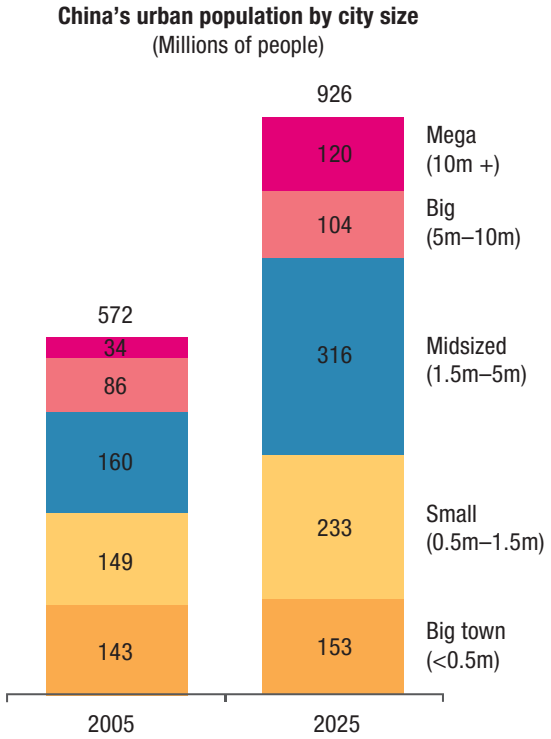
Read the two case studies of rural–urban migration on the previous page. Imagine you were living in a rural village and have left it. Write a letter to your father explaining why you left and explain what your life in the city is like. Use the other sections of the chapter to help you.

Source 7.31 New urban development in Shandong Province

Rapid urbanisation in industrial areas

As migrants move into areas in large numbers, and businesses continue to open up to take advantage of China's industrial strength and development, rapid **urbanisation** has occurred.

urbanisation an increase in the proportion of people living in built-up areas



Source 7.30 China's projected urban population by 2025

As the graph shows, almost 1 billion Chinese will live in cities by 2025. That is the equivalent of creating around 400 cities the size of Adelaide in just 20 years. While many of these people will earn higher wages, and some aspects of their life may be improved, there are also a number of negative impacts associated with rapid urbanisation, including pressure on water supplies, issues with pollution, and lack of services such as health care and schools.

Environmental effects of industrialisation in China

The rapid industrialisation that has occurred in China has caused some extreme environmental problems. While these problems also occurred during industrialisation in countries such as Britain in the 18th century, the huge scale of industrial output in China has led to more severe problems in terms of air and water pollution, as well as concerns over the burning of fossil fuels and carbon emissions.

Air pollution

Air pollution in China occurs as a result of both emissions from heavy industry and the burning of coal in power factories. Sulfur dioxide and particulate matter are estimated to kill over 600 000 people in China every year.

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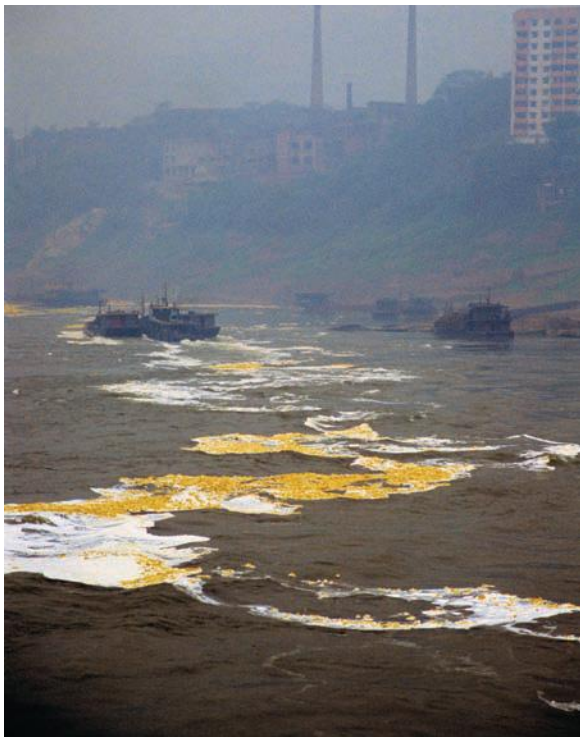
Source 7.32 Smog over Shanghai



Source 7.33 Industrial pollution in the Yangtze River

Air pollution in China is so severe that it has started to change atmospheric conditions in some areas, reducing rainfall and affecting the ability of vegetation to grow. Acid rain is also an increasing problem – it has been linked to the increasing number of cars in China. Neighbouring countries, including Japan, have seen forests destroyed as a result of acid rain created in China.

Water pollution

Up to 40% of China's river systems are considered to be suffering severe pollution. The main causes of this pollution are industry – chemicals and waste products – and inadequate waste systems in urbanised areas.

Responses to pollution in China

Until recently China has done relatively little to reduce pollution levels, arguing that other countries industrialised without strict pollution controls and they should be allowed to do the same. In the last 5 years, though, the government has conceded that something must be done and stricter monitoring and restrictions on emissions have been put in place. The Chinese government is also investing heavily in research into renewable energy. However, as factories continue to be built, requiring power which still largely comes from coal-powered electricity, emissions continue to rise. As the population becomes richer, pollution levels are likely to rise still further through increased car ownership and the use of more appliances.

Pollution in China: are we to blame?

While it is easy to think these environmental issues are entirely the fault of the Chinese and their government, in reality it is more complex than that. Our desire for cheap products means companies in Australia and other countries have their goods made in China. So by buying those goods we are, in some respects, responsible for at least some of this damage. It is important to remember that we live in an interconnected world: the decisions and choices we make have impacts in other countries.

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RESEARCH 7.3

Produce an A3 broadsheet entitled 'Environmental issues in China'. Carry out research into air and water pollution using the internet, books and journals. Use images, graphs and statistics to explain:

- causes
- effects
- possible solutions for industrial pollution in China.

Industry and regional growth in China

As this chapter has already stated, manufacturing has been hugely important to the national economy of China. These industries have also transformed entire regions, raising standards of living and changing the way of life for inhabitants. While Silicon Valley's growth has been led almost entirely by companies and private investment, with little planning, China's central government has carefully planned the growth of specific regions, providing the conditions for industry to succeed.

Case study 7.3
The Pearl River Delta

Source 7.34 Map showing the population of the Pearl River Basin

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Source 7.35 Shenzen in 2010. Its population was 25 000 in 1980.

Until the 1980s this small region of China was mostly rural, with small towns and villages. Its population is now around 40 million and its economy is worth almost $500 billion. The Chinese government took advantage of the finance and services in Hong Kong and created an SEZ here, attracting investment from Taiwan, Japan and Europe. While the area's success was at first based on huge production of low-quality low-tech products, the area has now diversified into hi-tech products and financial services. The government now focuses on attracting these higher-value foreign companies: service industry companies are more profitable because they pay higher wages; they also reduce the area's reliance on manufacturing.

The rapid urbanisation of the area has, however, created severe problems in terms of transport and infrastructure, and living conditions. As the map illustrates, the population density in some areas is 14 000 people per square kilometre, around 10 times that of the busiest cities in Australia. A lack of available land is also pushing prices of land up, so many businesses have relocated to cheaper regions of China with lower wages and more space.

1 State how much the economy of the Pearl River Delta is worth.
2 Use the map to find out which side of the river has the highest population density. Explain how you can tell.
3 List 3 problems the region is facing.
4 Describe 3 differences between the Pearl River Delta and where you live that are the result of the higher population density in the Pearl River Delta.

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The future of manufacturing in China

China's rise in terms of industrial output has been spectacular, but it is not clear what the future will hold. There are a range of factors that may affect its performance.

Environmental concerns

The chapter has already explored the problems of air and water pollution in China. Environmental pollution has started to affect productivity in many regions as workers become sick, and the costs of cleaning up polluted areas are immense. The need for cleaner power is also affecting their future. While giant hydro-electric power (HEP) schemes such as the Three Gorges Dam are meeting some needs, yet more power will be required – and it is likely to come from polluting sources such as coal.

Source 7.36 Three Gorges Dam. More power will be required to maintain industrial growth.

The threat of other countries

As the level of manufacturing in China has increased, the country has become wealthier and wages have increased. This has led to costs in Chinese factories also rising, which means they have become less competitive compared with poorer nations such as the Philippines, Thailand and India. These nations are increasingly rivalling China in lower technology manufacturing such as textiles and plastics.

Hi-tech industries

Many regions in China are now investing in hi-tech factories that produce goods with much higher retail value. This increases profitability, because of the greater difference in these companies (from western companies, which pay higher wages) between the cost of production and the price for which the product is sold. China has an increasing number of highly skilled workers who are graduating in fields such as IT and engineering, and they are increasingly employed in these types of industries.

The development of the interior of China

With almost all the major industrial hubs located on the coast, there is potential for more industries to be located in the middle of the country, where there is more land available and cheaper labour. This may allow China to remain competitive with its rivals.

RESEARCH 7.4

Using the internet, find and list products (other than electronics) that China is a competitive supplier of. Explain, for one of these products, how and why it is cheaper to produce it in China than in Australia. In your answer, refer to working conditions and technology used.

7.3 Where your laptop comes from

As this chapter has explored, where products are manufactured and sold is a complex and ever-changing story. An excellent example of these complexities revolves around where a laptop is produced. This product is likely to have been designed and manufactured in lots of different countries.

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Design

Your laptop, if it is made by a company such as HP or Apple, is likely to have been designed in Silicon Valley. These companies keep processes such as designing and research and development in these types of regions to take advantage of the expertise and skills of the workers there.

Sourcing of raw materials

Many parts in your computer are made from silicon chips. Silica for this purpose is mined in a variety of locations, including Nevada in the US. Other raw materials required may include rubber for keys, which may come from Brazil or Malaysia, as well as copper and other metals. Copper from this mine at Mt Isa may make its way into your laptop.

Manufacturing of components

A laptop has up to 30 components. These components are likely to be made in a wide range of countries. The country of origin is usually dictated by how advanced the manufacturing process is. So some complex items, such as the main CPU, are probably still manufactured in the US, South Korea or Taiwan, although new hi-tech factories are being built in Southeast Asia. Other items, such as keys, are likely to be pressed out in huge volumes in factories in China, or in countries with low labour costs, such as the Philippines or Thailand.

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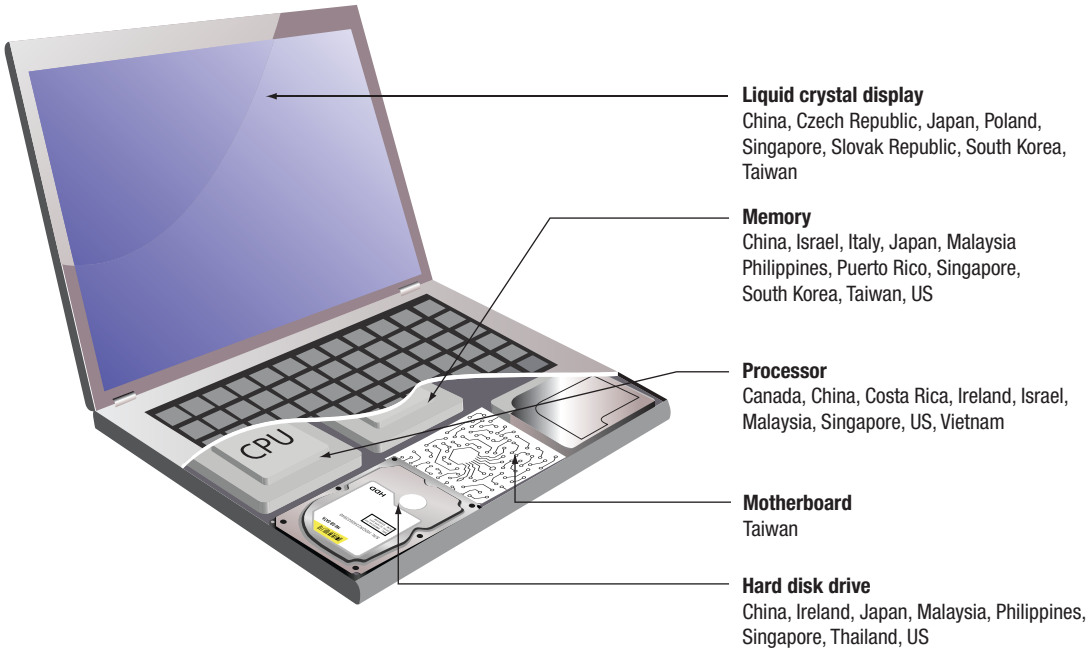
Assembling the laptop

Chinese factories assemble 70% of the world's laptops. While some companies, such as Toshiba, have their own factories, most businesses **outsource** their assembly lines to companies in China. Many of these assembly lines will be producing computers for a number of companies at the same time. These factories are likely to be near ports and airports so that components can be shipped in and laptops shipped or flown out.

outsourcing contracting part of a business function to another person or business



Source 7.37 Major laptop components and possible country of origin

Selling laptops

Until recently laptops may have been assembled in China but sold through retail outlets all over the world. Advances in communication and technology are now allowing companies to bypass this process, and sell direct to the consumer. As the diagram above illustrates, computers can be ordered in the US, custom built in Shanghai with the desired components, and shipped out directly to the customer within 24 hours. This type of process maximises profits for the computer companies, as they cut the retail step out of their costs, while increasing convenience for the consumer. It has, however, affected physical computer shops, which are struggling to compete with the computer companies because of their overheads – such as rent and staff. People are becoming more comfortable buying expensive goods over the internet, so this change in business practice is likely to accelerate.

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ACTIVITY 7.5

1. Explain why computers are still designed in countries such as the US.
2. List the steps in the designing, making and assembling of a laptop and then compare the levels of technology required for each step.
3. Discuss why computer companies outsource the assembly of their laptops.
4. Create a map of the country of origin for the computer parts used in the HP laptop.

NOTE THIS DOWN

Copy the graphic organiser below and create a storyboard that follows the production of a laptop. Find or draw an image of each step, and include notes on the process.

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Chapter summary

- Industrialisation, first seen in the Industrial Revolution and more recently in developments in China, has changed the way people work and live.
- Industrialisation has occurred at different times and at different rates depending on a wide range of factors, including physical location, influence of other countries and advances in technology.
- Capitalism has developed through industrialisation; capitalist countries have grown more, economically, than non-capitalist countries.
- Heavy industry shaped cities such as Pittsburgh, providing wealth and employment, but also producing severe environmental problems. In recent years, Pittsburgh has undergone regeneration, taking advantage of its industrial heritage.
- Hi-tech industries have grown dramatically in developing countries.
- Regions such as Silicon Valley in the US have taken advantage of a skilled workforce, venture capital and innovation to create economic growth.
- China has risen as a centre for manufacturing as a result of a range of factors, including a desire for cheap goods from consumers, careful central planning and a cheap and flexible workforce.
- Rapid industrialisation has occurred unevenly, creating wealth in only some regions.
- Products such as computers are designed, manufactured and assembled in a wide range of locations, linking developed and less developed nations. The way we buy items such as computers is also changing as a result of technology.

End-of-chapter questions

Multiple choice

1 The Industrial Revolution began in:

A the US.

B Britain.

C China.

D Australia.

2 Pittsburgh's development as a centre of the steel industry came about as a result of:

A cheap labour.

B abundance of raw materials.

C a reliable water supply.

D all of the above.

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3 Which two of the following features are associated with integrated mills?

- **A** Housing built nearby or on-site for workers
- **B** Water-driven machinery
- **C** Rail and water transport directly on the site
- **D** Built out of wood

4 What is a Special Economic Zone (SEZ)?

- **A** A region with its own currency and bank
- **B** A region with higher taxes and import duties
- **C** A region where foreigners are not allowed to own businesses
- **D** A region where there are tax reductions for business and free trade is encouraged

5 Why are computers assembled in China rather than in the US?

- **A** It is closer to the biggest market of computer buyers.
- **B** Workers are paid less there, making assembly cheaper.
- **C** Its climate is more appropriate.
- **D** It is cheaper to transport computers from there.

Short answer

1 Using an example, explain how the capitalist system is supposed to work.

2 Suggest one cause and one effect of the decline of motor vehicle manufacturing in Australia.

3 Using the Pittsburgh example and the other examples of regeneration provided, state 3 common factors required when renewing old industrial areas.

4 Describe and explain the location of China's industrial regions.

5 Provide two reasons for why it may be too expensive to construct and assemble a computer in the US.

Extended response

Write a report comparing industry in China (either in the Pearl River region or in Pudong) with that in Silicon Valley. You must:

- describe the different types of industry found in the two locations
- explain the causes of the two types of industry growing in these regions (refer to both the physical and human geography of the two locations)
- evaluate the effects of industry using the terms 'economic', 'environmental' and 'social'.

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8 Consequences of consumption

Source 8.1 Woman miner quarries stones in Shinyanga, Tanzania

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Before you start

Main focus

Decisions about what we buy, use and discard have short and long-term social and environmental consequences.

Why it's relevant to us

As global citizens, we are connected with all people living on Earth and hold responsibility for the wellbeing of future generations.

Inquiry questions

- What determines our purchasing decisions?
- What do we need to know to make our purchasing more socially and environmentally sustainable?
- How can we influence more sustainable manufacturing, consumer and waste disposal?

Key terms

- Fair trade
- Globalisation
- Global citizenship
- Information and communications technology
- North–south gap
- Transnational companies

Let's begin

When we buy something, we need to consider more than just how much it costs and what we will use it for. We also need to think about and understand the impact of our purchase on other people's lives and the environment. Where was the item made? Who made it? In what workplace conditions was it made? What is the short- and long-term impact of this on the environment? How did the item get to us? What will happen to the item after we have finished with it? What alternative items are available?

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8.1 Globalisation and global citizenship

The increase in trade across the world is part of globalisation.'Globalisation' is the term used to describe how obtaining raw materials, producing and manufacturing goods and services, trading and markets, financial services, technology and communications have become increasingly interdependent at the world level. The world marketplace is now more influential than national and regional marketplaces.

At the same time, people are becoming much more aware of the links between the economic and social impacts of globalisation and changing global environmental patterns and processes. For example, there are now studies on the relationships between human activities and changing local and global weather and climate patterns.

As consumers of the products of globalisation we are connected with the social, economic and environmental consequences of globalisation. How we see, and understand our rights and responsibilities as connected global consumers, and how we use those rights and bear those responsibilities, is us engaging in **global citizenship**.

global citizenship our rights and responsibilities as citizens of the global community as well as our rights and responsibilities as citizens in our local community and the country we live in

Global citizenship includes being interested in and informed about what is happening in our local community, country and other places in the world, and what that means to the world's, other people's and our future. It is also about what actions we are taking, or will take, to make the world a safer and fairer place to live in.

To be wise and responsible consumers we need to understand more about how what we buy is produced, manufactured and transported, about world trade, and about the links between all these things and human rights and environmental sustainability.

ACTIVITY 8.1

For a product that you have recently bought, or are looking at buying, find out about:

- the raw materials used – are they mostly:

Renewable | Non-renewable | Do not know

- the environmental impact (on habitat, biodiversity, water, greenhouse gas emissions (GGE)) of obtaining its raw materials:

Low | Moderate | High | Do not know

- the levels of GGE associated with processing the raw materials into the product

Low | Moderate | High | Do not know

- the working conditions in the raw material sites and the processing sites

Exploitative | Good | Do not know

- where the product was made:

Locally | Australia | Overseas

- how long you think you will use the item for

0 | 1 | 2 | 3 | 4+ years

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ACTIVITY 8.1 *continued*

- how you will dispose of the product:

Sell | Recycle | Store | Dump | Other | Do not know

- the environmental impact (on habitat, biodiversity, water, GGE) in disposing of the product:

Low | Moderate | High | Do not know

- whether or not the company that manufactured the product has policies relating to fair trade and work practices and environmental sustainability

Yes | No | Do not know

- where you can find out more about the social, environmental and economic impact of the product.

Once your class has finished their personal surveys, have a class discussion on the level of pre-purchase awareness of the class. Then use the graph below to indicate your opinion on pre-purchase awareness levels in your class.

LEVEL OF PRE-PURCHASE AWARENESS

Low High

Mark on the line where you think:

- the class average awareness is (A)
- the person with highest awareness is (H).

In the past this survey would have been a much easier task, as people purchased fewer products, particularly electronic products, than we do today. Also, people were also more likely to have produced a lot of what they used (especially food) themselves or purchased it from within their local area.

Now even a bunch of grapes we eat may have come from California and the garlic cloves we use in a stew could have come from Argentina.

Geographical fact

Research has shown that in the typical Australian household there are 67 items that run on mains power.

ACTIVITY 8.2

1. Describe what global citizenship means to you.
2. Explain how important global citizenship is to you.
3. Compare what you are now doing as a global citizen with what you intend to do in the future.

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8.2 Ethical behaviour and the information and communications technology (ICT) industry

information and communications technology (ICT) devices that can electronically receive, store, retrieve and manipulate digital data, and communications technologies, such as the internet and wireless, that transmit information

Information and communications technology (ICT) is a vital driving force behind globalisation because it connects the world.

The ethical use of ICT devices and technologies is more than using mobile phones or Facebook in socially acceptable ways. It also includes being aware of the social and environmental impact of the production, use and disposal of our ICT devices.

In terms of manufactured products, ICT devices, particularly smartphones, are among the fastest growing in the world today.

Geographical fact

By the end of 2012 there were over 1 billion smartphones in use in the world. The number is currently increasing by approximately 50% each year. If this trend continues, by 2020 there will be more smartphones in the world than people.

tantalum a heat-resistant powder, refined from ores such as coltan (columbite-tantalite), that can hold a high electric charge

capacitors passive electronic components – ie they do not require extra electricity to function – that, in a circuit, hold a voltage, or a charge, for a specific period of time when the electronic device is unplugged from electrical outlets

A wide variety of minerals are used in the manufacturing of smartphones and other electronic devices. Coltan is an ore that contains the mineral **tantalum**, which is used in the **capacitors** of smartphones. Tantalum is an essential element in smartphones, laptops and most other electronic goods.

The growth of multifunctional super computers such as smartphones and tablets has been made possible by reducing the size of the capacitors used in them: the smaller the capacitor, the smaller the electronic device can be.

Australia, Brazil, Canada, the Democratic Republic of the Congo (DRC), Ethiopia and Rwanda are among the world's leading tantalum producers.

Where and how the minerals are mined can have major human rights and environmental impacts. The mining of coltan in the DRC provides a significant example of human rights and environmental abuse.

