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FOR GEOGRAPHICAL SCIENCES

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# Geography

## Shaping Australia's Future



# Geography

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The Geographical Society  
of New South Wales

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## Executive summary

Geography is a wide-ranging and dynamic discipline concerned with exploring issues affecting the wellbeing of people and places. To Australian geographers, wellbeing includes economic welfare based on employment and incomes, as well as the core values of social justice, environmental sustainability, equity and cultural diversity. Geography provides an understanding of the diversity of environments, places and cultures on this planet, and the inequalities within and between places. Applying geographical understandings to contemporary issues allows us to integrate knowledge about the natural world, society and the humanities through the perspective of space, place and the environment. This approach plays an important role in shaping strategic directions in policy formation and in education at all levels.

Geographical thinking is based on a set of core concepts that guide the choice of research topics, identify significant questions, and suggest explanations. Geography's core concepts of space, place and environment overlap in various ways through other important concepts of interconnection, time and geographic scale. Geographers also stress the importance of the concept of scale dependency, i.e. that the past affects the present, and the interconnectivity of geographic scales.

This strategic plan, *Geography: Shaping Australia's Future*, produced by the National Committee for Geographical Sciences explains the contribution that geography makes to the social, economic and environmental wellbeing of Australians and Australia through research, education, training, skills, expertise and engagement with industry and the community.

The first two chapters explain geography as a discipline, including its structure and status in Australia. The chapters that follow review a selection of Australian geographers' recent research. The review looks at the contribution of geographical research to the wellbeing of Australia and Australians, and of Australia's neighbours in the Asia–Pacific region, with research areas chosen that focus on priorities identified by Australian federal and state governments over the past five years, as well as other important areas of Australian geographical research.

The research areas covered by the 10 chapters are:

- environmental change and human response
- land, water and food
- health and wellbeing
- the economy
- the Asia–Pacific region
- natural hazards
- rural and regional Australia
- Australia's cities
- coastal and marine environments
- geographical information systems and science.

The two penultimate chapters review the vital position of geography in schools and outline the roles of public geographical societies.

The final chapter outlines the four major challenges for the discipline in Australia, drawing on previous chapters to suggest appropriate responses and future directions.





# Introduction and acknowledgements

This strategic plan, *Geography: Shaping Australia's Future*, was produced by the National Committee for Geographical Sciences of the Australian Academy of Science. The plan focuses on the contribution of geographical research to the wellbeing of Australia and Australians, and of Australia's neighbours in the Asia–Pacific region.

The first two chapters explain geography as a discipline, including its structure and status in Australia. The chapters that follow review a selection of Australian geographers' recent research. The research areas chosen focus on priorities identified by Australian federal governments, as well as other important areas of Australian geographical research. These are:

- environmental change and human response
- land, water and food
- health and wellbeing
- the economy
- the Asia–Pacific region
- natural hazards
- rural and regional Australia
- Australia's cities
- coastal and marine environments
- geographical information systems and science.

Subsequent chapters review the vital position of geography in schools and outline the roles of the public geographical societies. The final chapter outlines how geographers can contribute to challenges facing Australia and our neighbouring region, and the discipline itself.

The committee decided to produce the plan at the end of 2013. The agreement of key partners to the concept of the plan, and their commitment to fund its preparation,

was obtained during 2014, and their support is gratefully acknowledged in the list of contributing organisations. Drafting commenced in 2015. Some chapters were written by a single author and others by a small group. These authors are acknowledged in the list of contributors to chapters. Chapters drafted by a single author were sent to experts on the topic for comment, and these are acknowledged in the list of peer-reviewers.

Most sources in the plan are drawn from the period from 2011 to early 2017 to ensure it provides a conspectus of recent geographical research. The bibliography of these sources, found in the online appendix, is by no means complete and omission from this bibliography is not a reflection on merit, rather a reflection of the fact that it is not feasible to include every piece of worthy research.

Consultation on the plan took several forms. An online questionnaire, which asked for comments on a range of issues, gained 195 responses. The former chair of the committee visited 18 universities across Australia, and discussed the plan with approximately 125 academic geographers. The plan was also discussed at sessions held at two conferences of the Institute of Australian Geographers. The assistance of all those who participated is acknowledged.

Finally, the committee gratefully acknowledges the support provided by the Australian Academy of Science and its officers to the preparation and publication of this strategic plan for geographical sciences.

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# 1 Geography

## Introduction

Geography is a wide-ranging and dynamic discipline that investigates many of the issues affecting the wellbeing of people and places in Australia and throughout the world. These issues are often inter-disciplinary, and geography brings an ability to integrate knowledge about the natural world, the social world and the humanities, through its perspectives of space, place and environment. For example, Australian geographers research:

- past environmental change, so as to better understand present and future change
- economic change and its effects on the movement of people
- perceptions of, and responses to, natural hazards
- the causes and consequences of spatial differences in human wellbeing, such as health or educational attainment
- managing the environmental consequences of the growth of Australia's cities and regions
- repairing the effects of human modifications of river environments
- the interactions between environmental, economic and social change in Australia's Asia-Pacific neighbourhood
- the sustainability of the ways we use environmental resources.

However, geography has a broader ambition than finding answers to environmental, economic and social problems. The discipline's ultimate goal is to help us to understand the world around us, the diversity of environments, places, peoples and cultures on the planet, and the inequalities within and between places. It is also to understand our place in this world—our dependence on the environment for our survival, our attachments to the places in which we live, and our connections with and dependence on places and people throughout the world. Consequently, geography has an important role in education at all levels.

Geographers bring particular ways of thinking to these matters, which define the discipline. They can be applied to a very wide variety of biophysical and human phenomena, some of them tangible, like landforms or the built environment, and others intangible, like social attitudes or cultural diversity.

## Geography as a way of thinking

Geographical thinking is based on a set of concepts that guide the choice of research topics, identify significant questions, and suggest explanations. The core concepts are space, place and environment, while interconnection and scale are important intersecting concepts. Although these concepts are also employed by other disciplines, such as ecology, archaeology, economics and sociology, in none are they as central to thinking and practice as in geography, and in none are they used as frequently in combination. Their application in geographical research is illustrated throughout this report.

Time is another important concept that intersects with the core geographical concepts, and geographers research changes that have occurred over timescales ranging from hours to hundreds of thousands of years. Geographers also recognise that the past affects the present, which in turn, will guide the future.

## Space

Spatial thinking is central to geography. One aspect of this is a focus on how physical and human phenomena are distributed across the Earth's surface. These spatial distributions have patterns, or regularities, and can be analysed to pose questions, identify relationships and suggest explanations. Spatial distributions, such as the concentration of most of the Australian population in just five cities, also have environmental, economic, social and political consequences that require explanation and evaluation.

### Spatial analysis of hospital admissions

A spatial study of small area variations in hospital admissions for children aged 0–4 showed an expected positive relationship between admissions and socio-economic disadvantage, but also an additional influence from location, through physical accessibility to medical services (Butler et al., 2013).

Spatial thinking is also involved in studies of economic processes and social structures. For example, the spatial segregation of socio-economic groups through the operation of the housing market or the location choices of particular social groups, can perpetuate social inequalities.

In studies of social phenomena, geographers do not view space as absolute but as produced by the relations between people and places. For example, space is experienced very differently by subsistence farmers in the highlands of Papua New Guinea compared with international bankers in New York.

### Place

Geographers contend that place matters. One reason for this is that each place is unique in many of its characteristics, whether these are internal to the place (e.g. soil resources) or the result of interconnections with other places (e.g. trade, flows of people or cultural influences). Consequently, the outcomes of similar environmental or socio-economic processes are likely to be different in different places. Likewise, similar problems may require different strategies in different places. Geographers are sensitive to the importance of place, and the need to adjust generic explanations and policies to the realities of individual places.

### Effects of differences between places in disaster recovery

Research by geographers into how regional communities recover from a natural disaster has shown that there are significant differences between places in the ability of their communities to effectively use resources, both their own and those from outside. Assistance provided by external agencies must recognise and respond to these place-based differences (Wood et al., 2013).

Another theme is that places, through their social and economic characteristics, or people's sense of attachment to them, influence the educational and economic opportunities, aspirations, physical and mental health, and quality of life of their residents. Identifying places where the influences of place perpetuate disadvantage enables governments and agencies to direct resources to areas of greatest need.

Geographers recognise that places are produced and continually changed by the actions of natural processes, individuals, businesses, organisations and governments, and by their relationships with other places through economic, social, demographic, cultural and political influences. Consequently, places can be described as both local and global. This knowledge is the basis of urban and regional planning.

Although transportation and communication infrastructure have made it possible to locate economic activities that are not tied to physical resources almost anywhere in the world, many still cluster in particular locations, like Silicon Valley for information technology and Sydney for financial institutions.

### Environment

Geographers' perspective of the environment is underpinned by the idea that humans are dependent on the biophysical environment for their survival, and are also an integral part of it. Geographical research linked with this idea follows several themes.

One involves basic research into the characteristics of Earth's climate, landforms, vegetation cover, water resources and other environmental features, and the processes that produce them. Recognising the significance of place, geographers are often particularly interested in the interconnections between these phenomena and processes in particular places and landscapes.

### Environmental record of past cyclones

Determining the frequency of very high intensity tropical cyclones has been limited by the lack of long-term meteorological records, which extend back less than 100 years. However, studies of Queensland beach ridges provide a record of these cyclones over the past 5000 years, and show that high intensity cyclones have been more frequent than thought (Nott et al., 2009).

A second theme is the effects of humans on the environment. For example, geographers have led studies of the effects of human modification of rivers and floodplains, and of changes to Earth's surface through vegetation clearance and urban development. The latter has been shown to influence changes in rainfall patterns in Australia. They have also studied the ways that societies manage environmental resources, such as through land tenure systems in pastoral regions, Aboriginal and Torres Strait Islander concepts and methods on their land and sea countries, the extraction and storage of water, or the designation of terrestrial and marine protected areas.

This knowledge can be applied to issues such as natural hazards, land degradation, sea-level rise, biodiversity conservation or the management of environmental change. It also directly contributes to our understanding of the concept of the Anthropocene, the name proposed for the present era in which humans are thought to be the dominant influence on environmental change.

A third theme is the influence of the environment on humans—their activities, economies and lives. This includes the effects of the coast on population distribution in Australia, of the environment on agriculture, of water resources on regional development, of droughts or tropical cyclones on settlements and economies, and of landscape on Australian identity.

#### **Water availability as a constraint on Australia's population growth**

A study of water availability concluded that there is adequate water in Australia to meet the needs of any likely future population. Most of Australia's population growth will take place in the major capital cities, which can be supplied from new sources of water such as recycled sewage, groundwater, desalinated water and treated stormwater. Population growth is also unlikely to be restricted by a lack of water for food production, as the increasing efficiency of water use in agriculture, and the diversion of food from exports, will enable production to keep up with population. However, environmental quality and biodiversity may suffer as more water is diverted to human uses (Rutherford and Finlayson, 2011).

A final theme is people's perception and knowledge of environments. This includes studies of Aboriginal and Torres Strait Islander environmental knowledge, European perceptions of drought, how knowledge of environmental issues is constructed, or community views on the objectives of environment management. The theme also includes fundamental thinking about the concept of nature, the place of humans in it, and our relationships with other life on the planet.

Prevalent in the last three of the four environmental themes is the significance of the interconnections between humans and nature, a long-standing area of geographical research. Geographers study the processes involved in these interconnections, and the ways they interact in particular places, in order to find answers to specific and complex environmental problems.

## **Interconnection**

Interconnection refers to the complex interrelationships between phenomena. These may be relationships within the one place, or between places, and may involve both biophysical and human elements. The concept underpins the study of processes, which are sets of cause-and-effect relationships, or interconnections, operating over time.

Interconnection is also about flows, such as the flow of migrants between countries, of water in the hydrological cycle, or of energy resources in the global economy. Flows are central to the concept of a system, a group of interconnected objects and elements linked together by flows of energy, matter and—in systems involving people—information. Systems thinking is important in geography, and can help in understanding change. Change in one element in the system can produce changes in other elements, which may be experienced in the same place as the initial change, or in different places, or at a different scale. These changes are often not anticipated, such as the salinisation of soils caused by the clearance of deep-rooted vegetation.

An awareness of interconnection prompts geographers to draw on knowledge from a variety of fields, both within geography and in other disciplines. As a result, they are well prepared for the interdisciplinary research increasingly needed to tackle complex issues.

## **Scale**

Scale can refer to the areal size of an investigation, a level of analysis (typically from local to regional to global), or types of interconnections. Because relationships between phenomena found at one scale may not hold at another, the choice of scale is crucial in designing research. In policy-oriented research it is important to consider the scale of the management system that will use the results of the research. For example, sustainable natural resource management is best achieved at the catchment scale.

Geographers also recognise that there are interconnections between phenomena at different scales. For example, an understanding of climate change requires analysis at a global scale, but the effects of climate change and adaptation strategies are often most effectively investigated at a local or regional scale.

## Research methods in geography

Geographers use a very wide variety of methods in their research. These include:

- collecting data through field work, which could involve the direct observation and measurement of environmental data, or interviews and discussions with human participants
- collecting data through remote sensing
- applying qualitative and/or quantitative techniques to obtain information
- using geographical information systems to manage and analyse spatial data
- analysing relationships between variables through statistical modelling, spatial modelling, laboratory experimentation or controlled comparisons of places
- using case studies to understand how processes operate and combine in particular places and at particular times to produce specific outcomes
- theorising from empirical work
- assessing how best to address a public policy problem.

At present, many areas of geographical research are being revolutionised by rapid advances in the spatial technologies that enable scientists to obtain and record very large quantities of data from precise locations. Global positioning systems, remote sensing, increased computing power, the internet, Google Earth, smartphones and drones have changed the geography of the world, and the world of geography. At the same time, developments in geographic information systems and spatial software make it possible to process, analyse and visualise this wealth of information. Geographers have the knowledge to ask the right questions of these data and undertake appropriate types of analysis.

## The branches of geography

The discipline is conventionally divided into physical geography—the geographical study of the biophysical environment—and human geography—the geographical study of populations, societies, economies and cultures. However, a growing number of geographers teach and work across this division, studying the inter-relationships between elements of the biophysical world and elements of society, a sub-discipline often called environmental geography. Many geographers also develop expertise in a related discipline like geology, biology, archaeology, anthropology, economics, urban planning, demography or sociology, and work and publish in the fertile borderlands between geography and these disciplines.

## Conclusion

Geography is distinctive in its emphasis on spatial thinking, its interest in knowledge generated from the study of specific places, and its recognition of the fundamental importance of the environment to human welfare. Its vision is both local and global. It is also marked by an awareness of the interconnections between phenomena and processes both within places and across space, and its fields of study span the natural sciences, social sciences and humanities.

Places and people are increasingly interconnected globally, and society's current problems require answers that integrate different fields of knowledge. In a world in which inequalities within and between places can threaten social cohesion, and where the pressure of human impacts on the environment is a growing concern, geography has much to offer.











# 2 Geography in Australia

Geography is taught in Australia's schools and universities, researched in universities, CSIRO and other organisations, supported and promoted by the public societies, and applied by geographers working in government, the private sector and non-government organisations.

## Geography in schools

Geography is a part of the curriculum in Australian schools from Foundation Year onwards. In primary schools, this may be as a specified sub-strand in a combined humanities subject, while in secondary schools geography is a separate subject and compulsory up to Year 8, 9 or 10, depending on the jurisdiction. The peak body representing teachers is the Australian Geography Teachers Association (AGTA), which has around 2000 members in its affiliated state and territory associations, and publishes *Geographical Education*. See [Chapter 13: Geography in Australian schools](#) for an in-depth review of geography in schools.

## The public societies

There are three state-based public geographical societies that help to promote geography and geographical education. These are the Royal Geographical Society of Queensland (established in 1885), the Royal Geographical Society of South Australia (also established in 1885, which publishes the *South Australian Geographical Journal*), and the Geographical Society of New South Wales (established in 1927, which publishes *Australian Geographer*). Their activities are also described in [Chapter 14: The public geographical societies](#).

## The Institute of Australian Geographers

The Institute of Australian Geographers (IAG), established in 1958, largely represents professional geographers employed in universities, CSIRO, research organisations, government departments and agencies, and the private sector, as well as postgraduate students. The IAG publishes a quarterly journal, *Geographical Research*, holds an annual conference, and funds the work of a number of study groups. It has a membership of more than 300.

Because of their interdisciplinary interests, many geographers also belong to the professional organisations of cognate disciplines, such as the Ecological Society of Australia, the Australian and New Zealand Geomorphology Group, the Australasian Quaternary Association, the Australian Population Association and the Australian Anthropological Society.

## National Committee for Geographical Sciences

The National Committee for Geographical Sciences is a committee of the Australian Academy of Science. It brings together representatives of the organisations described above, as well as other geographers from across Australia. It links Australian geography with the International Geographical Union, and serves as a forum to discuss issues of common interest within Australia.



Professor Griffith Taylor FAA (1880–1963). He was the first President of the IAG, and in 1976 was commemorated in the Famous Australians postage stamp series.

## Geography in the universities

Geography is a relatively small but dynamic discipline in Australian universities, with a strong research record and graduates who enter a wide variety of careers. The majority of geographers in Australian universities work in the 22 institutions that offer an undergraduate major in the discipline. However, three of these universities locate physical and human geography in separate schools, so there are 25 academic units involved. The term 'unit' is used to cover the variety of names given to the administrative groups in which geography is located.

There are more than 200 full-time geographers employed in these 25 academic units, including some who are non-teaching research fellows, and an unknown number of adjunct, part-time and sessional staff. There are also at least 200 academic staff with a background in geography employed in a wide variety of other centres, schools and institutes in Australian universities.

## The standing of Australian geography

One way of evaluating the standing of Australian university geography is through the Australian Research Council's 2015 assessment of Excellence in Research for Australia (ERA). The research classification used in the ERA, and discussed later, splits the discipline into physical geography ([Table 1](#)) and human geography ([Table 2](#)). Table 1 also includes data for environmental science and management, a classification that includes the research of a significant number of geographers. A rating of 3 means that average research performance was assessed at world standard, while a rating of 4 or 5 indicates performance at above or well above world standard. Although in Table 1 the research of geographers is combined with that of people from other disciplines, making it difficult to determine their specific contribution, overall geography compares well in research quality with related disciplines.

The QS World University Rankings of Departments, which are based on reputation with academics and employers, and citation counts, provides an international measure of the standing of Australian geography. In 2018, eight of the 22 Australian universities with a geography major were in the top 100 in the world. In comparison, only seven Australian universities were in the top 100 for economics and econometrics, nine were in the top 100 for environmental sciences, and seven were in the top 100 for overall university ranking.

## Size and critical mass

Geography units in Australia are relatively small by British and North American standards. The average number of staff identified as geographers in the academic units teaching a geography major is 9.4, with a range from 2 to 27, as shown in [Figure 1](#).

Small staff numbers limit the topics that can be provided in each university. They also limit opportunities for intellectual support from colleagues with related research interests. The minimum size needed to avoid these two limitations is difficult to judge. Anecdotal evidence suggests that at least 10 academic staff are required per academic unit, while a British study of research quality calculated that critical mass for a geography research group was a minimum of 15 people. The majority of Australian geography units are below both these numbers.

Australian geographers have been active in developing supportive research and professional networks through personal contacts, conferences and the 11 Study Groups supported by the IAG.

## Visibility and identity

Of the 25 academic units that teach a geography-related major, 14 do not have geography in their name; instead, the discipline is part of a School of: Social Sciences; Geosciences; Biological, Earth and Environmental Science or similar.

Furthermore, in only seven of the 25 academic units are the geographers clearly identified as geographers on the unit's website. The others are hidden in long lists of staff from unspecified disciplines. In the online questionnaire of geographers conducted for this report, 90 per cent of respondents thought that this lack of disciplinary identity was a significant or very significant problem.

This can lead to geography and the courses it informs being little known to other sections of the same university, and the exclusion of geography from new degrees in which its courses would be appropriate. A second problem is that hiding geography in multidisciplinary schools means it is not visible to potential students, including those from overseas looking for postgraduate study. Thirdly, the absence of the name geography in the organisational structure of a university makes the discipline invisible to government agencies, business and the public.

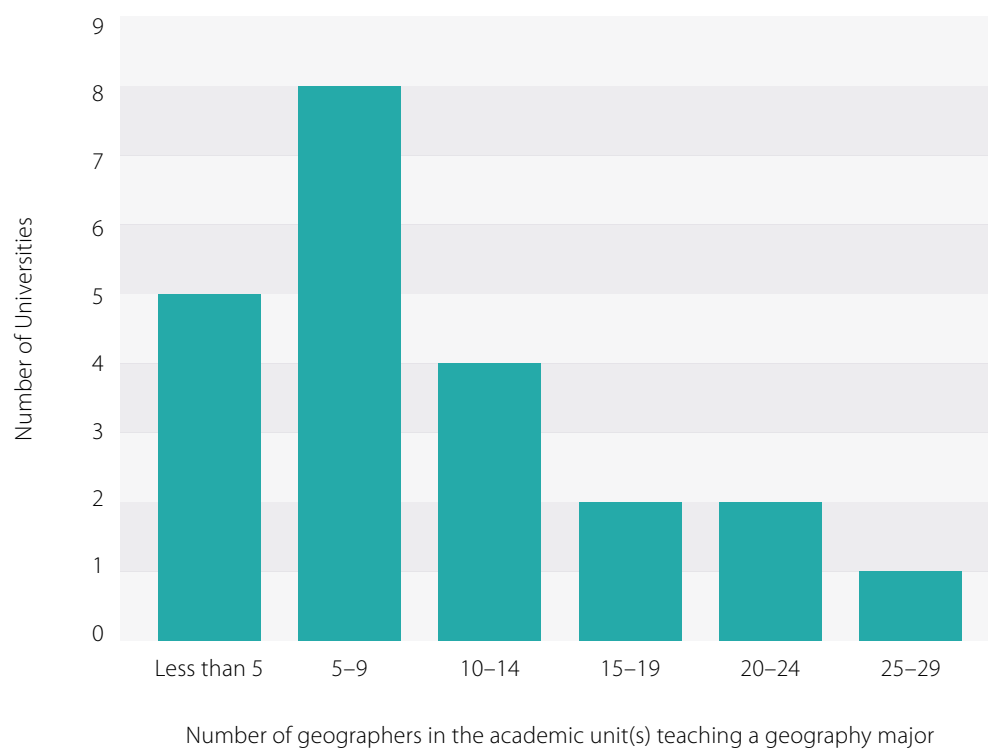
**Table 1. Comparison of ERA assessment of research excellence for physical geography and environmental geoscience, and environmental science and management, with related disciplines, 2015**

Discipline	Per cent of universities rated 4 or 5	Per cent of universities rated 3 or above
Physical geography and environmental geoscience	81	100
Environmental science and management	87	94
Geology	94	100
Geophysics	88	100
Ecology	79	96

**Table 2. Comparison of ERA assessment of research excellence for human geography with related disciplines, 2015**

Discipline	Per cent of universities rated 4 or 5	Per cent of universities rated 3 or above
Human geography	40	100
Psychology	66	81
Political science	50	70
Sociology	37	89
Urban and regional planning	28	86
Anthropology	27	100
Applied economics	20	80

**Figure 1. Size of geography units in Australian universities**





There is a particular problem when geography is merged with other subjects in schools in which disciplinary identities have been dissolved. If these schools do not train students in specific disciplines, they will not produce the next generation of geographers. They will also not produce the next generation of discipline specialists able to contribute to interdisciplinary teaching and research, which requires people to first have training in one or more disciplines.