Source 8.2 Tantalum capacitors

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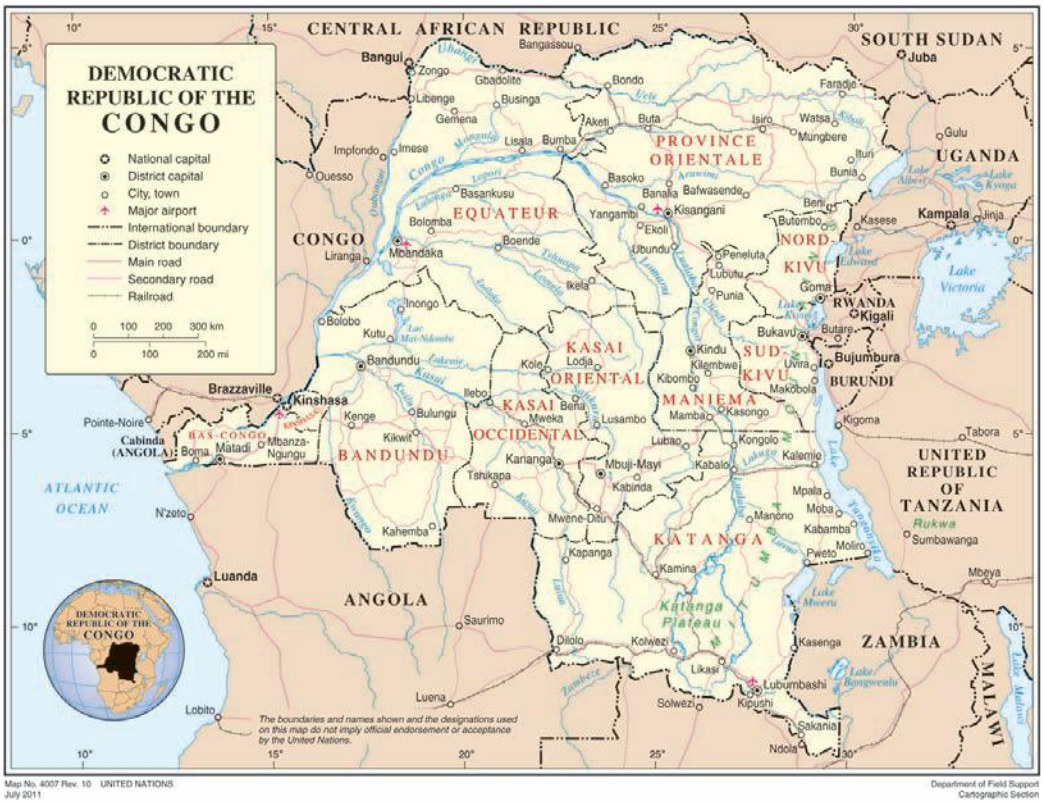
Coltan mining in the Democratic Republic of the Congo



Source 8.3 Location of the Democratic Republic of the Congo (DRC)

While many tantalum-producing countries follow satisfactory ethical, social and environmental practices, there are some, particularly the DRC, where this has not been the case. In the DRC there have been and continue to be major human rights abuses and severe environmental damage.

It is estimated that the DRC holds somewhere between 15% and 30% of the world's reserves of coltan.

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RESEARCH 8.1

Use the internet to gather information on the Democratic Republic of the Congo (DRC), then complete the following tasks. Go to www.cambridge.edu.au/geography9weblinks to find links to the following websites, which may be used as starting points in your research:

- Infoplease: Congo, Democratic Republic of the
- US Department of State background notes on the Democratic Republic of the Congo
- BBC News Africa Democratic Republic of the Congo profile
- Transport in the Democratic Republic of the Congo, Princeton University.

1 List four reasons why the DRC is a difficult country to govern. In your answer, consider the following:
   - the number of countries that border the DRC, the unrest in these countries and the relationship between these countries and the DRC – for example, research the internal fighting in Rwanda and Burundi that led to a huge flow of refugees into the eastern provinces of the DRC in 1994
   - the physical geography of the country and the location of Kinshasa, its capital city
   - the transport system – water, road, air and rail
   - the number of African ethnic groups and languages in the DRC.

2 Share and discuss your list with the class and select the top three reasons why the DRC is so difficult to govern.

Conflict minerals

conflict minerals minerals mined in areas where there are armed conflict and human rights abuses

The tantalum and other minerals being obtained from the eastern provinces of the DRC are mainly **conflict minerals**.

In the DRC, much of the coltan ore mining, along with gold, tin and tungsten (a metal used in smartphone and tablet devices' touchscreen technology because of its hardness, stability and ability to withstand extreme temperatures) occurs in the eastern provinces of Maniema and South and North Kivu.

The mining in these provinces is usually carried out by small groups (less than five people), often farmers, using manual labour and very basic tools. There can be thousands of miners in one river bed mining site. Using their hands and crude digging tools they dig down, forming pits in the river bed. Water is poured into the pit and mixed with the minerals and other material in the mud. The coltan nodules are heavier than the other material and sink to the bottom of the pit, where they are scooped out by hand. This form of mining is called **artisan mining**.

artisan mining individual or small group mining activity carried out using minimal machinery and very basic tools, such as a bucket and spade

The miners do not have licences to mine. Therefore they have no legal control over what they find. There is no organisation of the miners to manage how they work or to trade their minerals. Therefore they are very vulnerable to the powerful military groups who control much of the eastern provinces.

Source 8.4 Artisan coltan mining

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RESEARCH 8.2

Use the internet (start by going to www.cambridge.edu.au/geography9weblinks) to find more information on artisan coltan mining, then complete the following tasks:

1. Describe some of the physical features of a mining site and the surrounding area.
2. Discuss the working conditions of the miners.
3. Suggest reasons for the miners working under these conditions.

For over 25 years the eastern provinces have been in armed conflict. There are many armed groups involved. Some are local militia fighting for control of their land. Others are rebels, supported by neighbouring countries, such as Rwanda and Uganda, fighting to take control of the country. There are also criminal groups from within the Congolese Army. As a result of this ongoing conflict the DRC government struggles for control in the eastern provinces.

The rebel groups and the militias use the taxes, minerals, bribes or other payments they seize from the artisan miners to fund their activities. The miners and their families are powerless victims of these groups, in which child labour, torture and summary executions are commonplace.

transnational companies (or corporations) companies that operate their businesses in and across more than one country; also called multinational companies

Large **transnational companies** have also played a part in this abuse of the miners. The companies have negotiated with the rebel groups and militias to buy the minerals seized from the miners very cheaply. The rebels and militias use the money they make from the companies to buy weapons and further assert their authority over the local population through violence. So the foreign companies, and the global markets for their products, are contributing to the continuation of the wars and human rights abuses in the DRC.

The ore seized from the miners is moved across the borders into countries that support the armed groups or into the foreign companies' supply chain. The transportation and refining of the ore brings wealth to these countries and transnational companies. It also makes it difficult to trace the origins of the minerals – once they are refined, the minerals are moved a number of times through Africa, Europe and Asia. During all this the conflict minerals are mixed with those from legitimate mining sources.

It is therefore difficult to identify if the tantalum in our smartphones' capacitors came from a conflict mining site or a legitimate mine.

There are now a number of moves to prevent conflict minerals from entering the marketplace.

Eliminating conflict minerals trade

The United Nations, working with the DRC government and the African Union, is putting guidelines and regulations into place that it hopes will reduce the trade in conflict minerals in the DRC and its neighbouring countries. The guidelines aim to remove the money supply of the armed groups and reduce human rights violations.

The United States, under the Dodd-Frank legislation of 2010 – which made the most significant changes to financial regulation in the US since those made after the Great Depression in the 1930s, in response to the Global Financial Crisis of 2008/9 – requires all large public US companies (public companies are those that trade on the share market) to provide information on the source of minerals contained in their products every year.

There are also groups in the ICT industry working to provide guidelines to improve social, economic and environmental conditions in the global electronic supply industry. For example, in 2007 the Global e-Sustainability Initiative (GeSI) and the Electronic Industry Citizenship Coalition (EICC) joined, to build expertise in the business processes and issues surrounding extraction of metals used in electronics products. Their work includes identifying conflict-free **smelters**.

smelter a factory where a metal (such as tantalum) is melted under extreme heat to separate the mineral (such as coltan) from the ore containing the mineral; conflict-free smelters use only minerals from lawful sources

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RESEARCH 8.3

1 Go to www.cambridge.edu.au/geography9weblinks and follow the link to the Raise Hope for Congo (Enough Project) Conflict Minerals Company Rankings website to research what the ICT companies you buy products from are doing (or not doing) to contribute to a clean minerals trade in the DRC, and other countries, and their commitment to improving workers' human rights.

2 You can also visit the home pages of the companies to get information. Information on what you are looking for may be difficult to find. Sometimes it is under the tag 'About (company name)' and then under 'Global Citizenship'.

3 Write a report (2–3 paragraphs) summarising the information you found out about the companies' commitment to using clean minerals and maintaining workers' human rights.

4 At the end of the report explain how the information you gained could influence your future purchasing.

Environmental impacts

The artisan mining sites are also having major impacts on the local environment.

The coltan artisan mining sites are often located in or close to nature reserves such as the Kahuzi-Biega National Park and the Okapi Wildlife Reserve. The movement of hundreds of thousands of people into these areas is having a serious impact on the forests, as they are cleared for fuel and building materials, and on the native animals, as their habitat is being reduced in area. Many animals, including gorillas and elephants, are being slaughtered for food. Because coltan mining occurs in river beds and uses crude methods of extraction, it pollutes the waterways and river banks. It also can create major soil erosion problems.

Source 8.5 Democratic Republic of the Congo National Parks and Reserves

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Source 8.6 Crude methods of extraction cause pollution.

ACTIVITY 8.3

1. Suggest an alternative for countries obtaining their materials from artisan mining sites.
2. Describe other environmental impacts, including impacts on biodiversity, that the miners are having in the areas where they mine.
3. Suggest what can be done to reduce these impacts.

RESEARCH 8.4

1. Go to www.cambridge.edu.au/geography9weblinks and follow the link to Greenpeace – Guide to greener electronics. Research how the ICT companies you buy products from are performing on Greenpeace's three environmental criteria:
   - Energy and Climate
   - Greener Products
   - Sustainable Operations.
2. You can also visit the home pages of the companies to get their information. Information on what you are looking for may be difficult to find. Sometimes it is under the tag 'About (company name)' and then under 'Environment'.
3. Draft two letters, or emails: one to a company you believe has good environmental practices, congratulating it on what it is doing; the other providing advice to a company you believe can improve its environmental practices.

8.3 Disposal of e-waste

Inappropriate disposal of ICT and other electronic goods creates significant environmental and social harm. Australians, as major consumers of electronic goods, need to be aware of their responsibilities in the disposal of these goods.

With a population of 23 million people (as of 23 April 2013) Australia ranks just outside the top 50 nations in population size, but ranks in the top 10 nations in the purchase of electronic goods. Currently more than 4 million computers and 3 million televisions are bought in Australia annually.

A big issue is that over 80% of our **e-waste** goes into landfill. Less than 10% of these items are recycled. With the rapid increase in the purchase of electronic goods this problem will continue to grow unless we change our behaviour.

e-waste (electronic waste) rubbish created by throwing away used electronic devices and components, such as batteries; also, the disposal of materials involved in their manufacture or use

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Geographical fact

If half the televisions we discard were recycled, an estimated 23 000 tonnes of CO_2 emissions would be saved, which equates to about 5300 cars off the road for an entire year.

NOTE THIS DOWN

Copy the graphic organiser below and complete it by listing the reasons for and against each method of disposal.

E-WASTE DISPOSAL

	For	Against
Put in rubbish bin		
Sell		
Take to recycling centre		
Store at home		

Australian governments have been aware of e-waste problems for several years. One problem has been the dumping of e-waste in less developed countries in Asia or Africa. The e-waste was either just dumped in huge piles or crudely recycled. The toxic chemical wastes are exposed as the products break down and enter the waterways, soil and air.

In 1992 Australia signed the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes. The agreement places a duty on countries that export waste to ensure that hazardous waste (including e-waste) is managed in an environmentally sound manner in the country that is receiving it.

In 2011 the Australian government established the National Television and Computer Recycling Scheme. The scheme involves a combination of government rules and industry action to take responsibility for the collection and recycling of waste televisions, computers, printers and computer products. The scheme is continually being improved, but electronic dumping still occurs.

Under the scheme, householders and small businesses can drop off these items free of charge at designated access points, which may include permanent collection sites, take-back events or through a mail-back option.

Source 8.7 E-waste will continue to bring problems unless we change our behaviours as users of electronic devices.

These are positive steps in responsible disposal of our electronic waste. However, there are still major problems.

An SBS *Dateline* report aired on 25 September 2011 and titled 'E-Waste Hell Ghana' found that Australian e-waste was being exported to Ghana as working 'second-hand products' rather than as e-waste, to bypass the Basel Convention. It was then 'recycled' by the locals, including by burning wiring to extract the copper, which releases toxic smoke. People were living on or very near to the

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e-waste dumps. This still goes on in Ghana – go to www.cambridge.edu.au/geography9weblinks and follow the link to the Internal Voices website – with positive and negative consequences.

At the core of the problem for Australia is the fact that the cost of recycling e-waste properly can sometimes be more than the cost of buying the product in the first place.

ACTIVITY 8.4

1 Read the following questions and conduct a class discussion on them.
   - How are consumers of smartphones, tablets and other ICT devices contributing to human rights abuses and environmental damage in many parts of the world?
   - What can we do to be more responsible in our purchase, use and disposal of ICT devices?
2 Write a short essay (up to 250 words) explaining what the problems are and the actions you can take to reduce your environmental and human rights impact as a consumer and discarder of electronic goods.

8.4 Transnational companies

Along with the ICT industry, transnational companies are major drivers of globalisation. Most of the goods we buy have been touched in some way or other by transnational companies: most, if not all, of the electronic gadgets we use, for a start.

shareholder a person with a financial interest in a company

The main aim of the great majority of transnational companies is to increase their company profits and thus please their **shareholders**.

Shareholders are individuals or organisations who own shares (also called stock) in a company. In a sense, the shareholders collectively own the company. A shareholder, or a group of shareholders, has a say in what a company does – how much say depends on the number of shares they have in the company. The value of a company's shares is determined by the price at which the shares are sold in the marketplace (the stockmarket).

Companies gain economic advantages through operating in more than one country. These include:

- having more control over the sources – and therefore the costs – of the raw materials they use
- being able to reduce labour costs, especially in industries that depend on labour rather than machines, such as clothing and assembling electronic goods
- paying lower taxes to governments
- increasing the size of their markets.

These advantages mean that transnational companies can become very large and wealthy. These very large companies are often much wealthier than the countries they operate in.

This makes them very powerful, because poor countries depend on these companies to employ and provide their people with skills, pay taxes for the mining of their resources, and build factories and road, rail, sea and air transport networks.

Transnational companies can therefore help poor countries develop and protect their environment.

However, as we saw with conflict minerals in the DRC, this is not always the case. Some transnational companies are willing to sacrifice human rights and the environment in order to make a bigger profit.

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NOTE THIS DOWN

Copy the graphic organiser below and examine at least five transnational companies whose products you have purchased recently. The products could be food or beverages, clothing and sporting goods, ICT devices and other electrical goods, or something else.

To find the information you need, go to www.cambridge.edu.au/geography9weblinks and follow the link to the websites of the companies you have chosen.

Company name	Country headquarters located in	Types of product/s made and/or sold	Country or countries where products are made	Reasons for location (e.g. cheap labour, close to market, near mineral source)

Case study 8.1

Bangladesh garment factory fire kills at least 112

ABC News (US)
Brian Ross, Matthew Mosk and Ned Berkowitz, 26 November 2012

A company that makes clothes for Sean Combs' clothing brand ENYCE and other US labels reassured investors that a factory fire that killed 112 people over the weekend would not harm its balance sheet, and also pledged to pay the families of the dead $1200 per victim.

In an announcement on Monday (26 November), Li & Fung Ltd, an outsourced company (a small local company) that supplies clothes from Bangladesh factories to US brands, said 'it wishes to clarify' that the deadly Saturday night blaze at the high-rise Tazreen Fashions factory outside Dhaka 'will not have any material impact on the financial performance' of the firm.

The fire broke out on the ground floor of the nine-floor building as hundreds of workers were upstairs on a late-night shift producing fleece jackets and trousers for the holiday rush at American stores, including Wal-Mart, according to labour rights groups. Fire officials said the only way out was down open staircases that fed right into the flames. Some workers died as they jumped from higher floors.

After reassuring investors about its financial health, Li & Fung's statement went on to

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express 'deepest condolences' to the families of the dead, and pledge the equivalent of $1200 to each family. The company also said it would set up an educational fund for the victims' children.

As reported on *ABC World News with Diane Sawyer* earlier this year, Bangladesh has become a favourite of many American retailers, drawn by the cheapest labour in the world, as low as 21 cents (US) an hour, producing clothes in crowded conditions that would be illegal in the US. In the past five years, more than 700 Bangladeshi garment workers have died in factory fires.

'[It's] the cheapest place, the worst conditions, the most dangerous conditions for workers and yet orders continue to pour in,' said Scott Nova, executive director of Worker Rights Consortium, an American group working to improve conditions at factories abroad that make clothes for US companies. Nova said the fire was the most deadly in the history of the Bangladesh apparel industry, and 'one of the worst in any country'.

1 Describe the reason given for the workers working the late-night shift. Identify the main concern of Li & Fung Ltd about the consequences of the fire.

2 The US transnational companies whose clothing brands were being manufactured in the Tazreen Fashions factory said that they would no longer contract with the factory to make their clothing. Suggest, with reasons, other choices the US transnational companies could take to protect the rights and safety of the Li & Fung textile workers.

Geographical fact

In Australia, as of 1 July 2012 a trainee textile worker must be paid a minimum of $15.96 an hour and a minimum $606.40 weekly wage; the highest skilled workers are paid $19.75 and $750.40.

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NOTE THIS DOWN

Copy the graphic organiser below and compare the working conditions of Australian and Bangladeshi textile workers.

Australian textile workers	Bangladeshi textile workers

ACTIVITY 8.5

An increasing number of companies are following socially and environmentally sustainable principles and practices in all the countries they operate in.

A transnational company has asked you, as a global citizen, to form a team to write up a list of four social and/or environmental sustainability **principles** for their company to follow for all the countries they work in.

principles rules or morals that a person or company/group decides to follow

Work in a small group (up to 5 people).

1. Decide what the main business of the company is – for example, is it a mining company, clothing company, cool drink manufacturer, fast food chain, motor vehicle manufacturer? Give the company a name.
2. Identify 2–4 human rights issues that are important to the type of company you have chosen. (Hint: go to www.cambridge.edu.au/geography9weblinks, then follow the link to the Universal Declaration of Human Rights [UDHR], Articles 23 and 24, for some ideas.)
3. Identify 2–4 environmental issues that are important to the type of company you have chosen. (Hint: you could consider biodiversity, waste reduction, impact on carbon emissions, water quality.)
4. Choose 4 issues the company would like you to write principles for.
5. Write a principle for each of the four issues you have selected.
6. Check that the principles make sense, then share them with your class.

A principle is an underlying value or rule that an individual or organisation uses to guide their decision making in their day-to-day life and work.

For example, if the issue for a car manufacturer is to reduce waste, the principle could be: The motor company will design its vehicles so that all components of their vehicles are either reusable or recyclable. [The value is to eliminate waste and the rule is to recycle and reuse.]

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8.5 Fair trade

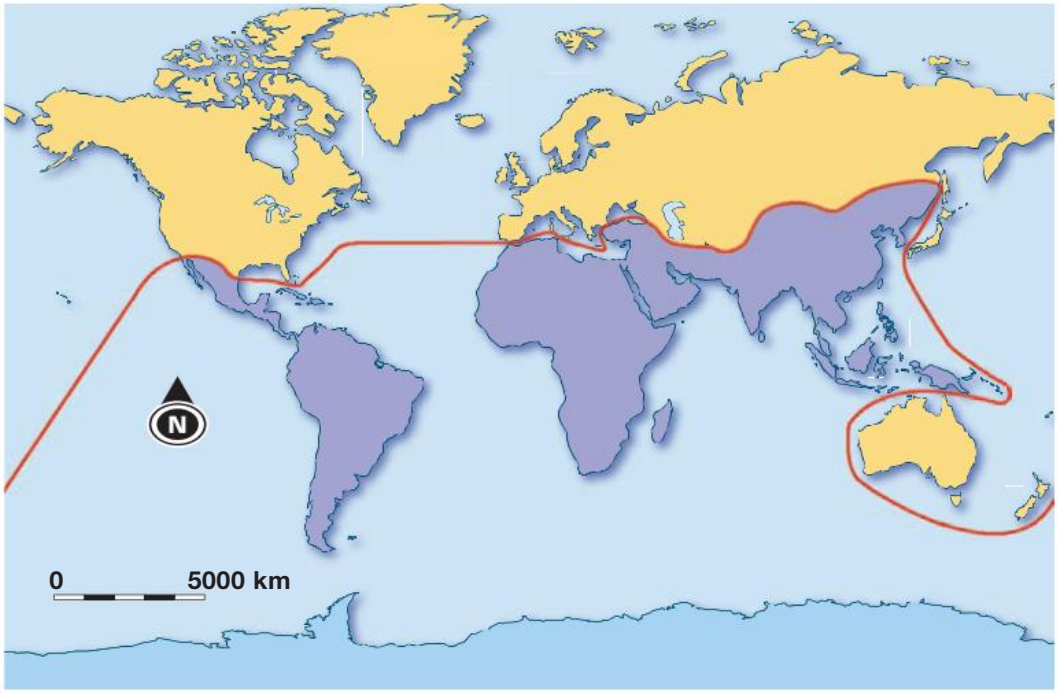
While globalisation and transnational companies are bringing the world together, there is a widening gap between the economically wealthy and the poorer countries of the world.

north–south gap the gap between the economically 'richer' and economically 'poorer' countries of the world – the Haves and the Have-nots

This gap between the richer and poorer countries is often referred to as the **north–south gap**, or divide.

The north (or developed) countries are mainly in the northern hemisphere (North America, Europe, Japan) and are the wealthy countries. These countries have high levels of industrial development, higher standards of living (in health and education, among other things) and are home to most of the transnational companies.

The south (or developing) countries are mainly in the southern hemisphere (South America, Africa and Asia) and are the poorer countries. These countries have less industrial development, lower standards of living and weak workplace protection laws.



Source 8.8 The north–south divide

ACTIVITY 8.6

As a class:

1. Decide whether Australia is a north country or a south country, and provide your reasons.
2. Determine whether China is now part of the north or the south. (Hint – the concept of the north–south gap originated in 1980 and times change.)
3. Investigate where the term 'north–south gap' was first used: was it by people in the developed countries of the north or by people in the developing countries of the south?

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trade the buying and selling of goods and services

Trade between north and south countries is seen as an essential way to reduce global poverty and close the gap between the rich and poor countries.

Developing countries trade mainly in primary goods (food and raw materials such as minerals and cotton) and labour-intensive manufactured goods such as clothing. There are few controls over working conditions and environmental standards. The prices for their goods are largely set by the importing developed countries.

This raises a question – is trade between the south and north countries fair?

fair trade trade based on the buying and selling of products (usually from poorer nations) that have been mined, grown or manufactured under humane working conditions, with appropriate wages for the workers and minimal environmental impact

The **fair trade** movement says that often the trade is not fair as workers, producers and the environment in the developing countries are often mistreated by transnational companies and restrictions are placed on their trade by the developed countries.

Origins of fair trade

The movement towards fair trade has many origins, and goes back to the 1940s. Initially it was mainly people from economically richer (north) countries buying craft work from the handicraft workers in developing countries and selling the craft in their local communities.

Edna Byler, from Pennsylvania, in the US, was disturbed by the poverty levels she saw in the villages she visited in Puerto Rico in 1946. She was impressed by the high quality of the linen needlework done by women in these villages. She bought some of the needlework and sold it to her friends and neighbours. In 1952 she and her friend Ruth Lederach displayed and sold the needlework at the Mennonite World Conference in Basel, Switzerland. The project became the Overseas Needlepoint and Crafts Project. In Europe, the fair trade movement began with Oxfam UK. In 1964 Oxfam began marketing handicrafts from developing countries, aiming to give small-scale producers fair prices, training, advice and funding.

Geographical fact

The name 'Oxfam' comes from the Oxford Committee for Famine Relief, founded in Britain in 1942 during World War II. The group campaigned for food supplies to be sent through an Allied naval blockade to starving women and children in enemy-occupied Greece.

The first Fairtrade Certification and labelling system started in the Netherlands in 1988, with 'Fairtrade' labelled coffee from Mexico being sold into Dutch supermarkets under the Max Havelaar brand.

In 1997, Fairtrade International, formerly known as the Fairtrade Labelling Organization (FLO), was established as an umbrella organisation for 20 Fairtrade certification initiatives in Europe, the US, Canada, Mexico, Japan, Australia and New Zealand. There are currently 586 Fairtrade-certified producer organisations and 469 certified traders in Fairtrade International's network, including TransFair, Max Havelaar, Fairtrade Foundation, and 1.24 million farmers and farm workers from 66 producing countries. Fairtrade International certifies individual products that bear the blue and green FAIRTRADE Mark.

The World Fair Trade Organization (WFTO), formerly the International Federation of Alternative Traders (IFAT), is a separate global network of Fair Trade Organizations. In 2004, WFTO launched its Fair Trade Organization Mark (FTO), through which organisations that meet WFTO's fair trade standards for working conditions, wages, child labour and environment can receive certification as Fair Trade Organisations. The FTO mark is a company label, or logo, and goes on the company letterhead.

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Geographical fact

Fair trade towns

Since 2001, starting with Garstang in England, there have been an increasing number of towns, especially in the United Kingdom and the US, that are committed to following fair trade principles. By the end of 2012 there were 554 fair trade towns listed in the UK, and worldwide there were over 1100 free trade towns spread across 23 countries.

Source 8.9 Products covered by the FAIRTRADE Mark (in the UK)

Food Products		Non-food products
Bananas	Juices	Cotton
Cocoa	Nuts/oil seeds and purees	Cut flowers
Coffee	Quinoa	Ornamental plants
Cotton	Rice	Sports balls
Dried fruit	Soya beans and pulses	
Fresh fruit and fresh vegetables	Sugar	
Herbs and spices	Tea	
Honey	Wine	

ACTIVITY 8.7

1 Identify where you have seen fair trade marked products for sale – specialty shops, supermarkets, street markets.

2 Estimate how often you and/or your family buy fair trade-certified products.

Never | Sometimes | Often

3 Critically analyse the advantages and disadvantages of establishing fair trade towns.

Geographical fact

Fair and ethical trade certification and ethical consumerism

Fairtrade Certified products are part of a growing ethical certification movement that aims to support consumers in richer countries to purchase products from poorer countries that have been produced under sound social, economic and environmental ethical conditions. For example, UTZ-certified coffee, tea and cocoa is based on acknowledging and supporting more sustainable farming methods, improved conditions and opportunities for farming families and a sustainable planet now and in the future.

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Where to now with fair trade?

The fair trade movement over the past 30 years has done a lot to raise the awareness of consumers in the developed world of the need to improve the working and living conditions of farmers, producers, other workers and their families, and their environment in developing countries. The fair trade movement has also made us aware that we, through our purchasing choices, can be part of the solution.

The success of the fair trade movement can be seen by the mainstream shops and transnational companies joining it. In Australia, supermarkets are now selling some Fairtrade Certified products, such as coffee.

Source 8.10 The Fairtrade International FAIRTRADE mark

In December 2009 Nestlé announced that it would be using Fairtrade Certified cocoa in its four-finger KitKats in Britain and Ireland. This was extended to the two-finger KitKats in January 2013.

In Australia KitKats are produced using Rainforest Alliance certified cocoa. For further information on Fairtrade Certified and other ethically certified chocolates on sale in Australia, go to www.cambridge.edu.au/geography9weblinks and follow the link to the World Vision website, then to The Good Chocolate Guide to Australia.

The Ethical Consumer Guide also provides information on Fairtrade Certified or other ethically certified (or not certified) chocolates on sale in Australia. A web search for a 'list of fair trade products Australia' will provide information about the types and sources of other fair trade products available in Australia.

Issues with the fair trade certification of products

Are transnational companies using fair trade certified products because of their commitment to human rights and environmental standards? Or because they see that it is a good way to market their products in places where consumers are committed to ethical buying?

When a fair trade certification or another form of social or environmental ethical certification is used as a marketing tool rather than as a commitment to ethical behaviour, it is referred to as 'cleanwashing'.

RESEARCH 8.5

1 Select two transnational chocolate manufacturers. Go to www.cambridge.edu.au/geography9weblinks and follow the link to the websites of the companies you have chosen. Find out for each company if:

- all, some, or none of the brands of chocolate manufactured by the company use Fairtrade Certified cocoa (hint: search 'Name of company fair trade' or the 'Ethical consumer guide')
- all the countries where the company makes and sells chocolate use fair and ethical trade certified chocolate (hint: search 'Name of company fair trade worldwide')
- the company has business principles that include good human rights, labour and environmental practices (hint: search 'Name of company principles', or 'Business principles' or 'Global citizenship').

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RESEARCH 8.5 *continued*

2 Analyse each of the companies you have researched and discuss whether the company is committed to fair trade ethics or is using fair trade as a cleanwashing exercise. Give reasons for your opinion.

3 The original fair trade producers were poor local farmers and workers and cooperative groups of these farmers and workers in developing countries. Now some large foreign-owned plantations and producers in developing countries are being granted certification status by Fairtrade and other certifers if they follow ethical practices. Respond to this statement in two paragraphs.

NOTE THIS DOWN

Copy the graphic organiser below and identify who benefits most from fair trade.

	High benefits	Some benefit	Little benefit	No benefit
Workers/growers in developing countries				
Fair trade organisations				
Consumers in developed countries				
Transnational companies				
Everyone				

There are now many ethical certifying organisations. For example, coffee can be certified under a number of certification organisations, including UTZ, Fairtrade, Rainforest Alliance and Fair Trade US.

While the sale of fair and ethical trade certified products is growing, they make up only a small fraction of total sales of these products. For example, in 2010 world coffee production rose to 7 000 000 tonnes, with approximately one-third being consumed in the producing countries and approximately 4 700 000 tonnes being exported. In 2010 global sales of Fairtrade coffee reached 88 000 tonnes.

ACTIVITY 8.8

Reflect on the following statement: 'The fair trade movement has been able to make trade between richer and poorer countries fairer.'

1 Divide the class into small groups with each group taking either a positive or a negative position on the statement. Each group needs to identify 3–5 arguments to support its position.

2 Debate, as a class, the statement above.

3 Write two paragraphs summarising your opinions on the outcome of the debate.

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8.6 Palm oil and responsible consumerism

Often we are not aware of the ingredients in the products we buy and therefore are ignorant of the environmental and social consequences of our purchases. Palm oil is one such ingredient.

Geographical fact

Palm oil is found in many of the products we buy at the supermarket. These include cooking oil, chocolate, cosmetics, chips, instant noodles, biscuits, margarine, shower gel, shampoo and soaps.

What is palm oil?

Palm oil comes from the fruit of the *Elaeis guineensis* species of palm, which originates in the equatorial (between 10°N and 10°S of the Equator) coastal regions of West Africa. It has been used by humans for over 5000 years.

Palm oil has a high resistance to oxidation, and therefore to decaying, so it is used in the production of margarine, sweets and baked goods to increase their shelf life.

Palm oil contains a balanced mix of saturated and unsaturated fats and as a result is considered healthier than many other vegetable/plant oils, especially for people concerned about high cholesterol levels.

Palm oil is also a relatively stable product, and remains solid at room temperature (its melting point is 35°C), which makes it well suited for soap and similar products.

Because it originates in the wet equatorial region of West Africa, palm oil is ideally suited for growing in other equatorial regions of the world, especially in Southeast Asia. Four West African Deli Dura palm oil seedlings were planted in Buitenzorg's (Java) botanic gardens in 1848. The descendants of these four seedlings became the breeding stock for the first commercial plantings in Indonesia and Malaysia in the early 1900s. Southeast Asia has both a favourable growing environment and a lack of pests and diseases, so these plants produced oil that was superior in quality to that from West Africa.

Since the 1980s there has been a rapid increase in the production of palm oil, particularly in Indonesia and Malaysia, which together produce over 80% of the world's palm oil.

Source 8.11 Fruit from the palm oil plant being dragged

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ACTIVITY 8.9

1. If you can work it out, make a list, over one week, of all the products that contain palm oil that your family buys.
2. At the end of the week share your list with the class and draw up a list of the top five products.
3. Discuss your findings with your family or friends and find out if they knew that palm oil was used in so many products.

Source 8.12 World palm oil production 2009–11 in millions of metric tonnes

	2009	%	2010	%	2011p*	%
Indonesia	21.00	46.00	22.20	48.40	23.90	48.79
Malaysia	17.56	38.79	16.99	37.04	18.00	36.75
Thailand	13.10	3.00	1.34	2.92	1.45	2.96
Nigeria	0.87	1.90	0.89	1.93	0.90	1.84
Colombia	0.80	1.80	0.75	1.64	0.85	1.74
Papua New Guinea	0.48	1.00	0.50	1.09	0.53	1.08
Ecuador	0.43	0.90	0.36	0.78	0.40	0.82
Cote d'Ivoire	0.35	0.80	0.30	0.65	0.32	0.65
Cameroon	0.34	0.70	0.35	0.75	0.35	0.71
Honduras	0.28	0.60	0.28	0.60	0.29	0.59
Costa Rica	0.22	0.50	0.24	0.51	0.25	0.51
Brazil	0.24	0.50	0.25	0.54	0.27	0.55
Others	1.39	0.30	1.44	3.13	1.49	3.04
World	45.27	100.00	45.87	100.00	48.99	100.00

* p means predicted: the table was developed in 2011, before the figures were finalised.

Environmental impacts

The expansion of palm oil production is leading to the clearing of the natural rainforest in large areas of Indonesia and Malaysia. The clearing of the forest usually also involves large wildfires and illegal logging operations.

This clearing is the major cause of deforestation in these countries. This deforestation results in a loss of habitat for animal and insect species and a reduction in plant biodiversity. The United Nations Environment Program (UNEP) has predicted that by 2022 the palm oil industry could wipe out 98% of Indonesia's remaining rainforests.

The reduction of habitat in the southern Malaysian peninsula has resulted in an over 70% reduction in bird numbers, and in Indonesia it could result in the loss of the orang-utan and Sumatran tiger.

The extensive deforestation also has major climatic implications, as mature tropical rainforest acts as a store or sink of carbon. When the forest is burnt or logged, carbon dioxide is released into the atmosphere. As the life cycle of a palm oil plantation is very short (less than 30 years) compared with that of rainforests, plantations contribute to carbon emissions into the atmosphere rather than acting as carbon sinks.

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The threats of deforestation and greenhouse emissions from oil palm plantations are so grave that the World Bank has now suspended lending to palm oil producers until safeguards are developed and implemented to ensure that such lending doesn't cause further social or environmental harm.

Source 8.13 Clearing land for palm oil production is a major cause of deforestation.

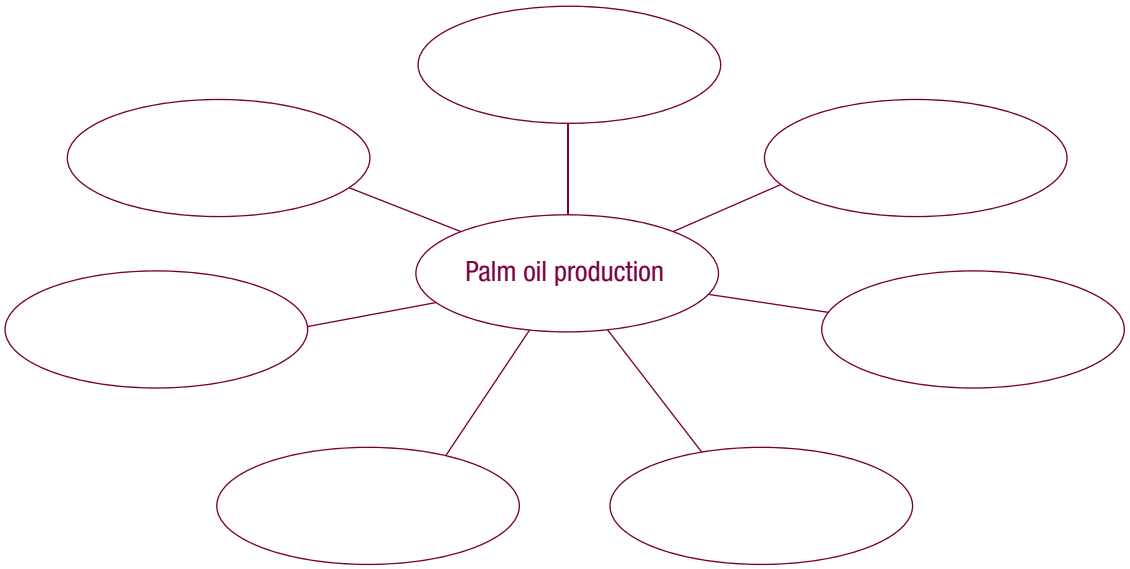
Social impacts

The destruction of the rainforests and the creation of large palm oil plantations, many of which are owned by transnational companies, has had a considerable impact on the lifestyle and rights of the people who have lived with the forests for hundreds, if not thousands, of years. Their sources of food have been removed and the use of pesticides and weedicides in the plantations has had adverse health effects, especially for those who work in the plantations.

The plantations have, however, improved the opportunities for employment in often very poor communities.

NOTE THIS DOWN

Copy the graphic organiser below and identify the major competing issues involved in the production of palm oil in Southeast Asia.



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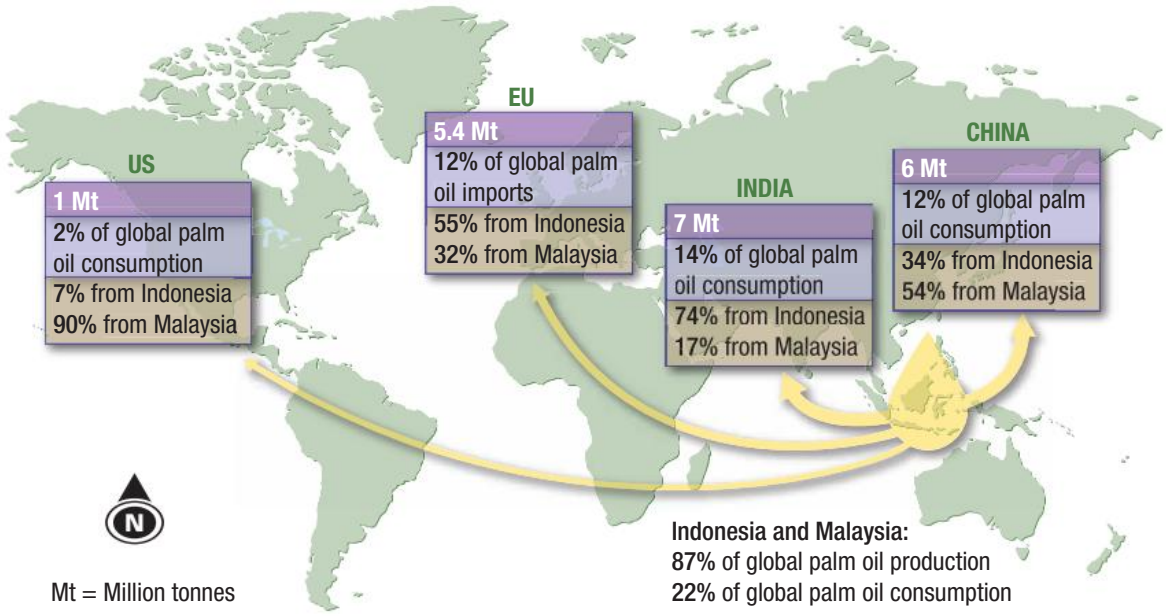
The certified oil debate

The exploitation of the traditional landowners and the natural environment has led to movements to establish ethical palm oil production methods. The establishment of the Roundtable on Sustainable Palm Oil (RSPO) in 2004 to promote more environmentally and socially sustainable palm oil products is a major step towards ethical palm oil production.

RSPO's members include palm oil growers, palm oil processors and/or traders, consumer goods manufacturers, retailers, banks and investors, environmental/nature conservation non-government organisations (NGOs) and social/developmental NGOs. Note that the traditional owners of the land are not included.

It remains to be seen how well the RSPO will be able to meet the economic demands of the palm oil industry while at the same time reducing, even eliminating, social and environmental harm.



Source 8.14 Major trade flows of palm oil

ACTIVITY 8.10

1. Describe the advantages of using palm oil.
2. List the countries that are the major producers of palm oil.
3. Identify the regions/countries that are the major consumers of palm oil.
4. Describe the major environmental issues of the palm oil plantation industry.
5. Explain what we can do to encourage environmentally and socially sustainable palm oil production.

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FIELDWORK 8.1 SURVEY OF CONSUMERS' ATTITUDES, KNOWLEDGE AND HABITS

Aims

- To gather information on consumers' attitudes to and knowledge of the social and environmental impact of their purchasing habits.
- To develop recommendations on what can be done to help consumers become more informed and responsible.

Method

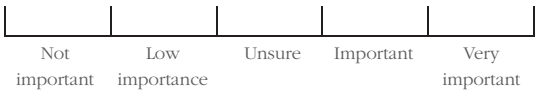
The information will be gathered through a survey. The following steps are a guide. First decide:

- Who you will survey – your friends and family; neighbours; wider community (the survey will provide more and better information if a diverse range of people is surveyed)
- The size of your survey sample – the more people you survey the more reliable your results will be
- How the survey will be delivered – face-to-face in the street or visiting people; letterbox drop with information about returning survey form, or online. (Your personal safety is an important consideration.)

Preparations

Then decide:

- What you will include in a covering letter you give to the people being surveyed: it should include the survey's purpose and when and how you want the survey returned to you
- What, and how many, questions you want to ask
- The type of questions that you will ask. For example:
  - open-ended questions – these allow more thought and more than a one-word answer. For example, 'How should people dispose of their old mobile phones and other ICT devices?' These questions are easier to think up, but the answers are harder to analyse as each person's will be different. It is often better to ask about opinions rather than ask a direct question about 'what you do', as some people will find that too personal.
  - closed questions – these lead to set, often one-word, answers. For example, 'Should people throw their old mobile phones into their rubbish bins?' – the possible answers are only Yes or No. These too are easy to formulate and easy to analyse, but they don't allow people to give the detail they may want to.
  - multiple choice – where you provide a list of answers the person can select from (you can ask them to select one only or more than one). For example, 'Where do you usually purchase ICT devices? Online ☐; ICT specialist shop ☐; Discount electronics store ☐; Seconds store ☐; Other ☐ _____.' This is more difficult to set up, but provides a good range of easy-to-collate responses.
  - multi-point rating – usually to do with seeking opinions or finding out the frequency of use of something. For example, 'How important is it for people to know the human rights and environmental record of companies they buy products from?'



This type of question is more difficult to set up, but it gives a clear view of the range of opinions.

- It is a good idea to draw up a draft plan, or chart, of how you will collate (collect, organise and show) all the responses into a single summary sheet. This helps you work out how easy it will be to collate the information you receive.

Data collection

- Distribute your cover letter and survey and/or run your interviews with the people in your survey group.
- Collect the survey forms and/or gather your interview notes.
- Use your draft collation plan to test if the survey information you have received fits with the plan.
- If necessary, modify your plan.

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- Fill in the results for each question on your collation document. For example, for the purchase of ICT devices, the totals could be: Online 8; ICT specialist shop 15; Discount electronics store 28; Seconds store 0; Other 2.
- For each question's collated responses write one or two sentences explaining what the results show (your analysis of the results). For example, if your result is as above – '53% of people surveyed purchased their ICT devices from discount electrical stores, 28% from ICT specialist shops and 15% online' – you might suggest that most people wanted to see the product before they purchased it, and that cost was important.
- Once you have collated the responses for all the questions and summarised the results for each question, write up to 250 words describing what your survey results show about consumers' attitudes to and knowledge of the social and environmental impact of their purchasing.
- Write up to three recommendations for what you think can be done to help people become more informed and responsible consumers.

Fieldwork presentation layout

Front page	Title and name
Contents page	Do this last, once you have numbered the pages
Page 1	Introduction – aims of the survey, types of questions asked, who and number of people surveyed
Pages 2–4	Copies of the survey and covering letter
Pages 5–9	The collated responses and summaries for all questions
Pages 10	Summary of what the responses showed about consumers' attitudes to and knowledge of the social and environmental impact of their purchasing
Page 11	Recommendations
Page 12	Concluding comments

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Chapter summary

- Global citizenship requires us to understand how our views of the world and the actions we take in our everyday life have consequences for the economic, social and environmental sustainability of our world.
- The decisions we make on our purchase, use and disposal of electronic devices should be informed by our research into the social and environmental impacts of these decisions and our principles.
- Through understanding what transnational companies are and how they operate in and across countries we are better able to influence these companies to adopt and follow more responsible human rights and environmental sustainability principles.
- The fair trade movement is an important movement trying to improve the working conditions and income of workers in poorer countries by making consumers in the richer countries more aware of the working conditions in the poorer countries and the purchasing choices available to them.
- The rapid expansion of palm oil production provides a powerful example of the significant consequences of not understanding the interdependence of economic, social and environmental sustainability in the mass production of goods, and of what can be done to adopt more sustainable practices.

End-of-chapter questions

Multiple choice

1 Which best describes the role of being a global citizen?

- **A** Having a vote in the UN General Assembly
- **B** Being willing to act to make the world a more sustainable place
- **C** Learning more about the world
- **D** Being a member of a local youth group

2 Conflict minerals are minerals:

- **A** mined in areas where there is armed conflict and human rights abuses.
- **B** used to make weapons of war.
- **C** that are not owned by anyone.
- **D** mined in areas where there are disputes between the miners and the mine bosses.

3 Transnational companies are companies that:

- **A** pay their workers very low wages under poor working conditions.
- **B** are in the air, road, sea and rail transport industry.
- **C** run their businesses in a number of countries.
- **D** are owned by a country's government.

4 Fair trade aims:

- **A** to make prices of products cheaper for consumers.
- **B** for environmentally responsible transporting of products to markets.
- **C** to improve the working conditions and pay for workers in poor countries.
- **D** to make the world a better place.

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5 Certified sustainable palm oil is important as it:

- **A** reduces the cost of palm oil to manufacturers and consumers.
- **B** promotes more environmentally and socially sustainable palm oil production.
- **C** reduces the number of products using palm oil.
- **D** includes the voices of the traditional landowners.

Short answer

1 Describe what determines your purchasing decisions.

2 Discuss what is meant by the ethical use of ICT devices and technologies.

3 Explain why transnational companies are so powerful.

4 Explain what the north–south gap is.

5 Evaluate whether or not fair trade is fair.

Extended response

Explain what your responsibilities are as a global citizen and a consumer of world products. Describe how you carry out these responsibilities.

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9 Technologies

Source 9.1 Social media – challenging our understanding of space

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Before you start

Main focus

This chapter focuses on the effects of information and communications technologies (ICT) on development in low- and middle-income countries.

Why it's relevant to us

Rapid changes in ICT create both opportunities and challenges. Geographic inquiry should go beyond issues of access, to effective use of these technologies in order for people to gain their potential benefits.

Inquiry questions

- What is ICT?
- How does the access and use of ICT vary over space?
- To what extent does ICT contribute to economic development in low- and middle-income countries?
- How does the location of ICT services such as call centres impact on places such as India?

Key terms

- Call centre
- Cloud computing
- Digital divide
- Economic development
- Gross national income (GNI)
- Information and communications technologies (ICT)
- Internet
- Low- and middle-income countries
- Megatrend
- Offshoring
- Outsourcing

Let's begin

Technologies that allow people to communicate across the world are changing our perception of space. An exploration of the nature and global patterns of ICT provides a basis from which to analyse its impacts on development in middle and low-income countries. The increasing use of mobile technologies and social media is creating new relationships – at local, regional and international scales. Case studies from Africa and India are used to evaluate the impacts of ICT.

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9.1 What is ICT?