A final problem with lack of disciplinary identity is that belonging to a named discipline can be important to a person's sense of professional identity. In the words of a senior Australian geographer:

**... disciplines are the basic network blocks of our academic and teaching work; we are socialised into them, read the journals that identify with them, know others who work in them, and rely on shared knowledges developed in them as an intellectual community. (Fincher, 2004)**

Reduced disciplinary identity is not a problem peculiar to geography, but is shared with other disciplines such as history and physics, and has serious implications for the production of basic knowledge. It is a problem compounded by the obsession of Australian universities with serial restructuring; many geography units have experienced regular changes in the name, composition and Faculty or School affiliation of the academic unit to which they belong. Geography at the University of Melbourne is a good example. It started as a Department of Geography, but from the late 1980s was successively a Department of Geography and Environmental Studies; a School of Anthropology, Geography and Environmental Studies; a School of Social and Environmental Enquiry; a Department of Resource Management and Geography; and is now the School of Geography.

Geography has an additional problem not shared with other disciplines, which is that university leaders have difficulty understanding and administratively locating a discipline that spans and often combines the natural sciences, the social sciences and the humanities. In a world where problems are interdisciplinary, this characteristic of the discipline should be an asset, not a liability.

### The Fields of Research Codes

Geography's identity as a discipline is strongly and negatively affected by the Australian Bureau of Statistics' Fields of Research (FoR) Codes. These are derived from the OECD Field of Science and Technology Classification, and are used by the Australian Research Council and universities to classify research output. In the FoR Codes, geography is the only discipline that does not have a code for the subject as a whole. Research undertaken by geographers is scattered between Human Geography (1604), Physical Geography and Environmental Geoscience (0406), Biogeography and

Phylogeography (060302), Geomatic Engineering (0909), Environmental Management (050205), Urban and Regional Planning (1205), Demography (1603) and other fields.

The Fields of Research Codes create several problems for geography. Firstly, they do not recognise the subject as a single discipline, which weakens its identity. Subsequently, in at least two universities, the codes have been used to justify dividing the discipline and relocate physical geography in a school of Earth or environmental sciences that matches the 0406 Code. Secondly, the codes make it impossible to assess the research quality of the discipline as a whole, which weakens its ability to compete for staff and resources within universities. Thirdly, the codes are deficient in their classification of types of geography. In addition to the lack of a single code for geography as a discipline, there is also no code for environmental geography, a major area of research, yet there are codes for 140205 Environment and Resource Economics and 160802 Environmental Sociology.

The Bureau of Statistics' Field of Education Codes, used to classify courses in universities, are even more deficient in their treatment of geography. There is no code for geography or for physical geography, but only one for human geography.

### RECOMMENDATION

The National Committee for Geographical Sciences and the IAG Council prepare a case for submission to the Australian Bureau of Statistics to amend the Fields of Research Codes and the Field of Education Codes to recognise geography as a discipline.

The same parties also submit a case to the ARC for geography to be evaluated in the ERA as a single discipline, as in the United Kingdom.

### The balance between physical and human geography

A major strength of geography is that it can combine studies of both the natural and social sciences, and help students to understand the relationships between elements from these fields of knowledge, and so break down some of the barriers between them. To achieve this, degree programs should have a balance between physical and human geography, and topics that teach students about the inter-relationships between them. This balance is also important in the training of teachers because the geography curriculum in both primary and secondary school years is a blend of physical and human geography.

Balance is lacking in some universities because there are few or no physical geographers on the staff, either to align with the social science focus of the school in which geography is located or because departing physical geographers have not been replaced, which may also be a consequence of the composition of the school in

which geography is located. Similarly, where geography is located in a school focused on environmental science, there may be few human geographers able to provide a social science perspective on the environment.

In universities where physical geography is strong, the balance between the two is threatened when the physical geography group is separated from human geography and located in a school of environmental or Earth sciences. This separation may, over time, erode collaboration between the two groups. Another threat is that where physical geographers are a minority in a large school of environmental sciences, or an even larger school of environmental, Earth and biological sciences, there is a risk that they will not be replaced when they retire or leave, or that their topics will be rationalised and cease to be distinctively geographical.

### Australian exceptionalism?

The issues commented on above are less common in other countries with a similar academic tradition to Australia. In Canada, for example, the vast majority of geography academic units are departments of geography and have been for many years. Some are called Geography and Environmental Studies or Geography and Earth Sciences, but in only two is geography not part of the name. Physical geography is absent or administratively separate in only a few universities. This makes the discipline more visible, more unified and more stable in Canada than in Australia. It is difficult to find any good academic reasons why Australia should be different.

#### RECOMMENDATION

The National Committee for Geographical Sciences and the IAG Council prepare a case to present to Vice-Chancellors presenting the arguments for increasing the visibility, identity and unity of geography.

### Careers for geography graduates

A major in geography leads to two types of careers. One uses specifically geographical knowledge and skills in careers in environmental management, environmental policy, natural hazard management, urban planning, regional development, geographical information systems, applied economic and social research, market research, teaching, tourism and travel, and other fields. Some of these careers require further study for a professional qualification, as in the case of urban planning and teaching.

The other type of career is based on the broad knowledge base and general capabilities gained through studying geography. The broad knowledge base includes the ability to comprehend information and ideas from the natural and human sciences, and a better understanding of the world and its diversity of places, environments and peoples.

The capabilities are variously described as soft, enterprise or transferable skills, and are increasingly sought by employers. Those gained from the study of geography include:

- breadth of thinking
- the ability to see interconnections
- teamwork skills
- analytical skills
- digital literacy
- oral, written and visual communication skills
- problem solving
- problem identification
- interviewing
- strategic thinking
- critical thinking.

These are also the capabilities needed by young people to successfully navigate their way through varying career paths in different occupations and industries during their working life, which is rapidly becoming the career path of the future. However, the extent to which Australian geography programs develop these capabilities in their students is unknown, and worth investigating by individual programs.

#### RECOMMENDATION

Geography programs investigate the experience of their employed graduates on the adequacy of the general capabilities they gained from their degree studies.

Both breadth of knowledge and the capabilities of geography graduates are valued in a wide variety of careers. In the UK, data suggest that many geography graduates get jobs in banking, finance, marketing and other types of business. In fact, one advantage of a geography degree is that it does not have a set career path but can lead in many directions.

However, many potential students of geography at both upper secondary school and university do not perceive it as leading to a career, except perhaps in teaching, and consequently do not take the subject. Some studies indicate that this misperception is fostered by school careers advisors.

#### RECOMMENDATION

The IAG Council and AGTA develop a short pamphlet and online resource promoting the various careers that geography graduates can work in, and distribute it to schools through the state teachers' associations, and other appropriate groups.



Great Barrier Reef Near Whitsunday Islands, Queensland.

CREDIT: NASA / PUBLIC DOMAIN



# 3 Environmental change and human response

## Understanding environmental change

Australian geographers are at the forefront of understanding how the environment of our planet changes, and how societies respond to those changes.

Environmental change encompasses all variations to Earth's atmosphere, oceans and ecosystems, including changes occurring in urban centres and industrial areas. These types of changes are inter-related to the issues raised in other sections of this strategic plan, namely land, water and food, natural hazards and human-induced climate change. Geographers research the causes, consequences, relationships and responses to a diverse range of environmental changes including environmental changes over the last two million years, and the impact of humans on the atmosphere, biosphere, hydrosphere and geomorphology of the planet. A burgeoning contribution of geographers is studies of responses to past changes.

Many of the changes may be termed 'background' or 'natural', as the environment is always changing and evolving. Other changes may be labelled 'anthropogenic', meaning that they are caused by humans. Geographers research both types of change. They are also interested in determining whether changes may be catastrophic, beneficial, preventable or manageable, and what sorts of behavioural responses, policy instruments and institutional interventions may be most effective in addressing problematic change.

Geographers also research the inter-relationships between human activities and natural events. This concept is central to appreciating the challenges of the Anthropocene, as this contemporary epoch is marked by the fundamental inter-connection between the environment and humanity. The environment changes in response to human action, but we also change in response to the environment.

In the context of the Anthropocene, biodiversity loss and climate change are of particular concern. They are both global and local in scale and their effects, and therefore also our responses, may vary greatly according to location.

One feature of the Anthropocene is mass extinction of species, and Australia has one of the highest extinction rates in the world. Biodiversity loss refers to a reduction in biological diversity—the spectrum of plant and animal species that constitute different ecosystems. Rich biodiversity is important to maintaining the healthy function of all ecosystems, including those that provide crucial services to human populations—biological control of disease vectors, pollination of crops, building of soil nutrition and sequestration of carbon from the atmosphere. Land clearance and habitat modification are two major causes of biodiversity loss, but climate change is also emerging as a critical factor.

Climate change comprises a constellation of inter-related environmental changes due to the increase in greenhouse gas emissions—particularly carbon dioxide and methane—into the atmosphere. Existing atmospheric carbon causes a natural 'greenhouse' effect, which provides the conditions that support current life on Earth. However, elevated levels of atmospheric carbon may result in increased air and sea temperatures with consequent changes to weather patterns, sea ice melt and sea-level rise.

These environmental changes affect Australians in different ways. For example, heatwaves have a direct effect on human health, which is of particular concern for the most vulnerable in our society.

Hotter and drier conditions also cause water shortages in urban and rural areas and may increase the frequency and severity of bushfires and droughts. In the case of sea-level rise, a substantial proportion of the Australian population live in coastal areas and therefore will potentially be affected by inundation, which may be exacerbated by an increased frequency of storm events. Carbon emissions also affect the marine resources surrounding Australia due to ocean acidification, which can compound the impacts of coral bleaching and other disruptions to marine ecosystems. Within terrestrial ecosystems, some species are being forced to move as their original habitats are no longer within their tolerance ranges, or the species on which they

themselves are dependent have already moved or died out. This has consequences for agricultural production and food security, affecting both crops and livestock.

## Human responses

Human responses to conserve biodiversity include public policy measures to establish protected areas, such as national parks, and to control animal pests and weeds that threaten ecosystems. In the case of private lands of high biodiversity value, landholders may be compensated for fencing off these areas, removing them from agricultural production and controlling pest species. Habitat destruction may be controlled through regulation, with land clearing forbidden in some areas and in other places 'off-set' by preservation of alternative or additional sites. Invasive species, both native and introduced, may have management stipulations. Restoration is also attempted in order to forestall species extinction. Increasingly, it is being recognised that additional areas will need to be conserved to ensure that species can move into new zones to adapt to climate change.

Human responses to climate change may be grouped into two main categories. The first of these is mitigation, which involves seeking to reduce the levels of greenhouse gas emissions and thereby ameliorate anthropogenic climate change. Due to the extent of past greenhouse gas emissions, some degree of climate change is inevitable. Therefore, the focus of mitigation is not so much on preventing climate change, but in limiting the degree of future impacts.

The second main category of human response is adaptation, which is concerned with preparing for and responding to the consequences of climate change. Mitigation and adaptation are interdependent in that the more mitigation society can achieve, the less it needs to adapt to the consequences.

In practice, however, the two categories of responses are often quite different. Policies and programs for climate mitigation have a longer history in Australia compared with those for climate adaptation and are often national or state-wide initiatives emphasising uptake of low carbon technology (e.g. economic incentives for solar hot water systems and roof-top photo-voltaic panels). In contrast, climate adaptation responses tend to be focused locally or regionally, because the impacts of climate change will manifest differently according to location. This includes local infrastructure projects and preparing for more severe disaster events.

In the past, climate change has tended to be treated as an environmental issue and, for a long time, responses were directed by dedicated environmental agencies and institutions, particularly in regard to climate mitigation. Programs concerned with energy efficiency, such as the nation-wide uptake of high efficiency lighting, have become common. More recently, and particularly with the recognition of unavoidable climate impacts requiring adaptation, the

importance of climate change has been recognised within other types of interventions and by different sectors of the economy. This includes the insurance industry and companies investing in infrastructure projects, as the long-term financial risks of climate change on investment decisions become apparent. Other types of climate adaptation responses are land use planning in risk-affected areas, including adjustments to development control processes, and urban and regional strategies by local and state governments.

## Geographical research on environmental change

Geographical research into environmental change is multi-faceted. One focus is understanding the nature and location of environmental change. For example, geographers monitor variations in precipitation and evaporation over time and space, and patterns of land degradation such as erosion. They assess land cover change—vegetation gain and loss—and its effects on climate and habitat. For example, a recent study showed that land clearing has contributed to drier conditions over much of Australia in recent decades. Geographers research the effects of different weather and climate on native vegetation in different parts of Australia and consider the implications for biodiversity loss and bushfire risk. Other research focuses on monitoring, evaluating and reporting changes in biodiversity due to human activities, such as land clearing in rural areas and modifications to native vegetation cover within or close to urban centres. Evaluation is often a specific focus of geographical research. Examinations of responses to formal legal interventions suggest that public participation is essential and that private law may also offer benefits. Furthermore, geographers consider the ways that climate change is entwined with other environmental challenges, such as food security, weed management and feral animals.

Geographers work closely with local and regional organisations to help them plan for climate change and support biodiversity in particular landscapes. Traditional ecological knowledge (known as TEK and also by other acronyms) is held by Aboriginal and Torres Strait Islander people who have managed their environments for thousands of years. Geographers are involved in learning from these practices and employing participatory and collaborative approaches to address the causes and negative consequences of environmental change. Geographers also often work with many other groups, including local governments and natural resource management agencies, bringing together different types of knowledge and perspectives to help inform and guide future actions.

The feeling of inclusion generated by participatory approaches can also be critical for policy success, and support the existing connections people have to their environments.



In particular, people may be attuned to the environmental changes occurring in their local environments, which may be a powerful guide for human action and responses.

## Geographical research on environmental change and vulnerability

Geographers research the factors that make people, other species and environmental systems, including rivers and nutrient cycles, either more or less vulnerable to the impacts of environmental change in different contexts. For example, heatwaves will affect urban populations differently according to place of residence, age, gender and pre-existing illness. Geographers can map these factors to identify 'hotspots' of vulnerable populations and assist in risk reduction.

Some communities will possess attributes that make them more resilient to climate change. Resilience can mean that people and ecological communities have the ability to 'bounce back' from perturbations in their environments but it can also mean that there is a transformational shift in modes of operation and behaviour required for sustainability.

Geographers often possess multi-disciplinary knowledge and skillsets, as geography as a discipline synthesises and integrates across many fields. This is especially vital in understanding the challenges of the Anthropocene—geographers understand and appreciate the biophysical aspects of our environment, the socio-economic features of our communities, as well as the enviro-social inter-relationships between the two. As a result of their multi-disciplinary backgrounds, geographers place high value on the contributions of other disciplines. For example, in collaboration with psychologists and other social scientists, geographers consider the ways that Australians view the risks related to environmental change and how these views change according to context. This research includes designing, conducting and reporting the results of surveys with residents of diverse landscapes to understand household perceptions of climate risk and to take stock of the priority accorded to environmental hazards relative to other household concerns. Geographers have demonstrated that the capacity to respond to severe disruptions, such as more intense natural hazards, is shaped by underlying inequalities and social differences which vary by location.

## Geographical research on mitigation

Geographical research also examines mitigation as a response to climate change. For example, research on the potential for increased uptake of new and existing carbon abatement initiatives with different community and cultural groups, including Aboriginal people's and Pacific Islanders' participation in carbon offset strategies. This research includes consideration of potential national benefits in mitigating environmental change as well as potential local and regional economic benefits for participating communities.

A major focus of geographical research is understanding and supporting carbon mitigation responses at individual and household scales. For example, geographers research the ways different cultural groups engage with technologies and practices to reduce carbon emissions at the household level. One such study examined the uptake of solar hot water systems, demonstrating differences between passive and active users, linking differences to cultural norms.

## Geographical research on adaptation

Geographers have reviewed the climate adaptation options available for different stakeholders in particular contexts, from World Heritage Listed Wet Tropics to urban metropolises and remote rangelands. This work has focused on considering and distilling options for decision-makers and managers.

Considering that environmental change manifests differently throughout diverse local contexts, geographers have paid particular attention to local and regional institutions, taking stock of the ways local governments prepare for the impacts of climate change. In doing so, they have shown that the responses of different local governments vary enormously, particularly between metropolitan and non-metropolitan areas. They also consider how the actions of local governments interact with other institutions within the broader suite of responses to climate change.

## Impacts of geographical research

Geographers have contributed directly to biodiversity management, as well as climate change adaptation plans and strategies developed by natural resource management organisations and all levels of government. They have also indirectly contributed to similar plans by designing processes which allow organisations to think through and jointly develop appropriate data and scientific information tools for particular circumstances, leading to better-targeted and more effective plans, policies and programs.

Because this research is connected to specific places, communities and interventions, geographers can establish ongoing relationships that contribute to the evaluation and adaptive management of interventions over time and help re-frame and expand issues. In this way, research into particular local, regional or sectoral adaptation settings both builds stakeholder capacity and also informs state and national-level policy and program development. Understanding the assumptions and interests behind different stakeholder positions on environmental change also helps to unlock protracted conflicts and contribute to identifying shared pathways forward.

## Future directions

The pressing questions for future geographical research examining environmental change include:

1. How does environmental change impact other thematic areas of this strategic plan, such as the fire management implications of hotter, drier weather in different parts of the country?
2. What are the emerging implications of shifting rainfall and temperature patterns for biodiversity protection and preventing land degradation around the country?
3. How might different ways of conceptualising environmental change and human and environmental interactions influence human responses?
4. What sorts of different institutions and policy interventions can assist in addressing biodiversity loss, land degradation and climate change?
5. How can we further exploit and improve our capacity to understand past environments using new tools, including using the past to understand the present?
6. How can we continue to translate our understanding of the environment to address and reverse environmental degradation?
7. How do rates of environmental changes vary across Australia, and what are the key spatial patterns of change?



CREDIT: NASA / GSFC / LARC / JPL / MISR TEAM / PUBLIC DOMAIN





Tamarama Beach, New South Wales.

CREDIT: GHIFFARI HARIS / UNSPLASH / PUBLIC DOMAIN







# 4 Land, water and food

## Understanding land, water and food

The development of agriculture, and the resulting transformation of the environment, is one of the central geographical stories of Australia. It is now well established that Aboriginal people modified the landscape in many ways to increase food and fibre production, particularly through the use of fire. European colonists then appropriated and cleared much of country for agriculture, which resulted in the dispossession of the Aboriginal population and major changes to the environment.

Today, 58 per cent of Australia's land is used for agriculture, while 23 per cent is set aside as conservation or other protected area (which includes Aboriginal uses), and 15 per cent has minimal use (see [Figure 2](#)). Sheep and cattle grazing occupy 45 per cent of uncleared natural vegetation in arid and semi-arid areas. Pastures modified for grazing occupy 10 per cent of the land area, mainly in the wetter eastern and south western edges of the continent, and 4 per cent of land is used for dryland cropping, such as wheat.

Land clearing, grazing, cropping and irrigation have had major impacts on the environment, including soil erosion, soil degradation, salinisation, groundwater depletion, degradation of rivers and water quality, and loss of habitat and biodiversity. Although just 1 per cent of land is under intensive horticulture with irrigated crops, watering this small area has also transformed the surface and groundwater systems

of Australia, with irrigation accounting for 70 per cent of all water use. The condition of rivers throughout the country has steadily declined since European colonisation. Most of the rivers in south eastern Australia are now dammed and most have more water allocated for irrigation than they carry.

The millennium drought led to major changes in the water sector, especially in the Murray Darling Basin. The most notable change was the introduction of a water market, and the allocation of water for the environment. In cities, water use is being transformed by new approaches to the 'water sensitive city', as noted in [Chapter 10: Australia's cities](#).

Agriculture is a critical component of the Australian economy. While the sector contributes just 2.3 per cent of GDP, it produces 13 per cent of export revenue, and is a major employer in rural areas. As in the past two centuries, there are always calls for the expansion of agriculture, particularly into northern Australia, as illustrated by the Ord River Irrigation Scheme. Calls for further development in the north are currently being driven by the opportunities presented by expanding markets in Asia. As in the past, however, most future development will continue from agricultural intensification rather than an expansion in area.

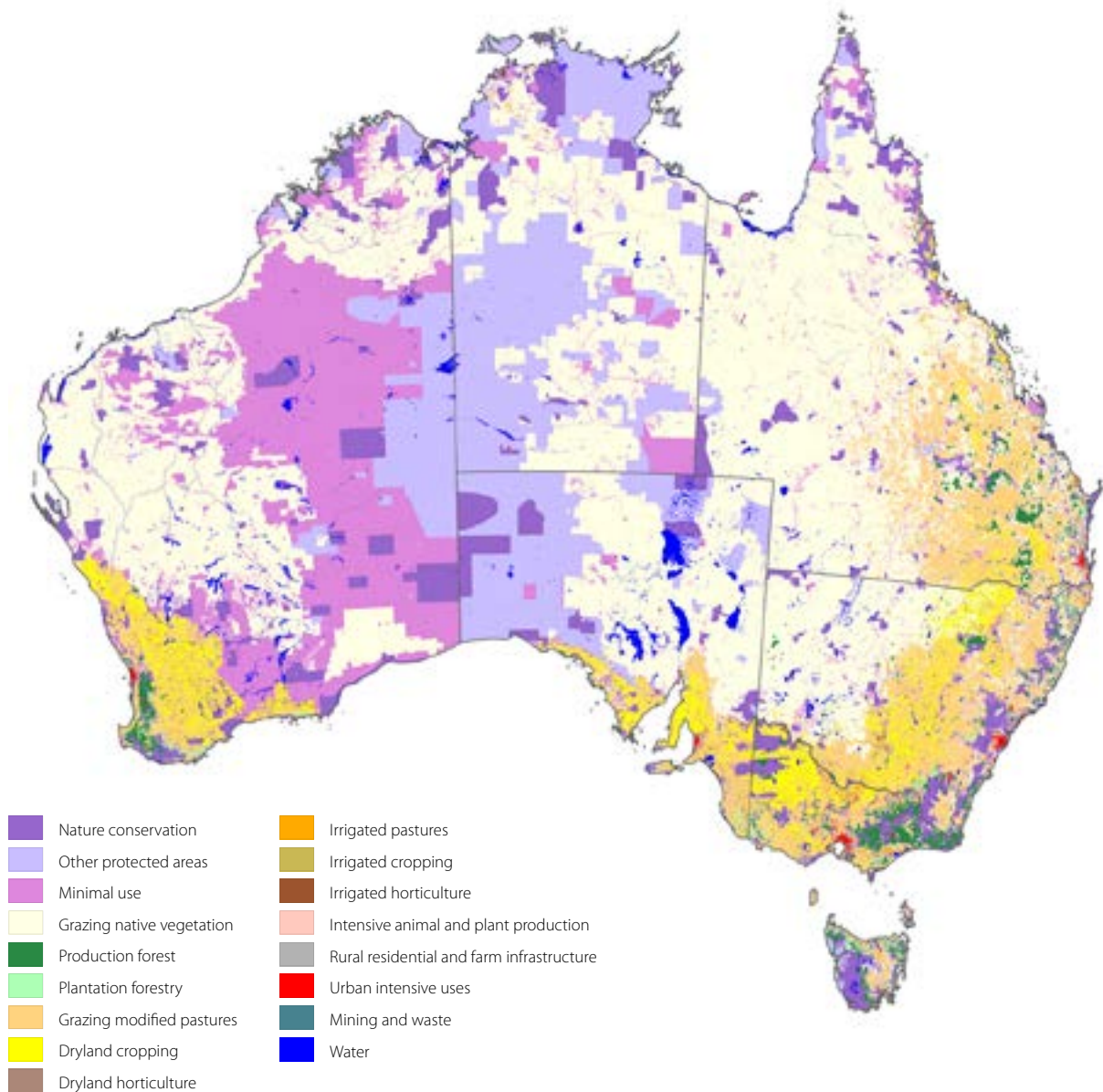
The use of land and water for agriculture is a fundamental part of the relationship between humans and the environment, and as such is a highly appropriate area for geographical research.