Information and communications technologies (ICT) are the tools that help us connect with each other. At a local scale this may involve linking computers in a school or accessing the global community using the **internet**. The internet and the **World Wide Web (WWW)** are not the same thing. The internet is all the networks of computers that are linked together; the World Wide Web is the linked pages that are accessed using the internet and web browsers. The internet combined with the World Wide Web enables file sharing, social networking, gaming, research, email, telephone and video calls, and more.

internet a worldwide interconnected network of computers

World Wide Web (WWW) the sites and pages that are connected across the internet

Source 9.2a An ICT network

Source 9.2b Simplified timeline from abacus to smartphone

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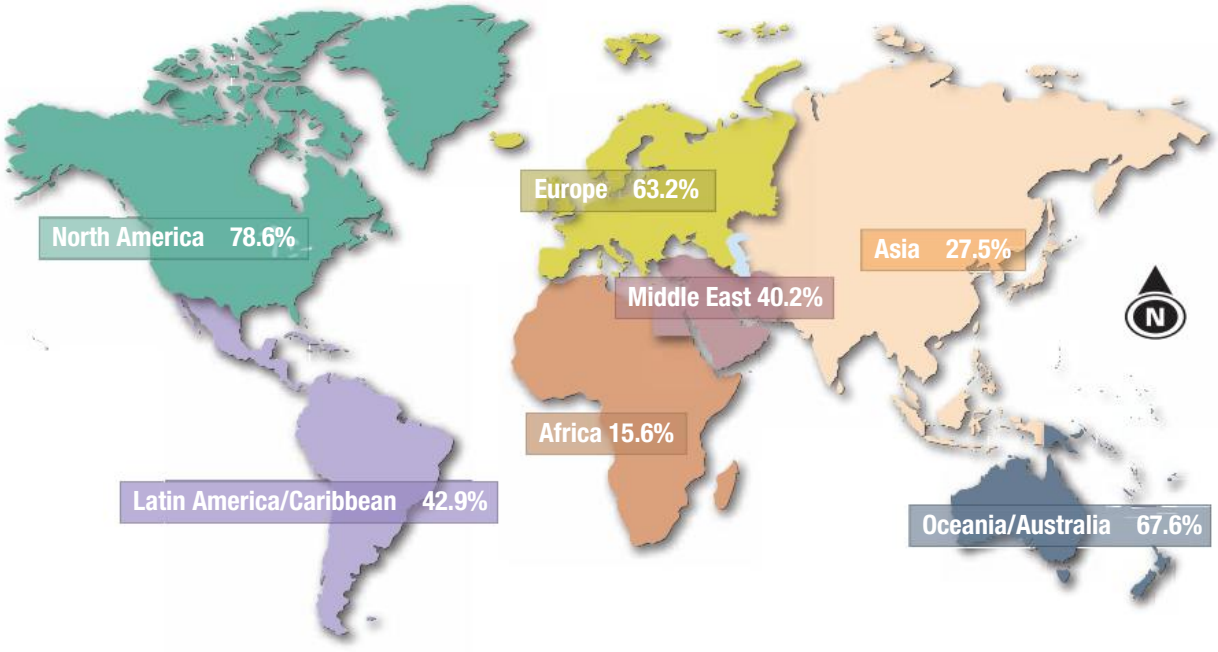
Information

Information must be meaningful to people. The presentation method chosen will vary depending on factors such as age, educational level and cultural background. For example, a table of statistics about internet use around the world may be easier to interpret if it is presented as a graph or map.

Source 9.3 World population and internet users

World regions	Population (2012 est)	Internet users 31/12/2000	Internet users 30/06/2012	Growth in internet users 2000–12 (%)	Internet penetration 2012 est (% pop'n)
Africa	1 073 380 925	4 514 400	167 335 676	3607	16
Asia	3 922 066 987	114 304 000	1 076 681 059	842	28
Europe	820 918 446	106 096 093	518 512 109	393	63
Middle East	223 608 203	3 284 800	90 000 455	2640	40
North America	348 280 154	108 096 800	273 785 413	153	79
Latin America/ Caribbean	593 688 638	18 068 919	254 915 745	1311	43
Oceania/ Australia	35 903 567	7 620 480	24 287 919	219	68
World total	**7 017 846 922**	**360 985 492**	**2 405 518 376**	**566**	**34**



Source 9.4 Distribution of internet penetration by world regions (30 June 2012)

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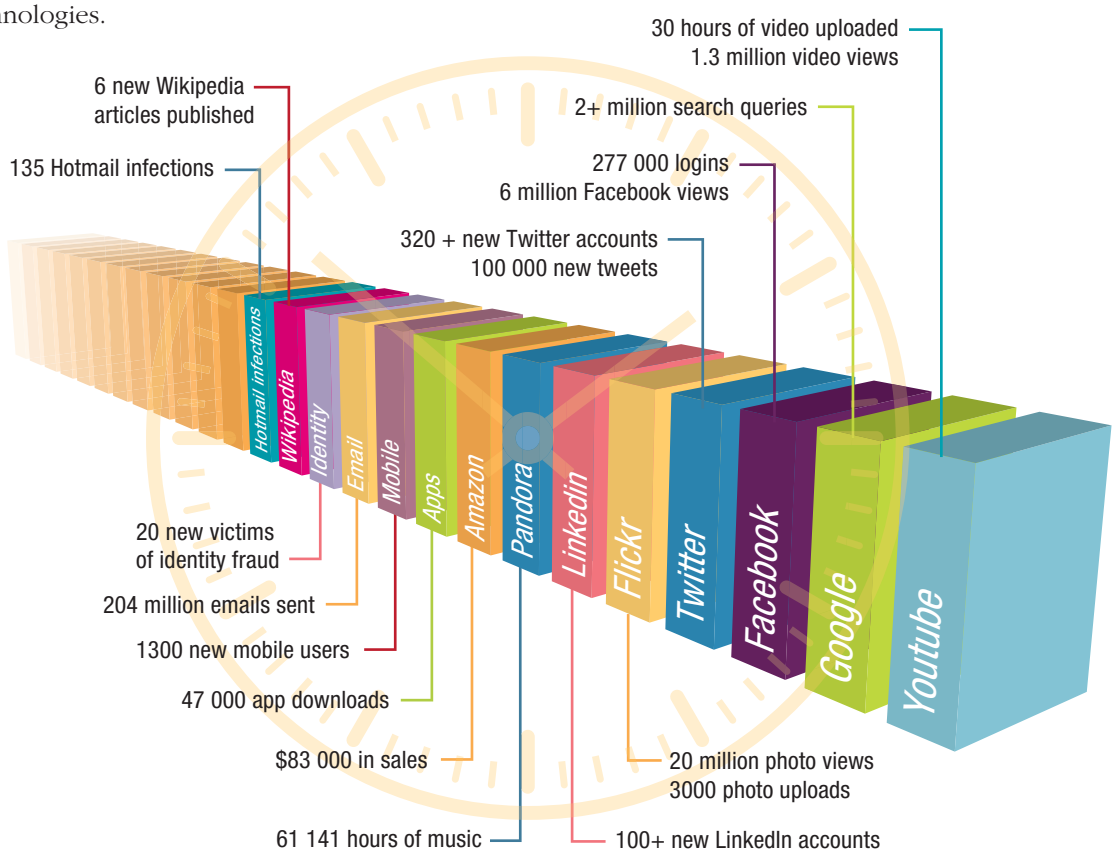
Communications Technologies

Communication involves the transfer of information using technologies or tools. In order to connect to the internet, infrastructure is needed – it may include cable, wireless, microwave or satellite technologies.



And future growth is staggering

Today, the number of networked devices = the global population

By **2015**, the number of networked devices = 2 x the global population

In **2015**, it would take you **5 years** to view all video crossing IP networks each **second**.

Source 9.5 The internet is host to a vast number of communications every minute.

ACTIVITY 9.1

Refer to Source 9.3 for 1 to 3.

1. Name the region with the largest number of internet users and the one with the smallest.
2. Explain how the internet penetration figures are calculated.
3. Compare the number of internet users with the internet penetration figures.
4. Discuss which information source – Source 9.3 or Source 9.4 – is easier to understand. Suggest reasons.

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Benefits of ICT

In general, the aims of using ICT are to complete tasks better, faster and with less effort. Predictions suggest that existing technologies will continue to merge, in the way that the telephone and internet access already have merged using mobile phone technology.

Source 9.6 The internet and World Wide Web

RESEARCH 9.1

Research and evaluate one example of an innovation in ICT from the following areas, using the template below:

- education
- sport
- music/entertainment
- transport.

Template: Device name – Portable mobile WiFi router
Description and purpose: This device is the size of a credit card and contains a SIM card so that you can connect to a country's mobile network just like a mobile phone does. It could be used for iPads, laptops or even cameras capable of connecting to the internet.
Advantages: Allows internet connection when travelling …
Disadvantages: May be a slower speed of internet connection …
Your overall opinion: Consider the advantages and disadvantages of your device and develop a personal opinion.

Global use of ICT

Change in the field of ICT is rapid and ongoing. According to the Secretary-General of the United Nations International Telecommunications Union, the number of internet users increased from 250 million in 2000 to 2.1 billion in 2011. The number of mobile phone subscriptions has also increased globally from 500 million in 2000 to an estimated 5.28 billion in 2011.

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The digital divide – variations in access to the internet between and within countries

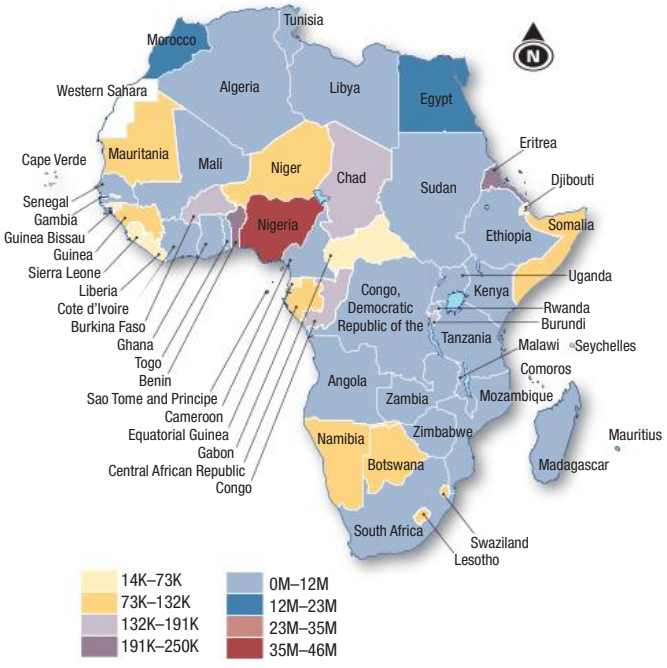
economic development improvement in the standard of living in a region as measured by financial indicators

digital divide inequalities in access and use of technology between countries, or between rural and urban regions, and even between men and women

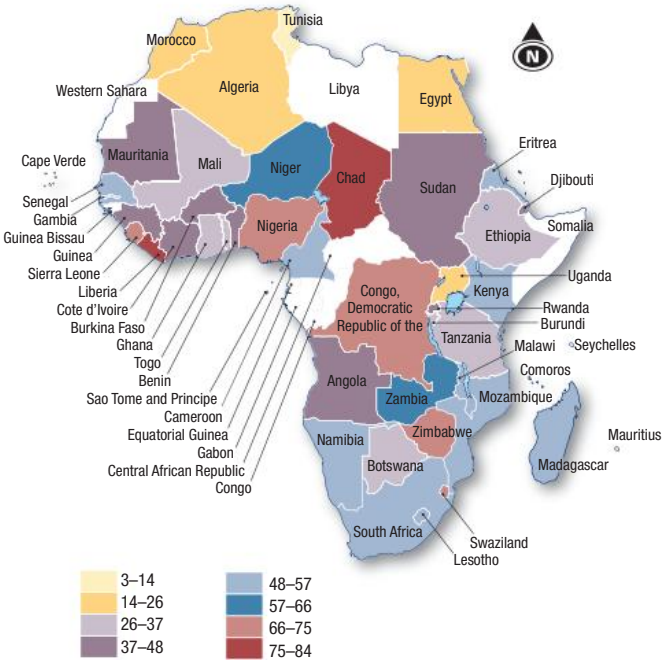
It is generally believed that access to the internet varies both within countries (especially between rural and urban regions) and between countries according to their level of **economic development**. Any reference to a '**digital divide**' should also consider other factors that affect the provision and use of ICT, such as cost, speed and quality of internet connections, personal skills, maintenance of equipment, privacy issues and the threats of computer viruses.

Analysing spatial data using interactive mapping

Go to www.cambridge.edu.au/geography9weblinks and follow the link to the website IndexMundi. It gives access to statistics, graphs and mapped data about many countries worldwide. The site collects data from many sources and allows users to explore those data at a global, regional and country scale. The following activities relate to ICT and mobile phone usage in Africa. There are other development indicators, such as electricity consumption per capita or GDP per capita, on the site that you may wish to explore. Purchasing power parity (PPP) allows international comparisons to be made: it is a conversion factor for calculating how much foreign money would be needed to buy the same goods or services in the United States market.



Source 9.7 The distribution of internet users in Africa



Source 9.8 Percentage of the population below the poverty line in Africa

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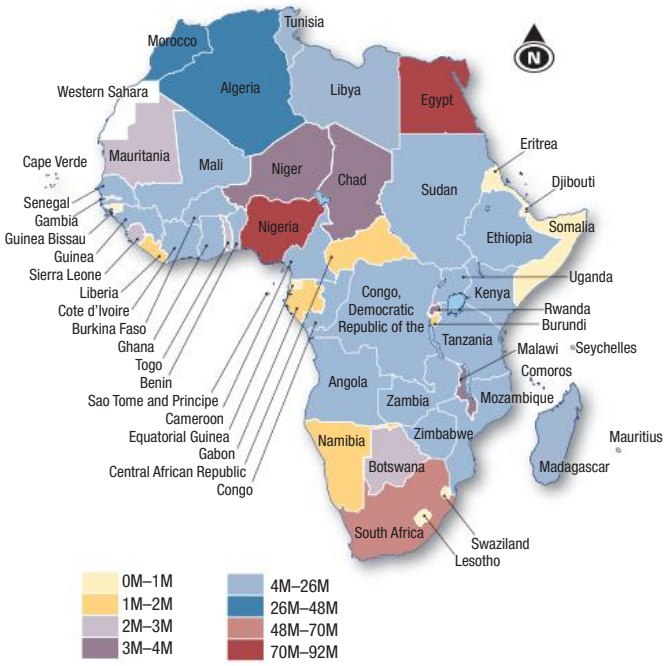
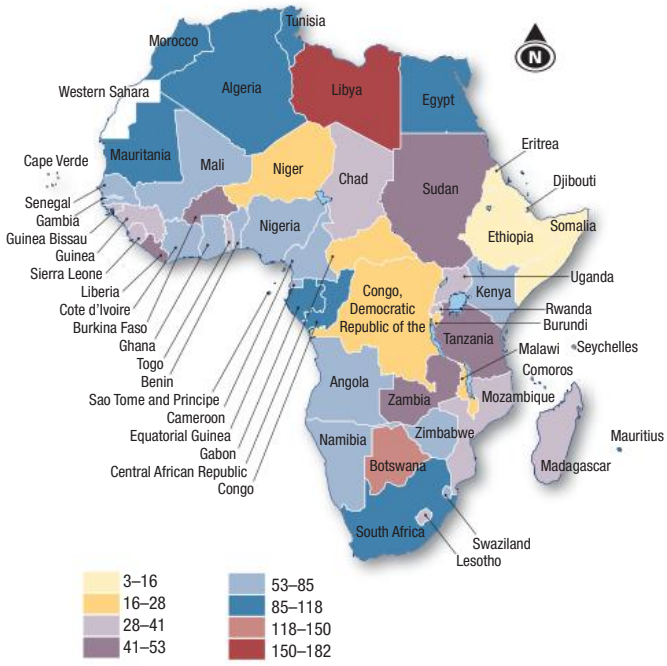


Source 9.9 Mobile cellular telephones in Africa



Source 9.10 Estimated number of mobile phone lines per 100 people in Africa.

ACTIVITY 9.2

1 Define PPP (purchasing power parity).

2 List the problems associated with interpreting statistics relating to the internet.

3 Describe the distribution of internet users in Source 9.7:
- general trend
- examples
- exception(s).

4 Describe the spatial association between the distribution of internet users in Source 9.7 and population below the poverty line in Source 9.8.

5 From the evidence suggested in these maps and your investigation of the websites for IndexMundi and the World Bank (follow the link to these through www.cambridge.edu.au/geography9weblinks), to what degree does ICT correlate with other economic development indicators across Africa?

a What does 'per capita' mean?

b Compare Sources 9.9 and 9.10, which show the pattern of mobile use and mobile phone lines per 100 people in Africa.

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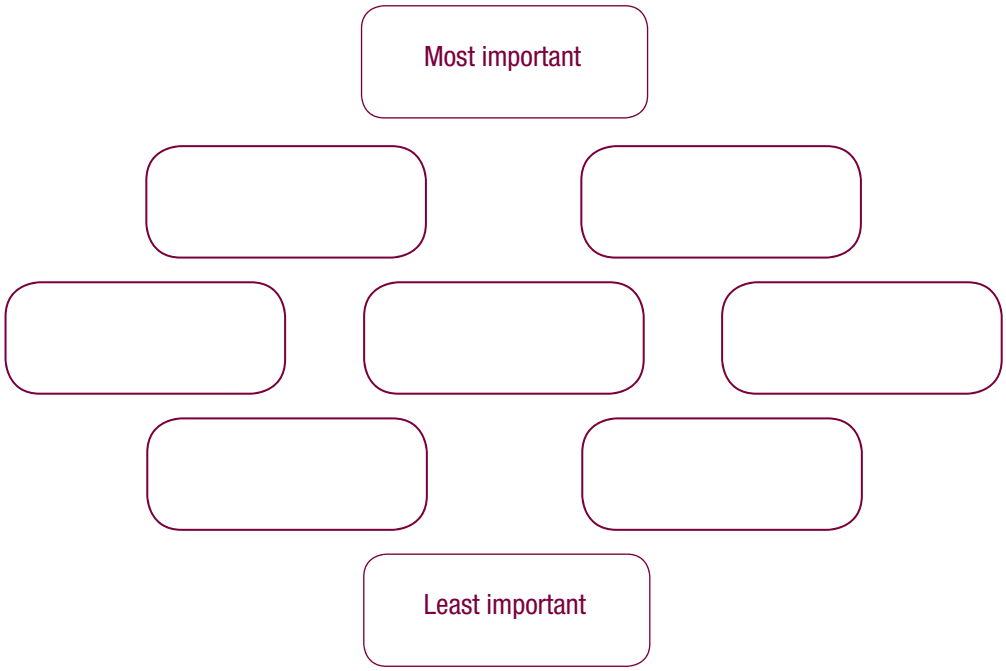
NOTE THIS DOWN

Copy the graphic organiser below and rank the factors that may affect access and use of the internet. Make sure you can justify your decisions.

Factors affecting internet access and use

- poor access to ICT infrastructure (such as satellites, cables, routers)
- shortage of government investment (in electricity, for example)
- profitability for the telecommunications industry
- lack of bandwidth/capacity resulting in slower data transfer
- social customs (such as more limited access for women)
- language barriers
- small scale and fragmented nature of non-government projects
- internet 'black holes' (for example, lack of internet access due to government restrictions)
- people's fear of using technology.



Cloud computing – helping to overcome ICT barriers

Recent developments, including **cloud computing**, may provide opportunities for less economically developed regions to access software and services (such as data storage, applications or file sharing) via the internet and help countries become less reliant on physical infrastructure.

cloud computing broadly, programs and services available via the internet; the 'cloud' is a metaphor to symbolise the worldwide and intangible character of the internet

ACTIVITY 9.3

1. What is cloud computing?
2. How does Apple Inc. use the concept in iCloud?
3. Suggest the benefits of ICT for low- and middle-income country users. Identify any limitations of cloud computing.

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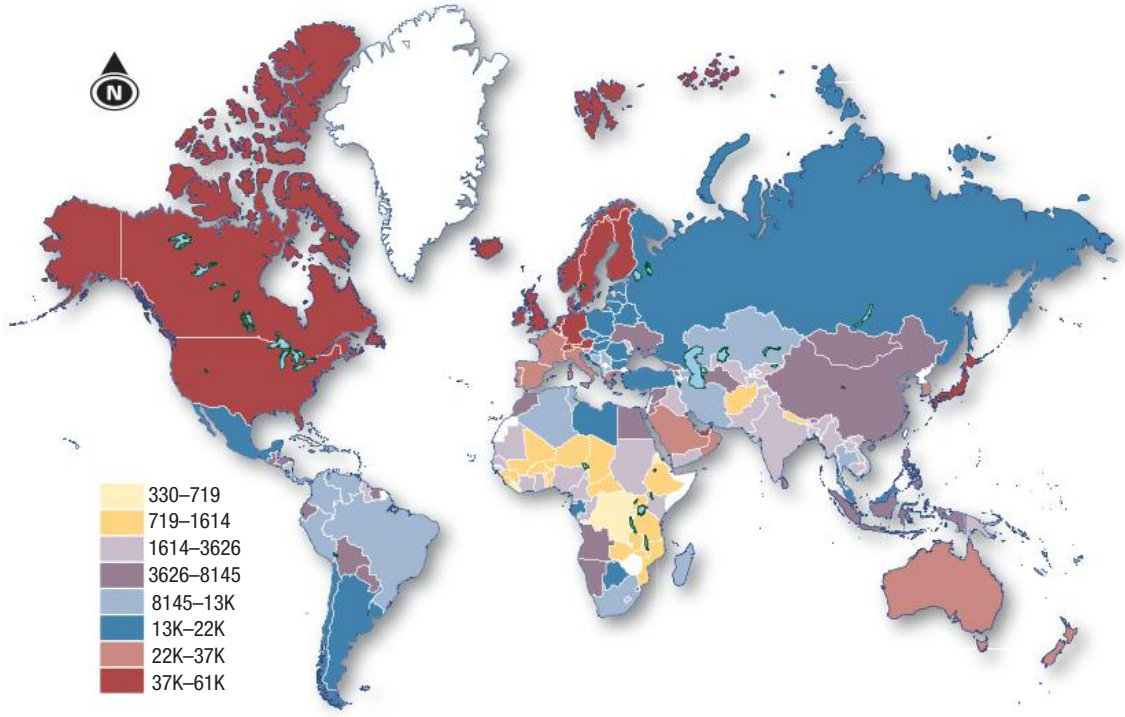
9.2 ICT and economic development

low- and middle-income countries countries that have a lower GNI per capita than wealthier countries

gross national income (GNI) per capita the average total annual income of each person in a particular country

Over the past two decades, ICT has played an important role in creating economic development in **low- and middle-income countries**. The World Bank classifies a country as low or middle income according to its **gross national income (GNI) per capita** (per capita means per person). However, this is only one economic indicator, and in order to understand the development of a region a range of indicators should be used. The World Bank releases updates each year; the following categories are for 2012:

Low income	US$1025 or less
Lower middle income	US$1026 to $4035
Upper middle income	US$4036 to $12 475
High income	US$12 476 or more



Source 9.11 Gross National Income (GNI) per capita in international dollars (PPP)

Geographical fact

The international dollar is the hypothetical money used to represent the purchasing or buying power of a US dollar.

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ACTIVITY 9.4

1 Explain what an international dollar represents.

2 Refer to Source 9.11 and name 3 low-income countries and 3 middle-income countries. Go to www.cambridge.edu.au/geography9weblinks and follow the link to the *Global Finance* magazine website (for the actual interactive map) and the UN data site.

3 List one example for each development indicator type using the following categories:

Social for example, number of doctors per capita

Historical

Economic

Environmental

Political

Technological

9.3 The rise of mobile phones

In recent years the increasing use of mobile technology and social media has changed the way people use the internet, which has implications for low- and middle-income countries.

Vodafone and Oxfam International are examples of a business and a non-government organisation working collaboratively to reduce the impacts of rural poverty. Mobile phones can play a role in this by helping overcome infrastructure barriers. For example, mobile technologies can give isolated and poor farmers access to information and to services, such as micro-banking and insurance. One example is the Kenyan Farmers Helpline, known locally as Huduma Kwa Wakulima, which allows farmers to access assistance for immediate issues, such as weather information and pest control. M-Farm is another example: it allows farmers in Kenya to buy and sell their produce or obtain information about market prices via their mobile phones. The introduction of solar-powered recharge devices has reduced the need to walk (sometimes long distances) to a power source, but the rate of change in technology, compatibility issues and affordability are still problems.

A recent report relating to mobile phone use and gender in low- and middle-income countries by the GSMA (Global System for Mobile Communications Association) revealed the following data in 2010:

- Males are 21% more likely than women to own a mobile phone.
- Women in rural areas are 23% less likely to own a mobile phone than women in urban areas.
- There are estimates of US$13 billion in future business opportunities in these countries.
- Women are two-thirds of the potential market for mobile phones in the next 5 years.
- 90% of women feel safer when they have a mobile phone.

Source 9.12 Using a mobile phone to take photographs in rural Zambia

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Socio-cultural factors are significant when seeking to explore the gender gap in mobile phone use and ownership: the traditional role of women, rural living, education and income levels all make a contribution. Also, the introduction of any new technology needs to include respect for cultural differences. For example, an online database may be useful to record health details of people living in rural communities but inconsistencies with data may arise if a person's date of birth is given as 'the day of the torrential rains'.

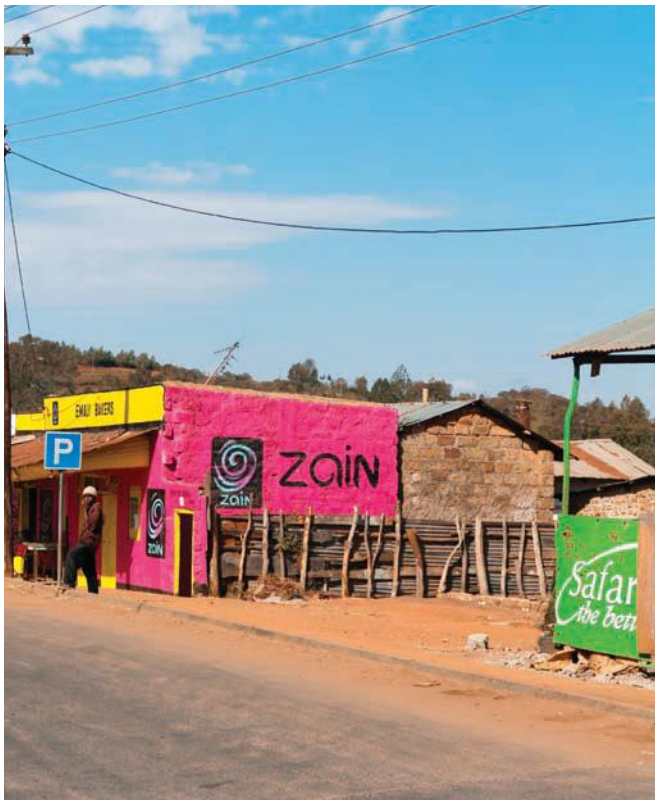
Mobile technology – issues for consideration

The following are some of the challenges for the future:

- lack of computers and equipment
- difficulty of teaching skills needed to make effective use of equipment in terms of accessing and evaluating information
- lack of teachers with ICT skills
- breakdowns and maintenance of devices, software and network connections
- lack of electricity and other infrastructure
- cost of computers, mobile phones and internet connection
- theft of equipment
- cyberbullying and other forms of anti-social or criminal behaviour on the internet, such as viruses and scams.
- inadequate personal skills to make effective use of equipment in terms of accessing and evaluating information.

Geographical fact

The World Bank reported in 2009 that there was a 1.3% increase in economic growth for every 10% increase in broadband internet connection.



Source 9.13 Advertising mobile phones in rural Kenya (on the pink wall)

ACTIVITY 9.5

1 A child aged between 10 and 15 living in a rural village in northern Kenya has pains in the stomach, diarrhoea and vomiting. Identify the medical condition by only searching on the internet, then:
   - **a** explain your diagnosis (that is, of the health problem)
   - **b** list the disadvantages of using the internet to research a health issue without consulting a doctor
   - **c** discuss the treatments you would suggest
   - **d** compare your findings with a partner and discuss why the results may be different.

2 Investigate the access, cost and use of mobile phones in the poorer regions of Nairobi (Kenya) or Mumbai (India). Present a written report, using subheadings to organise your findings.

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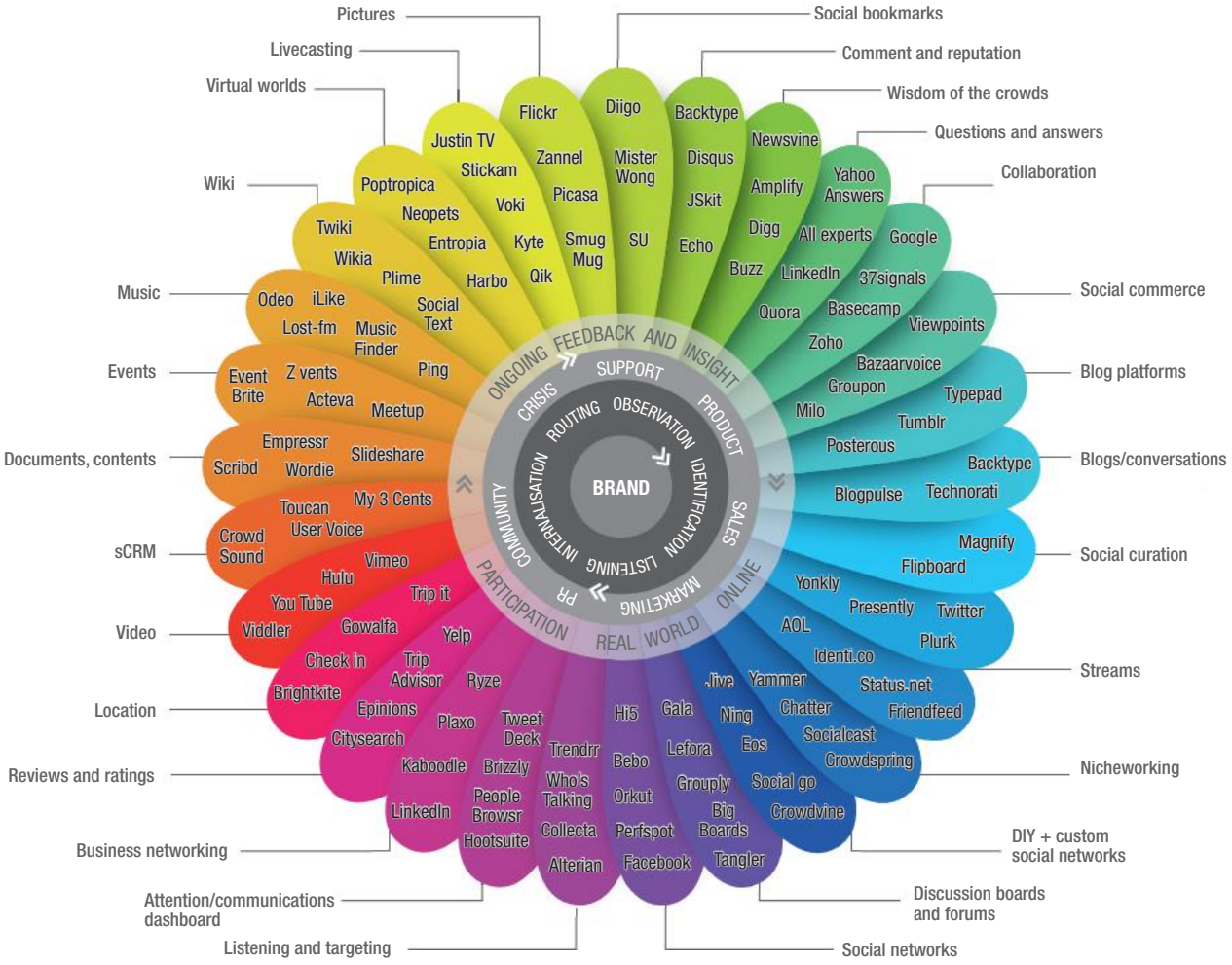
ACTIVITY 9.5 *continued*

3 Take action: It is estimated that there are 22 million disused mobile phones in Australia alone. Organisations such as Mobile Musters (go to www.cambridge.edu.au/geography9weblinks and follow the link to the website) provide opportunities for mobile phone recycling. Investigate the environmental costs of unrecycled electronics waste (e-waste). Create a poster for a campaign to recycle mobile phones in your school or local community. Include in the poster the environmental costs of unrecycled electronic waste (e-waste) in Australia.

9.4 The rise of social media

Social media use and sophistication have increased dramatically during the last 10 years. It is enabling new ways of map making and understanding relationships across virtual space. While social networking originated as a means of maintaining relationships between already established friendship groups, the use of the likes of LinkedIn and Twitter are now also considered part of social networking.

Source 9.14 shows how people are starting to conceptualise space differently and organise their relationships differently.



Source 9.14 Visual representation of social media

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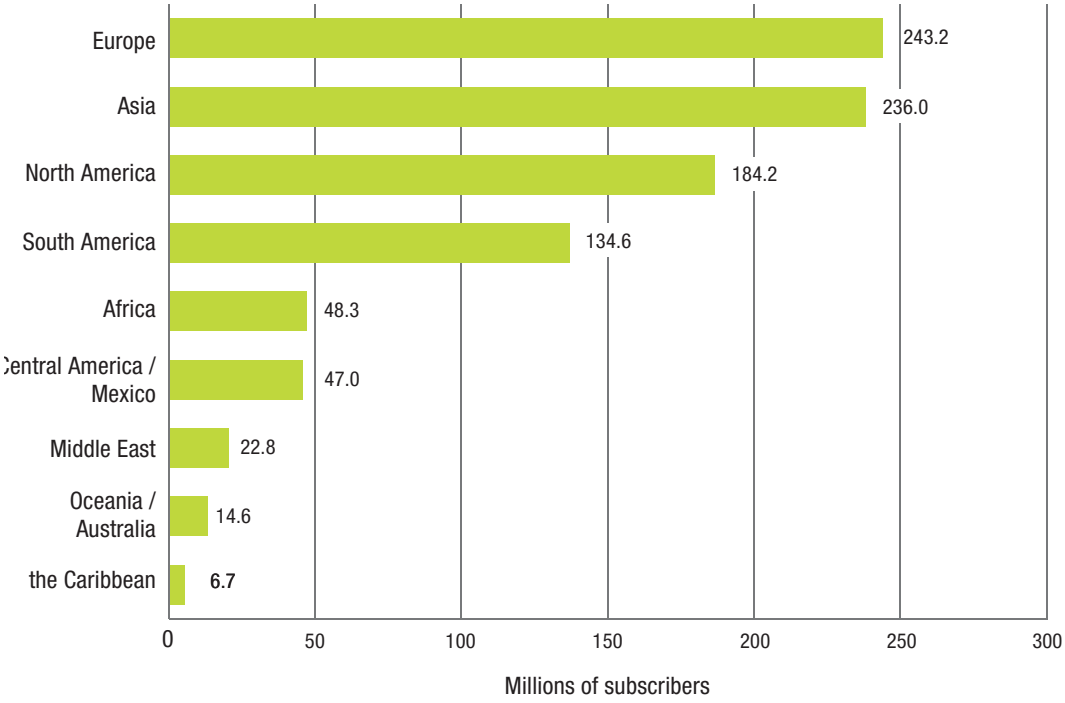
In general, social media involves internet-based applications that allow users to create and share content that is in a variety of multimedia formats. The following are some examples of social media:

1 collaborative projects and content communities where users add or delete information in a continuous manner via wikis and/or that are interest specific – such as Flickr for photographs or YouTube for videos
2 blogs, which can range from personal travel diaries to a discussion forum about a product or company
3 social networking, which generally involves making connections between people
4 virtual gaming and social worlds using avatars, such as 'Second Life'.

In January 2009, Facebook had over 175 million users. According to Website Monitoring, it now has over 500 million users; Africa is the region with the fastest growth in users.

Source 9.15 Facebook now has over 500 million users.



Source 9.16 Facebook users by world regions (September 2012)

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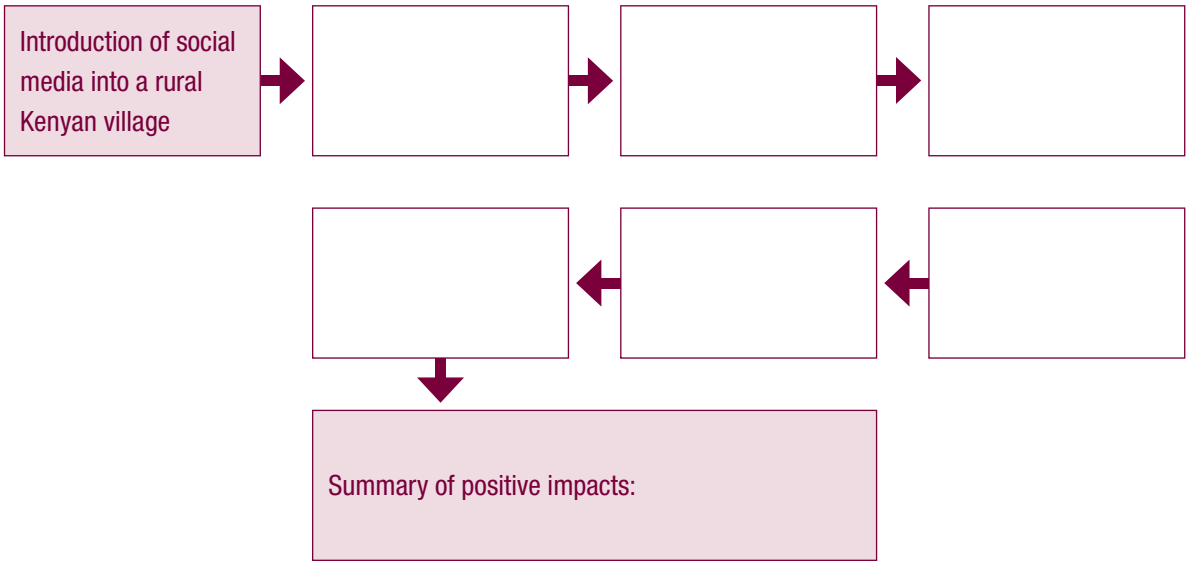
ACTIVITY 9.6

1 Predict how the distribution and number of Facebook users as shown in Source 9.16 may change in the next 10 years.

NOTE THIS DOWN

Copy the graphic organiser below and analyse the flow-on effects of using social media in a rural African village. Repeat the procedure for the negative impacts.

Positive impacts of social media



9.5 ICT as development tools

appropriate technology the idea that technology used in low- and middle-income countries should meet the community's needs, be compatible with local socio-cultural traditions, and be cheap, small and promote independence by using local natural and human resources

The following are examples of how ICT can be used as development tools that use the concept of **appropriate technology**.

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Case study 9.1

The Lifeplayer – 'Addressing Energy Poverty through Technology', from Lifeline Energy

Lifeline Energy is a non-government organisation based in the United Kingdom (go to www.cambridge.edu.au/geography9weblinks and follow the link to the website). Founder Kristine Pearson has remained committed to introducing sustainable and appropriate technologies, initially with a focus on the isolated villages of sub-Saharan Africa. She has a particular passion to support the most vulnerable, including women and children. Access to education and a sharing of knowledge has the potential to transform lives.

Source 9.18 Community use of the Lifeplayer in Kenya

Source 9.17 The Lifeplayer

The 'Lifeplayer' is a multi-functional device that includes a radio, media player, internet access and data storage; it can also be used to charge a mobile phone. It costs around US$100 to donate one to a community. The Lifeplayer uses solar energy (US$25 for a Solarstor device) or can be powered by people using the wind-up handle. The device also has a speaker function and has been used with groups of about 100 people. Education is central to the Lifeline Energy vision and it has been important to create partnerships with the Education Departments in such countries as Namibia, Ethiopia and Kenya.

The following statements are all from Kristine Pearson, the Founder of Lifeline Energy.

> We never do anything in isolation; partnerships are one of our key values.

> Villagers can now meet together and discuss information ranging from weather forecasts, farming advice, health information and education programs, and that helps them feel connected to their local and global communities.

> It is often said that knowledge is power, and we believe that the more that women know, the more things will change, and the more personal power they will exercise in their families and communities.

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Source 9.19 Kenyan rural children using the Lifeplayer at school

Source 9.20 The Lifeplayer in class

1 Describe the Lifeplayer.

2 Why are 'partnerships' considered critical to successful integration of ICT?

3 Discuss how 'knowledge' can be a source of power for a villager in sub-Saharan Africa.

Case study 9.2

Leading innovation and technology for a sustainable future – Siemens Ltd Australia

SIEMENS

Source 9.21 Siemens is a multinational technology organisation working in the areas of energy, health care and city infrastructure

Siemens is a German-based multinational organisation that has existed for 165 years and now operates in around 190 countries (go to www.cambridge.edu.au/geography9weblinks and follow the link to their website). The company aims to provide technology-based solutions in the areas of energy, health care, industry and city infrastructure (such as transport).

Siemens commenced business in Australia during 1872 and with its affiliates, including Siemens New Zealand, has over 3200 employees. In order to work successfully across many countries, quick and efficient sharing of information using communications technologies has been crucial. Siemens' focus is on government and business customers. The company is proud of its long history and reputation as a reliable and trusted brand in the global market.

Business related to the environment and sustainability has been increasing over time, and in the last Siemens financial year (1 October 2011 to 30 September 2012), the company earned €30 billion (approximately A$40 billion) from their environmental portfolio globally. Siemens is currently one of the world's major suppliers of 'eco-friendly' technologies.

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The four global megatrends

megatrend a major movement, pattern or change emerging in the global environment

Siemens places great importance on research and design. It has used four global **megatrends** that reflect challenges facing our world and created business solutions to guide the company.

Urbanisation: Since 2009 more than 50% of people around the world live in cities, and UN estimates suggest that this may increase to 70% by 2050. This places enormous pressures on existing resources and increases the need for more sustainable and energy-efficient design of urban buildings, transport and water supply.

Source 9.22 The United Nations estimates that 70% of the world's population will live in cities by 2050.

Changing demographics: The world population is expected to increase from 7.06 billion (July 2012) to 9.2 billion in 2050. There will be a need for more preventive and early diagnostic technologies to cope with the dual trends of ageing and growing populations in various regions.

Source 9.23 The average age of the world's population is expected to dramatically increase by 2050.

Globalisation: Technology is one factor that has helped the world become more interconnected; growing international trade and movement of workers are examples of the globalisation process.

Source 9.24 International trade has made the world more interconnected.

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Climate change: There is a need for more efficient and renewable energy options to deal with the projected impacts of rising average global temperatures, and the world's reliance on non-renewable fuels such as coal.

Source 9.25 The world will need to find renewable sources of energy to limit the effects of climate change.

Working to improve rural health care in India

Siemens currently employs over 15 000 people in India. There are 10 Research and Development Centres and 20 major factories, with another 6 due for completion in mid-2013.

Siemens uses the concept of sustainability in terms of building the knowledge and skills of its workers. Empowering local people with leadership skills encourages an ongoing and collaborative work culture.

In 2001, Siemens developed the 'mini-clinic on wheels' with the aim of increasing access to and affordability of health services to rural areas in India. The Sanjeevan is a bus providing diagnostic equipment such as X-rays, ultrasound, a basic testing laboratory and some refrigerated medicines. These vehicles have been sold to local governments, private health providers and non-government organisations throughout India. Experts at the Siemens Corporate Technology Centre in Bangalore are now investigating other high quality but reasonably affordable options to improve the health of rural communities such as CT (Computed Tomography) scans or MRI (Magnetic Resonance Imaging) equipment.

Source 9.26 The Siemens 'Sanjeevan' bus or 'mini-clinic on wheels' in India

1. Explain the term 'megatrend' using an example.
2. Discuss why the four megatrends listed are used by Siemens Ltd.
3. List other megatrends that Siemens Ltd could consider. Include reasons for each suggestion.

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Geographical fact

During the 2011–12 Siemens financial year, the company's products and services enabled their customers to reduce CO_2 emissions by 332 megatons. This amount is equal to 40% of Germany's total CO_2 emissions.

Case study 9.3

The One Laptop Per Child (OLPC) project

The general goal of the One Laptop Per Child project (OLPC) is for children in the least economically developed regions to gain empowerment using a laptop as a learning tool and as a means of connecting them with the wider world. The non-profit organisation based in the United States began providing laptops to children in 2007 (go to www.cambridge.edu.au/geography9weblinks and follow the link to their website). The green and white XO laptops are generally sold to governments and then allocated within the country by the Ministry of Education. The XO laptops use a wireless broadband connection. They can be used with electricity or other renewable energy options such as solar, wind, hydro or even 'human power'.

According to the Project Coordinator Nkubito Bakuramutsa, the 2012 shipment cost about US$200 for each laptop: the aim was to allocate 200 000 by the end of the year to upper primary school children. Given that the laptops were designed for children, the processing speed is slower, but estimates suggest that they are about five times more energy efficient than conventional laptops. They are also robust, so they can cope with student use. The key advantage of the laptop is its mobility. Students can take them home and therefore involve the family in shared learning. The philosophy of the project is that the computer should be regarded as a tool, like a pencil or paper. It is also important that students take ownership of – and care for – the technology.

Over 1500 teachers have been trained, which is another benefit in terms of the transfer of knowledge within these predominantly rural communities. The President of Rwanda introduced the project in 2008 to build the capacity of young learners and promote the country's future development as a knowledge-based rather than a rural-based economy.

1 Discuss why the laptops need to be robust.
2 Contrast a laptop with a mobile phone in terms of increasing learning opportunities for children in rural communities in Africa.
3 Suggest other benefits of the XO laptops for the students at school and at home.

Geographical fact

If India followed the World Health Organisation's recommendations of a 1:25 ratio of doctors to patients, India would require 4.8 million doctors.

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NOTE THIS DOWN

Copy the graphic organiser below and evaluate the three projects in the case study material:

1 Lifeplayer

2 Mini-clinic on wheels

3 One Laptop Per Child.

Develop a list of 6 criteria in order to make comparisons, and use the criteria to evaluate them:

	Lifeplayer	Mini-clinic on wheels	One Laptop Per Child
Aim or goal of project			
Criterion 1: cost to produce			
Criterion 2:			
Criterion 3:			
Criterion 4:			
Criterion 5:			
Criterion 6:			
Preferred example of innovative and appropriate ICT – summary of findings			

9.6 ICT: a global service

outsourcing contracting part of a business function to another person or business

offshoring moving your business activity or part of your business activity to an overseas location

There is a growing trend to both **outsource** and **offshore** ICT services. The broad terms used in industry help classify the type and role of ICT services:

Information Technology Outsourcing (ITO)

Examples:

- **Information technology support** may include designing computer networks or helpdesk assistance.
- **Software development** involves creating programs to help businesses manage their finances, use video conferencing or manage websites.

Business Process Outsourcing (BPO)

Examples:

- **Data processing** may consist of maintaining a company's financial records or customer lists using a database.
- **Employee services** refers to some human resources activities that relate to payroll or job applications.

Knowledge Process Outsourcing (KPO)

Knowledge process outsourcing relates to areas that are more specialised, and that require a higher level of knowledge and skills: examples include the legal, medical and financial consultancy or animation and design areas. Pay rates are significantly higher.