The Ord River Irrigation Scheme, northern Western Australia.

CREDIT: REISE-LINE / WIKIMEDIA CC-BY-SA 3.0

Figure 2. National scale land use



CREDIT: ABARES 2016, LAND USE OF AUSTRALIA 2010–11, VERSION 5 / ABARES / CC-BY 3.0

## Geographical research

Australia's capacity to produce food and fibre has long been a focus of interest for geographers. Debates about the continent's water resources, and its capacity for agriculture, were central issues in the 1920s. At that time, the geographer Griffith Taylor shocked the establishment by arguing that the continent could not sustain a large population because of constraints on water availability and soil fertility. Geographers have continued to contribute to this debate, but with the benefit of a much more extensive knowledge base. For example, a study noted in [Chapter 1: Geography](#), concluded that Australia's population growth is unlikely to be restricted by a lack of water for food production, as the increasing efficiency of water use in agriculture, and the diversion of food from exports, will enable production

to keep up with population. However, environmental quality and biodiversity may suffer as more water is diverted to human uses. Geographers can also provide valuable comments regarding the feasibility of expanding or increasing agricultural production in particular areas.

The next sections are organised around a series of themes that describe the distinctive contributions made by geographers in the area of land, water and agriculture. These range from physical geographical studies of environmental processes to human geographical studies of cultural attitudes to the management of environmental resources. It is estimated that there are around 50 geographers publishing across these broad areas Australia, with around 30 of them working mostly on Australian issues. Many more work as consultants or in government, and



this review draws on the work of geographers in both academia and practice. To put the review into context, in the journal *Australian Geographer* alone, there are more than 1000 articles that mention the term 'water', 800 that mention the term 'river', and 500 that mention 'agriculture' in their titles. Most of these articles relate to Australia.

## Land and water processes

Surface processes, particularly hydrology and geomorphology, are a special focus for geographical research. Geographers continue to make rich contributions to the basic science of understanding Australian landscapes, particularly in relation to its unique vegetation, hydrology and morphology. This basic scientific knowledge is fundamental to understanding how to use and manage Australia's agricultural and water resources. For example, in collaboration with engineers, geographers have identified Australia's extremely high inter-annual runoff variability compared with that of other continents, explaining that it is caused by both the higher variability of precipitation and the evergreen nature of Australian vegetation. The evergreen vegetation also reduces annual runoff into streams, because evapotranspiration continues throughout the year. This has substantial implications for water management.

Geographers have also documented the degradation of the fragile Australian landscape by European agricultural management. Numerous studies have described changes to vegetation, increasing erosion, salinity, acidification, pollution, weed and animal invasions, and groundwater resources. In Western Australia, geographers have been central to understanding landscape transformation and the interaction between agriculture and salinity. A particular contribution has been in understanding changes to landscape and river geomorphology, especially from vegetation clearing, dams and river regulation.

More recently, geographers have been at the vanguard of bringing disparate descriptions of impacts together in landscape-scale assessments, often using powerful spatial tools. For example, they have been involved in interdisciplinary teams modelling catchment-scale erosion and sediment delivery to the Great Barrier Reef. One study found that the use of generic input parameters in previous modelling applications produced overestimates of sediment yields, and argued that catchment-specific data are needed to improve modelling accuracy. This emphasises the value of the geographer's consideration of place. These sorts of studies of catchment hydrology are crucial in understanding how to minimise human impacts on marine environments.

Another recent development is the new practice of landscape and river restoration, which attempts to repair past damage. Many geographers, most specialising in geomorphology, have worked with others to move the science of stream restoration from a fledgling idea to accepted government policy, and a mainstream activity of

government agencies, which includes an internationally recognised river classification system. Geomorphologists are now routine collaborators in restoration projects involving engineers and biologists, and catchment and river management is a growing area of employment for geography graduates, especially those with skills in spatial analysis.

Contributions from recent research include:

- a study of the potential for revegetating saline catchments to control erosion, including developing an approach using streamflow salinity, surface texture characteristics, topography and reach morphology to evaluate the likely success of revegetation efforts
- arguments for the importance of maintenance after river repair, based on an understanding of the recovery trajectories of aquatic systems
- advocacy of adaptive management frameworks in which river restoration activities are conceived as 'moving targets' of what is realistically achievable, given the condition of a river at any one time
- a case for managing urban streams by addressing the cause of problems at their source in the catchment zone
- a review using geomorphic condition assessments for river rehabilitation planning, implementation and monitoring
- a review of the concept of river recovery, and its application to river management practice
- calls for more holistic studies of river restoration that include human geography and allied disciplines
- studies of the contribution of Aboriginal and Torres Strait Islander knowledge, viewpoints and concerns to river management.

Geographers contribute to the basic understanding of land and water systems, and a recent paper on climate classification, contributed to by a prominent Australian geographer, has been cited more than 2.8 million times on Wikipedia—possibly the site's most widely cited paper (Redi et al., 2018).



Inter-annual variability of runoff is a feature of the Australian landscape.  
CREDIT: PERIPITUS / WIKIMEDIA CC-BY-SA 2.5



Lake Eyre Basin: Australia's largest inwardly draining catchment, in which water flows inland, rather than to the sea.

CREDIT: KMUSSEY / WIKIMEDIA CC-BY-SA 3.0

## Understanding the geography of agriculture

Geographers have made many contributions to describing and understanding the widespread changes occurring in Australian agriculture. They have described the spatial changes in farms and production types, demographic changes in rural areas, including analysis of the expansion of life-style properties. Much scholarship has concentrated on the environmental, social, demographic and regulatory conditions within which farmers operate, and the extent to which the 'family farm' unit can survive ongoing pressures (e.g. the long-running cost-price squeeze) to increase their scale economies.

A recent study by geographers was the first to analyse changes in rural land ownership using land title information at a national scale. Among many important findings, they identified that each year 4.25 per cent of agricultural land changes hands (but with great variation across the states) and that there is likely to be a strong 'neighbour' effect where nearby properties tend to be acquired.

Other recent research has focused on how farmers (and towns) have been affected by successive federal and state governments' pursuit of a 'dry' political-economic agenda, including freer inter- and intra-national trade, removal of all forms of industry protection, and the deregulation, corporatisation and/or privatisation of former state utilities and agencies. This 'rural restructuring' research is strongly connected to research on rural population change, town survival and service provision outlined in [Chapter 9: Rural and regional Australia](#).

Geographical research on agriculture has also examined topics like the pressures that are making mixed farms more specialised and less environmentally sustainable, the food security implications of investment in Australian agricultural land by Australian and overseas financial institutions, and changing attitudes towards giving agriculture priority in the allocation of water resources.

## Integrated land and water management

A distinctive contribution by geographers is the integrated planning and governance of land and water management at a catchment scale. Many of these contributions relate to international river basins, with sustained work by many Australian geographers on rivers throughout south east Asia, but also the Murray Darling Basin in Australia.

## Cultural aspects of water, land and landscapes

Water and agriculture are usually viewed as issues of engineering, economics and environment. Cultural geographers bring an often radically different way of understanding these systems. They explore them as cultural systems, often by disentangling how power is distributed among different groups, and how accepted ways of behaving (norms) influence the ways landscapes have developed. They demonstrate the false division between nature and farming and have shown how embedded cultural and political norms govern:

- food production and water use in the rice growing areas of the Murrumbidgee River
- land use change and land management, e.g. work on 'amenity landscapes' and how this affects practices of weed management
- custom and traditional norms regarding country in Arnhem land
- understanding how gender mediates cultural practices of water use at a household level
- the drivers of resilience in the face of drought and other challenges, particularly in rural agricultural areas.

A growing area of scholarship is in Aboriginal and Torres Strait Islander aspects of land and water. In particular, this work is demonstrating that there are many ways to understand land and water, beyond the narrow European approach. For example, one of the most substantial, and under-appreciated, land-use changes in Australia has been the spectacular growth of land under the control of Aboriginal and Torres Strait Islander communities. For example, 30 per cent of the continent is now held under exclusive or non-exclusive possession native title or land rights regimes.





Wine grapes, Adelaide Hills.  
CREDIT: ALARIC MAUDE ©

In the area of water, a group of geographers have powerfully argued for Aboriginal and Torres Strait Islander rights to water, and are shaping the 'cultural water' debate. They have demonstrated that it is much too restrictive to assume that Aboriginal and Torres Strait Islander water interests will be served through recognising environmental interests. They have also explored the planned development of northern Australia, and the Ord River Scheme in particular, which is an excellent example of a complex cultural issue that benefits from a geographical perspective.

### Managing conflicts over scarcity of land and water

Managing conflicts over resources like land and water has long been an interest of geographers, who seek to explain the connections between scale, power and space in dealing with scarcity. In Australia, much of this work has focused on two key areas of research. The first concerns conflicts over water management and reform in the context of increasing pressures from both drought and regional economic restructuring. This includes:

- critical evaluations of the role of markets in mediating scarcity—particularly with respect to water reform in the Murray Darling Basin
- evaluations of historical and new planning and regulation systems of the Murray Darling Basin
- the role of communities in driving arguments about 'drought-proofing' and coal seam gas development in the Hunter Valley
- how water is valued in the Lake Eyre Basin, which is as much about social variability as physical variability.

The second area of research is around conflicts over land use and land management, with examples including:

- historical drivers of conflict—particularly the effects of colonialism and Aboriginal and Torres Strait Islander and settler conflict, as well as current tensions in land rights in northern Australia
- how understanding the complex social and cultural perspectives and attitudes of farmers and irrigators in Victoria and New South Wales can reduce conflict over land management changes
- how various forms of property rights can be used to respond to the sustainability challenge, recognising the role that tenure can play in both complicating and resolving environmental problems in the coal seam gas sector.

### Planning for change

Human geographers have contributed to a growing body of research on the institutional frameworks for planning for change in land and water management. This work occurs across a range of geographical contexts, such as peri-urban land use change where geographers are contributing to understanding the impacts of urbanisation on land use change and planning. Examples include:

- investigating the institutional barriers and transformations in land and water planning systems, particularly focusing on urban innovations like water sensitive design
- managing uncertainty in land use planning under conditions of increasing urbanisation
- examining the role of education in planning for sustainability.

In regional contexts, research has focused on planning for changes in global and local processes, such as economic restructuring and changing patterns of land ownership that are transforming the way that we farm and manage resources in Australia. The theme of sustainability for rural communities integrates many geographical issues that have been explored in depth.



Cattle raising, inland Australia.  
CREDIT: ALARIC MAUDE ©



Urban agriculture.

CREDIT: WPCPEY / WIKIMEDIA CC-BY-SA 4.0

## Future directions

Geographical perspectives can be brought to bear on a range of critical land and water issues, a selection of which are:

1. Integrated assessments of water planning and management. In some ways, international river basins have received more attention from Australian geographers than have Australian catchments. These would include:
  - 1.1. critical analysis of regional development proposals, in particular the proposed development of Northern Australia
  - 1.2. coal seam gas developments, and other conflicts between agriculture and mining
  - 1.3. managing the catchments of the Great Barrier Reef to sustain both communities and the reef
  - 1.4. the continuing transformation of the management of the Murray Darling Basin
  - 1.5. the interface between the rural and the urban communities—peri-urban, tree-changers.
2. Integration of physical, social and cultural information across space. Existing projects have demonstrated the power of 'big spatial data'. There are tremendous opportunities to use geographical information systems to develop new insights into Australia's agricultural landscapes and communities (see Chapter 12: Geographical information systems and science).
3. A focus on Aboriginal and Torres Strait Islander interests, rights and management of water and land.
4. Research into farmers', community members' and community organisations' (e.g. Landcare) knowledge regarding sustainable production (e.g. intensive and extensive farming) at all scales.
5. Further investigation into climate change effects on water, agriculture, and Australian landscapes. So far, many geographers have focused on coastal and urban systems rather than agricultural areas and rangelands. Impacts on food systems, and adaptation of rural communities should be a particular focus for geographers.
6. Examining the social and economic impacts of the continuing structural changes in the economies of rural areas.
7. Understanding Australia's agricultural and agro-ecological systems in the context of global developments.
8. Improving understandings of terrestrial and marine ecosystems as well as the sustainable limits for the productive use of soil, freshwater, river flows and water rights.
9. Evaluation of cross-property collaboration for landscape-scale benefits within productivity and conservation initiatives.
10. Further investigation of the impacts of continued corporatisation of agriculture on the family farm basis of Australian agriculture. An updated understanding of current land tenure arrangements across the country's rural and remote lands is integral to such research.





A cattle station in the Flinders Range, South Australia.

CREDIT: ALEX WISE / UNSPLASH / PUBLIC DOMAIN





# 5 Health and wellbeing

This chapter reviews research by geographers that contributes to understanding the determinants of Australians' health and wellbeing. The research is reported under three headings: health, wellbeing, and Aboriginal and Torres Strait Islander health and wellbeing.

## Health

Geographical studies of health enable us to understand the influence people's residential location can have on their health. Key areas of interest include:

- disease concentrations
- spatial inequalities in health determinants and health outcomes
- accessibility to services
- spatial analyses of disease prevalence and incidence
- environmental influences on health
- housing and health
- health planning.

Research in these areas is used to inform planning and policy decisions and identify places to target interventions or where the environment could be altered to improve health outcomes. Health geography is multi-disciplinary and uses a range of quantitative and qualitative analytical methods. Spatial analysis using geographical information systems is a particularly important technique. The sections below describe some examples of geographers' contributions to health research, usually within multi-disciplinary teams.

### Accessibility to healthcare

In an acute cardiac event, access to care via specialist centres is critical to survival and improving longer term outcomes, but many places lack this access. The Cardiac Accessibility and Remoteness Index of Australia (Cardiac ARIA) was developed to measure access to cardiac care based on the travel time and distance from any population location to an appropriate medical facility. The Index classifies the accessibility of localities to acute care from 1 (most accessible) to 8 (least accessible), and similarly from A to E for aftercare.

This access model identified people living in locations that could not access cardiac care within a time frame recommended by the latest cardiac care guidelines. It shows the importance of the availability of portable and potentially life-saving therapies, such as defibrillators and thrombolytic therapy, as well as efficient cardiac triage and transportation.

### Undiagnosed disease

Data from the North-West Adelaide Health Survey were used to predict total expected diabetes incidence at a small area level, while GP practice data for 9327 patients were used to measure diabetes diagnoses. The difference between expected and diagnosed diabetes was defined as undiagnosed diabetes and was estimated for each small area. Overall, it was estimated that there was one case of undiagnosed diabetes for every 3–4 diagnosed cases. The highest prevalence of diagnosed diabetes was in the most socio-economically disadvantaged areas, while the highest prevalence of undiagnosed diabetes was unexpectedly found in the least disadvantaged areas. The method provides a tool to identify areas with high levels of unmet need for diabetes care, enabling policy-makers to target appropriate interventions to specific areas.

### Design features of neighbourhoods that promote health through active living

Researchers in Perth examined the relationships between neighbourhood design and walking, using data on the walking behaviour of 663 residents in 36 new suburban developments, and various measures of the design and accessibility features of each suburb. The aim of the research was to provide clearer guidance for planners on the key design features required to build neighbourhoods that promote active living. The study found that active walking was most associated with neighbourhoods with a centre and good street connectivity, and with higher residential densities. Also significant was the diversity of destinations, activities and public open spaces. Micro-design elements, such as street trees and landscaping, had the least effect. However, the research also showed that to have the maximum effect on walking behaviour, all these features need to be

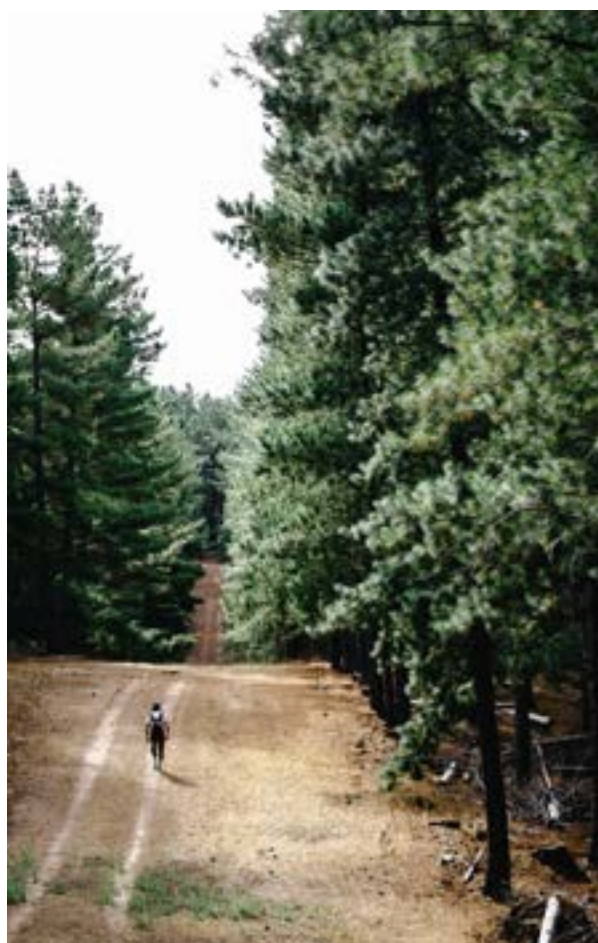


combined. Related studies have examined whether fear of crime discourages walkers, and the effects of the design of the built environment on people's perceptions of crime risk.

### Housing and health

Several research projects involving geographers have investigated the relationships between housing and health. One study focused on the effects of poor quality housing. It estimated that around one million Australians live in housing regarded as being in poor condition, with a tenth of them in dwellings rated as very poor or derelict. Young people, people with long-term health conditions and disabilities, low-income households, unemployed and under-employed people, and Aboriginal and Torres Strait Islander Australians were all over-represented in this population. The research found that poor condition housing has a statistically significant relationship with people's self-assessed mental, physical, and general health. A related study found a bi-directional relationship between housing affordability and health, in which 'prior mental health appears to predict current affordable housing outcomes and housing affordability is associated with current health' (Baker, Mason, Bentley and Mallett 2014, p. 81).

These four examples of health geography apply the geographical concepts of place, space and environment, depending on the question being investigated.



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## Wellbeing

Wellbeing is a broad concept that is difficult to define. It is more than just having a sufficient income and an adequate material standard of living, and encompasses qualities such as:

- education
- employment
- housing
- health
- accessibility of services
- environmental quality
- social relationships and social connectedness
- security
- respect.

Australian geographers have studied several of these aspects of wellbeing, and some of their recent research is outlined in the following sections.

### Spatial inequality and locational disadvantage

Locational disadvantage refers to the idea that socio-economically disadvantaged individuals and households are often concentrated in places—both urban and rural—with poor employment, training and educational opportunities. This makes it more likely—but not inevitable—that they, and their children, will remain disadvantaged. The residents of these places sometimes suffer from their suburb being stigmatised as a poor neighbourhood, while other recognised locationally disadvantaged areas may have substantial social capital and community pride, and be positively viewed by most of their residents.

In Australia, the primarily state-based provision of major services, such as education and health, has produced a lesser extent of inequality between neighbourhoods than in countries like the USA. However, geographical studies of in Australia have investigated the mechanisms, principally the housing market, that lead to concentrations of disadvantaged people, often in locations in the middle and outer suburbs. Studies of residential mobility show that around 15 per cent of Australians move house every year, and that on average there are more moves up the socio-economic scale of residential areas than down. Socio-spatial mobility is therefore a feature of Australian society. However, those who move up are likely to be advantaged in income, education or occupation. Those who are disadvantaged are pushed by unaffordable housing costs to places with poorer access to employment, lower quality social and environmental settings. A similar trend is found for people with disabilities who, if they move, tend to move to less-advantaged areas.

Some studies explore the relative merits of place-based strategies that target issues of infrastructure, employment and education on a neighbourhood basis, compared with structural strategies that address social inequality and its causes at a regional or national scale. A general conclusion is that both approaches are needed.



## Social isolation

Social isolation can be defined as ‘living without companionship, having low levels of social contact, little social support, feeling separated from others, being an outsider, isolated and suffering loneliness’ (Beer et al., 2016, p. 172). It affects the health and wellbeing of the people who are isolated, as well as the cohesion and functioning of the communities in which they are located. A recent broad-scale study of older Australians found that about 20 per cent of subjects could be classified as socially isolated. Geographically, the incidence of social isolation was highest in Sydney and Melbourne and in the sparsely settled regions of non-metropolitan South Australia and Western Australia, and lowest in more densely settled non-metropolitan areas of Tasmania and Victoria. Regional cities and towns appeared to provide a better social environment for older residents, while the study also found that moving away from a familiar neighbourhood—including retirement migration to the coast or other amenity destination—increased the risk of social isolation.

## Housing and wellbeing

Another study examined the effects on wellbeing of three major forms of housing assistance for low-income groups—public rental housing, subsidies for private rental housing, and assistance to purchase a home. The research concluded that while all three forms of assistance had a positive effect on people’s self-reported mental and physical health, financial position, ability to secure employment or training, and children’s educational attainment, assistance with home purchases produced the greatest benefits.

## The effects of the mining boom on wellbeing

A major area of research has been into the effects of the boom in mining investment and employment in Australia on the socio-economic wellbeing of communities. While international studies of resource-dependent communities have often found a prevalent theme of social disruption, Australian research has found mixed evidence for its extent.

One study argues that there are few positive social outcomes for small mining towns from the resources boom, as local residents may be displaced from rental housing, newly formed households cannot afford the cost of housing, local businesses are forced to close because they cannot compete with mining-based wages, accommodation for tourists is diverted to housing mining employees, and government services are affected by the difficulty in attracting and retaining staff because of the high cost of living. Furthermore, the adoption of Fly-In/Fly-Out (FIFO) employment practices by companies may undermine community interaction, restrict the development of local services, and limit the beneficial effects of mining on regional communities.

On the other hand, a study of social wellbeing in 33 small mining towns across Western Australia found that on three key measures—welfare expenditure per capita, percentage of low-income households, and unemployment rate—these places were not as problematic as has sometimes been suggested. The study also showed that the experience of resource towns varied considerably over space and time according to the commodity they produced, their location, the mining company’s level of community engagement and their socio-demographic structure.

Similar studies of larger centres and local government areas yielded similar results, and even suggested substantial improvements in aspects of social wellbeing. In addition, research shows that some of the problems noted above have been exacerbated by poor co-ordination and planning between the public and private sectors, and a failure of government agencies to adequately prepare for the demands produced by rapid expansion.