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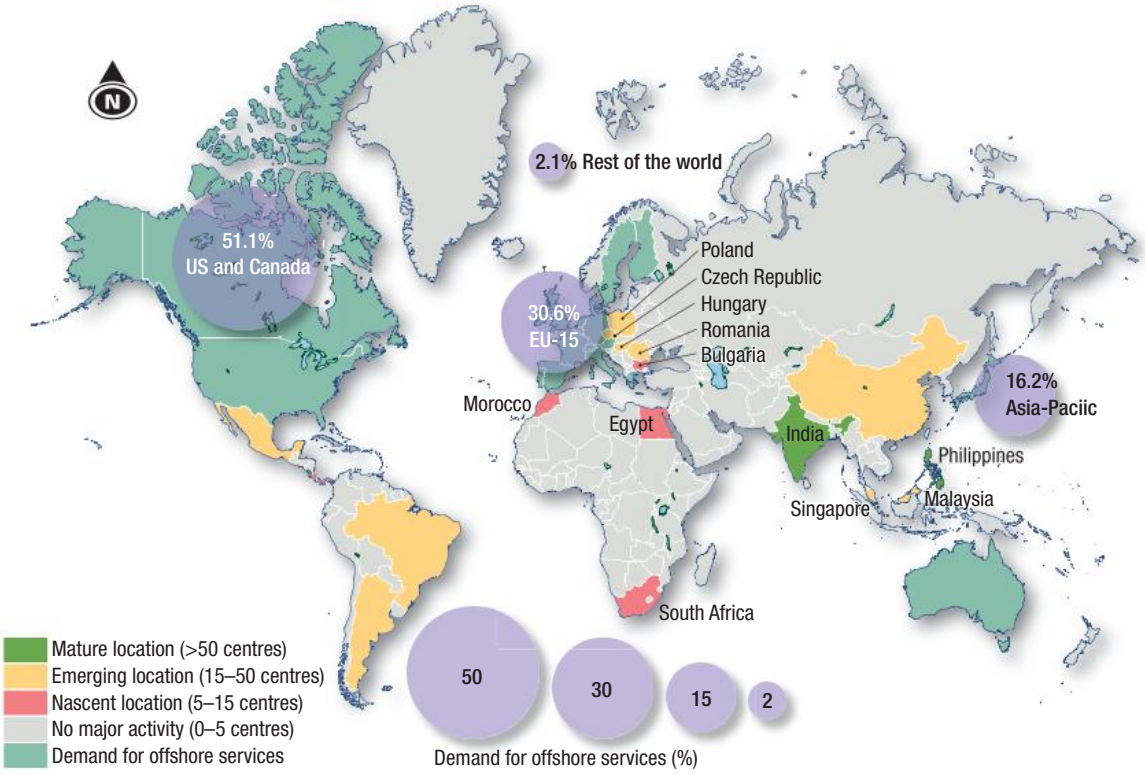

Source 9.27 Distribution of global offshore services

In 2010, the OECD (Organisation for Economic Cooperation and Development) estimated that the general offshore market for services was US$252 billion. The ICT industry is a significant and growing contributor to this market. Global outsourcing is not a new process. It started in the 1960s and 1970s largely in the manufacturing area – for shoes, clothes, electronics and toys. Transport and travel evolved next, but now the growth is in business services that generally have an ICT basis, such as telecommunications.

ACTIVITY 9.7

1 List 3 offshore and 3 outsourced products or services.

2 Refer to Source 9.27 and select a country that has emerging offshore activities. Suggest reasons for this trend.

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Case study 9.4
The call centre industry

call centre a facility that handles telephone enquiries by providing information and/or assistance

The **call centre** industry is a well-known ICT-related service. There has been a trend to outsource and offshore call centres to less economically developed countries where the cost of labour is cheaper. Labour laws may also be less strict in terms of conditions such as hours of work.

Generally call centres are located close to major cities due to the larger supply of workers and the higher quality of nearby ICT infrastructure, such as broadband connections. However, with improvements in wireless technology there has been some transfer to regional areas.

India has dominated the ICT services and call centre markets because it has a large number of graduates in the IT area who are also fluent in English or another language. This is particularly valuable in help desk or software customer support roles.

In the last few years there has been a significant growth in the call centre industry in the Philippines. English is the second official language there and it is widely spoken; also, labour costs are lower than they are in India. In 2010, the Philippine Software Industry Association alone reported a 28% growth, and export earnings of US$725 million.

Source 9.28 An Indian call centre

Source 9.29 Call centres are a thriving industry in India.

Factors that influence the location of call centres

- Supply of labour
- Cost of labour
- Government support in host country
- Accents of call centre workers
- Flexibility of labour laws
- Communications infrastructure

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Advantages and disadvantages of working in a call centre	
Advantages	**Disadvantages**
• Regular work and salary • Not manual or outside work • Training • Other benefits (some provide medical insurance, for example) • Transferable skills	• Long hours (fatigue) and working with different time zones • Shift work • Health issues (such as sleep disorders and back pain) • Close supervision and repetitive work • High staff turnover • Limited promotional opportunities and skills development

1 List the differences between outsourcing and offshoring.

2 The future may see the expansion of offshoring to professions such as medical and legal services. Select one of these examples and evaluate this change from an Australian perspective.

3 Discuss the attitudes of people in your class towards international call centres.

9.7 Problems with ICT

While renewable energy options have sometimes been successful at a local scale, the situation in India described on the following page highlights the problems that occur when the electricity network fails.

Geographical fact

According the Asian Development Bank, 700 million people across Asia do not have access to electricity.

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One of the world's biggest power blackouts affects India

A failure in India's northern and eastern electricity grid on 30 July 2012 left over 600 million people without power. The initial outage lasted for 15 hours, and despite repairs a second breakdown occurred the following day. In New Delhi, the rail network – which caters for approximately 1.8 million people per day – was closed and traffic lights were down, creating major delays on the roads. Hospitals were generally able to function using generators, but the banking sector reported closures. Even mining operations ceased: lack of power meant the equipment that pumps oxygen to miners who work underground could not operate.

It was believed that a high demand for electricity meant that power was being shared between electricity grids, which was what caused the collapse of the system. The breakdown highlighted the country's reliance on electricity, and questions were raised about the adequacy of the power infrastructure in India.

Source 9.30 Traffic congestion in New Delhi, India

Analysing spatial patterns from electricity use

This image was taken by a crew member using a digital camera on board the International Space Station during 2011 as it was moving in a southeasterly direction over northern India and Pakistan. The largest clusters of lights are the capital cities: Islamabad in Pakistan and New Delhi in India. The lines of the highways and the cloud-covered Himalayan mountains are also visible. The unusual feature in this image is the orange line of lights across the centre. This is the border zone between the two countries, and it is floodlit and fenced to help prevent arms trading and smuggling between India and Pakistan.

Source 9.31 Satellite night image of northern Indian border region

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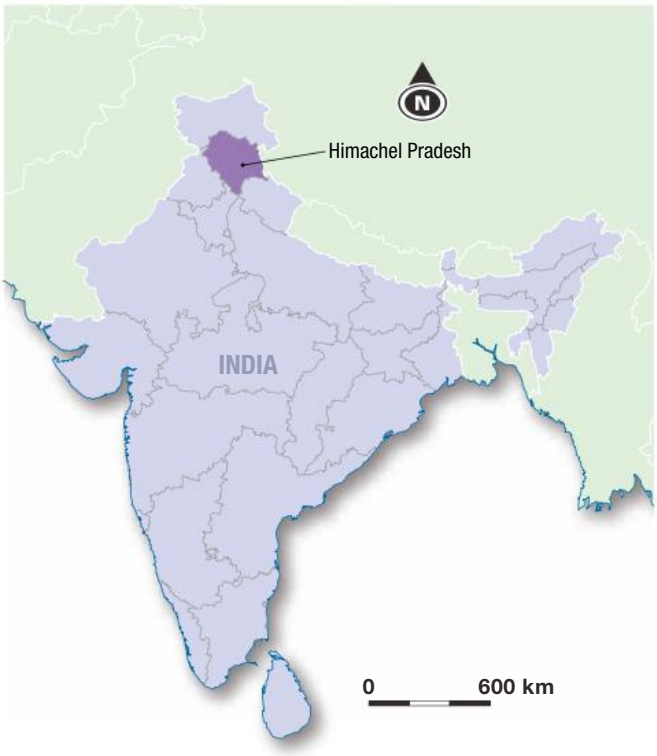
ICT and economic development in rural north India



Source 9.32 The location of Himachel Pradesh in India

Historical and geographic background

Dharamsala is located in the province of Himachel Pradesh in north India. It has a population of approximately 1149744 and a land area of 5739 km^2. Temperatures range from 0°C in January to 38°C in June and average rainfall is 290–380 mm per year, which is considered semi-arid. The altitude ranges from 1250 m to 2000 m and the blending of cultures here has created a diverse human environment. It is well known as the headquarters (Gangchen Kyishong) of the exiled Tibetan government and home of the 14th Dalai Lama (at the Namgyai Monastery). This means there is a visible Tibetan influence and a large settlement of Tibetan refugees.

The population of the region is also affected by conditions in neighbouring Rajasthan. Rajasthan is a large and predominantly desert state. It has a majority Hindu population and most of the rural families are farmers. Encroaching desert and the degradation of common lands (mainly due to harvesting firewood and growing grass for animal fodder) have led to reduced agricultural productivity. Traditional inheritance practices of dividing land between the male children has led to smaller and smaller land holdings, which are less and less able to support family groups.

Some sons may seek work elsewhere to increase the household income, and some whole families move. In the city of Kangra, in Himachal Pradesh, for example, there are many families from farms in Rajasthan; they live in the slums near the tourist regions such as Dharamsala. Families also come from other states in northern India, including Maharashtra and Punjab, for similar reasons. There are an estimated 10000 environmental refugees living in Himachel Pradesh, mainly along the access roads to towns.

In Dharamsala there are many people living in temporary hand-made housing which provides

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little protection from the weather. Families find work in construction, collecting rubbish or mending shoes. Children can be seen trying to make a living by begging in the streets. Poor hygiene and general health, malnutrition, lack of education and disease are all prevalent in these slum communities.

Source 9.33 Housing conditions in the slums of Dharamsala

Source 9.34 Women from the Dharamsala slums working in the construction industry

Tong-Len is a small charity established to help the families living in the slums of Dharamsala (go to www.cambridge.edu.au/geography9weblinks and follow the link to their website). A new hostel opened in 2011 to house children from some of the poorest families and to give them a private school education. The children now have an opportunity to break the cycle of poverty through education. The use of ICT gives these children access to information and to online learning programs. A computer room is available in the hostel for all the children.

Tong-Len works with a particular community of about 250 families. Most have neither the means nor the opportunity to establish stable homes for themselves. In addition, they are in an environment that can at times be hostile – the threat of eviction is a constant fear. The following are some personal stories from people living in the slums of Dharamsala.

Personal stories from Dharamsala

Lako lives with her one son and five daughters. She came to Himachel Pradesh before they were born, when her family's land in Rajasthan began to yield too little food to sustain them. When Lako arrived in Dharamsala she looked for work and somewhere to stay but nothing was available. She was forced to move into a temporary shelter with a group of Rajasthanis already living in the area. She lives in the same situation today, with no running water or electricity. Lako says, 'It is a hard life, particularly during the winter.' Her son is coping with a deteriorating mental illness and she fears that if she cannot find a way of earning some extra income she will not be able to afford any medication for him.

Gemal moved to Himachel Pradesh 18 years ago. Like Lako, his land suffered from sustained drought and he came with his family in search of work. Gemal lives with his parents, his wife and their five children, and occasionally he finds work as a day labourer. His wish is to earn a steady income so that his children can go to school, and to build a permanent house for his family. However, he fears for their future – they are living on land that is not theirs and risk eviction.

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Source 9.35 Children from the hostel

Source 9.36 Children from the hostel working in the new computer room

Source 9.37 Project between volunteers and the children of Tong-Len hostel to present their messages to the world

Source 9.38 The five eldest children living at the Tong-Len hostel – Nisha is standing on the extreme left of the photograph.

Nisha is now 18 years old and in her last year of school. She has been living at the Tong-Len hostel since she was 8. Before she lived at the hostel Nisha was a beggar, and she thought that she would always be a beggar. However, recently it was reported that she had received a number of academic awards from the Indian government – Nisha now plans to study medicine.

Source 9.39 Completion of 'the wall' – you can see Nisha's contribution on the left.

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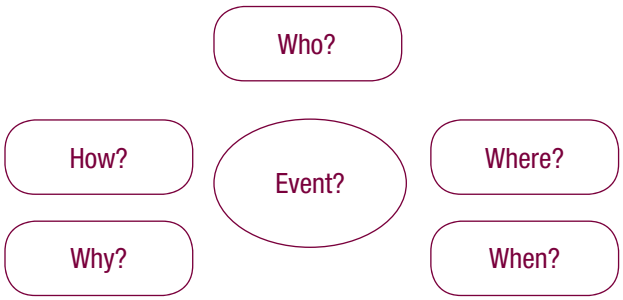
Social action – using ICT to gain international attention

In rural north India the life of farmers is quite precarious. In Madhya Pradesh in early 2012, a group of approximately 50 villagers, mainly women, submerged themselves up to their necks in water to protest against the decision to raise the waters of the Narmada River dam. They stayed in the river for 17 days as a protest against losing their farming land and being offered insufficient compensation by the regional government.

NOTE THIS DOWN

Using the internet, search the phrase 'Madhya Pradesh neck deep water' to find the YouTube videos showing footage of the protest and the response from the Madhya Pradesh government. Copy the graphic organiser below and summarise your findings.



To what extent would this have been successful without the assistance of the internet to present the story both within India and to the world?

RESEARCH 9.2

The following activities use different learning styles. In each section you have choices, so consider your personal goals. Remember to make sure that your submission is respectful of all people.

VISUAL–SPATIAL ('I ENJOY PAINTING, DRAWING AND SPATIAL THINKING SUCH AS MAPS OR DIAGRAMS')

Option A: Create an artwork panel for a wall (refer to Sources 9.37 and 9.39) showing the positive role that ICT can play in the education of students. Include a written submission that outlines the purpose of the design and the benefits of ICT.

Option B: Construct a map to show the location of Dharamsala in Himachel Pradesh and the movement of internally displaced people – for example, from Rajasthan. Include images and text annotations to explain the reasons for this movement and its impacts on Dharamsala.

Useful source: Go to www.cambridge.edu.au/geography9weblinks and follow the link to the UN High Commission for Refugees website.

LOGICAL–MATHEMATICAL ('I ENJOY WORKING WITH NUMBERS AND SCIENTIFIC THINKING')

Option C: Compile statistical evidence that compares development indicators from Himachel Pradesh (regional scale) with those from India (national scale). Start by going to www.cambridge.edu.au/geography9weblinks and follow the link to the Himachel Pradesh official website. Present your findings as an 'infographic' that provides a statistical overview of the use of ICT within India.

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Useful source: Go to www.cambridge.edu.au/geography9weblinks and follow the link to the pinterest.com website.

A comparison between the development indicators for the state of Himachel Pradesh and those of India

	Himachel Pradesh (2011)	India
Population	6 856 809	
Population density	123/km^2	
Rural population	90%	
Literacy rate	83.78%	

Option D: Tong-Len charity would like to raise money for new ICT in their classroom (for 30 students). As an ICT consultant, present a formal submission to the charity outlining the costs and benefits of the proposal. Your report should include a justification for each item to be included and possible funding options.

VERBAL–LINGUISTIC ('I ENJOY READING, WRITING AND SPEAKING')

Option E: Prepare a debate around a topic such as 'ICT is reducing the digital divide in India' or 'The benefits of using ICT in rural India outweigh the problems.'

Option F: Imagine that you have just been given an ICT device by the Tong-Len charity and write a diary entry describing your reaction, and your feelings and hopes for the future.

BODY–KINAESTHETIC ('I ENJOY DOING PRACTICAL ACTIVITIES, SPORTS AND DANCE')

Option G: Create a theatrical performance highlighting the positive and negative impacts of using ICT in the slum community of Dharamsala or about working in an Indian call centre. Include a prepared dialogue and simple costumes.

Option H: Construct a model call centre or a classroom that incorporates sustainable use of ICT. Include a submission that justifies the building decisions you have made.

MUSICAL–RHYTHMIC ('I ENJOY MAKING AND LISTENING TO MUSIC')

Option I: Perform a song or dance that incorporates a theme developed during this chapter.

INTERPERSONAL–SOCIAL ('I ENJOY WORKING WITH OTHERS')

Option J: Establish a team of students and find a way to raise money for the Tong-Len charity or plan a campaign to recycle mobile phones for an organisation such as Mobile Musters.

INTRAPERSONAL–INTUITIVE ('I ENJOY WORKING BY MYSELF')

Option K: Research the history, philosophy and goals of the Tong-Len charity and present your findings in the form of a written submission to the Indian government for additional financial assistance for ICT.

Option L: Select one of the personal stories and prepare a written report on it. Evaluate the role and type of ICT that may improve this person's (or family's) standard of living and quality of life.

NATURALIST ('I HAVE AN INTEREST IN THE NATURAL ENVIRONMENT')

Option M: Research how ICT could overcome the environmental problems that occur in slum regions within Dharamsala (for example, water quality, sanitation, soil erosion).

Option N: Research and video a documentary-style report that explains why the villagers submerged themselves in the Narmada River during 2012.

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Chapter summary

- ICT is rapidly changing, with increasingly merging and wireless tools that enable easier connections between people to be made.
- The distribution of ICT around the world, as measured by internet-related use, is uneven.
- Internet-enabled mobile phones and social media are changing the use of the internet.
- Generally, people have greater access to ICT, but access is not universal: it is more limited in rural areas, for example. The poorest sectors of society remain excluded, and there is a possibility that the 'digital divide' may widen, increasing the gap in living standards between these people and those who are better off.
- ICT has the potential to assist development, as is evident in the many successful (and generally small-scale) initiatives of government, non-government and corporate organisations, but barriers remain in terms of cost, pace of change, infrastructure and research data.
- Outcomes for ICT should be integrated with development goals relating to education, health and employment etc.
- The ICT service industry has generated economic gains in terms of standards of living (incomes), but the evidence as to whether or not this translates into improvements in quality of life is not conclusive.

End-of-chapter questions

Multiple choice

1 ICT involves:

A all technologies.

B using those technologies that can be linked by cables or microwave.

C technologies that transfer and receive meaningful information.

D those technologies that use the World Wide Web.

2 Social media includes:

A collaborative projects and content communities.

B blogs.

C virtual gaming.

D all of the above.

3 Low- and middle-income countries are generally classified according to:

A wages and salaries of people.

B the UN Human Development Index.

C the average income of people within the country.

D the GDP of a country.

4 The 'digital divide' is:

A an electronic border between countries.

B inequalities in access to and use of ICT.

C the difference between men and women.

D differences in computer hardware.

5 Rural-urban migration involves:

A daily trips to an urban area for shopping and work.

B permanently relocating from a village to an urban area.

C the conversion of rural land to urban land.

D people moving from cities to rural areas.

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Short answer

1 Marshall McLuhan (1911–80) was a Canadian philosopher with an interest in media and communications who coined the phrase 'global village'. How could the increasing use of ICT create a 'global village'? (Hint: use the concepts of distance and movement in your answer.) Include a sketch to assist your explanation.

2 *Future Geographical Careers*: This report by Fast Future (commissioned by the UK government in 2010) made some suggestions about employment options that may be popular in 2030. These include a Waste Data Handler, Vertical Farmer, Weather Modification Police Officer, Alternative Vehicle Developer, Classroom Avatar Manager and Old Age Wellness Consultant.

Select one of these possible future careers and discuss with a partner the following:

A the knowledge and skills that may be involved in this occupation

B the value of studying Geography for this future role.

3 Evaluate the role of mobile phones in the development of low- and middle-income countries.

4 How could social media be used to enhance development in rural Africa?

5 You have the opportunity to help establish a new call centre in the Philippines. Media reports have suggested that staff turnover has been an issue in Indian call centres. Your goals are to create a profitable and ethical business. Using the information in Case Study 9.4 and the Think-Pair-Share template, analyse 6 problems that should be minimised in the new call centre. Present your recommendations as a written or oral report.

Think-Pair-Share			
Problems in call centres	**My opinions**	**My partner's opinions**	**Shared proposal**

Extended response

Claims are being made that ICT is 'revolutionising' the development opportunities for low- and middle-income countries. Research is currently being undertaken, and while there are many examples of positive outcomes for people, questions remain about the equitable access to technology and the uneven distribution of projects in rural communities. Even in regions with reliable internet access, uncertainty remains as to whether the use of the technology is leading to improvements in the people's standard of living and quality of life.

Evaluate this statement using evidence from independent research.

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10 Global mobility

Source 10.1 We live in a highly mobile world.

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Before you start

Main focus

People have the freedom to choose where and how to live in a highly mobile world.

Why it's relevant to us

Mobility influences people's identity, attachment to place and perceptions of other places, and transforms the world.

Inquiry questions

- Why do people move?
- What attracts people to places?
- How does the mobility of people impact on places?
- In what ways does mobility influence the character of a place?

Key terms

- Attachment
- Employment
- Environment
- Ethnicity
- Identity
- Landscape aesthetic
- Lifestyle
- Migration
- Motivation
- Personal mobility
- Place

Let's begin

Our daily survival depends on food gathering or finding some other means of acquiring food and shelter. For most Australian citizens, basic everyday needs are achieved by working in order to earn a wage or salary with which to purchase goods. Finding employment is a major motivating factor in where people choose to live.

Australia's history of settlement reflects a process of migration, starting with Indigenous people thousands of years ago, and followed by waves of arrivals from near and distant places after the first European settlers landed in 1788. This has changed the landscape of the continent irrevocably, adding towns and cities, farms and mines, factories and shops, and roads, railways and airports. The flow of people from other places continues, with arrivals from all parts of the world; also, Australian citizens leave the country, sometimes permanently. Generally, people on the move are seeking better lives. A multitude of reasons help explain these movements.

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10.1 To move or not to move

People move from rural to urban areas for education and jobs, travel to remote mining settlements for employment, cluster around the coasts for easy access to other places, and seek warmer climates during winter – all within Australia. Movement can be short term (such as holidays), medium to long term or fairly permanent. Access to transport means Australian citizens can choose, at relatively low cost, a variety of holiday movements – nearby, or further away in Australia or, increasingly, overseas.

To understand why people move requires some thinking about the important elements in our lives and the qualities that attract us to a place. All of us have a feeling of attachment to place and familiar surroundings. When we move around we are likely to seek places that provide us with a degree of connection to familiar features.

ACTIVITY 10.1

In small groups, reflect for a moment on what it is that you think attracts people to where they live or wish to live. The following list of features will help start this process:

- the people are friendly
- it's quiet and peaceful
- the shops and cafes are good
- there are plenty of sports facilities
- it's easy to get around
- the houses all look the same
- it's safe
- people speak many languages
- there's no violence
- I feel at home because …

Source 10.2 Chinatown in Sydney

As well as finding those features in a place, we can also create them. People are social beings. They share language, values and beliefs, plus food and clothing customs, literature, music, recreation activities, work and education. We probably are not aware of how much our thinking and our behaviour are shaped by these aspects of our personal histories. Here is an example of how important they are: when the first European settlers arrived in Australia from England, they cleared the native trees and replaced them with trees from the northern hemisphere, such as pines and deciduous species. They also built houses and planted gardens like English ones. Their **landscape aesthetic** governed their decision making in their new homeland.

landscape aesthetic the way a person responds to their environment

migration movement from one location to another

Many Australians today live in places or suburbs that have developed unique cultures through a series of **migration** waves. Particularly in the bigger cities – Melbourne, Sydney, Brisbane and Perth – there are significant concentrations of people from particular ethnic backgrounds. In

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Melbourne, for instance, the suburb of Carlton is synonymous with post-World War II Italian immigration; Caulfield with Jewish people; Richmond with Vietnamese; and Box Hill with Chinese. The shops, and the cultural practices of business, in each area reflect the customs and cultural practices of the migrant group who settled there and made that location 'home'. Each of these communities along with many dotted around Australia are illustrations of **diasporas**.

diaspora a community of people who have had to leave their homeland but wish to return or remain connected to it

Diaspora

In its strictest sense a diaspora is a group of people who are forcibly exiled from their homeland. They maintain their sense of belonging to that homeland, and their wish to return to it. The longer the period of displacement, though, the more the diaspora is likely to lose connection with the homeland and become rooted in the place where they live. However, for many Australian diasporas there is a lingering connection to a far distant 'home'. This is well illustrated by the Irish celebrations on St Patrick's Day (17 March) and the Chinese celebration of the lunar New Year in February.