## Aboriginal and Torres Strait Islander health and wellbeing

The health and wellbeing of Aboriginal and Torres Strait Islander Australians is intrinsically linked to place. As a discipline, geography can provide an understanding of contemporary Aboriginal and Torres Strait Islander expressions of connection to place, sovereignty, self-determination, caring for country, and socio-spatial organisation. Geographical research also examines the social policy dimensions of the impediments and challenges faced by Aboriginal and Torres Strait Islander Australians on these important issues and provides theoretical advances that enable us to think about them differently.

A unique lens that geography brings to these questions is the commitment to understanding how geographical differentiation matters. These expressions and challenges manifest differently and unevenly between inner cities, remote areas, rural landscapes, suburbs, small towns and regional centres. One study, for example, contrasts the (albeit limited) recognition of Aboriginal and Torres Strait Islander land rights and native title in the more remote regions of the country to the resistance encountered to any form of recognition in the settler regions of Australia.

## Measuring Aboriginal and Torres Strait Islander wellbeing

Geographers have questioned the validity of conventional indicators of wellbeing for Aboriginal and Torres Strait Islander populations. For example, conventional frameworks use the non-Aboriginal and Torres Strait Islander population as the measure of wellbeing outcomes, which ignores the possibility of alternative worldviews and perceptions. In addition, census data are poor at capturing the reality of Aboriginal life, which does not conform to the assumption of discrete, settled, nuclear households, while economic

measures ignore subsistence activities and alternative cultural indicators of economic prosperity. Possible alternatives or additions to the conventional measures of wellbeing include:

- cultural health, such as participation in cultural activities and access to ritual, spiritual and kinship knowledge
- access to and management of country
- Aboriginal and Torres Strait Islander ownership or control of land
- literacy in Aboriginal and Torres Strait Islander languages and cultural expression
- Aboriginal and Torres Strait Islander governance and cultural autonomy
- population counts that measure the size of the population accessing services in a place, as this may be more than the resident population recorded in census data
- measures of mobility that capture the reality of Aboriginal and Torres Strait Islander life
- age breakdowns that are consistent with Aboriginal and Torres Strait Islander life stages, which differ from conventional classifications
- data on Aboriginal and Torres Strait Islander expenditure as a measure of economic activity.

### Aboriginal and Torres Strait Islander peoples and mining

Aboriginal and Torres Strait Islander communities living in resource development regions have gained relatively little from the mining boom—improvements in their levels of employment, socio-economic wellbeing, health and education have been marginal. A geographical study of the Pilbara region argues that despite some progress, particularly since the establishment of native title required mining companies to negotiate with Aboriginal communities, there are many obstacles to Aboriginal involvement in the mining industry. These include lack of education and skills, poor health, inability to afford housing in mining centres, and the difficulty of combining the inflexible work requirements of mining with cultural obligations and the maintenance of Aboriginal and Torres Strait Islander institutions.

Several studies have explored ways in which this situation could be improved, such as through negotiated agreements between Aboriginal and Torres Strait Islander communities, government, and private companies to build local capacity and institutions, and changes to work requirements (such as work sharing) that make it easier for Aboriginal and Torres Strait Islander employees to satisfy family and cultural demands. A study examined a Rio Tinto program to attract and retain Aboriginal people in Geraldton to work on distant mine sites in Western Australia. The company provided information, training, and continuing support

and mentoring, and addressed cultural and family needs. The program resulted in generally positive outcomes for the workers, their families and their communities.

### Caring for country

A substantial body of work by Australian geographers is about the ways in which caring for country activities are fundamental to Aboriginal and Torres Strait Islander health and wellbeing. In collaboration with Aboriginal and Torres Strait Islander organisations and other partners, this significant body of geographic literature has paid special attention to the interlinking of cultural, social and environmental values. Questions of governance, self-determination and property rights are further key areas to which geographers contribute, with recent work focusing on the intersection of native title negotiation with land management governance and practice. Valuing Aboriginal and Torres Strait Islander knowledge, and finding a common and complementary ground between this knowledge and Western science, features strongly in this literature. Much of this research highlights the intrinsic importance of place-based knowledge in addressing key environmental challenges, such as climate change, land degradation, water and biodiversity conservation, threatened species, aquaculture, weeds and feral animals.

One study in which geographers were involved explored desert Aboriginal people's view that their health depended on their relationship with their land. The study concluded that:

***Engagement with land management can lead desert Aboriginal people to feel that their own actions are consistent with their own sense of the right and proper way for them to behave towards land, family and community. This increased 'sense of control' impacts positively on health by moderating the impact of sustained stress from health risk factors in the environment and lifestyle. (Davies et al., 2011, p. 417)***

### Aboriginal and Torres Strait Islander social policy

Another body of work has focused on a range of Aboriginal and Torres Strait Islander social policy issues, including planning, housing, population mobility, welfare and social services. Some of this work is also described in [Chapter 9: Rural and regional Australia](#) but three examples are outlined below.

One study explored the relationship between Aboriginal and Torres Strait Islander mobility practices and educational attainment. The frequent movement of Aboriginal and Torres Strait Islander children accompanying family members visiting other places is widely considered by educational authorities to contribute to poor attendance and limited educational performance. However, statistical analysis found that while overall Aboriginal and Torres Strait Islander mobility is high, children were more sedentary. Absence from

a home base could account for no more than one-third of non-attendance at school, and probably less. This leaves other factors mainly responsible, which another study identified to be the school environment, the relevance of schooling content, household stress, housing issues and family crises. Nevertheless, mobility is an issue for a number of Aboriginal and Torres Strait Islander children, and researchers argue that school systems need to work closely with the local Aboriginal and Torres Strait Islander community to find ways to engage with these children and their families.

A second study found, somewhat unexpectedly, that temporary mobility (defined as absence from their usual place of residence on census night) was higher in communities with more jobs in health care, more Community Development Employment Projects (CDEP) jobs and higher rates of Internet access, but lower where new houses had recently been provided. This may be because people in the former communities are more likely to have jobs, and can more easily afford to travel.

A third research project used geographical information systems to analyse Aboriginal and Torres Strait Islander access to services of the centralised hub and spoke system of service delivery established across much of northern Australia. The study found that because many Aboriginal and Torres Strait Islander residents lived in more remote areas, they had to travel greater distances than non-Indigenous residents to reach the nearest hub. This sort of inequity is inevitable when service delivery is centralised for economic efficiency.

Research of this nature has the ability to inform the effective delivery of services in Aboriginal and Torres Strait Islander communities.

## Ethics

Across all of these bodies of work, geographical researchers and educators have at the same time been addressing fundamental questions about the ethics and practices of knowledge production and geographical education. Australian geographical research and teaching embodies a strong ethic of recognising the co-existence of Aboriginal and Torres Strait Islander and non-Indigenous laws, cultures, knowledge and responsibilities. Research ethics has been a core concern of Aboriginal and Torres Strait Islander communities and the researchers with whom they work. Australian geographers have contributed to addressing Aboriginal and Torres Strait Islander communities' concerns of about research by developing and practicing collaborative, community-engaged models of knowledge production. Major contributions have been the commitment demonstrated by Australian geographers to Aboriginal and Torres Strait Islander methodologies, and capacity development for research within Aboriginal and Torres Strait Islander communities.

Research has also shown the importance of geographical knowledge production tools to the health and wellbeing of Aboriginal and Torres Strait Islander peoples and places. For example, mapping techniques have played a pivotal role in the development of globally significant participatory and customary-based mapping practices. This work highlights the importance of inverting the historical relationship between research institutions and Aboriginal and Torres Strait Islander peoples, and has reminded non-Indigenous researchers that there is no 'right to research' with Aboriginal and Torres Strait Islander peoples. Both in research practice and in education, Australian geographers have provided critical, but hopeful, perspectives and analysis.



## Future directions

There are several important avenues for further geographical research in the area of health and wellbeing, including:

1. Further research to identify places with high levels of undiagnosed disease, to guide future targeted interventions.
2. Research into places with high incidence of specific health problems, to guide future targeted interventions.
3. Modelling accessibility of key health services for the many chronic health issues for which this information is not currently available.
4. Linking cohort and case study datasets to create larger national databases for research.
5. Investigating community governance arrangements in mining communities to determine best practice for truly sustainable local economic, social and demographic development.
6. Evaluating service provision models for remote communities, particularly communities with distinct cultural needs.
7. Examining the effects of the expansion or contraction of non-mining rural industries on the social and economic wellbeing of rural populations.
8. Assessing the role of leaders, social networks and governance structures in promoting socially innovative responses to pressing economic, environmental and social challenges.
9. Qualitative investigation of the extent to which places of apparent locational disadvantage constrain the ability of people to move out of disadvantage, and evaluating the implications of the findings for social, economic and planning policies.
10. Research into strategies to improve housing provision and housing conditions.
11. Investigating the role of place (where people live) on social isolation.
12. Increased research relating to Aboriginal and Torres Strait Islander peoples in southern and urban Australia, where the majority live, exploring:
  - 12.1. Themes of urban Aboriginal and Torres Strait Islander identities, rights, histories, and claims, particularly in relation to how these all interface with statutory planning and regulation systems.
  - 12.2. The changing nature of Aboriginal and Torres Strait Islander demographic and socio-economic profiles in urban areas and the implications for social policy and planning in various sectors, such as housing (e.g. the impact of gentrification, mixed-used social housing schemes and public housing sector retrenchment).
13. Investigating the spatial distribution and effects of loss of industries and unemployment, particularly on the wellbeing of rural residents.
14. Research critically examining how socio-economic disparities between Aboriginal and Torres Strait Islander and non-Indigenous populations are defined, discussed, measured, and addressed.
15. Research into Aboriginal and Torres Strait Islander access to land rights and resources.









George Street, Sydney, New South Wales.  
CREDIT: LAURA CROS / UNSPLASH / PUBLIC DOMAIN



# 6 The economy

The economy, and the employment it creates, the incomes it provides, and the services and infrastructure it funds, are of central importance to households and individuals. Geographical research on the economy focuses on places and regions, including the effects of economic change, the processes producing these changes, and ways of promoting regional development. Australia has been described as having a patchwork economy, with regions of growth contrasting with regions of stagnation or decline, and geographers seek to understand the causes of these differences across the country. Such studies are important, because 'The economic growth of a country is the sum of the growth of its local economies or regions' (Kotey and Sorensen, 2014, p. 405). Geography brings to the study of the economy a sensitivity to the differences between places, grounded in real world knowledge of places and regions.

This chapter reviews some recent geographical research on the Australian economy, excluding work on the urban economy, which is reviewed in [Chapter 10: Australia's cities](#). The selection illustrates the distinctiveness of economic geography in Australia when compared with the USA or European countries. Australia has a unique history, economy and population, and theoretical approaches and policy issues that are appropriate in those countries may not be as relevant here. For example, Australian research has emphasised studies of globalisation, the role of the state, mining, rural and remote areas, Aboriginal and Torres Strait Islander economies and cultural economies.

## Natural resource exploitation and regional development

The mining boom in Australia between 2001 and 2012 had a profound effect on economies in mining and non-mining regions across the nation, stimulating a range of geographical studies. Some examined the extent to which remote and generally small towns can capture the economic and demographic dividends associated with mineral and energy extraction, or whether these towns are bypassed as ore or energy sources are transported out of the region. Several studies used interpretations of Innis's staples theory, developed in Canada, to highlight

the unequal development between resource peripheries and core cities. This research shows that while increased mining employment in mining regions was accompanied by growth in the region's non-mining sectors, it was largely confined to wholesale trade, accommodation and food services, transport, and rental and real estate services, and was highly dependent on the success of mining.

This lack of diversification is explained by the limited extent of local processing of minerals before export, the purchase of supplies and services from the cities rather than locally, the transfer of profits by mining companies out of the region, and company preference for a largely non-resident workforce even when there are workers available locally. The widespread practice of long distance commuting by the mining workforce limits their engagement with the local communities in mining places, and results in most of their income being spent in their home locations. These are likely to be the major cities, coastal towns, or even overseas. Another factor is limited investment by governments in the provision of the infrastructure and services to support new industries. The outcome is generally a set of small economies dominated by a single industry and one or two corporations, which are highly susceptible to downturns in demand for their staple product.

Instead of producing new and diversified economies in mining regions, much of the wealth and employment generated by mining has been captured by the cities, with Perth developing into an international mining services centre. As a result of political pressure from non-metropolitan regions, the Government of Western Australia implemented several programs in an attempt to redress this imbalance. The Royalties for Regions program was initiated in 2009 with the broad aim of promoting and facilitating economic, business and social development in regional Western Australia. The program stipulated that 25 per cent of all royalties earned by the state from mining must be spent in non-metropolitan regions, and this expenditure must be additional to normal state government spending on services and infrastructure. Other elements in the program were designed to give non-metropolitan areas greater control over how the funds were spent.



An iron ore train loading at the Brockman 4 mine, Western Australia.  
CREDIT: CALISTEMON / WIKIMEDIA / CC-BY-SA 3.0

Although one of the objectives of Royalties for Regions was to increase economic diversification, a study of the program in the Goldfields region of Western Australia found that a considerable amount of the funding was being spent on subsidising mineral exploration, and on improving the transport infrastructure required to export raw materials. This reinforced the region's specialisation in mining, rather than promoting economic diversification.

Another Western Australian program, the Pilbara Cities scheme, aims to more than double the population of three cities in the region—Karratha, Port Hedland and Newman—by 2035, create a more stable population by reducing long distance commuting and providing housing and services, and diversify the local economies. These are ambitious targets, given the preference for a long-distance commuting workforce and the scale of infrastructure investment required.

Other geographical research on mining has:

- examined the land use conflicts produced by the expansion of mining into rural areas, the resulting threats to agricultural production, rural life and sense of place, and the competing narratives about the future of these places
- demonstrated that coal seam gas (CSG) development in Queensland shows signs of mitigating or reversing rural population decline, with CSG regions having larger, younger and more educated populations than non-CSG regions
- evaluated strategies to manage the social impacts of mining on local communities.

## Regional development processes

Analysis of the processes driving change in the spatial pattern of the Australian economy is another important area of geographical research. Earlier work focused on the effects of globalisation, economic deregulation,

privatisation of government-owned enterprises, and the growing financialisation of the national economy on regional economies. Despite the decline in manufacturing employment, these forces tended to further concentrate economic activity in the major cities and disadvantaged many non-metropolitan regions.

Some recent research has focused on the evolution of regional economies, and the relative influence of endogenous (local) and exogenous (external) factors on their development. A series of spatial econometric and other quantitative studies of non-metropolitan regions and cities in Western Australia found that while external trading relations are generally the most significant drivers of regional economic change, there are differences between regions that have created a patchwork economy. These differences are partly explained by path-dependence, in that the regional economies followed trajectories influenced by past events and trends. The differences are also place-dependent, in that the trajectories vary from place to place because of local conditions such as the economic base, amenities and infrastructure, relative location, local leadership, and land use regulations and planning. The researchers conclude that:

***This points to the necessity of employing 'local' geographically contextualised explanations, which are grounded in 'situated' knowledges of the geography of uneven development. (Plummer and Tonts 2013, p. 239).***

Other studies complement this finding, by showing that enterprise-based local competitiveness across Australia's regional economies is statistically associated with both local human capital and the ability of the people representing this capital to adopt and generate new technologies. One study advocates local strategies to stimulate the formation of technology-based enterprises, such as initiatives to foster talent and innovation, promote business leadership, provide access to venture capital and encourage rural networking.

The effects of path-dependence are well illustrated in a case study of tourism development in the Flinders Ranges. The study identified a number institutional barriers and conflicts that are products of the region's history of dependence on the export of staples. The reduced capacity of the region to innovate and diversify its economy, has required the import of people and knowledge from outside the region.

## Place-based regional development

The previous section introduced the idea of regional development policies based on local conditions and initiatives. This place-based regional development involves local and regional communities identifying their strengths and opportunities, and then developing strategies to use their assets and capacities to develop the local economy. The focus on place within these policies has attracted the interest of Australian geographers. Some have examined

the formation of the regions created by state and federal governments to undertake the work of place-based development. One such study argues that place-based development must recognise that the borders of regions are fluid, differing according to the scale of governance involved, and that regions and places are linked to others through flows of capital, people and knowledge.

The effectiveness of place-based strategies for regional development also depends on communities' ability to identify and agree on their interests and goals. One research project has shown that the consultation processes designed to achieve this outcome can be dominated by a well-connected minority of the community, leaving a significant majority who feel that their voices are not being heard and their interests not represented in community-based decision making. Similarly, studies of regional development boards have pointed to the lack of diversity in their membership.

The ability of places and regions to undertake place-based development depends partly on their institutional capacity. This includes the quality of local human capital and leadership, the presence of major organisations with skilled employees (e.g. research centres and universities), locally controlled financial resources, a commitment to business growth and economic development, and a history of success in engaging with external political and administrative processes. An index based on measures of these indicators shows that:

***... both institutional capacity and effective institutional power are concentrated in the capital cities ... This is a longstanding feature of Australia's economy and pattern of urban development and it is disappointing that the Australian nation has not found a way to empower its less developed regions in their efforts to grow. (Beer and Lester 2015, p. 225)***

If place-based development is to be effective in Australia, much more needs to be done to improve the institutional capacity of disadvantaged regions.

Place leadership is a component of institutional capacity, and has been another topic of geographical research. Leadership at a local or regional scale is difficult in Australia because of the highly centralised system of government at both state and federal levels, but one recent study shows that local leaders can have an influence, even when their powers appear to be limited. This study also challenges interpretations of regional economic change in which the state and global capitalism are the only determinant forces.

Some geographers have examined the strategies used by places to boost their economies. One area of investigation has been the role of the creative arts in promoting rural towns and regions. For example, one research project investigated the role of music festivals in regional development, and gathered data from nearly 100 regional events. The

research found that while major commercial musical events generated large profits, they did not make a similarly large contribution to regional development, apart from a few notable exceptions, such as Tamworth's Country Music Festival. In contrast, the smaller community-organised, non-profit music festivals had relatively stronger local economic linkages, a greater involvement of local people, and contributed to community cohesion and place identity. This research shows that promoting the arts can achieve outcomes that are more than just economic. These include fostering local entrepreneurialism and artistic/cultural expression, and generating greater non-local awareness of and interest in rural places and their lifestyles.

Another study advocating locally driven development extends the concept to local views on the meaning of development. A study of low-income places across the north of Northern Australia points to the failures of large-scale externally resourced and directed development, and proposes small-scale internally oriented development as an alternative. In addition, it suggests that development initiatives that reflect the preferences of local people, emphasising social and environmental factors, may produce better outcomes.

## Labour mobility

The mobility of labour is an important economic issue that is also geographical, because many places and regions lack the labour needed for economic growth (e.g. mining in remote areas), and many remote areas lack the labour needed to provide skilled services. For example, geographical research into FIFO shows that it is a labour supply response to shifts in the location of employment that does not require the relocation of workers and their families. Along with other forms of long distance commuting, FIFO enables

***... workers to have a well-paid job in remote areas while at the same time retaining family and friendship ties in their residential communities, taking advantage of facilities and leisure opportunities there in the furlough period which are not available in remote and small communities. (Haslam-McKenzie, 2016, p. 14)***

FIFO is also preferred by companies partly because it reduces their costs, but perhaps more because it fragments the workforce and separates them from the local communities, which removes a site of union and community power.

While most research has focused on the receiving end of FIFO movement, some has examined the source places of FIFO workers. One study, for example, investigated the effects of FIFO movement on the town of Busselton in Western Australia, one of several places chosen by Rio Tinto as a labour source community. The study showed that FIFO brought a large amount of income and expenditure into the city, which helped to retain population and counteract the effects of declines in some local industries. Consequently,



FIFO has been suggested as a strategy that might help country towns retain population in the event of industry decline or closure. However, the study also identified a leakage of this income and expenditure to Perth through the purchase of major items, and the flow of savings out of the local area through centralised financial institutions.

Other recent geographical studies that have examined the mobility of labour include:

- research into the mobility of recent graduates. Understanding this mobility is important because many regions lack the skilled labour needed for their development
- investigation of ways to attract and retain skilled and professional staff in remote locations. This research adds to the previous topic by reviewing several successful attraction and retention initiatives, and emphasises the importance of health and education provision, housing, and inclusive communities with strong social capital
- research into the complex patterns of short-term population mobility in rural and remote areas of South Australia and the Northern Territory. Short-term population mobility involves circulation between a number of locations with a regular return to one or more home bases, and the research examined the effects of several examples of this mobility. These included the FIFO workforce associated with mining and resources projects, the movement of non-resident health workers, temporary contract labour employed in government administration in more remote areas, and the movement of Aboriginal and Torres Strait Islander peoples from remote areas into large urban service centres.

## Manufacturing

A national economic policy area where some geographers have voiced concerns is related to the role of manufacturing. Some argue that the decline of manufacturing, seen by many economists and politicians as a necessary part of the transition to a knowledge-based—and predominantly service—economy, is not inevitable. They point out that Australia continues to make many products, some based on local skills, or which are expensive to transport, or have customers who want customised products and ongoing support. Furthermore, while many manufacturing workers do not have adequate skills to transition to the new knowledge-based or service jobs, they have skills in making things and working with materials that could be used to make specialised products for which their locations have some competitive advantage. This advantage is based on histories of product design and manufacturing skills that are specific to particular places, and such places are not confined to the major cities. The authors of a study of manufacturing in Wollongong concluded that:

Shifting the discourse on manufacturing means inviting more open conversations about what makes up manufacturing, and where it is concentrated regionally in Australia. Beyond assembly lines are product design, prototyping and testing, customisation and ‘learning firms’ engaging international niche markets, as well as loyal communities regionally. Wollongong exemplifies this, and is an ideal place to move beyond thinking about manufacturing and innovation as mutually exclusive. (Gibson and Warren 2013, p. 10)

An additional argument is that to prevent ever-growing pressure on environments, manufacturing must shift from low-cost, low-quality products that need to be replaced regularly, to higher quality and longer-lasting products. Many of these can be produced in Australia, through a reintegration of the creative design skills with the manual manufacturing skills. An example of this integration is the revival of many forms of craft-based production. The potential, as well as the pitfalls, of this form of manufacturing have been illustrated by studies of the guitar and surfboard industries.

## Aboriginal and Torres Strait Islander economies

Geographical research on the economies of Aboriginal and Torres Strait Islander Australians has focused on remote areas, and on Aboriginal access to, and use of environmental resources. Aboriginal and Torres Strait Islander economies in these regions are often hybrid. They combine a market sector based on private sector employment and sales of products, a state sector based on government employment and transfer payments, and a customary economy based on subsistence activities. Both the first and the third sectors use terrestrial, aquatic and marine environmental resources. Research shows that the capacity of Aboriginal and Torres Strait Islander communities to use and benefit from these environmental resources is limited by:

- crown ownership of sub-surface resources. This reduces the ability of Aboriginal communities to derive income from mineral resources
- mainstream development activities that degrade environmental resources. For example, water resource developments that alter river flow regimes, modify habitats, restrict access and change the distribution of species can all reduce Aboriginal and Torres Strait Islander production from fishing and harvesting rates
- environmental management plans that fail to recognise Aboriginal and Torres Strait Islander worldviews. These worldviews do not separate humans from nature, or the utilitarian value of the environment from its social and cultural significance. Consequently, researchers question whether the rationalist planning processes followed by state agencies can accommodate Aboriginal and Torres Strait Islander worldviews

- the assumption that water management plans that provide for environmental flows will be sufficient to protect Aboriginal and Torres Strait Islander interests. For example, research has shown that environmental flows may be designed to conserve rare and endangered species, but not necessarily those valued by Aboriginal and Torres Strait Islander communities
- political pressure from some environmental groups to conserve 'wilderness'. If this pressure is successful it will prevent Aboriginal and Torres Strait Islander commercial development of the resources of these areas
- lack of political support for the 'hybrid economy' of remote settlements, and limited recognition of the role of these settlements in Aboriginal wellbeing and effective management of the environment.

An important new area of research on Aboriginal and Torres Strait Islander economies, in which geographers and other social scientists have been involved, is on the potential benefits of carbon farming. There is now a large number of projects that enable Aboriginal and Torres Strait Islander land managers to earn income through practices that reduce emissions from savanna fires or increase the amount of carbon stored in vegetation. Carbon farming might also increase the ability of communities:

***... to protect a sacred site by establishing an appropriate fire regime, to encourage the reintroduction of rare or endangered wildlife, or to enable people to be on country so that a younger generation can learn from their elders (and be employed at the same time). (Jackson, Palmer, McDonald and Bumpus, 2017, p. 9)***

These practices are based on customary knowledge and, unlike non-Indigenous carbon farming, are embedded in and reproduce the social and cultural relationships between people, and between people and country.

Aboriginal and Torres Strait Islander advocates and non-Indigenous geographers therefore argue that carbon farming by Aboriginal communities can be a cultural as well as commercial activity, and consequently has the potential to strengthen these societies and improve economic health. It can also improve land management across large areas of sparsely populated Australia.

## Community economies

Geographers have also been involved in theoretical work on the concept of 'diverse economies', which argues that there are economies other than the capitalist one of waged and salaried labour and profit-seeking enterprises. For example, labour may be exchanged, or paid for in ways other than money, or unpaid and voluntary. Goods and services can be exchanged outside formal markets (e.g. in underground markets, bartering, sharing or gifts), and enterprises can

have aims other than profit, such as with non-profit organisations. These diverse economies are not driven solely by monetary considerations. This potentially provides more scope for ethical actions, and for building socially and environmentally just economies, because the economy is not seen as separate from society, politics or the environment.

This theoretical research is complemented by the development of techniques for working with and involving communities. These techniques, which have been applied in the USA, Australia and the Philippines, enable communities to work together to identify and implement a wide range of economic practices that support wellbeing and provide a social safety net for vulnerable people. The researchers argue that such community economies are not only more socially just, but also more economically resilient because they are diversified. The group has established a community economies project website ([www.communityeconomies.org](http://www.communityeconomies.org)) to promote the concept and link practitioners around the world.

Some projects are specifically aimed at developing community food economies as alternatives to the dominant food system. These may directly connect food producers and consumers, through community-supported agriculture, farmers markets, food cooperatives and community gardening, promote ecologically sustainable methods of agriculture, and build cooperative networks between producers.

## The role of the state

Many Australian geographical studies have used the concept of neoliberalism—the application of market approaches to government policies, programs and services—to interpret and explain regional economic trends. These studies often view neoliberalism as a pervasive international ideology, and its adoption in Australian government policies as little different to other parts of the world.

However, some geographers have questioned the extent to which Australian governments have pursued neoliberal agendas. They argue that a variety of historical and geographical reasons, neoliberalism has not been as dominant in Australia as in the UK or the USA. These reasons include:

- the ability of states in a federation to block market-based reforms advocated by the central government that might disadvantage them
- the ability of voters in a strong democracy to resist policies they see as disadvantaging them, which constrains governments from moving too far from the political centre
- a still-surviving egalitarian culture, which has maintained support for minimum wage standards and social welfare payments



- Australia's large but sparsely populated space, which hampers the development of national markets, and enables the establishment of 'natural' monopolies at urban and regional scales. This makes market-based reforms ineffective, so privatisation in Australia relies on regulatory frameworks rather than competition.

In support of these arguments, a study of Western Australia suggests that the state government's use of agreements with companies as a regulatory tool for the development

of natural resources and infrastructure in the regions is inconsistent with neoliberalism. Similarly, another study describes government funding for the construction of major sporting stadiums as a neoliberal paradox.

The ongoing debate among geographers over the role of the state illustrates the need for care when applying ideas from other countries to Australia's distinctive context.

## Future directions

Some of the proposed directions are a continuation of current and promising research areas, derived from the preceding review. These include:

1. Further work to clarify the role of the state in shaping the geography of the Australian economy.
2. Exploring best practice approaches to 'bottom-up' or 'locally led' regional and local development.
3. Assessing the contribution of artistic and cultural creativity to fostering sustained economic, social and demographic change.
4. Understanding the different processes and dynamics supporting economic diversification in urban and rural economies, given the increasing importance of productivity and innovation for all industry, irrespective of location.
5. Evaluating the potential for small-scale place-based industries based on local skills and materials.
6. Evaluating the contribution of the concept of diverse economies to urban and rural places.
7. Exploring ways to support and develop hybrid Aboriginal and Torres Strait Islander economies where appropriate.
8. Furthering the understanding of regional economies' development pathways, and ways of altering those that are no longer appropriate.
9. Other research directions involve topics that seem to be neglected in current research. These include:
10. Investigating the potential impacts of climate change on regional economies. This research area encompasses both the direct effects of climate change on economic activity, and the effects on regions of strategies to respond to and manage climate change, such as carbon pricing.
11. Forecasting the effects of technological change on regional economies and societies, such as the impacts of automation and robotics on employment in both rural and urban economies. These technologies are likely to have different impacts in different places and regions, and therefore require geographical study. Linked with this topic is work on the geographical effects of digital technologies on industries such as retailing, transport and accommodation, including the impacts of firms such as Amazon, Uber and Airbnb.
12. Explaining and forecasting the location of new industries in both urban and regional areas. There is little geographical research on this topic, other than on cultural industries, but considerable potential for studies of emerging industries, including those involving innovative technologies.
13. Examining the capacity of remote communities, including Aboriginal and Torres Strait Islander groups, to forge economically, demographically and socially viable developmental agendas in spite of their distance from the major centres of political and economic. For example, with the construction phase of the mineral and energy resources boom now over, an understanding of how local mining towns and hinterland communities have adapted to less buoyant conditions is important. Research could focus on the demographic and socio-cultural composition of such places, and whether these are reverting to a pre-boom condition or are moving on a different trajectory altogether in the post-boom era.
14. Investigating the extent to which funds (i.e. 'resource rents') derived from energy and mineral extraction are returned to mining towns and regions and how such funds are used.







The hemisphere centred on Australia. Our half of the world consists of Antarctica, New Zealand, a number of Pacific Island nations, and south, southeast and east Asia.

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# 7 The Asia–Pacific region

The Asia–Pacific region is our regional neighbourhood and we have growing connections with its countries and peoples. Geographical research and teaching makes a major contribution to educating and informing Australians about the region. For the purposes of this chapter, the region is defined as comprising the countries in an arc from Pakistan to Japan, and the island nations of Southeast Asia and the Pacific Ocean. These countries contain considerable diversity in environments, cultures, economies and political systems, and the area is called a region only for convenience. Recent geographical work on the region has covered a wide variety of topics, a selection of which are described in this chapter.

## Climate change

Australian geographers have explored many aspects of climate change in the region—including the biophysical and human processes contributing to climate change, and the interconnections between the two. Sea-level rise caused by global warming is a major concern for the island nations of the Pacific, and has gained international attention.

Research by Australian coastal geomorphologists has examined the ways small islands in the Pacific have been affected by sea-level rise. In many cases, there has been no reduction in island size, because sediment accretion has balanced erosion losses. However, there have been changes in the shape and position of islands on the reef surface, retreat of shorelines, and examples of small reef islands that have disappeared because of increased wave erosion.

Research also shows that the environmental changes often attributed to sea-level rise, such as coastal erosion and flooding, have many possible causes. These include tectonic movements that have produced subsidence; erosion and accretion processes associated with the El Niño–Southern Oscillation and occasional extreme events; and human modifications of the environment, which have interrupted sediment transport and increased erosion. Consequently, it is difficult to separate the effects of long-term sea-level rise from other causal factors.

While this research suggests that small Pacific islands will not disappear in this century, the habitability of many of them, and of the coastal areas of larger islands, will be threatened by saltwater intrusions into groundwater, loss of land through coastal erosion, and inundation by sea-water caused by very high tides or storms. A study by geographers classifies 1532 Pacific islands according to their susceptibility to these threats, and provides a methodology that can be applied by decision-makers to identify specific coastal areas at risk.



Reef island, French Polynesia.  
CREDIT: ALARIC MAUDE ©

## Adaptation to climate change

Mitigating and adapting to climate change is a major challenge across the region, but one that requires place-specific responses. For example, a study in Nepal and Bangladesh argues for supporting the actions of local communities to develop their own diverse ways of responding to climate change, and for building on local knowledge and resources to enhance adaptive capacity, rather than seeing these as too small-scale to be effective. Studies in the Nepali Himalaya have developed sophisticated measures of household vulnerability to climate change, and shown that differences in households' livelihood assets lead to considerable differences in their capacity to adapt. The researchers argue for adaptation policies that address the needs of the most vulnerable households first. In Tuvalu, researchers have pointed out that climate change is only one of several stressors being experienced by the population, and that adaptation initiatives need to take all stressors into account.





An Indonesian oil palm smallholder sells fruit bunches to a trader. Riau, Samatra.

CREDIT: L. POTTER ©

Geographers have also explored the political dimensions of mitigation and adaptation that shape how and where projects are implemented. Poorer countries in the Pacific, for example, are shown to have limited capacity to influence international climate change debates despite their high profile in climate narratives, while other researchers have warned that climate change programs may have negative impacts on marginalised groups.

## Rural studies

Recent research by Australian geographers on rural change in the Asia–Pacific region illustrates the application of geographical understandings of place, interconnection, scale and human–environment relations. One or more of these concepts are central to:

- investigations of linkages of rural communities with urban areas through permanent or temporary migration; with national and global economies through trade; with national governments and international organisations through development programs; and with the world through the cultural influences of globalisation and international tourism. These studies emphasise the multi-local and multi-scalar nature of people’s lives
- studies of agrarian change that reflect on the increasingly post-subsistence, post-agrarian nature of rural society in southeast Asia, and the blurred distinction between urban and rural
- understanding the multi-scale changes that have increased risks for rural livelihoods in southern Vietnam, such as resource development in the Mekong Basin, climate change and market volatility, and communities’ responses to these
- analysis of the anthropogenic causes of wetland loss and degradation during the past 200 years in the Mekong Delta and the resulting environmental problems
- research into conflicts over land and resource development that examine how complex interactions between local, regional, national and international levels produce different outcomes in different places

- studies of the difficulties associated with commercial crop production experienced by growers in locations distant from urban centres and from the required processing and transport infrastructure
- research into the ways that national resource development programs, such as dams, mining and the commercialisation of agriculture, have reduced the access of poor households to land and failed to improve their welfare
- comparative studies of oil palm cultivation in Southeast Asia and Melanesia, which show that ‘oil palm livelihoods and economies vary from place to place and are as much a product of their local geography—political, social and economic—as they are an outcome of irresistible capitalist processes’ (Cramb and Curry, 2012)
- critiques of value-chain interventions in rural development that do not take account of the complexity of livelihood strategies.

## Challenges to conventional development pathways

Much of the geographical research on the Asia–Pacific region is grounded in intensive field work and community engagement, and is sensitive to issues of social justice and the welfare of local communities. This research has frequently been undertaken to support the efforts of local communities and marginalised peoples to find ways of development that meet their needs and values.

As a result, geographers researching rural places in southeast Asia and the Pacific Islands have questioned the widespread assumption that the incorporation of local societies into the global economy will follow a simple development pathway from a pre-capitalist economy to a capitalist one and from tradition to modernity. One reason for this is that many rural areas do not have the resources or the accessibility required to develop a capitalist economy able to eliminate poverty. Another is a concern for forms of development that are responsive to local aspirations and conditions, recognise the importance of customary social relations, and promote self-determination and independence.



Delivering supplies and collecting cocoa from small farmers in remote areas of East New Britain province, Papua New Guinea.

CREDIT: G. CURRY ©



The starting point of the South-to-North Water Transfer Project. Looking toward the Danjiangkou Reservoir, from which the water is coming.  
CREDIT: NSBDGC / WIKIMEDIA CC-BY-SA 4.0

***Research in Melanesia, for example, shows that 'at the local level people strive to maintain their identity in the context of change, and desire to forge a modernity compatible with their own registers of value'. (Curry et al., 2012).***

Similarly, geographers working in Timor-Leste have argued for more endogenous development pathways derived from local contexts, values and worldviews. They have also highlighted how recognising and legitimising local customary institutions and practices could assist the development of water resources.

A number of geographers have studied and advocated forms of development based on diversified local economies and community-based social enterprises, which produce a more resilient local economy and sustain social relationships. They also argue that customary systems of land tenure and other environmental resource rights, which are central to people's culture and identity, should be maintained or adapted rather than replaced by 'modern' concepts.

To become resilient, many geographers also believe that community economies need to be re-embedded into local ecologies, and recognise the inter-dependencies between all life forms that are vital in sustaining future life. This means that economic activities must be designed to restore and maintain habitats, increase ecological diversity, and recycle materials and energy.

Such development pathways 'may better serve the place-based needs and desires of people who are seeking to maintain and enhance a way of life' (Curry, 2003). In Papua New Guinea, geographers have contributed to this aim by designing payment systems for smallholder farmers that accommodate traditional economic practices and raise the productivity and incomes of vulnerable groups such as women and young people.

Migration is another development pathway in these areas. For example, in Pacific Island countries where mainstream economic development strategies based on agricultural exports and tourism have failed to provide sufficient employment, individuals and households have migrated, mainly to New Zealand, Australia and the USA. The remittances they send home have contributed significantly to

national economies and household livelihoods, minimised the impacts of natural hazards, played some part in reducing both poverty and inequality, and supported community projects.

## Water management

A group of Australian physical and human geographers, in collaboration with scientists in China, has been engaged in a major study of water management in China. One aspect of their research has been a study of the South-to-North Water Diversion project, the largest inter-basin water transfer scheme in the world, designed to deliver water from the Yangtze river in the south of China to the north of the country. The researchers argue that pollution and environmental fallout, as well as high maintenance costs and water prices, make the project unsustainable both ecologically and socially. The Chinese Government plays dual roles as both entrepreneur and regulator in this project and sees increasing supply as the main solution to water scarcity in the north.

In the trans-boundary context of the Mekong River Basin, studies of water and resource governance have explored environmental, livelihood and institutional aspects of large-scale resource development. These studies have operated across a range of scales, from basin-wide geopolitics to community-level studies of fisheries and other dimensions of common property governance.

## Food security

Food security has been a research focus for some Australian geographers. For example, in Micronesia research shows that inadequate food security is a result of a decline in the local availability and production of subsistence foods, combined with lack of income. It is increasingly an urban and peri-urban problem. Climate change is also a threat to food security. In the islands of the Pacific, rising temperatures, changes in rainfall, and an increase in the intensity and frequency of cyclones, will affect subsistence and commercial agricultural production, as well as the food productivity of reef-lagoon systems. This reduces the local food supply as well as households' capacity to buy imported food.



Studies by geographers in Melanesia, however, find that this region is relatively food secure. This research questions the ways that narratives of food insecurity and dependency in the Pacific have been constructed, and shows that some communities have improved the resilience of their food systems by adopting 'innovative solutions to their land use, food supply, and sustainability challenges' (Allen, 2015).

A study in Myanmar shows a close relationship between land ownership and food and nutrition security in rural areas, indicating that strategies to widen land ownership would improve people's nutrition. Research in India reveals a more complex situation, identifying three ways in which vulnerable households are restricted in their ability to gain access to sufficient food. These are that institutional shortcomings within key food programs have reduced people's ability to obtain food; people's ability to earn money to buy food through wage labour is limited because economic growth has bypassed their location; and their ability to grow their own food has been affected by land fragmentation and environmental degradation.



Migrants in Cabramatta, Sydney.  
CREDIT: C. FORSTER ©

## Migration between Asia–Pacific countries and Australia

Geographical research into migration flows between the Asia–Pacific region and Australia shows that these flows are complex, involving:

- permanent movement to Australia
- long-term migration of Australians to an Asian country
- permanent return of migrants to their Asia–Pacific homeland
- long-term but temporary movement from Asia–Pacific countries to Australia with no intention of settling (e.g. migration for education)
- shorter-term circulation of people between Asia–Pacific countries and Australia.

The author of these studies argues that there is no stronger and more significant link between Australia and Asian countries than those created by the movement of people

between them, because these are creating 'a myriad of robust channels and corridors for two-way flows of goods, ideas, money, information and understanding' (Hugo, 2015). Consequently, the permanent or temporary return of migrants to their homeland should be seen as a successful outcome of migration.

## Challenges to geographical thought and practice

One Australian geographer with considerable research experience of China has argued that the re-emergence of China's economy raises challenges for the content, theories and practice of economic geography. China's economic development, he contends, requires rethinking the institutional management of the global economy, the applicability of Western geographical theories and generalisations to non-Western contexts, and concepts such as modernity. He also argues that research into the current process of economic growth in China could improve understanding of past growth processes in developed countries. He calls for cooperation between Chinese and Western scholars to redirect economic geography away from concerns relevant only to the West.

A further example of research in the region that challenges geographical practice is a multi-disciplinary evaluation of international schemes to reduce deforestation and forest degradation as a climate change mitigation strategy. The project combines the roles of critical researchers, who focus on issues of power, marginalisation and social justice, with those of practice-oriented researchers, who focus on developing, testing and implementing policy and processes. The researchers call this approach 'practical critique', and argue that it provides a way of investigating that has practical value while maintaining critical insights.

## Sustainable Development Goals

In September 2015, the United Nations General Assembly adopted the 2030 agenda for sustainable development, a plan of action for people, the planet and prosperity. Seventeen Sustainable Development Goals (SDGs) with 169 associated targets integrating the economic, social and environmental dimensions of sustainable development. The goals address a variety of wicked problems related to human–environment interactions—environmental degradation, climate change, sustainable management of natural resources, fresh water scarcity, and loss of biodiversity—whose achievement require integrated solutions and collaborative work across disciplines. The broad focus of the SDGs across fields such as climate change, disaster response and access to services, health, and food security represent a unique opportunity for Australian geographers to contribute to the global discourse of sustainable development.



All of the Sustainable Development Goals and what they represent, in pictorial form, agreed upon by the United Nations.  
CREDIT: UNITED NATIONS DEPARTMENT OF PUBLIC INFORMATION ©

## Future directions

Areas in which future geographical work regarding the Asia–Pacific region should focus include:

1. Further studies of the effects of recent sea-level rise on small Pacific Island nations, and of appropriate coastal management strategies for these places, to inform Australian Government policies towards and assistance to these countries.
2. Strengthening geographical research on China. This is a rapidly changing country of great interest geographically, and of considerable significance to Australia, but at present there are relatively few Australian geographers undertaking research on China.
3. Investigating the demographic, cultural and economic interactions between the Asia–Pacific region and communities with Asia–Pacific origins in Australia, and their effects on the sending and receiving countries.
4. Developing methodological approaches for designing appropriate and equitable development pathways that build upon local knowledge and strengths.
5. Using participatory methods to examine and design livelihood systems that enhance the adaptive capacity of communities in the Asia–Pacific to respond to environmental and economic change.
6. Improving and developing climate change mitigation and adaptation strategies that build upon local capacities and priorities in socially and environmentally just ways.
7. Research ways of reducing deforestation in the region.
8. Developing a better understanding of urbanisation in the Asia–Pacific region, including the economic, social, political and environmental transformations taking place in the rapidly expanding cities, and the effects of urban growth on rural areas. By 2050, the urban population of south, southeast and east Asia is estimated to reach around 3 billion people, comprising nearly half the world’s urban population, yet research by Australian geographers on Asian-Pacific urbanisation and urban areas, with the exception of China, is at present relatively limited.
9. Using research in Asia–Pacific countries to test and revise geographical theories, generalisations and methods based on Western experience.
10. Finding ways to communicate geographical knowledge of the Asia–Pacific region to the Australian public and in Australian schools.



A river of smoke more than 25 kilometers wide flowed southeast toward the Tasman Sea from fires burning in the Great Dividing Range Mountains in Victoria on December 5, 2006.

CREDIT: NASA / MODIS RAPID RESPONSE TEAM / PUBLIC DOMAIN



# 8 Natural hazards

## Understanding natural hazards

Extreme natural events are a recurring feature of the Australian environment. They are mostly weather-related, and include droughts and floods, severe tropical cyclones, and heatwaves and bushfires. These events become hazards when they result in material damage to infrastructure, production and environmental resources, and/or the injury or death of people. In Australia, nearly every part of the country is directly or indirectly affected by one or more hazard, including the major cities.

Natural hazards are not solely 'natural'. One reason is that humans have often magnified the impact of extreme events through landscape modification, and poor planning and policy decisions. For example, clearing mangrove vegetation along the coast removes natural buffers to storm surges and tsunamis, land clearing in rural areas increases runoff and riverine flooding, draining wetlands may remove areas that absorbed flood waters in the past, and the hard surfaces and lack of vegetation in urban areas increase temperatures. In the future, if not already, anthropogenic global warming is predicted to increase the intensity, frequency and distribution of some extreme weather events.

A second reason is that the damage produced by a natural event depends on the exposure, sensitivity and vulnerability of the affected communities and their assets. Vulnerability is determined by variables such as:

- the number of people exposed and their characteristics
- whether they live in places likely to be strongly affected by a natural event (such as the flood plain of a river or forested areas on the rural-urban fringe)
- the design of infrastructure and housing
- community knowledge, capacity and preparedness
- the availability of resources at local, regional and national levels.

A third reason is that the way people and communities respond to natural hazards is influenced by their perceptions. Drought, for example, has often been perceived as an

unusual event rather than a normal and recurring feature of the Australian environment. Government policies have consequently tended to focus on providing relief rather than assisting landholders to adapt to its inevitability and reduce its impact. Similarly, urban residents are often attracted to peri-urban and rural areas for the landscape and lifestyle choices they offer, and their cultural interpretations of these places can mean they have quite different views on bushfire risks and their management compared to long-term residents and the emergency services.

Understanding natural hazards therefore requires a study of both environmental and human variables, and this makes them a good subject for geographical research.

## Prehistoric, contemporary and future hazard frequency and intensity

Some research by Australian geographers on natural hazards has examined prehistoric events. An example is investigating the frequency and intensity of tsunamis and tropical cyclones over periods of up to 6000 years, through research into the geomorphic record left by these events. These data are essential for validating the models used to estimate the future incidence and magnitude of these hazards. They also show that both the west and east coasts of Australia have experienced tsunamis in the past. This information has been used by state and federal government agencies to identify vulnerable areas and develop warning systems.

Geographers have been involved in similar attempts to establish benchmark frequencies for extreme bushfires from long-term climatic and palaeo-environmental data. While such data are limited, available records suggest that fires have increased in frequency and changed in nature in south eastern Australia since European settlement, mainly but not only as a result of broad-scale changes in fire weather conditions.



Geographers have also contributed to:

- research that demonstrates the effects of the El Niño–Southern Oscillation on fire frequency and area burnt, a result that can be used to predict fire activity
- the use of climate and land surface models to assess the effects of future climate change on fuel loads and fire weather.

## Drought

Drought has been a longstanding topic of geographical research in Australia, involving studies of perceptions, impacts and policy responses. Recent work by geographers has reiterated the argument that drought is not an exceptional event but a normal part of the Australian climate, and one that is expected to increase with global warming. However, detailed case studies of rural communities using qualitative methods, have also argued that a combination of pressures is making successful adaptation to drought by rural communities more difficult.