Members of a diaspora feel they have two homes – where they actually live, in Australia, and the land sometimes long since left and now mainly sustained by dreams, myths and legends.

This lingering desire for the past is not simply a desire for a lost life; it can be also be associated with feelings of loss of personal power. Leaving behind all the memories of growing up and becoming attached to a nation, home, school, street, town and set of daily rituals is painful. At the same time, finding a place or community in a new and welcoming homeland can offset the loss, particularly if it also creates new wealth and a comfortable lifestyle.

To better understand the complexity of the Australian people, their origins and customs, we need to know more about the Australian government's migration policy and how this has impacted on settlement in the past and today. One interesting starting point for finding out about the local population would be a local Migration Museum, if there is one near where you live. These have rich sets of resources, including recorded stories of immigrant settlers, memorabilia from past 'homes' in other lands and images of courageous journeys into the unknown.

ACTIVITY 10.2

1. Identify areas near where you live that have features associated with another country. These could be food shops and restaurants.
2. List any languages other than English that you, your family, or anyone else you know, speaks.
3. Imagine that you have migrated to another country. Write a letter to a family member or friend and tell them about your new 'home'.

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10.2 Immigration in Australia

Source 10.3 Immigration has transformed local landscapes.

Prior to 1788

immigrant a person who has left their country of origin and settled in a new country

The first waves of **immigrants** were the Aboriginal and Torres Strait Islander peoples. They arrived via island and land bridges from the north over 50 000 years ago. As they spread across the continent Aboriginal people developed close connections with the lands that supported them, and ways to communicate the meanings they attached to events and places through language and cultural practices. Passed down through generations of younger Aboriginal people is the notion that their ancestors should be accorded great respect and that this will contribute to their spiritual wellbeing. This layer of occupancy of Australia is best understood through listening to and talking with Aboriginal people in your local area. One of the many important things we can learn from them is the interrelationship between Aboriginal people and their lands: the power of attachment to place.

Colonial settlement, convicts and early 'free settlers'

Most of the 19th century is marked by British colonial influence. Waves of convicts, primarily from the working classes of Ireland and England (mostly London), transported here because the English jails were full, were used as labourers, and constructed the roads, bridges and early buildings for the expanding settlements. The military presence dominated this early period. They were there to guard the convicts and make sure that the grand vision for the settlement created by the politicians back in London was fulfilled. Sydney and Hobart were the first settled colonies; they were followed by Melbourne, Brisbane, Perth and finally Adelaide, which was the first planned and 'free' (no convicts) colonial city. All are named after military or political leaders.

By the mid-1800s news of Australia's rich resources and prosperous lifestyles had filtered back to Britain, and a steady stream of free settlers started to arrive. Access to land attracted farming communities, and mineral wealth soon emerged – gold was discovered. The English, Scottish, Irish and Welsh were the dominant migrants during this phase but were soon joined by Chinese prospectors and other European migrants, notably from Germany. Each group brought specialties that transformed local landscapes:

German influence in the Barossa Valley, South Australia, dates back to the 1830s. Recognised today as a leading wine-producing area, the local population is largely made up of families of German origin. The names of the towns and local produce reflect these this.

With the discovery of copper in the 1840s Cornish miners flocked to South Australia's Yorke Peninsula. Soon to be known as 'Little Cornwall', the region dominated the copper trade and the Moonta–Wallaroo region became the copper capital of the British Empire. Population statistics today indicate that the region remains dominated by families of Cornish descent. Celebrations of Cornish traditions such as the famous Cornish pasties are part of that heritage.

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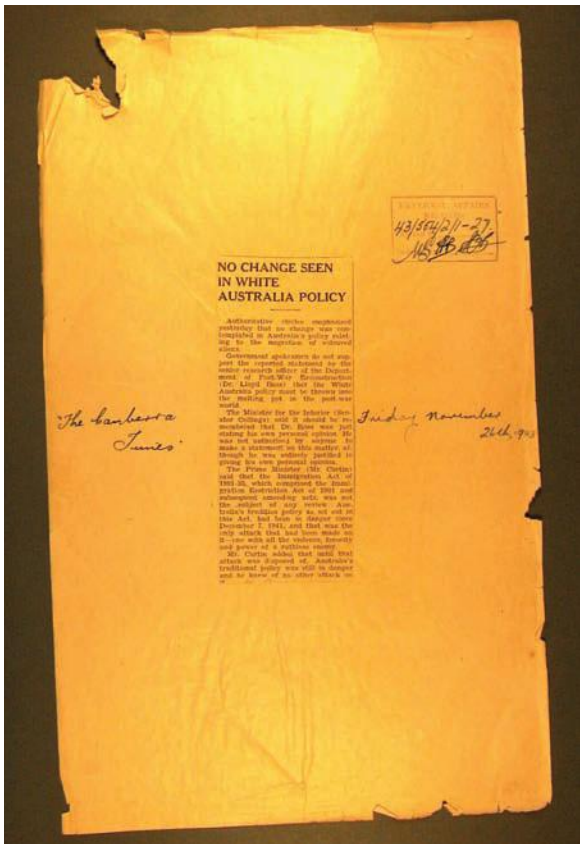
Following the end of convict transportation in the 1840s, Chinese workers were contracted as replacement labourers. Many stayed on, and were soon joined by significant numbers of Chinese who sought their fortunes through gold. The goldrushes of the 1850s to 1870s in Victoria especially attracted large numbers of Chinese immigrants. Many Chinese-born people remained after the goldrushes and settled as market gardeners or set up businesses trading in Chinese products.

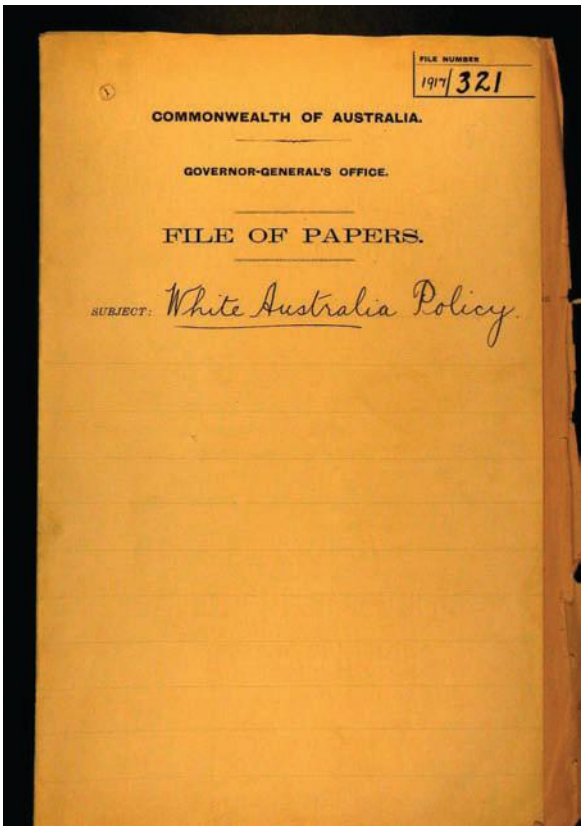
White Australia Policy

For most of the 19th century and the first half of the 20th century Australia's immigration settlement was dominated by the White Australia Policy. The policy was unashamedly aimed at keeping Asian settlers, especially the Chinese, out of Australia. This was despite the fact that many Australians can trace their Chinese descent back to the early 19th century. The images from the National Archives Library shown in Source 10.4 are illustrative of these views. The policy stated that people of 'colour' were a threat to the nation.

After World War II the policy was progressively softened. Japanese war brides were given citizenship and limited numbers of people of non-European backgrounds began to be permitted to migrate. The government introduced the Colombo Plan, which gave students from Asian countries places at universities in Australia. The citizenship rules began to change, and the long path towards today's multicultural Australia began.

The post-World War II period was a time of rapid growth, with significant numbers of people from war-ravaged Europe looking for a new life free of the past. Many were refugees escaping persecution and prison camps. The 1950s was a time of great hope and increasing prosperity in Australia. The boat arrivals included families like the Zevenbergen family, the 100 000th Dutch arrivals in Australia.


NO CHANGE SEEN IN WHITE AUSTRALIA POLICY


FILE NUMBER 1917/321

COMMONWEALTH OF AUSTRALIA.

GOVERNOR-GENERAL'S OFFICE.

FILE OF PAPERS.

SUBJECT: White Australia Policy.

Source 10.4 White Australia Policy papers

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Case study 10.1
Boat arrivals – the Zevenbergen family

Source 10.5 The Zevenbergen family arrive at Port Melbourne in November 1958.

Source 10.6 The Zevenbergens move into their new home: Geelong 1960.

When Adriana Zevenbergen first thought of coming to Australia with her husband Cornelis in the early 1950s she never imagined that years later she would arrive at Melbourne's Station Pier as Australia's 100 000th Dutch migrant. The young couple considered making the big move before they married in 1953 but postponed their dreams of migrating to Australia for six years.

Looking for a better future

The couple's adventurous spirit was rekindled in 1957 after receiving letters from one of Adriana's childhood friends, who had settled with her husband and five children in Newcastle, New South Wales.

In June 1958 the Zevenbergens submitted an application to the Australian Migration Office in The Hague for assisted passage to Australia under the Netherlands Australia Migration Agreement. The young family typified the Australian government's image of the type of migrants viewed as most desirable for Australia at the time.

Adriana was an accomplished housewife, raising two young children, and Cornelis was a skilled engineering fitter employed at the Caltex oil refinery. The selection officer described the family as 'an excellent family group' who would integrate well into Australian society. As a result, Adriana was chosen to carry the title of Australia's 100 000th Dutch migrant soon after their application was accepted.

A celebrity welcome

A great deal of excitement accompanied the family's journey, to ensure maximum publicity in both the Netherlands and Australia. Official photographers took more than 100 black-and-white and colour photographs of the family at home in the Netherlands and of the formal receptions in Melbourne on arrival. The family was presented with gifts to help them settle into their new life, including a new fridge and washing machine.

Adriana's son Addo recalls his mother's new-found fame: 'I was too young to remember our arrival but growing up I was always reminded that Mum was famous. With all that attention, she saw herself as a celebrity!'

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In 1960 the Zevenbergens moved into their own three-bedroom brick veneer home, built to Cornelis' design, in the Geelong suburb of Newtown. 'We grew up in a semi-rural area on the outskirts of Geelong,' Addo recalls. 'We spent our time swimming in the river, catching rabbits and snakes and lizards. It was a great area to grow up.' A third son, Ricky, was born in 1963.

Adriana and Cornelis continued to live in the Geelong home long after their children grew up and left. 'They never moved from the original house,' Addo says. 'It was a good spot. In the 1970s they built upstairs.' After Cornelis died in 1983, Adriana stayed in the family home until her death in May 2006, aged 75.

(Source: National Archives of Australia, Destination Australia website. Refer to www.cambridge.edu.au/geography9weblinks for link.)

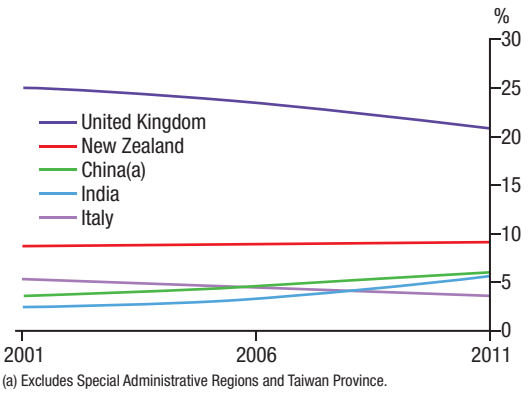
1 Discuss why celebrating the 100 000th Dutch migrant would have been important.
2 Examine ways in which Australia would be appealing to European migrants.
3 Compare the celebration of migrants in the 1950s with attitudes towards migrants in recent years.

The White Australia Policy finally ended in 1973, with the Australian government declaring its support for Australia becoming a multicultural country and making it illegal to consider a person's race as a factor in migration applications. The numbers of places for migrants from Asian countries was increased. This was the period following the Vietnam War, and many asylum seekers and refugees from the Indo-China region were resettled in Australia.

The 21st century

While Australia has remained a land of opportunity and a safe, friendly place to settle, other parts of the world have endured internal conflict, economic hardship and political upheaval. A steady stream of immigrants from troubled regions – including east African countries, the Balkans (including Albania and the former Yugoslavia), Lebanon and Iran, and Chile and Argentina – has sought refuge in Australia. The changing profile of the Australian population is evident in the Australian Bureau of Statistics' (ABS) census data. Source 10.7 shows the region of birth for overseas-born Australians in 1981 and 2001.

The highest proportion of overseas-born Australians came from the United Kingdom and Ireland in both censuses, but there has been a noticeable increase in the numbers from Asia and Oceania. After England and Italy, New Zealand ranked third place for country of birth.



(a) Excludes Special Administrative Regions and Taiwan Province.

Source 10.7 Top 5 countries of birth as a proportion of total overseas-born population, 2001-2011

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Case study 10.2

New Zealanders in Australia

Australia and New Zealand enjoy a unique relationship, nurtured by a number of factors including close geographic proximity, shared histories as members of the British Commonwealth and the ANZAC tradition. This relationship has led to arrangements that enable citizens of Australia and New Zealand to migrate freely between the two countries. Over recent decades, the most significant trans-Tasman movements have been of New Zealanders moving to Australia, with the pattern tending to reflect the relative economic conditions and opportunities within the two countries.

The number of NZ-born people living in Australia increased by 89% over the last two decades, from 280 200 in 1989 to 529 200 in 2009.

Between 1989 and 2009, the proportion of NZ-born people in Australia's estimated resident population (ERP) increased from 1.7% to 2.4%. This makes New Zealand the second largest single country contributor to Australia's overseas-born population (the United Kingdom is the largest contributor at 5.4% of ERP). In 2009, the proportion of the Australian population that was born in China (1.6%) or India (1.4%) were both smaller than the New Zealand share.

Compared with the other contributor countries of migrants, New Zealand has a relatively small population, with an estimated 3.0 million NZ-born people living in New Zealand in 2006. This means that for every 100 New Zealanders in New Zealand in 2006 there were 15 NZ-born people living in Australia.

(Source: Australian Bureau of Statistics).

1 List the factors why Australia and New Zealand enjoy a unique relationship.

2 Identify the percentage of NZ-born people in Australia's estimated resident population in 2009.

NOTE THIS DOWN

Copy the graphic organiser below and complete a timeline of immigration in Australia. How do you explain the pattern?

Aboriginal and Torres Strait Islander people arrived via island and land bridges from the north over 50 000 years ago

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Refugees

Immigration policy has two major components. One is the program for skilled workers and families who seek a new way of life in Australia. The other is based on humanitarian aid for refugees and people who are forced to leave their homeland and seek asylum or resettlement in new lands.

Source 10.8 A refugee camp in Somalia

Source 10.9 shows the number of visas granted by the top 10 countries of birth. Notably, in this 2010–11 period 'women at risk' received specific attention.

Geographical fact

According to the Australian Department of Immigration and Citizenship, in 2010–11, 759 visas of the Refugee category were granted to Woman at Risk visa applicants, exceeding the nominal annual target.

Source 10.9 Humanitarian visas by country of birth (2010–11)

Countries	Number of visas granted
Iraq	2151
Burma	1443
Afghanistan	1027
Bhutan	1001
Congo (DRC)	565
Ethiopia	381
Sri Lanka	289
Iran	271
Sudan	243
Somalia	190

RESEARCH 10.1

One way to grasp the significance of Australia's changing population profile is to conduct a class census. You can design your own questions along the lines of the official Australian Census (go to www.cambridge.edu.au/geography9weblinks and follow the link to the Australian Bureau of Statistics' Census at School pages). Questions might include the following:

- What country were you and your parents born in?
- What languages (if any) other than English are spoken at your home?
- How long has your family lived in the place you live in now?
- What other places have you lived (if any) in the last 10 years? Why did you move?
- During the past year, what places did you visit outside your home location? This list could be pooled and categorised into numbers of visits to relatively close places (local capital city), interstate and overseas places.

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Multiculturalism

The nation's most recent policy statement on multiculturalism, from the Department of Immigration (2011), shows the development in acceptance of our cultural diversity. There are four major policy principles:

Principle 1: The Australian Government celebrates and values the benefits of cultural diversity for all Australians, within the broader aims of national unity, community harmony and maintenance of our democratic values.

Principle 2: The Australian Government is committed to a just, inclusive and socially cohesive society where everyone can participate in the opportunities that Australia offers and where government services are responsive to the needs of Australians from culturally and linguistically diverse backgrounds.

Principle 3: The Australian Government welcomes the economic, trade and investment benefits which arise from our successful multicultural nation.

Principle 4: The Australian Government will act to promote understanding and acceptance while responding to expressions of intolerance and discrimination with strength, and where necessary, with the force of the law.

(Source: Department of Immigration and Citizenship)

Transition from the White Australia Policy to the current position on multiculturalism reflects a new phase for a country that is still in transition from its colonial past. While reparation has in part been made to our Indigenous people, there is still a wide gap in health, education and wealth between Indigenous and non-Indigenous people.

There are also challenges ahead with the second generation of immigrants. These minority groups are being integrated into the employment and lifestyle patterns of the modern nation, and there is a sense that all Australians are in a transitional stage of identity. Poetry, theatre, film and painting as well as writing and music are all rich means of self-expression for the Australian people.

RESEARCH 10.2

Think about all the annual events in your local community that illustrate connection to place – both near and far. Create an event calendar with illustrations of related art, craft and other representations of culture, including Indigenous, diaspora and older Australia.

10.3 The 'pull' of the cities

Where people live in Australia is largely linked to settlement history. The major cities along the east coast provide sea links for trade and the movement of people. Sydney, Melbourne and Brisbane alone account for more than 40% of Australia's total population; if we add two other state capitals – Adelaide and Perth – it totals more than 50%. With the addition of all other significant urban areas, the population resident in cities is estimated to be around 90% of Australia's total population. Source 10.10 shows the percentage change in rural and urban growth since 1950, with projections to 2025.

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Source 10.10 Rural and urban population figures including major cities

Indicator	1950	1970	1990	2010	2025
Rural population	1 881 000	1 876 000	2 496 000	2 439 000	2 428 000
Urban population	6 297 000	10 853 000	15 601 000	19 829 000	22 813 000
% urban	77	85.3	85.4	89.0	90.4
Rural annual growth rate (over 5 years)	0.22%	0.84	–0.40	–0.50	–0.04
Urban annual growth rate (over 5 years)	2.98%	1.90	1.49	1.49	1.14
Major cities					
Adelaide	429 000	792 000	1 046 000	1 181 000	1 535 000
Brisbane	442 000	798 000	1 329 000	1 993 000	2 627 000
Melbourne	1 332 000	2 334 000	3 117 000	3 896 000	4 962 000
Perth	311 000	611 000	1 160 000	1 955 000	2 121 000
Sydney	1 690 000	2 667 000	3 632 000	5 254 000	5 646 000

The figures indicate the gradual decline in rural population and the increasing percentage of people living in the major capital cities. Factors that help explain these outcomes include: declining rural employment and consolidation of small farms into large ones; redistribution of infrastructure including services and employment; migration from rural areas to cities; and expansion of the major cities by the addition of job-seekers and new arrivals.

Source 10.11 It is estimated that there will be 5 646 000 people living in Sydney by 2025.

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The ABS explains how migration has added to this growth pattern:

> Since the end of World War II, over 6 million new settlers have arrived in Australia. Over the same period, from 1947 to 2001, the proportion of the population born overseas increased from 10% to 23%. Most people born overseas have shown a preference for city living – 81% or 3.3 million people lived in capital cities in 2001, making them more highly urbanised than the Australian-born population. This is not a new phenomenon – it has been evident since at least the 1970s. Some of the main factors that affect where migrants decide to live are the location of family members or people of the same ethnic background, the point of entry into the country, and the economic attractiveness of the destination in terms of employment opportunities.

One of the consequences of this trend is urban sprawl. Accommodating the new arrivals is difficult, and affects both rental and home ownership costs and options. Many new settlers – and others – have to move to the city fringe, where housing is more affordable. This requires **personal mobility** to get to work and access services – often through car ownership – because of poor public transport locally.

personal mobility one's ability to move around

There are positive effects of increased population on urban areas: more people helps create growth economically, including housing, schools and services. There can be negative consequences if there are problems in constructing those services for expanding suburbs; also, communities can suffer through having limited access to support services and to parks and green spaces.

ACTIVITY 10.3

Look around your area and identify signs of negative and/or positive growth.

1. Discuss the effects of this on your community.
2. Projecting to 2030, what is your vision for your area?
3. Evaluate how sustainable your area is.
4. Rate the livability of your community.

Geographical fact

In 2001, 8 out of 10 people born overseas lived in a capital city and just over half were in Sydney or Melbourne.

10.4 Internal migration

So far in this chapter our attention has been on movements of people in the workforce – those moving internally and those migrating here from overseas. The push factors in most of these contexts revolve around the difficulty of having a successful and satisfying way of life. The pull factors are usually connected with work and settlement opportunities. There are, however, groups of people who are on the move all the time, for short-term purposes or to find another place that appears to offer additional lifestyle quality or meet changed personal standards of what constitutes a livable place. The desire 'for a change' and the ability to do something about it are usually associated with affluence – relocation can be expensive.

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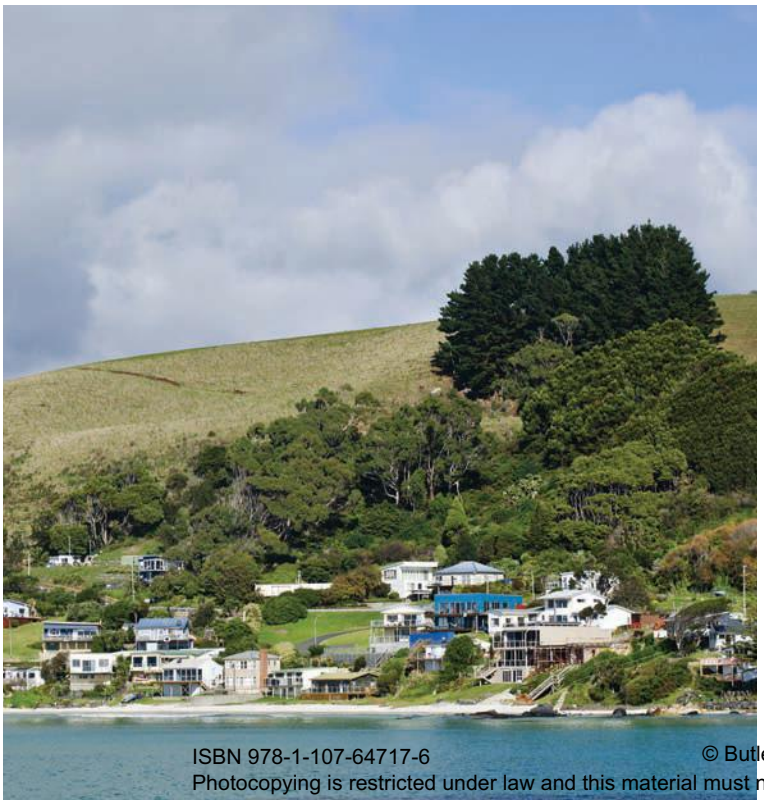
Sea changers

sea changers colloquial term for people who opt for what they perceive as an improved quality of life by the coast

Local councils having to deal with the influx of **sea changers** have established a National Sea Change Task Force to share information and strategies.