These pressures come from a rapidly evolving water market, the increasing competition of commodity markets, wide-ranging rural demographic shifts, and changing rural service provision. They have resulted in declining incomes, increased debt, rising uncertainty, an ageing population, poor health and a reduced capacity to adapt. Consequently, government support programs need to address the range of challenges facing farming communities, and not just react to drought with short-term crisis management measures that have been largely ineffective in the past. More holistic policies are required that will help farmers and rural communities to adopt new farming systems or be assisted to leave farming altogether.

Another geographical study argues that social cohesion is an important contributor to the resilience of farmers in the face of drought and other pressures, and that the local town has a vital role in providing social support to rural communities. This is because the town 'is the primary place where they [farmers] connect with others, offer and seek support, and build up feelings of affiliation and belonging.' (McManus et al., 2012, p. 28)

Another geographical study investigated the role of festivals in drought-affected areas, and their contribution to helping communities cope with drought by stimulating economic activity, encouraging 'creative frugality' and lifting community spirits. The researchers argue that festivals and events are important ways of coping with and recovering from environmental extremes.

## Geomorphology and floods

Geographers have worked with other Earth scientists to gain a better understanding of how flooding affects river morphology, and how the morphology of rivers

affects flooding, as a guide to the management of flood risks. One major research project ([www.thebigflood.com.au](http://www.thebigflood.com.au)) has investigated the Lockyer Creek in south eastern Queensland, which experienced catastrophic floods in 2011 and 2013. The results of the project include:

- a timeline of floods over the past 2000 years, based on analysis of alluvial sediments. This information can be used to improve predictions of the timing of flood events in the future, as the records from gauging stations cover far too short a time span for streams which experience both floods and extended drought periods
- testing an alternative method to estimate the magnitude and frequency of a 1 in 100-year flood, as traditional methods are based on short gauging station records and many have a poor representation of extreme flood events
- identification of the major inundation surfaces and their average flood recurrence interval. Each type of surface poses different flood risks, but at present these differences are not recognised in flood mapping and planning. Notably, these surfaces often coalesce to form spill-out zones that are areas of high risk because of the speed of inundation
- a longitudinal study of riverbank erosion, using multi-temporal LiDAR and high-resolution aerial imagery to determine the processes and volumes of erosion in the 2011 flood, and maps, photographs and aerial images to identify geomorphic change from early settlement times in 1865 to 2011. Studies like this are necessary to understand a river's behaviour and range of variability. The research found that the river channel had been very stable (resilient) since European settlement, throughout a succession of floods
- modelling the effects of raising levee heights, a common response to a major flood, showed that this could both increase the risk of breaching, and prevent the return of water to the channel in the event of water inundating the floodplain
- identifying priority areas for restoring riparian vegetation that can attenuate the flood wave, increase the deposition of sediment, and reduce bank erosion. These priority areas are based on the classification of inundation surfaces noted above.

The research group argues that geomorphic knowledge more accurately informs the prediction of flood risks than methods based on past measures of water heights, and that their study 'highlights the importance of understanding the key geomorphic processes occurring within a catchment and developing effective catchment management plans to suit these conditions' (Croke et al., 2017, p. 9).



Flooded street in Perth, Australia. March 2010.  
CREDIT: MICHAEL SPENCER / FLICKR CC-BY 2.0

## Cyclones and environmental resources

Another line of geographical research has examined the vulnerability of environments to tropical cyclone damage. While intact tropical forest areas show remarkable ability to recover from cyclonic disturbance, forest remnants, littoral rainforests, and riparian vegetation are susceptible to damage, weed invasion and degradation. These natural resources should be treated 'as valuable commodities by including their protection and rehabilitation in the same way that human livelihoods, infrastructure and industry are covered in disaster management planning' (Turton, 2012).

## Reducing hazard impacts

Other geographers have explored ways of avoiding or reducing the impact of extreme events. These include:

- hazard risk assessments based on the interaction between exposure to a hazard and community vulnerability and resilience. The results have been used to identify risk mitigation and reduction strategies
- a review to identify the most appropriate remote sensing and spatial analysis techniques and datasets to use both before and after a cyclone event, to predict cyclone risk, assess impacts and monitor progress towards recovery
- developing a framework for assessing disaster resilience, based on a combination of coping and adaptive capacities
- providing information for residents, especially in flood-impacted areas where people are not nearly as well informed and prepared as those living in cyclone-prone regions. This research has influenced the Bureau of Meteorology's educational materials and warnings as well as local government information campaigns
- better planning design at the subdivision stage of development in fire-prone, peri-urban locations to reduce bushfire risk

- regulation of settlement in bushfire-prone areas around the major cities, as research by geographers shows that the managers of native vegetation have little influence over settlement planning
- regulation to restrict settlement in areas that are vulnerable to flood or storm surge. Some existing policies and legislation are at risk of failing to protect people and property because they are based on an inadequate understanding of the geomorphic processes operating along rivers and coasts. As noted earlier in this chapter, the knowledge developed by Australia's geomorphologists needs to be better used by government agencies and policy makers
- improved building codes in places at risk of a variety of natural hazards
- using insurance to encourage people to be better prepared to reduce bushfire impacts, and to provide a price signal for high-risk locations. However, research shows that many people living in bushfire-prone areas do not take out insurance, for a variety of complex reasons
- relocation away from at-risk areas. However, policies to assist relocation may leave small communities less resilient than before by reducing their social capital, leaving those who won't or can't move, often because of their age or income, the most vulnerable.

These types of research have, for example, influenced the development of Queensland's planning policy for natural hazards, and guided a policy shift at federal and state levels from a focus on community vulnerability to one on community resilience.

## Natural disasters and Aboriginal and Torres Strait Islander communities

Remote Aboriginal and Torres Strait Islander communities, because of their location, are among those most at risk from the effects of hazards such as cyclone, flooding, and bushfire. Geographers have pointed to some major problems in the responses to natural disasters affecting these communities. One is the labelling of these communities as vulnerable, without understanding that their vulnerability results from the ongoing effects of colonisation and dispossession, and is not the result of Aboriginal and Torres Strait Islander culture. Another and closely related problem is a lack of recognition of the resilience, capacities and coping strategies of local communities, and a failure to strengthen them. For example, many of the Aboriginal and Torres Strait Islander peoples evacuated from Darwin in 1974 after Cyclone Tracy, and interviewed in 2011, thought that they were better able to cope and recover from the disaster than non-Aboriginal and Torres Strait Islander



peoples. Their reasons were that Aboriginal and Torres Strait Islander peoples were often more self-sufficient, and had strong connections with country and community.

A third problem is a failure to acknowledge the contribution that Aboriginal and Torres Strait Islander knowledge can make to social and environmental recovery after a natural disaster. A fourth is a failure to respect and use Aboriginal and Torres Strait Islander institutions in an emergency. The value of these institutions was revealed by a study of the evacuation of a remote island community in the Northern Territory threatened by Cyclone Monica in 2006. The evacuation went smoothly and without conflict as emergency services personnel allowed local representatives to persuade people to evacuate and to arrange departures according to local cultural protocols.

Researchers conclude that while efforts have been made to align emergency service responses to the needs and capacities of Aboriginal and Torres Strait Islander communities, the outcomes have been limited because of deficiencies in the cultural understanding of staff in the emergency services. They call for this intercultural deficit to be remedied, and argue that:

***What remains lacking in the way that emergency responses are framed in Australian Aboriginal and Torres Strait Islander contexts is effective integration of Aboriginal and Torres Strait Islander worldviews into mainstream procedures. The focus remains firmly on emergency services' perspectives, with insufficient thought given to how agencies work with remote communities or to developing agencies' understanding of community perspectives about seasonal events that are classified as risks. (Howitt et al., 2011, p. 55)***

### **Bushfire management and the relations between humans and nature**

One research project found that different attitudes towards bushfire management were related to people's perceptions of their relationships with nature. For some, humans were quite separate from nature, which was to be controlled, while for others humans were in nature, which was to be lived with, and change and disasters accepted and learnt from. A second research project compared bushfire management training programs, one based on scientific management and the other on Aboriginal and Torres Strait Islander conceptions of country. On the latter approach, the research argued that:

***Encouraging landholders to be self-reliant and 'read' Country, as they develop physical capacities and embodied memories relating to human/fire/land relationships, could ultimately empower them to work more creatively and productively with 'nature' during fire emergency situations. (Edwards and Gill, 2015, p. 219)***

Research projects like these apply contemporary thinking about humans and nature, and about Aboriginal and Torres Strait Islander environmental knowledge, to natural hazard management.



A grass fire burns through an open area. September 1983.  
CREDIT: MALCOLM PATERSON / CSIRO CC-BY 3.0

### **The role of communities in disaster management**

Another area of research by Australian geographers has examined how communities and organisations manage disasters. For example, geographers have investigated the ways in which responsibility is increasingly shared between the emergency agencies and governments, communities, businesses and individuals, and have proposed mechanisms that give communities and non-government parties active roles in implementation and goal-setting.

This research also reveals the different and competing values the various parties may hold, and the trade-offs that are necessary in decision-making about how to share responsibility. The concept of subsidiarity—the idea that functions should be devolved to the lowest level at which they can be exercised efficiently—has also been applied to evaluate how authority and responsibility are allocated between disaster management actors. However, research also shows that communities must be involved in discussing sharing responsibilities, and their local knowledge respected and used.

Other research related to community involvement has demonstrated a need to engage women in bushfire safety and risk management, and strengthen their bushfire awareness and preparedness. This research has also:

- identified successful strategies for achieving this engagement
- led to the production of an official publication on the role of women in the New South Wales Rural Fire Service
- developed national gender guidelines for emergency management

- contributed to the development of a Weather the Storm kit aimed at supporting women to prepare for disasters and emergencies, which received a highly commended award at the Resilient Australia Awards in December 2013
- contributed to the New South Wales Rural Fire Service online tool for householders to assess their bushfire risk and preparedness.

A similar need to strengthen women's awareness, preparation and resilience in relation to wet season hazards of flood and cyclone has been identified in North Queensland.

A recent area of research is into the role of volunteered geographical information (VGI) in disaster management. VGI refers to the widespread creation and sharing of geographical information by private citizens, often through platforms such as online mapping tools, social media, and smartphone applications. Through VGI, vast amounts of diverse local knowledge can now be collected and shared for disaster management at a fraction of the cost associated with traditional data collection and map-making, while at the same time potentially fostering community engagement in disaster prevention, preparation, response, and recovery.

Geographers in Australia have also been interested in how regional communities recover from a disaster, and have highlighted the importance of local social capital in enabling a community to effectively use resources, both their own and those from outside. However, geographical research shows that there are significant social differences between places that policies and strategies must take into account if they are to be effective. For example, community-level research on responses to drought has found that concurrent economic and social pressures mean that local people may not have the means to adapt. Similarly, a spatial analysis of bushfire, flood and storm disaster declarations in New South Wales between 2004 and 2014 identified a 'hot spot' of declarations in the northeast of the state, an area that is coincident with 43 per cent of the most socio-economically disadvantaged local government areas in New South Wales. This has clear implications for disaster risk management.

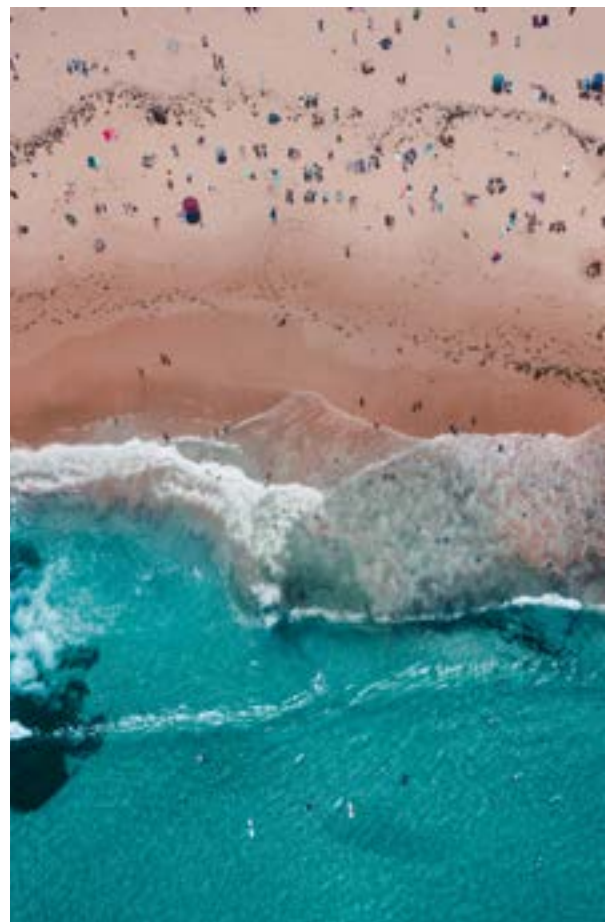
The policy implications of this research are twofold. One is that state and regional government assistance that facilitates community initiatives and builds community resilience may produce better results than a top-down approach. The second is that to be effective, agencies need to understand the strengths and weaknesses of each community, and to recognise that not all places are the same.

## Heatwaves

Heatwaves caused by extreme weather events are responsible for more death and illness than any other natural hazard in Australia. For example, a heatwave in south eastern Australia in January 2009 is estimated to have caused 404 deaths in Victoria and South Australia, and 3334

illnesses in Victoria alone. Geographers have investigated the relationships between heatwaves and health, and developed strategies to reduce the associated mortality and morbidity.

One study investigated the effects of heat on acute myocardial infarction (AMI) admissions to Melbourne hospitals. The research found that on days with average temperature in excess of 30°C there was a 10 per cent increase in admissions, and periods in which three-day average temperatures were 27°C or greater resulted in a 37.7 per cent increase in admissions. To respond to this problem, geographers have been involved in developing a heat alert system for Melbourne, which is issued to local government authorities, emergency services, the health and aged care sectors, government departments and agencies, and major metropolitan service providers. Media briefings alert the general community to actions that can be taken to minimize health risks associated with high temperatures. This system is believed to have significantly reduced deaths in the January 2014 heatwave to less than in 2009, even though the 2014 heatwave lasted longer. The same research group has developed maps of population vulnerability for Australian cities, and identified ways to reduce urban temperatures through green infrastructure that cools through evapotranspiration.



Bondi Beach, New South Wales  
CREDIT: SACHA STYLES / UNSPLASH / PUBLIC DOMAIN



## Future directions

Opportunities for future geographical research that will contribute to Australia's capacity to manage natural hazards include:

1. Strengthening the data on the magnitude and frequency of past geophysical, meteorological and hydrological events that have produced hazards, to validate models of future events under a changing climate.
2. Investigating the likely effects of climate change on the frequency, intensity and spatial patterns of natural hazards.
3. Improving the understanding of community adaptive capacity and disaster resilience—what determines it, how it can be measured, and how responsibilities are shared between communities and government agencies.
4. Evaluating Aboriginal and Torres Strait Islander conceptions of human-environment relations and their application to methods of fire hazard reduction.
5. Investigating ways that social media could be used to share information within communities to provide real time data on unfolding disasters that can enhance warning and response actions—e.g. real-time updates on moving fire fronts.
6. Studying how intersecting social characteristics such as gender, sexuality, race, class, age and (dis)ability affect disaster vulnerability and resilience.
7. Investigating how volunteered geographical information (see also [Chapter 12: Geographical information systems and science](#)) could be used to foster community engagement in bushfire preparation and improve disaster resilience.
8. Studying how people's sense of, attachment to and construction of place influences their perception of, and preparedness for hazards, as well as their capacity for recovery.
9. Researching how migrants respond to hazards in new locations—does migration increase their vulnerability, and how can we build their resilience?
10. Reviewing whether policies and legislation to protect people and property from flood and storm surge damage are based on sound geomorphological knowledge, and communicating the results to decision-makers.
11. Application of geospatial technologies (e.g. drones) into early warning systems for natural disasters.



Large swaths of Rockhampton, Queensland were flooded on 9 January 2011 after days of rain pushed the Fitzroy River over its banks, inundating parts of the city.

CREDIT: NASA EARTH OBSERVATORY / JESSE ALLEN / PUBLIC DOMAIN





The night lights of Australia as observed by the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite in April and October 2012. The composite image includes manmade light sources and the light of wildfires.

CREDIT: NASA EARTH OBSERVATORY / ROBERT SIMMON / PUBLIC DOMAIN

# 9 Rural and regional Australia

## Introduction

Rural and regional Australia is defined as the areas outside the state and territory capital cities. In the 2016 Census, these had a population of 8 million, which is one third of the national population, with most of these people living in towns and regional centres. Rural and regional Australia contains a wide variety of environments, economies and settlements, and a wide range of opportunities for geographical research.

Geographical studies of rural and regional Australia are concerned with investigating, describing and explaining:

- dynamic population and environment interactions in non-metropolitan (outside the capital cities) settings
- the demographic, socio-cultural and economic characteristics of different rural places (e.g. country towns)
- how and why these characteristics differ over space and from place to place.

Many of the topics and issues addressed overlap with those of other geographical fields, including population, social and economic geography. However, rural geographers highlight the influence that the physical environment and space—levels of remoteness/inaccessibility, varying dependence on land-based production and processing, and relatively low population densities—play in shaping rural places and their settlement systems, socio-cultural composition and economic structures. Through their critically informed but applied research, rural geographers have shed valuable light on important areas of rural Australian public policy, leading to better informed debates and discussions, and also helping develop policies and programs that better fit the rural Australians' needs, along with those of their environments.

Rural and regional geographical research spans a number of major topics. In a country that has long exhibited a high degree of urbanisation, an early concern of Australian geographers was the spatial and temporal evolution of non-metropolitan settlement. In contrast to the urban hierarchies of Europe and Britain, settlement in Australia tended to radiate out in a linear dendritic fashion from the major coastal cities. A key focus of this research

involved a critical review of the ideologies and political decision-making underlying the expansion of agricultural settlement, given the often-catastrophic consequences of frontier development for Aboriginal and Torres Strait Islander Australians and the physical environment. Part of this research involved important studies of Australia's experiments with different land tenure arrangements, and their use as policy instruments to shape rural settlement and manage the environmental impacts of pastoralism.

## Non-metropolitan settlements

Building on this understanding, an important contemporary theme in rural geography is concerned with the current demographic, economic viability and vitality of each scale of the non-metropolitan urban hierarchy, from dispersed farm and non-farm hinterland settlements, to villages, country town service centres and major regional centres. Population and demographic decline (e.g. rapid ageing) in the drier and predominantly broad-acre farming-dependent zones is particularly an issue in remote non-urban areas and smaller towns. Concerns regarding their long-term economic and social viability are raised as private and public services dwindle and sporting clubs struggle to survive as population numbers decline.

An example of this type of research is a study of demographic change and population ageing between 1981 and 2006 in 412 rural communities in New South Wales, Victoria and South Australia. The study showed that while there was significant population growth in the region as a whole, population numbers remained almost the same in the higher rainfall farming areas, and declined in the irrigation and dry farming regions. Growth was concentrated in the 'sea change' and 'tree change' areas of amenity-based in-migration, and in the regional cities. The research also found an almost 50 per cent increase in the number of identifiable small settlements, most of them along the New South Wales seaboard inland from the coastal strip, but many also in better watered and accessible tree change locations in Victoria and New South Wales. These represent a relatively new part of the Australian settlement pattern.



Population ageing also differed between settlement types, being least advanced in the regional cities, most advanced in the sea change retirement settlements, and of most concern in the agriculture-based rural settlements where the out-migration of younger age groups exacerbates the effects of overall population decline. The new settlements identified in the research differed yet again in that they had added a small younger population to a predominantly old one.

The research then explored the policy implications of these findings, such as ways to help farming areas adjust to declining and ageing populations, programs to address labour shortages through international migration (the subject of several research projects by geographers), measures to re-shape service and social provision, and policies to strengthen the roles of the regional cities. Given the significant differences between regions and settlement types, the researchers also argued for a spatially differentiated population policy involving the three levels of government.

Complementing this broad-scale research are more detailed geographical studies that have explored the complex and very diverse patterns of migration to and from rural and regional places that produced the outcomes reported above, and their drivers and impacts. By examining rural youth migration trends and processes, Australian geographers have identified the very difficult situations that young rural people face in deciding whether to leave home for a capital or major regional city for education and employment opportunities. They have also considered elderly urban-rural and amenity-led migration, while recent research has advanced knowledge on the rarely discussed topic of international migration to rural Australia, highlighting the increasing tendency for young temporary migrants to partially replace those locally born young people who have left.

One of the processes commonly thought to be contributing to the decline of smaller country towns is described as the 'uncoupling thesis'. One aspect of this is that farmers and farm households are increasingly bypassing these towns in their expenditure in preference of larger regional centres, thereby 'uncoupling' the economic relationship between the towns and the surrounding farm economies. However, a study of three sparsely populated rural areas in New South Wales and Victoria finds that this:

*... understates the extent of farmers' continued attachments to local towns. Whilst it is clear that higher-order functions (such as farm capital spending and large household expenditure items) accrue to larger regional centres in significant amounts, it is equally evident that farm households and businesses continue to make extensive use of their local towns for everyday 'maintenance purchases' and for a range of other supplies ... (Pritchard et al., 2012, p. 554).*

The researchers label this pattern the 'local-if-possible principle', and argue that farmers have highly localised preferences for the recurrent purchases that keep their farms going, which helps to sustain small rural towns in Australia. Recognition of this 'is needed to temper the untoward pessimism sometimes voiced about small towns in rural and regional policy debates, both in Australia and elsewhere.' (Pritchard et al., 2012, p. 554).

Geographers have also explored the methods and techniques by which local sporting teams and social and service organisations (e.g. the Country Women's Association) that provide important contributions to small towns seek to remain viable.

## Rural health provision

A related research topic is the critique of existing, and the development of new models of service provision (e.g. primary health and medical care, welfare, financial services) for small and sparsely settled rural populations. Inequality in health outcomes and in health service provision is a recurrent concern of Australian geographers. Research has highlighted the inverse relationship between levels of remoteness, and the mental and physical health of remote and rural residents. This relationship reflects the combined influence of the standard and level of medical and health services in rural areas, the hazardous nature of some rural occupations (e.g. farming and mining work), the behaviours of rural people themselves, and the difficulties in providing services to small and widely scattered communities.

A geographer has been one of the leaders in research into the provision of primary healthcare in rural Australia. This included involvement in the development of the Modified Monash Model, which classifies metropolitan, regional, rural and remote areas according to both geographical remoteness and town size. The system was developed to recognise the challenges in attracting health workers to more remote and smaller communities, and is used by the Australian Department of Health to determine eligibility and incentives under a range of health workforce programs for doctors working and training in rural areas.

Another rural healthcare project evaluated a networked model of primary health care delivery suited to small communities in low-density rural areas. The health service studied provides health care to six small communities and one large regional centre. The network has a critical mass of healthcare professionals that can mentor new staff and provide them with central administrative services and continuing professional development, enable staff to take leave, and support succession planning. This model overcomes many of the difficulties experienced by isolated individual rural healthcare providers.



Alice Springs, a regional centre. Population 23 726 (2016).  
CREDIT: ALARIC MAUDE©

These studies have helped to shape public policy and strategy in relation to more locally appropriate health and medical service delivery in rural areas.

### The diversity and complexity of rural and regional Australia

The geographical research into Australia's rural and regional areas described in this chapter reveals the considerable physical, economic and socio-cultural diversity between regions and places. For example, while some studies have documented the long-running net migration loss from the country's agriculture-dependent inland areas, others have explored sea change and tree change migration to inland and coastal rural areas, the growth of many regional towns and cities, and the rapid changes produced by mineral and energy production.

Research has also identified a growing diversity within regions, a trend captured by the concept of 'multifunctionality'. This describes the way that rural landscapes are being increasingly valued for a range of attributes:

- productive (e.g. farming, mining)
- lifestyle (e.g. scenic settings attractive for tourism and/or permanent residence)
- ecological (e.g. valued/endangered environments for conservation)
- cultural (e.g. Aboriginal and Torres Strait Islander lands and seas).

Conflict likely exists between these competing uses. Some geographers have also recognised different 'modes of occupation' for different regional types. That is, different

rural environments and regional types are likely to produce particular patterns of land use and associated economic and demographic development. This process tends to be both path- and place-dependent in that once a mode of occupation becomes established it is likely to be continually reproduced in that same place.

### Aboriginal and Torres Strait Islander geographies of rural and regional Australia

Aboriginal peoples have an important presence in rural and regional Australia. This is partly because the majority of Australia's Aboriginal population are not heavily concentrated in the metropolitan cities, but tend to live in regional cities, smaller towns and non-urban areas. In parts of rural and regional Australia, the Aboriginal and Torres Strait Islander population is therefore a significant component of the total population. Another reason is that a growing proportion of the Australian continent is now under some form of Aboriginal and Torres Strait Islander land tenure (see [Figure 3](#)), or mode of occupation, a change in which some geographers have been constructively involved. In these areas land rights have:

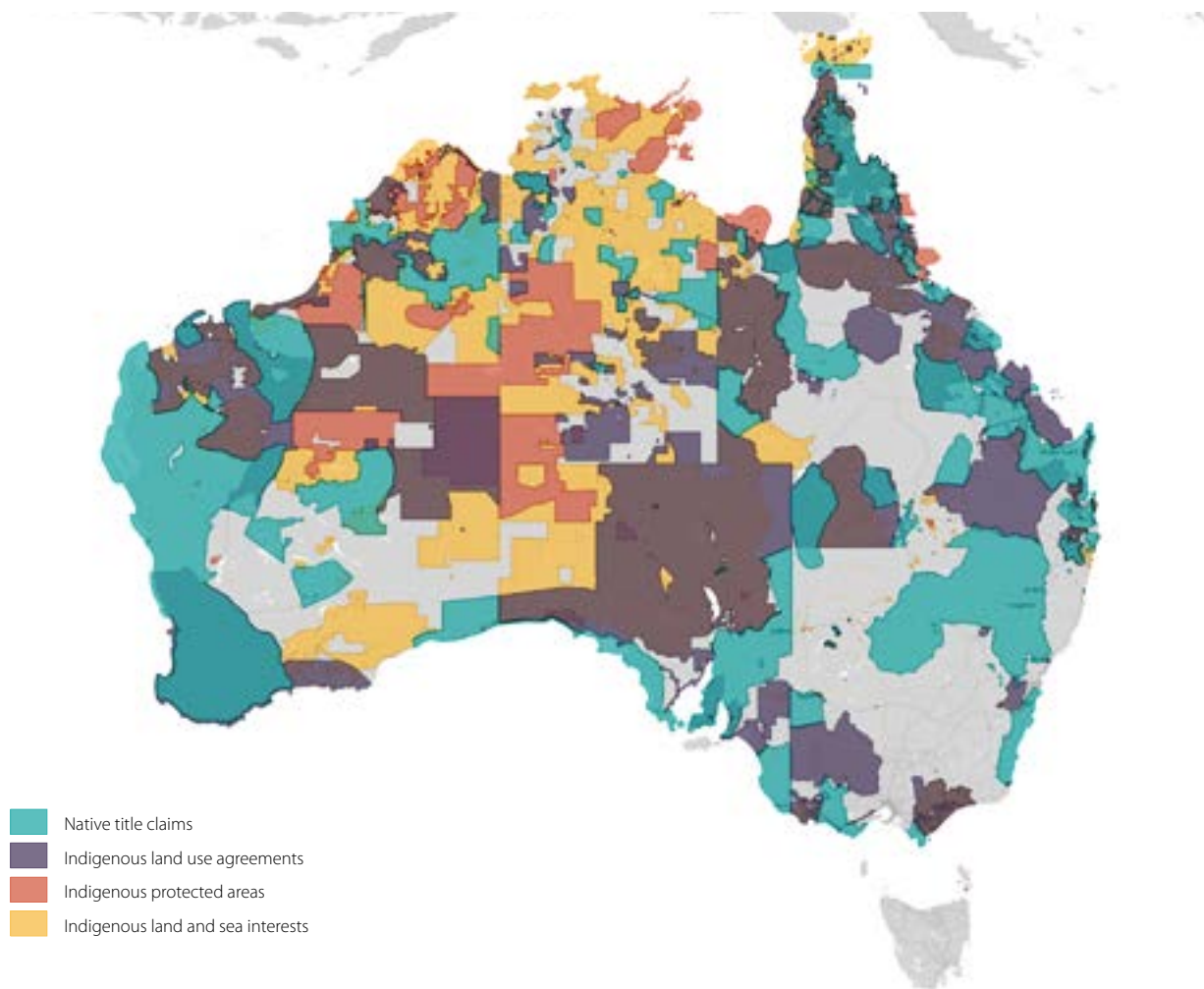
*helped to sustain an Aboriginal and Torres Strait Islander presence across rural and regional Australia in areas where population decline has otherwise been endemic. Associated with this has been a dispersal of population into small family-based settlements consistent with Aboriginal and Torres Strait Islander custodial relationships to land. (Taylor, 2014, p. 120)*

Geographers have contributed to an understanding of Aboriginal and Torres Strait Islander life in rural and regional Australia in several ways. Research similar to that already reported in this chapter includes studies of Aboriginal and Torres Strait Islander patterns of mobility and their policy implications. For example, a study of Broome found that the regional centre provided services for a large number of temporary Aboriginal visitors from the town's hinterland, as well as for the local Aboriginal and Torres Strait Islander population. This visiting population should be included in planning for government and other key services located in regional towns and cities. Other research has focused on mainstream attitudes to Aboriginal mobility, arguing that this is seen as acceptable when practised by people living in remote areas, but not when practised by urban Aboriginal people. Geographers have called for a better understanding and accommodation of Aboriginal mobility and spatial practices, and the ways these demonstrate Aboriginal and Torres Strait Islander connectedness to family and country as well as to mainstream social and economic institutions, and link urban, rural and remote areas in a coherent geography.

Much research and commentary has been about the policies Australian governments should adopt towards Aboriginal and Torres Strait Islander communities in rural and remote places. Some geographers have been critical of mainstream policies, and argued for:

- greater self-determination for Aboriginal and Torres Strait Islander communities
- recognition of their property rights in land, waters and resources
- the abandonment of market mechanisms in isolated and remote locations
- recognition of the viability of a hybrid economy in these places (based on environmental, social and cultural resources, see [Chapter 6: The economy](#))
- respectful engagement and negotiation
- an end to paternalism.

**Figure 3. Native title claims, Indigenous land use agreements, protected areas, and land and sea interests**



SOURCE: REGISTER OF NATIVE TITLE CLAIMS 2018, INDIGENOUS LAND USE AGREEMENTS 2018 / NATIONAL NATIVE TITLE TRIBUNAL / CC-BY 4.0  
 SOURCE: LAN14 INDIGENOUS LAND AND SEA INTERESTS ACROSS AUSTRALIA, AND INDIGENOUS PROTECTED AREAS 2016 / STATE OF THE ENVIRONMENT / CC-BY 3.0 AU



## Future directions

Numerous rich opportunities exist for geographers to engage in further research in rural and regional Australia. Topics for study include:

1. In-depth examination of how rural migration processes impact local and regional population structures is needed to assess the extent to which rural populations can continue to (sometimes only partially) replace themselves.
2. Studies of rural and regional areas' capacity to attract and retain international migrants, given rural Australia's continuing demand for seasonal and other labour, but its net migration losses in the younger workforce cohorts. Related to this is more detailed analysis of the approaches taken by regions and localities to settling migrants, to help identify best practice.
3. Research attention should also be given to examining dimensions of rural repopulation, the return migration of rural young people, retirement in-migration and their associated potential and actual developmental implications. These investigations are important in themselves, but are also needed to better plan for future service demand and provision.
4. Further investigation of the extent of foreign direct investment in Australian agricultural land (and its natural resources) and what effects this is having on local land management, labour and input markets, and local economies more broadly.



Uluru, Northern Territory.  
CREDIT: COREY LEOPOLD / FLICKR / CC-BY 2.0



The central business district of Melbourne.

CREDIT: LOUIS AMAL / UNSPLASH / PUBLIC DOMAIN



# 10 Australia's cities

Since the beginnings of European colonisation, and as outside observers have noted for more than a century, Australia is a highly urbanised country. Compared with other developed countries, a high proportion of Australia's population lives in urban areas, and a high proportion of its urban population is concentrated in cities with populations of more than one million. The 2016 Census revealed that two-thirds of the population lived in the state and territory capital cities, which grew in population at nearly twice the rate of the rest of the country. These cities have a wide range of environmental, economic, infrastructure, social and cultural issues, and not surprisingly are the subject of extensive geographical research. Only some of this can be reviewed here, but work not included is listed in the online bibliography. Much of the research follows the geographical themes of space, interconnection and environment, and the management of space and place through planning. A concern for social equity and justice is also a common interest.

## Global and national city hierarchies and networks

The relative position of Australia's cities within global and national city networks is a matter of interest to state and local governments, business and the general public. The media regularly reports on global city rankings and the relative standing of Australian cities compared with each other and cities around the world, and urban planners look for ways to design cities to enhance their global status and attract international firms and functions.

Geographers have questioned the validity and utility of these rankings. They have argued that all cities are global to some degree, that there is no single hierarchy of global cities, and that there are many globalising influences on cities. Geographers examine the connections between cities and the networks these form, and the ways these networks vary between industries and at different scales. For example, Sydney is the dominant Australian city in the financials network, with strong connections with Melbourne, Brisbane, Perth and London, and weaker connections with Adelaide, Auckland, Singapore, Hong Kong and New York. Perth, on the other hand, is the leading

Australian city in the energy and materials networks, which link it with West Africa, South America and Southeast Asia, and to global hubs such as London and Houston.

Geographers have also shown that there are distinct networks at different scales. For example, the energy industry city network is divided into regional networks in Europe, the Americas and Asia–Pacific. Within the Asia–Pacific, Brisbane is the centre of a Queensland and Pacific Islands sub-network. The policy implication of this research is that strategies to promote a city's place in the global economy must be based on an understanding of the city's existing networks and connections, and its particular competitive strengths within these networks. Becoming more 'global' requires sound knowledge of the 'local'.

Within Australia, geographers have charted the relative positions of the state capitals and regional centres. Some studies have used the location of large corporate headquarters as a measure of a city's standing. Corporate headquarters are important because they are centres of economic power and influence, providing economic growth, employment and investment. Research based on the location of the 100 largest publicly listed companies, as measured by the value of shareholder funds, has shown that there has been only gradual change over the past six to seven decades, with Sydney and Melbourne maintaining their dominance within the Australian urban system, although in somewhat different ways. For example, while Sydney has significantly more corporate headquarters than Melbourne, those in Melbourne tend to be larger and more profitable than those in Sydney.

The other mainland capitals have only a small number of headquarters of the largest 100 companies, but over time Perth has increased its number, Brisbane has maintained a reasonably stable number, and Adelaide has experienced a decline. For Adelaide, this means a loss of corporate power and control, and a more vulnerable urban economy. For Perth, on the other hand, research looking beyond just the largest 100 companies and including all 1913 companies listed on the Australian Securities Exchange shows that the city is now well ahead of Brisbane in number of headquarters and market capitalisation.



There is a longstanding 'rivalry' between Australia's two largest cities, Sydney and Melbourne. In recent years, the population of Melbourne has been growing faster than that of Sydney. Two geographers have tested a variety of explanations for Melbourne's faster growth, and their conclusions are worth quoting in full because they illustrate geographical thinking:

***Melbourne has closed the gap on Sydney since 2000 by becoming more competitive globally and nationally. Its greater share of Australia's international air traffic has generated jobs and allowed it to increase its share of tourism, supported by effective state policies such as special events. Its lower housing costs have contributed to greater construction, the generation of extra building-related jobs, and a very low internal migration out-flow in comparison with Sydney. There is also evidence that Melbourne is reducing Sydney's lead in advanced producer services, although Sydney is building on its national financial sector advantage.***

***More generally, it seems that Melbourne's underlying geography is now starting to be an advantage in competition with Sydney. Its less expensive and more easily developed urban fringe reduces land costs for housing, logistics and other uses. Melbourne airport's location does not necessitate a curfew, unlike Sydney's. The European quality of the built form of Melbourne's central areas, such as its laneways and trams, has also captured the zeitgeist of Generation Y and helped make it Australia's preferred destination for aspirational young professionals. These are all significant features that will keep Melbourne very competitive with Sydney. (Searle and O'Connor, 2013, p. 10)***

## The internal structure of Australian cities

Australia's major cities are large and sprawling urban areas, and have long been criticised for their low population densities. However, research has revealed significant changes in population density patterns over the past 30 years. The 1980s witnessed population growth in the middle and outer suburbs and declines in the centre and inner areas, but in the 1990s there was renewed growth in the centre and inner suburbs. In the 2000s, population densities also increased in the middle suburbs and towards the outer suburban fringe. The research concluded that inner locations are now the preferred residential choice of a growing percentage of the population.

Another study suggests that this preference is having an influence on the location of particular industries. Data on the location of the headquarters and branch offices of all firms listed on the Australian Securities Exchange indicates that while firms in the financial services and

media industries are strongly attracted to CBD locations, industries like advertising and software are often located in inner city areas just outside the CBD. These locations are still sufficiently central, but are cheaper, have good transport linkages, and fit the residential and lifestyle preferences of a young and technologically skilled workforce.

## Employment, transport and mobility

Transportation is a major issue in Australia's large and sprawling cities, and includes:

- goods shipment
- people commuting to work
- children and adults travelling to schools and further education
- people travelling for shopping, entertainment, social and family visits, and recreation.

Geographers, and geographically trained urban planners, have examined strategies to improve transport solutions within Australia's cities. These include:

- self-containment strategies of balancing the number of residents and employment opportunities in sub-regions of cities, to reduce the need to travel long distances to work. Research in Perth shows that such strategies will have limited effect because employment in industries other than consumer services is unevenly distributed within cities, and cannot be manipulated to match the distribution of the population. Furthermore, people's specialised skills require them to travel to wherever these are in demand, which is unlikely to be confined to their sub-region of residence
- transit-oriented development, which concentrates medium- and high-density housing within walking distance of a railway station. One research project shows that the success of this strategy depends on having large sites in single ownership, and government measures to facilitate development approvals
- designing new suburbs to encourage children to walk or cycle to school, by minimising distances to school and providing safe bikeways and walkways. Research shows that the effects of such designs are below expectations, because policies of increasing the size of primary schools increases the distance children have to travel to school, and because of parents' reluctance to allow children to walk or cycle to school independently, and their lack of time to accompany them.

A qualitative study of a small number of residents in an outer suburb of Melbourne produced some advice on these issues for planners. One was that public transport must be provided before car-dependent patterns of land use and living have become established, not after. Another was that much more attention should be given to establishing local employment,

business, retailing and other activities, rather than assuming that residents will want to travel long distances to access them. Suggestions to assist this include relaxing the strict zoning restrictions on home working, and the co-location of residential land uses and service sector employment.

## Infrastructure

Infrastructure, both hard (e.g. railways and roads) and soft (e.g. education and business services), is essential for cities to function effectively, and also influences the spatial structure of the city. Recent geographical work has focused on two main topics. One is the concept of critical urban infrastructure. At present, this is defined by the Australian Government as nationally significant physical facilities, supply chains, information technologies and communication networks. However, the study argues that the definition needs to be broadened to include environmental assets such as urban water catchments, and infrastructure that is critical to people's lives and livelihoods, even if this is at a local scale.

A second topic concerns the private financing of urban infrastructure. This research starts with the argument that infrastructure plays a crucial role in the efficient functioning of the city economy, by enabling the spatial flows of labour, consumers, materials, products and information essential for businesses to be profitable. In this way, it delivers benefits to for-profit business that could not be supplied on an individual basis. Infrastructure also has public benefits, both by supporting a strong urban economy and the employment it generates, and by enhancing people's daily lives through the provision of essential services, including movement through the city.

The research observes that privately owned and operated infrastructure, such as electricity supply and roads, has become more common as governments have retreated from their historical role in infrastructure provision. While noting the positive benefits of this investment, the research raises the issues involved in ensuring the interests of infrastructure investors do not conflict with the needs of businesses and people, particularly as these are likely to change rapidly. For example, private suppliers of electricity and water with long-term contracts could resist the adoption of more efficient distributed supply technologies that might reduce their profitability.

## Housing

Recent research by geographers on housing has explored several topics. These include:

- the concept of housing transitions. This examines the ways people move through different types of housing during their life, and the effects of life events on their ability to maintain their position in the housing market

- the multiple causes of housing vulnerability. Research shows that housing problems are closely linked with income, employment, location, housing tenure, welfare policies and disability, and that these issues need to be addressed together for individual households. Other research shows how women who are sole parents have been particularly disadvantaged by the combination of precarious housing and labour markets, compounded by reduced welfare payments designed to encourage them to return to employment despite the barriers preventing them from doing so
- the housing situation of the Aboriginal and Torres Strait Islander population. The 2011 Census showed that, contrary to widespread beliefs, there was a greater number of Aboriginal and Torres Strait Islander households in housing need in the urban areas than in remote regions, although the percentages of Aboriginal and Torres Strait Islander households in housing need were higher in remote areas
- the size of Australian homes. A qualitative study of some middle-class Sydney households found that large houses that provided separate spaces for adults and children were wanted because they 'managed and mediated the soundscapes of everyday family activity' (Dowling and Power, 2012, p. 616), while helping to maintain a tidy and respectable home to present to the outside world
- the language used to describe social housing. A study of the views and perceptions of people involved in or near to new social housing developments found that the language used ranged from negative towards 'Housing Commission' provision to positive towards developments described as 'community housing'. The findings can be used to mobilise positive attitudes towards social housing tenants.

## Diversity

Australian cities are ethnically and culturally very diverse, and increasingly so as international migrants settle in the major cities, especially Sydney and Melbourne. Geographers have been studying this diversity for some decades, with a particular emphasis on the spatial patterns of initial settlement and subsequent dispersal of each migrant group. Recent work has also examined ways of facilitating successful settlement. For example, a study in Geelong identified the role of organisations such as community groups, schools, sporting clubs, local governments, workplaces and churches in providing migrants with access to social capital that they can use to create social connections.

Recent research has investigated some of the claims made about Asian and Muslim migrant populations in the cities. Some examples are outlined below, and these show how spatial analyses are able to reveal relationships that would be concealed with non-spatial data.

- one project used spatial analysis to test claims that Australia's suburbs are being 'swamped' by Asian and Muslim people. Data from the 2011 Census did not show any evidence of intensive residential segregation of either of these ethnic groups. In Sydney, 80 per cent of Asian people live in suburbs that do not have an Asian-majority population, while in Melbourne the equivalent proportion is 88 per cent. Muslim people are even less concentrated—there is only one suburb in Australia with a population that is greater than 50 per cent Muslim
- other studies have investigated attitudes towards ethnic diversity. For example, a study in Brisbane used spatial analysis to show that the strongest anti-diversity attitudes were in areas with no significant ethnic minority group presence. The researchers suggested that lack of contact with other communities prevents people from having experiences that challenge media stereotypes
- a similar study mapped young Muslim people's perceptions of hostility towards Islam across Sydney, and also found that areas with few or no Muslim people in the population were perceived to be the most racist, while areas with a greater Muslim presence were perceived to have a stronger sense of acceptance.

A related study challenges popular stereotypes about the economic contribution of refugee settlers in Australia, many of whom are Muslim. It finds that while their labour force participation rates are lower than for other migrant groups or the Australian-born, this gap lessens over time, and the second generation performs at a higher level. The research also finds that 'refugee-humanitarian settlers show greater propensity to form their own business than other migrants and that risk-taking, entrepreneurialism and an ability to identify and take advantage of opportunities is a key characteristic of the group' (Hugo, 2014, p. 31). Addressing the barriers to their fuller participation in the economy would benefit not only the settlers, but also the Australian economy.

Geographers have also examined the struggles of urban Aboriginal and Torres Strait Islander people to have their history of ownership and the subsequent dispossession of places that are now urban acknowledged, and their right to maintain a connection with and presence in urban places of significance recognised. One such place is Redfern in Sydney, which has an important role in the provision of services for urban Aboriginal people, and as a site for interaction and collaboration with non-Aboriginal and Torres Strait Islander actors and supporters. Researchers have also reviewed the limited involvement of Aboriginal and Torres Strait Islander communities' knowledge and perspectives in urban and regional planning. They have criticised planners' lack of awareness of these issues and proposed ways of planning for coexistence.

A rather different example of diversity research is a study of independent creative subcultures in music, theatre, art and media, and their contribution to city culture and life. These subcultures tend to cluster in inner city areas with non-residential uses and low rents, but are being displaced by gentrification. Graffiti are another form of urban creativity produced by particular subcultures. They define urban spaces in distinctive ways, and challenge official views on the public use of urban spaces. Actions against graffiti also challenge official claims about the creative city, which in some cases has led to the recognition of street art galleries, or legal graffiti walls.

A final example of geographical research on diversity is a major comparative international study of the ways that planning engages with multiculturalism in cities. Taking Sydney as a case study, researchers reviewed three major areas of planning intervention—social mix housing, promotion of ethnically identified businesses, and planning for public spaces and encounter—and evaluated whether these interventions promoted diversity or reinforced difference.

### The urban physical environment

Large urban areas have distinctive environmental characteristics. They are often hotter than non-urban areas, a phenomenon known as the urban heat island effect. It is caused by several factors:

- dark surfaces like roads, roofs and car parks absorb more of the sun's heat than grass and trees
- buildings and other artificial materials store heat
- energy use releases anthropogenic heat
- the removal of vegetation for urban development reduces the cooling effect of shade and transpiration.

In addition, much of the rain that falls on urban areas does not penetrate into the soil, but is carried away from buildings and roads by stormwater drains, which transport pollutants into rivers and coastal waters. Cities are also major consumers of water, most of it drawn from outside the urban area, and occasionally experience serious water shortages. Australian geographers have studied these features of the urban environment, helped develop strategies to address them, often as members of multi-disciplinary teams.

The role of green space and trees in the urban environment is one such research area. Geographers have been involved in measuring the cooling effects of street tree canopies, parks and experimental rooftops in urban environments. They have shown that green spaces are more common in higher income suburbs, and their limited provision in lower income suburbs makes those residents more vulnerable to rising temperatures. This is an important issue, as heat waves are a significant cause of mortality and morbidity in cities (see [Chapter 8: Natural hazards](#)).



Geographers have also identified the actors and processes influencing the extent of the urban tree canopy, examined the institutional barriers to planning for green infrastructure, and developed principles and strategies to increase tree cover. One study questions whether urban greening programs are environmentally effective, or are dominated by 'marketable aesthetics' that will make the location more attractive to higher income people and result in the displacement of lower income residents.