Local councils estimate that the growth rate of these towns is 60% above the national average. In 2006 their Sustainability Charter was published. It makes a commitment to:

- develop innovative and best practice strategic planning at regional and local levels
- preserve local character and sense of place
- provide for the timely provision of resources to meet the needs of high growth communities for infrastructure and services
- integrate coastal management and conservation objectives with economic development
- support community wellbeing
- ensure community ownership and participation in key planning decisions affecting the coast.



Source 10.12 Boat Harbour, a seaside town in Tasmania

Retirees are the group most commonly associated with this pattern of movement, which can be for the annual visit to coastal resorts in northern latitudes or for permanent settlement – typical of the Gold Coast and Sunshine Coast towns of southern Queensland, and of northern New South Wales towns. Demographically, this is an important group for study. Retirement villages in attractive coastal locations are a lucrative source of investment income. So are caravan parks, used by the 'grey nomads' who circle Australia in their retirement years. These are the baby boomers, now on the move and doing things that were not possible in their earlier years of working and child rearing.

Young people

The most common internal movements are associated with the capital cities. A large percentage of the movements between cities are young people or recent arrivals. For young people, moving from country locations to the cities is generally associated with training and higher education, which in turn can lead to city-based employment opportunities. However, most young people do not move out of their local areas or shift states. Similarly, new arrivals generally seek to remain in the major cities. This pattern applies particularly to people of Asian background. The ABS reported in 2001, for instance, that people of Vietnamese origin lived almost exclusively in the major cities (97%). The same applied to people from China (96%), India (91%) and the Philippines (85%).

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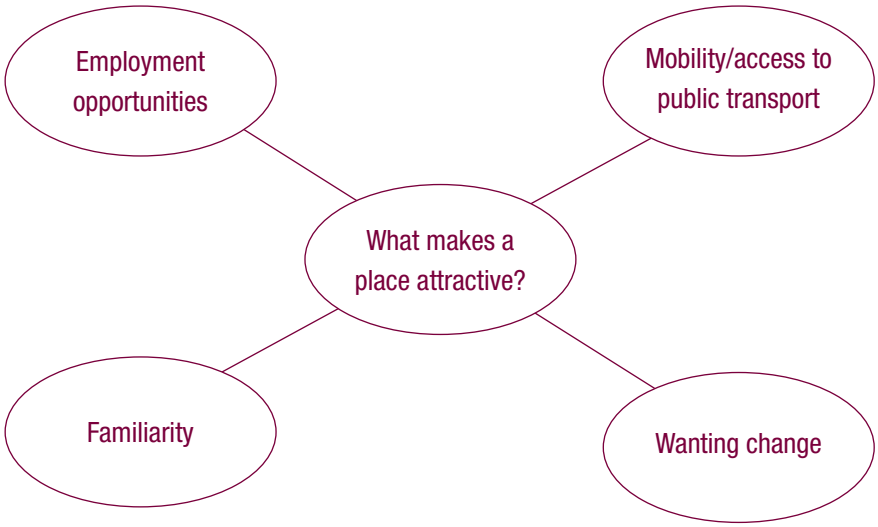
NOTE THIS DOWN

Copy the graphic organiser below and explore the reasons why people are attracted to a particular place.



Geographical fact

Young people (people aged 15–24) are one of the most mobile population groups. Mobility rates increase from the mid-teens through the young adult years, peaking at age 27, and falling sharply from that point, through to age 75.

International migration has increased markedly as a result of the rise of the global labour market, more affordable international transport and sophisticated communication technologies. The movement of Australians overseas is an important issue not only because of its impact on the size of the Australian resident population, but also through its impact on the labour force and the economy.

10.5 Overseas migration

The final movement trends discussed here relate to Australians moving away from the country. International holidays or short-term trips have become increasingly affordable. However, the major shift has been in the numbers of people now seeking to leave the country to work internationally. The ABS figures show that for 1991–2003, around 3 in every 100 Australian-born people aged 15 plus were living in another Organisation for Economic Cooperation and Development (OECD) country. The consequences are described by the ABS as follows:

Generally, expatriate Australians have high educational levels, as do the expatriate populations from other OECD countries, including those who seek to come to Australia.

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RESEARCH 10.3

Our focus has been on physical movements of people. However, social media also 'moves' people. Nowadays anyone with online access can transport their thinking to distant places or communicate with other users across national and international borders. The Arab Spring is a recent illustration of the power of social media to mobilise a region for a political cause. Closer to home, in Australia the power of social media to supplement official broadcasts to communities under threat from fire or flood is well recognised. Both these examples are based on information being shared quickly. The sustainability of transporting ideas and cultural beliefs is complex and worthy of investigation. The question for you to consider is how social media is contributing to a new Australian identity. Do our radio, TV and online news media reflect our cultural diversity? How well do we score on tolerance, inclusive responses, acceptance of difference, praise of 'otherness'?

1. Design a score sheet with a 10 point scale for each of the above criteria and others that your class considers important.
2. Monitor selected programs on your local radio, TV and/or newspapers for a week. Select programs that will enable you to make a judgement over time.
3. Collate your results into tables, analyse critically and write up your findings in a report.

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FIELDWORK 10.1 THE INFLUENCE OF SETTLERS

Aim

To analyse the impact of settlers over time on the character, land use and design of a place.

Method

Examine your local area or another area of your choice.

Preparation

Locate a map of your local area, town or suburb and make a list of street names – the more the better. Once you've done this, look at the names and see if you can identify their source. Once you have a good overview of the information, analyse it. For the street names, your analysis may look like the following.

Street name	Indigenous	British	European	Asian	Other?
Melbourne					
Canberra					
Your local street names					

Then think about the influence these cultures may have had on your local area and create a list of obvious connections. For instance, think about the food shops in your area. How would you describe the variety of foods sold? Does this reflect one or more dominant ethnic cultures within the area? What of the trees and architecture of the commercial buildings, public buildings and houses – by way of background you can conduct some independent research on the styles of architecture and plant species that may derive from each of the settlement influences. What about festivals and recreation events? Which cultures do they represent? Are there elements of these events that have historical links exclusive to the place where you live?

Create a list of what you see as the connections related to street names, food culture, religious and/or cultural festivals, events, buildings and recreation spaces. The next step is to conduct fieldwork to map the land use features and test your hunches.

Take a blank map of a 1 km^2 or less section of your local city or town and record the land use activities. You could divide the area for class groups once in the field. Using symbols you created beforehand in class, note every aspect you observe. These will be streets, businesses, residences, factories, parks, schools, car parks, train stations, tram and bus stops, churches and recreation places (including sporting facilities). What are the most observable features of change as you move around the area? Take some photographs to complement your mapped information.

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Data collection

1 As well as recording the land use activities on your map, be sure to observe the people walking and shopping in the area.

- **a** During a 15-minute snapshot, count the numbers of pedestrians who walk past you at a designated location on your map. What age group seems dominant – school age, adult under 30, adult 30–60, or over 60?
- **b** Photograph what appear to be the main features of the location.
- **c** Make a list of at least 10 businesses and list the major products they sell. Look for connections with the list of sources you made earlier in class.
- **d** Look for signs in shop windows that advertise local events.
- **e** Identify a site whose use has changed over time, such as a cinema building that is now used as a warehouse. Take photographs of buildings you consider to be pre-1900s (if at all), built pre-World War II, built post-World War II and built in the last decade.
- **f** If approved, conduct short interviews with passing shoppers asking questions such as 'Do you live in this area?', 'What do you like about the area?', 'What attracts you to this shopping area?'

2 What evidence is there of changes over time? Look for evidence of older and newer buildings and land use activities.

3 Sketch examples of features that seem to typify the location.

Fieldwork presentation layout

Front page	Title and name
Contents page	Do this last, once you have numbered the pages
Page 1	Aims and methods
Page 2	Location map
Page 3	Introduction – brief description of the study site
Page 4	Mapped land use
Pages 5–6	Description and photographs of the land use and analysis of findings based on your initial hunches
Pages 7–8	Description of observed changes over time, including support photographs and/or sketches
Page 9	Evaluation of the differences and predictions for the future of your local area 10 years from now, and conclusion
Page 10	References

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Chapter summary

- People on the move in Australia reflect changing policies and opportunities for travel as well as international pressures from regions in conflict.
- Liberalising the immigration policy – the shift away from European countries of origin and the increased intake of people born in Asian countries in particular – has led to a culturally changing profile, as has the humanitarian intake program.
- Movement within Australia reflects job opportunities, especially for younger people. The same is true of international movement, with increasing numbers of Australian citizens leaving the country for short and longer periods.
- Expatriates tend to be better educated and may return following an extended period overseas.
- Our increasingly diversified cultural identity is transforming the Australian nation.

End-of-chapter questions

Multiple choice

1 The least likely reason for people to move permanently is:

A to seek happiness.

B for a better job.

C lifestyle opportunities.

D politics.

2 The White Australia Policy was aimed at:

A cultural assimilation.

B excluding people from non-European backgrounds.

C ethnic purity.

D colonial dominance of the British Empire.

3 Sea-changers are most likely to be the:

A young.

B elderly.

C recently retired.

D mid-career.

4 International movements have increased because of:

A political conflict.

B job opportunities.

C affordability.

D government policy.

5 The most significant trans-Tasman movements have been of New Zealanders moving to Australia because of:

A economic conditions.

B cheap air travel.

C easy visa arrangements.

D employment opportunities.

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Source 10.13 Chinese New Year festival, Melbourne, Australia

Short answer

1 What does the term 'diaspora' mean? Give an example.

2 Discuss how transport has influenced the mobility of Australian citizens in the last two decades.

3 Suggest the major motivating factors for people seeking permanent resettlement.

4 What evidence is there of changed thinking about travel from people of different ages in your local area – younger people, your parents and grandparents, say?

5 Reflect on how you see migration changing the profile of Australian citizenship in the future.

Extended response

Older people in Australia grew up with the White Australia Policy. Anti-Asian sentiment in the postwar period reinforced the bias towards European cultures. The Australian identity was strongly associated with the idea of assimilation – that people from other lands should adopt Australian ways once they moved here. In the 21st century this has changed. People today are more likely to move both within their country and between countries. Today we need to imagine a different identity. What is your imagined Australian community? What are its strengths, weaknesses, threats and opportunities? What does it really mean to be a multicultural country? Write a poem that reflects your answers to these questions.

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Glossary

acidification the process whereby a substance becomes acidic, or is converted into an acid

adaptation an evolutionary trait a plant or animal develops to better suit its environment

agrarian (society) a society that depends on agriculture for its livelihood

Agricultural Revolution a period of massive change in the way that agriculture is practised

agriculture the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool and other products

alluvial (soils) soils that are rich and fertile and deposited by rivers

anaerobic (organism) an organism that can live without free oxygen (oxygen in the air)

animal husbandry the agricultural practice of breeding and raising livestock

appropriate technology the idea that technology use in low- and middle-income countries should meet the community's needs, be compatible with local socio-cultural traditions, and be cheap, small and promote independence by using local natural and human resources

arable suitable for farming

artisan mining individual or small group mining activity carried out using minimal machinery and very basic tools, such as a bucket and spade

aspect the warming effect of the sun's rays on vegetation

bed and breakfast a guest house that supplies sleeping accommodation and a meal in the morning

bias mindset with a particular interest or view that limits one's ability to make a fair judgement

biodiversity the diversity of plant and animal life in a particular habitat

biofuel fuel made from natural sources

biomes groupings of plant and animal communities that have adapted to inhabit particular parts of the Earth's surface

brackish (water) having higher salinity than fresh water, but not as much as seawater

bund a built embankment with two sides

call centre a facility that handles telephone enquiries by providing information or assistance

capacitors passive electronic components – ie they do not require extra electricity to function – that, in a circuit, hold a voltage, or a charge, for a specific period of time when the electronic device is unplugged from electrical outlets

capitalism an economic system in which resources and means of production are privately owned and prices, production, and the distribution of goods are determined mainly by competition in a free market

cereal crop grasses grown to produce edible grains, such as wheat, oats and rice

chlorophyll the green substance in plants that allows them to use the energy from the sun

city a larger town; in Australia this is generally defined as being a metropolitan centre

climate the long-term changes in temperature and rainfall experienced in an area

climate change the shifting or change in the world's climate/weather

climax vegetation the most dominant form of vegetation in an area

cloud computing broadly, programs and services available via the internet; the 'cloud' is a metaphor to symbolise the worldwide and intangible character of the internet

colonisation the process by which a species enters a new area and dominates it

colonisers the first plants to inhabit an area

commodity a raw material, such as an agricultural product, that can be bought and sold

conflict minerals minerals mined in areas where there are armed conflict and human rights abuses

confluence the point at which rivers meet

coniferous an evergreen tree that grows cones

consensus an agreement reached by a group as a whole

crepuscular active at dawn or in the early evening

Crown land land owned by the government

deciduous trees trees that drop their leaves each year, typically for winter

decomposers animals, fungi and bacteria that break down or 'clean up' waste matter

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demographic related to the structure of a population

desert an area that receives less than 250 mm rainfall per year

diaspora a community of people who have had to leave their homeland but wish to return or remain connected to it

digital divide inequalities in access and use of technology between countries, or between rural and urban regions, and even between men and women

diurnal active during the day

domestic tourism where people travel within their own country for recreation

domesticated plants plants grown from seeds originally harvested from plants growing wild, which are used to plant areas such as rice fields

domestication the process of taming animals or cultivating plants for uses that benefit humans

dryland agriculture farming that depends only on natural rainfall and soil moisture to water crops

dugout a shelter that is dug into the ground and roofed over

ecology the way in which everything living interacts with the world around it

economic development improvement in the standard of living in a region as measured by financial indicators

economy of scale the advantage that a larger producer or consumer has over a smaller one because of costs that do not increase proportionately with size or amount purchased

ecosystem an area of the Earth's surface where living organisms interact with parts of the Earth

El Niño extensive warming of the eastern and central Pacific Ocean, leading to an increased possibility of dry conditions in eastern Australia

environmental degradation a change or disturbance to the environment perceived as harmful or undesirable

erosion the wearing away of the surface of the Earth by the action of water and wind

eutrophication an excess of nutrients in water, resulting in an increase of algae and bacteria, which leads to the deaths of animals as the oxygen levels in the water decrease

evapotranspiration the process by which water evaporates from the land and water and is expired from plant material and joins the atmosphere

e-waste (electronic waste) rubbish created by throwing away used electronic devices and components, such as batteries; also, the disposal of materials involved in their manufacture or use

expat a worker from overseas

extensive agriculture crop or livestock production over large areas of land which requires fewer inputs such as labour: one example would be wool production

exurbia a residential area beyond the suburbs

factory farm a farm where many animals are raised together in a small space

fair trade trade based on the buying and selling of products (usually from poorer nations) that have been mined, grown or manufactured under humane working conditions, with appropriate wages for the workers and minimal environmental impact

floating (a company) letting the public buy shares in it; this gives the company money to invest or spend

food chain the sequence of feeding arrangements in an ecosystem in which each member may be food for the next highest member of the chain

food security the knowledge that enough food will be provided for the population now and in the future

footloose an industry that can relocate easily

fragmented broken up into smaller or separate parts

GDP (Gross Domestic Product) the total value of all goods and services produced in a particular country; often used to compare the size of national economies

global citizenship our rights and responsibilities as citizens in our global community and our rights and responsibilities as citizens in our local community and the country we live in

globalisation the process by which the world is becoming more interconnected, with an increase in social and economic integration between countries (eg an increase in international trade and communication)

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governance the set of rules, organising processes and structures that groups, societies and countries follow to make decisions and maintain order in their day-to-day living

Green Revolution a period beginning in the 1940s when new agricultural techniques brought great increases in production and greatly decreased the incidence of hunger worldwide

gross national income (GNI) per capita the average total annual income of each person in a particular country

hectare 10 000 square metres

high-yielding varieties (HYVs) varieties developed by selective breeding and cross-breeding to achieve faster growth and to produce more seeds

hi-tech products and technology that are complex, and that use or produce the latest advances in computers and electronics

hunting and gathering the practice of obtaining food requirements through the hunting of wild animals and the collection of natually growing plants and plant products

identity the ways in which we define ourselves

immigrant a person who has left their country of origin and settled in a new country

industrialism when a country's economic and social systems become based on the production of goods through mechanised industries in urban centres, rather than through agriculture

industry a type of commerce or business, such as the metal industry or the tourism industry

information and communications technology (ICT) devices that can electronically receive, store, retrieve and manipulate digital data, and communications technologies, such as the internet and wireless, that transmit information

in situ in the original position; not having been moved

intensive agriculture farming a small area with a crop that has a high monetary value

international tourism where people travel outside their own country for recreation

internet a worldwide interconnected network of computers

intertidal wetlands the part of a shore between the high water and the low water marks

irrigation the process of supplying water to a crop, typically via channels

La Niña cooling of the central and eastern Pacific Ocean, leading to an increased possibility of wet conditions in eastern Australia

landscape aesthetic the way a person responds to their environment

latitude an imaginary line measured in degrees north and south of the Equator

leaching the draining of water-soluble compounds out of the soil by the flow of water

legume a type of plant, such as clover, soybeans and lupins, that carries nodules on its roots; working with certain bacteria, legumes are responsible for the biological fixing of nitrogen in the soil

longitude an imaginary line measured in degrees east and west of the Prime Meridian (or the Greenwich Meridian)

low- and middle-income countries countries that have a lower GNI per capita than wealthier countries

maize a grain known in most English-speaking countries as 'corn'

manufactured produced on a large scale

megatrend a major movement, pattern or trend emerging in the global environment

Mekong Delta a region in southwest Vietnam where the Mekong River empties into the sea

metropolitian pertaining to a large city, its surrounding suburbs, and other neighbouring communities

migration movement from one location to another

monocot a flowering plant that grows its parts in threes (the number of petals is typically a multiple of three); it only produces one embryonic leaf (cotyledon) in its seeds

monoculture the growing of a single crop in an area

nitrogen an odourless, colourless, unreactive gas forming about 78% of the atmosphere

nocturnal active at night

nomadic herding moving one's cattle or other animals, such as goats or yaks, from place to place as food becomes available and so as not to exhaust the biome

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north–south gap the gap between the economically 'richer' and economically 'poorer' countries of the world – the Haves and the Have-nots

nostalgia remembering good things about the past

ocean current the regular movement of water in the ocean in a particular direction

offshoring moving your business activity or part of your business activity to an overseas location

offsite sedimentation the contamination of waterways by sediments washed from the land

orographic rainfall rainfall produced when rain-bearing winds are forced upwards by mountain ranges; they then form clouds and often rain

outsourcing contracting part of a business function to another person or business panicle a cluster of flowers from which the grain develops

pastoral land used for the grazing of cattle or sheep

penal colony an institution where prisoners are held (often located on an island or an isolated location from which escape is difficult, or impossible)

peri-urban areas just beyond the boundaries of the major urban centres

perpetual frost an area that is constantly covered in ice, such as the polar caps

personal mobility one's ability to move around

perspectives the ways in which people view the world around them

pesticides substances used to destroy insects and other organisms that can harm or damage plants or animals

phosphate the salt of phosphoric acid, which is commonly used as fertiliser

photosynthesis the process of plants converting sunlight to energy

pneumatophore a 'breathing root' that helps mangroves survive at high tide

population the number of people residing in an area

precipitation water, in forms such as rain, snow or hail, that condenses in the air, becomes too dense to remain suspended, and falls to the Earth's surface

primary producer an animal that eats only plant matter

primary source information that comes directly from the event or area we are studying. It is 'first hand' and is how we classify the majority of data collected during fieldwork.

principles rules or morals that a person or company/group decides to follow

qualitative methods methods used to gather data that are expressed in non-numerical form (and therefore can only be described)

quantitative methods methods used to gather data that are expressed in numerical form

rainforest a tropical forest environment with a large rainfall

recession a period of economic downturn: many businesses close and people lose their jobs

redevelopment when an area is rebuilt, redesigned or renewed

regeneration new life coming from something old or obsolete

remediation the removal of pollution or contaminants from the environment

rural–urban migration the movement of workers from farmlands to cities and other urban areas

salinisation when salt is deposited on the soil

salinity the level of salt in soil and water

savanna a grassy plain with only scattered trees and shrubs

scale (on a map) the amount by which the real world has been reduced so that it fits onto the map

sea changers colloquial term for people who opt for what they perceive as an improved quality of life by the coast

secondary source information that is put together by someone else or someone not directly involved in the event or area that we are investigating

selector a farmer, often with few resources, who bought a small parcel of land following the land reforms in Australia in the 1860s

sequent occupance land use changing over a period of time

service centres settlements (villages, towns and cities) that have shops and services such as education, health and banking. Larger service centres (cities) have a greater range of services than smaller service centres.

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shareholder a person with a financial interest in a company

shifting cultivators people who farm a section of land for 2–3 years, then move on to another section to allow the original plot to revitalise itself

smelter a factory where a metal (such as tantalum) is melted under extreme heat to separate the mineral (such as coltan) from the ore containing the mineral; conflict-free smelters use only minerals from lawful sources

soil acidification a gradual increase in the acidity of a soil, which reduces crop productivity

solstices the two times of the year when the sun is at its greatest distance from the celestial Equator. The summer solstice is the longest day of the year and the winter solstice is the shortest

squatter a farmer who in colonial Australia occupied large tracts of Crown land in order to raise sheep or cattle

staple food the most commonly eaten food in a specific region

subsistence (agriculture) producing just enough for the family to survive

surplus excess

sustainable agriculture farming that is conducted in a way that preserves resources

sustainably when a resource is used in such a way as to preserve the resource and its surrounds

synthetic pesticide a pesticide in which the active ingredient has been manufactured (as opposed to a natural pesticide, in which the active ingredient occurs naturally)

tantalum a heat-resistant powder, refined from ores such as coltan (columbite-tantalite), that can hold a high electric charge

tariff a government tax on imports and exports

temperate zones broad climate zones between the tropics and the poles

terms of trade the price farmers receive for their products divided by the price paid for inputs such as fuel, labour and/or fertiliser

title deed a legal document that shows ownership of a piece of land

topography the surface shape and features of an area, including human-built features

torrid hot and dry

town a built-up area somewhere between a city and a village in size

trace element a chemical element required in only minute amounts by living organisms for normal growth

trade the buying and selling of goods and services

transnational companies (or corporations) companies that operate their businesses in and across more than one country; also called multinational companies

tundra an area where plant growth is limited by low temperatures and a short growing season; usually found at high latitudes or high altitudes

turbidity cloudiness in the water due to the presence of extremely fine particles of matter that are held in suspension

urbanisation an increase in the proportion of people living in built-up areas

vegetative phase the stage at which a plant produces its leaves

venture capitalists companies or individuals that invest large sums of money in small companies to help them start up and grow

vineyard a plantation where grapevines are grown, usually for use in wine-making

water table the level below which the ground is saturated with water

weather the state of the atmosphere at a given time

winery a place where wine is made

World Wide Web (WWW) the sites and pages that are connected across the internet

worldviews the collection of ideas, beliefs and spiritual connections through which we – personally, as groups and as cultures – understand, connect with and interact with the world

xeric extremely dry, or adapted to extremely dry conditions

zonation variation in plant life due to differing environmental conditions

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