In a series of studies geographers have explored the attitudes of different groups to urban trees. The research looked at the relationships of urban residents with trees in gardens, their attitudes towards tree removal and tree planting, and the views and role of professional arborists. One of the conclusions of this research was that:

***Our finding that the majority of residents of eastern Australian cities, while valuing trees, are likely to remove healthy trees on a regular basis as a result of aesthetic and lifestyle preferences or value-laden judgements about nativeness indicates that tree managers face a challenge. (Kirkpatrick et al., 2013, p. 174)***

A second major area of research has been on water in urban areas. Some of this work advocates the concept of a 'water sensitive city', based on holistic management of the integrated urban water cycle. Strategies include:

- constructed wetlands and bio-retention systems to retain and treat stormwater within the urban area
- rehabilitation of degraded waterways
- diversification of urban water sources by recycling stormwater and wastewater
- the restoration of vegetative cover.

These measures will reduce urban temperatures through enhanced evapotranspiration and surface cooling, and should be targeted at areas of high heat exposure.

Other water-related research has examined how governance arrangements and formal risk allocation interact with risk perceptions to either promote or constrain innovations in the use of stormwater as a potable source. Geographers have also critiqued government water planning strategies, finding they are dominated by economic considerations, and neglect issues such as environmental flows, social equity and cultural values.

Collectively, this research is characterised by a sensitivity to spatial differences within cities, a holistic approach to environmental management, and a concern for social equity in urban greening programs. The research has also developed a range of strategies to improve urban environments.

## Urban sustainability

Sustainability is an important topic for geographers, because it is about our environment's capacity to continue to support human wellbeing. Recent Australian geographical research into urban sustainability has focused on:

- using sustainability indicators to measure the sustainability of a city, and guide decision-making
- the barriers to constructing more sustainable residential buildings in Sydney
- the lessons to be learned from an examination of the policies implemented in Sydney over 45 years to create sustainable neighbourhoods
- successive rounds of failure in the 'neoliberal' Melbourne docklands development to achieve their aspirations for sustainability, resulting in growing public criticism of the project and control handed to the City of Melbourne
- the effects of a household's internal structure, dynamics, cultural values and practices on the efficiency of sustainable technology use, such as solar hot water heaters and water tanks, and on practices to reduce resource use. This research also highlights the importance of supporting household members in the effective use of new technology.

The generally low residential density of Australian cities is widely held to be a barrier to improving sustainability, because it leads to high levels of private car use and of energy and water consumption. One study questions this focus on density, and instead proposes a typology of urban areas based on variables such as urban structure, residential type, public transport accessibility, and land use mix. This typology has been tested with small-area data for Sydney, and the results show that factors other than density are important in explaining sustainability behaviour.

## Planning

There is a great deal of geographical research on aspects of urban planning, only some of which can be outlined here. Some research has reviewed metropolitan plans and planning systems, and planning reforms. One study argues that there is an urgent need to develop more flexible and adaptive urban planning systems able to respond to the disruptions likely to be produced by future technological change.

A second research area has involved critical assessments of programs, such as urban design projects, festivals and events, which have been adopted to change the image of a city, and market it both internally and externally.

Urban programs based on the concepts of the cultural economy and creative city form a third research area. These programs seek to use the arts to revitalise run-down urban areas and regenerate their economies. A study of one such program, Renew Newcastle, argues that the objectives

of cultural development and economic regeneration are incompatible if steps are not taken to prevent the latter from eventually displacing creative workers, as well as low-income residential and commercial tenants. Another study argues that creative industries are not restricted to large cities, as is frequently assumed. However, their acceptance in smaller cities and towns may depend on the existing place-based class legacies and perspectives regarding the role of the arts as part of their image of their city.

A common theme in much of the geographical research on urban planning has been the ways that urban renewal projects result in the displacement of low-income residents and small businesses. One study finds that even when low-income communities are not displaced by urban renewal,

the 'transformations in shops and meeting places, and in the nature of local social structure and government interventions, cause a sense of loss of place' (Shaw and Hagemans, 2015, p. 323). Several studies explore ways to include social equity in the design and management of these projects.

Geographers have also produced theoretical work defending the concept of 'the city' as a key category for critical urban theory against proponents of the concept of 'planetary urbanisation'. They argue that 'For many millions of people across the planet, the particularities of city life continue to be the context from which urbanization processes are experienced, understood, and potentially transformed' (Davidson and Iveson, 2015, p. 646).

### Future directions

Opportunities to engage in urban geography research are wide-ranging, and include:

1. Investigating the causes and consequences (both positive and negative) of the Australian population's concentration in five large cities, and of strategies to shift urban population growth from Melbourne and Sydney to smaller cities and regional centres.
2. Studying ways to improve the physical quality of city neighbourhoods that do not lead to the displacement of low-income households and the services and businesses that support them.
3. Studying strategies to improve mobility in Australian cities, covering the range of different groups of people using the city for a range of purposes.
4. Researching the internal structure of Australian cities, and the relationships between and within the central, inner, middle and outer zones.
5. Researching ways of using green infrastructure to make cities cooler in the face of climate change and more extreme temperatures, especially in places with vulnerable populations.
6. Studying water use and management in cities.
7. Researching ways to improve the provision of housing, especially for vulnerable populations.
8. Researching the barriers preventing households from practising more sustainable ways living practices.
9. Studying how to include Aboriginal and Torres Strait Islander knowledge and perspectives in urban planning.
10. Researching ways to maintain the relatively low spatial segregation of immigrant groups in cities, and enhance interaction between ethnic communities.
11. Studying how to use diversity to enhance the quality of urban life.
12. Researching how to make cities liveable, as well as ecologically sustainable and economically viable.
13. Studying infrastructure provision, focussing on the range of funding/operating models and evaluating their efficacy.
14. Studying how various age groups, including the elderly and children, experience and negotiate the city, and how their experiences could be improved.
15. Researching the experiences of LGBTQIA communities and their cultural and economic contribution to urban environments.
16. Researching food production within cities, and its contribution to nutrition, community life and the environment.









# 11 Coastal and marine environments

## Introduction

The coast is a highly dynamic zone, constantly changing through the action of marine and terrestrial processes, and varying in its characteristics from place to place. As the location of the vast majority of the Australian population, and a focus for tourism and recreation, the coast is also a major site for human–environment interactions. This makes it an important area for geographical research, made all the more significant by the current and projected effects of climate change, sea-level rise, increased storm activity and shoreline erosion. This chapter reports on key geographical coastal and marine research that contributes to the wellbeing of Australians and Australian environments.

## Coastal geomorphology

The 35 900 kilometres of the Australian mainland and Tasmanian coast consist of more than 11 000 beaches, dune systems backing many of these beaches, estuaries and deltas, rocky coasts and coral reefs. Approximately half the Australian coast consists of unconsolidated sediments, whose form is determined by the interaction of waves, tides and the supply of sediments from terrestrial and marine sources. Change in these landforms can be rapid, whether produced by natural events like severe storms or high rainfall, or by human actions like the construction of groynes and seawalls. Much of the remaining half of the coast is rocky and more resistant, and shaped by the interaction of waves and tides on different types of rocks.

The length and diversity of the Australian coast provides an excellent laboratory to study coastal processes. Australian geographers have used this laboratory to develop a distinctive morpho-dynamic approach to the understanding of coastal landforms. This approach focuses on the interactions between the hydrodynamic processes (waves, winds, tides and currents) that erode or deposit coastal materials, and the morphology or forms that these produce. The hydrodynamic processes create forms, which in turn, modify the processes. It is now firmly established and used as a research framework by coastal scientists in Australian and overseas.

The morpho-dynamic approach has been advanced by various investigative methods:

- direct measurement of waves and currents
- more accurate dating of sediments
- remote sensing using global positioning systems (GPS), Light Detection and Ranging (LiDAR), video imagery, and aerial and satellite photogrammetry.

Significant advances have also been made in using geographical information systems to process and display spatial data and numerically model morpho-dynamic systems, enabling greater predictive capabilities.

## Beach hazards: rip currents and sharks

The beach has an iconic place in Australian recreation and culture, but rip currents are a major hazard for beachgoers. On average, at least 19 people drown per year across the nation as a result of rip currents. Based on beach and surf zone morpho-dynamics, geographers developed a beach hazard rating system for Surf Life Saving Australia (SLSA), who have applied it to Australian beaches. This approach has been extended to rocky coasts, where many drownings occur when people fishing on shore platforms are washed into the sea by waves. Recent studies have built on this geomorphological framework to include human and social factors, such as the presence or absence of lifeguards, the number of beach users and cultural perceptions of the beach. Pioneering research has investigated the strategies used by swimmers caught in rip currents, and the advice that should be given to them in light of new scientific knowledge of both rip behaviour, and differences between beach surf zones and morphologies. This collaborative research between physical and human geographers has directly influenced SLSA's beach safety messages.

Geographers have also studied the role of recreational surfers in rescuing swimmers, mainly from rips, and mainly at beaches without lifesaver patrols. This research estimated that the number of rescues conducted by Australian surfers each year is probably equivalent to the number conducted by volunteer surf lifesavers. It also identified



Rip channels separated by shore-attached transverse bars on which surf is breaking, Lighthouse Beach, New South Wales.  
CREDIT: A. D. SHORT / OZCOASTS / GEOSCIENCE AUSTRALIA CC-BY 3.0

gaps in surfer ability to perform a successful rescue and to treat severe injuries, and advocated the provision of training in basic water safety rescue techniques and first aid.

Sharks are another beach hazard, the management of which is the subject of considerable controversy. Geographers who have contributed to research on this issue are building on a growing interest in human–non-human interactions. Their research finds that the majority of ocean-users encounter sharks often and without harm, and oppose shark hazard management methods that result in shark deaths. Instead, they ‘strongly support further research and education focusing on shark behaviour and shark deterrents, and approaches that enable people to understand and accept risks associated with ocean use’ (Gibbs and Warren, 2014).

### Coastal and marine ecosystems

Much of the geographic research on coastal and marine ecosystems is designed to identify the areas that most need protection, and ways of providing it. For example, research has highlighted the value of the ecosystem services provided by Australia’s saline coastal wetlands, such as mangroves and salt marsh, and proposed a number of actions that could improve their protection.

Other research has investigated the governance and management regimes required to support the resilience of marine biodiversity and ecosystems affected by future climate change. The desirable characteristics of any such regime include:

- adaptive management
- a systems perspective
- an ability to embrace diversity and change
- an ethical orientation.

A third example is a project that developed integrated methods for identifying refugia—habitats that marine biota can survive in under projected anthropogenic climate change, and which therefore should be a priority for conservation.

### Climate change

The effects of sea-level rise and other climate change impacts are still not sufficiently understood. Australian geographers are helping to find answers to this question by:

- studying past sea-level changes and their effects on coasts, as a guide to future impacts
- identifying past geographical variations in sea level that can inform projections of future change
- looking for evidence on the rates of sea-level change that particular ecosystems have coped with in the past, as a guide to future adaptation and sustainability
- isolating anthropogenic effects of sea-level rise and associated changes to the coastal environment
- developing probabilistic methods of estimating beach and foredune erosion caused by storms, and projecting future shoreline positions. This requires subdividing the coast into compartments and cells according to their sediment budgets, to estimate net sediment loss or gain
- assessing the vulnerability of estuaries and their adjacent floodplains to inundation and erosion resulting from climate change. Estuaries differ from open coasts because they are exposed to a combination of marine and land-based hydrological processes. They are important regions to study as most of Australia’s coastal settlements are located along or around estuaries
- assessing the socio-economic vulnerability of Australian coastal communities to climate change impacts and environmental hazards
- investigating household perceptions of the relative importance of climatic and non-climatic risks and how this affects household adaptive action
- understanding why scientific advice on sea-level rise may fail to be accurately incorporated into planning documents and decisions
- developing a framework for evaluating and improving the resilience of marine-dependent economic sectors experiencing climate change.



## Coastal policy, planning and management

Recent geographical research on coastal policy, planning and management has involved contributions by both physical and human geographers. Work by physical geographers includes:

- developing a framework for assessing beach condition and suitability for different uses, to inform management guidelines for individual beaches
- data gathering to support evidence-based coastal management decisions and practice
- demonstrating how working with nature, such as by constructing wetlands, protecting mangroves and saltmarshes, or helping existing wetlands to retreat, could protect coasts from rising sea level, as well as have economic benefits.

Human geographers have studied the complex arrangements that have evolved to manage coastal environments and resources, and make planning decisions about coastal development. Recent work includes:

- analyses and critiques of coastal management governance, decision-making and funding, and recommendations on what is needed to manage problems and data gaps identified by research
- studies of ways to improve the translation of scientific knowledge into coastal and marine management policy, such as by incorporating learning processes into coastal management, promoting social learning through communities of practice, or engaging local stakeholders in the research process
- analysing the role of social networks in contributing to coastal management decisions that conflict with scientific advice on the risks posed by sea-level rise. The research emphasised the importance of engaging with the socio-cultural drivers of coastal governance systems, and suggested that alternative social networks might be promoted to achieve more sustainable outcomes for coastal environments
- identifying the factors that influence the success of social learning in the context of local government management of coastal areas
- advocating coastal governance methods that enable different forms of knowledge to be used in decision-making.

In much of this research, geographers have worked closely with the agencies responsible for coastal management, while some have written reviews of coastal policy issues specifically for politicians, policy-makers and decision-makers.

## Aboriginal and Torres Strait Islander sea management

Geographers working with coastal Aboriginal and Torres Strait Islander communities have argued that strategies of sea management attempting to integrate Western and Aboriginal and Torres Strait Islander approaches lead to the domination of Western methods and concepts. For example, Aboriginal and Torres Strait Islander communities reliant on Natural Resource Management funding for their sea management activities have to frame these to match the objectives of the funders. The result is an emphasis on managing resources and outcomes rather than processes and relationships, and on Western rather than Aboriginal and Torres Strait Islander knowledge and worldviews. This limits the ability of communities to undertake 'caring for country' activities based on their own knowledge and ways of thinking and acting, and on their understanding of the interrelationships between humans and country. An alternative approach proposed is that of 'co-existence', in which multiple worldviews are respected and given equal value.



Beaches near Port Stephens, New South Wales. The three beaches and the spit are likely to each behave differently.

CREDIT: ALARIC MAUDE ©

### Future directions

There are several areas that should be examined in continued geographical research into Australia's coastal and marine geomorphology and ecosystems, including:

1. Research to develop more precise methods of modelling the effects of climate change on different types of coast, incorporating sea-level rise, increased frequency of major storms, coastal erosion and flooding events. This may include studies that can provide the evidence of coastal geomorphic behaviour needed to validate simulation modelling, particularly over decadal to century timescales. This research will enable local and state authorities to better plan for future risks.
2. Research into the evolving governance of coastal environments.
3. Gaining a better understanding of the values, perceptions and behaviour of coastal users.
4. Continued research and data gathering using a synthetic approach of physical, human, environmental and biogeography to provide critical evidence-based findings for the implementation of future coastal management decisions and strategies, both in Australia and globally.
5. Further work on developing the coastal compartments framework for projecting future shoreline positions, and extending it from south eastern Australia to other coasts, and to incorporate the role of estuaries.
6. Research on the relative merits of environmental compared with engineering solutions to coastal protection.









# 12 Geographical information systems and science

Geographic information systems (GIS) are a key methodological tool and framework geographers use to conduct their research. They enable the representation, analysis and modelling of Earth's natural and human processes. GIS connects data and people to the places they live and work. The emergence of tools such as Google Maps, What3Words, Google Earth and Bing Maps have mainstreamed GIS into everyday life.

However, GIS is more than a means of getting maps into and out of a computer. It provides a capability for gathering, integrating, linking and analysing geospatial datasets to generate new questions and solve long-standing environmental and socio-economic problems. GIS has a critical role in addressing major challenges facing humanity including sustainable development, our environmental future (biodiversity loss, ocean acidification, land degradation and natural hazards), our future social lives (smart cities) and population wellbeing. Such topics have already been summarised in the other chapters of this report. Here the focus is on how GIS can enable such research, and also how GIS itself is a subject of research for geographers.

GIS is a nexus between geography and other related fields (e.g. agriculture, biosecurity, climate science, geology, surveying, urban planning, and health). Rapid advances in orbital and airborne remote sensing technologies and the proliferation of geo-referenced data through location-enabled devices, have dramatically transformed the way geographic information is produced, negotiated and shared. This presents exciting opportunities for geographers in exploring geographical patterns in environmental and social landscapes.

## Representation of space

Any phenomenon that can be represented using a set of spatial coordinates is amenable to analysis using GIS. These might be explicit geographic coordinates (latitude and longitude), grid coordinates (Northing and Easting), or place name references such as suburbs, census mesh blocks, town names and street addresses that can be mapped

to coordinates. They might also be people's conceptual spaces, possibly using a non-geographic coordinate system based on travel time or other perceptual measures of distance. These are important for researchers whose work focuses on the design of navigation and way-finding systems that translate human-generated directions into geographic distances and directions that can be shown on a smartphone map, as well as in natural language form such as "walk along the road towards the CBD for five minutes, then take the eastbound train for another ten minutes".

Geographers work on representations and conceptualisations of geographic relationships, often examining connections between places. Such research uses measures of 'cost distance' instead of simple Euclidean (as-the-crow-flies) distance. For example, two frog populations in adjacent waterways might be very close together geographically, but the connecting waterways along which they can travel mean that the true travel distance is an order of magnitude greater. The same principle applies with connectivity of people along traffic networks, where a freeway might act as a barrier between two places that are only tens of metres apart. Similarly, public transport networks might be structured so that commuters must pass through central interchanges instead of being directly connected. Such transport network data can be accessed from tools such as Google Maps, enabling geographers to examine the connectivity between places provided by public transport.

## Access to data

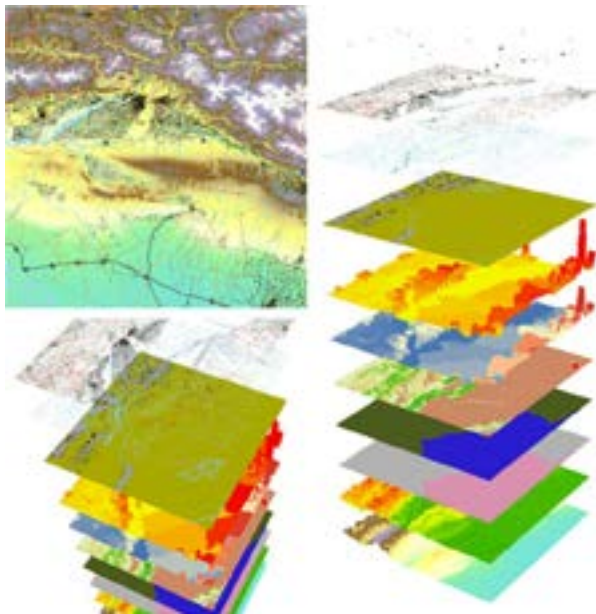
The data explosion in the digital era permeates nearly all fields of research, and geography is no exception. In an era of big data, a very large proportion of that data already includes geographic coordinates or can be quite easily located in geographic space. The past decade has seen an exponential increase in geo-located data through technologies such as GNSS<sup>1</sup>-enabled smartphones, public transit smartcard data, sensor networks, the ever-expanding

<sup>1</sup> GNSS: global navigation satellite system: an umbrella term that encompasses all global satellite positioning systems (GPS, GLONASS).

stream of remotely sensed data from satellite, aircraft and drone (UAV<sup>2</sup>) mounted sensors, digitisation of museum collections, and internet traffic such as social media posts.

In addition, democratisation of data access has arrived through open access initiatives. One example is the WorldPop project initiated in 2011, which produced harmonized sets of 3- and 30-arc-second resolution gridded data layers with global coverage for use in population mapping. Such datasets are vital to measure impacts of population growth, monitor change, and plan interventions<sup>3</sup>.

These developments open many new avenues for quantitative geographic research, especially for the social sciences and humanities for which such data have historically been difficult to obtain. It does come at the potential cost of increasing complexity and computational demands, but many of these issues are generic and thus geographers can readily leverage research from other fields such as computer science.



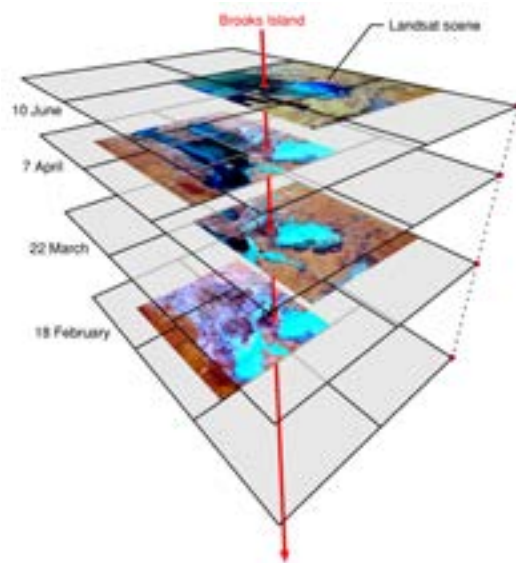
An excerpt of selected WorldPop gridded datasets at 100m resolution, in plan view and as pseudo 3d stacks.

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Some specific examples that geographers are using in their research are:

- Digital Elevation Models (DEMs) that cover the globe at 1-arc-second resolution (approximately 30 metres) derived from orbital platforms such as the NASA Shuttle Radar Topography Mission (SRTM), JAXA's Global ALOS 3D World and the German Tandem X satellite mission
- the Australian Geoscience Data Cube (AGDC)<sup>4</sup> developed by Geoscience Australia uses NASA Landsat and ESA Sentinel satellite archive imagery. The AGDC provides a time series of satellite imagery for Australia at 30-metre

resolution spanning more than 30 years at 16-day intervals. This enables researchers to track changes across Australia in thematic applications related to mapping soil and coastal erosion, crop growth, water quality, or with a spatial focus, such as particular cities or regions



The AGDC data cube concept (after Lewis et al., 2016). Landsat scenes are re-formatted as spatially consistent tiles of data. The spatial footprint of Landsat scenes changes over time, whilst the tiled datasets maintain a constant footprint.

CREDIT: LEWIS ET AL. (2017) / CC-BY

- the NASA MODIS (Moderate Resolution Imaging Spectroradiometer) time series provides daily measures at a global extent and a resolution of approximately 250 metres, with many derived products (e.g. Normalised Difference Vegetation Index, Photosynthetically Active Radiation) provided at monthly and annual intervals
- the Soil and Landscape Grid of Australia provides a wealth of soil and landscape attributes such as clay content, pH, depth of soil, topographic slope, and net solar radiation, across Australia at approximately 90-metre resolution
- the Atlas of Living Australia (ALA) provides access to more than 70 million occurrence records for biota across Australia and its region, as well as analysis tools
- the Terrestrial Ecosystem Research Network (TERN): through its portal it delivers ecosystem data at a variety of scales (from plot to regional): gas, energy, and nutrient exchanges; remote sensing data; modelled data products about soil, climate, and landscape attributes; and vegetation and soil samples for physical analysis. It also provides tools for the research community, including nationally consistent field methods, data collection apps, and data publishing tools

<sup>2</sup> UAV: unmanned Aerial Vehicles

<sup>3</sup> Lloyd, C. T. et al., (2017) High resolution global gridded data for use in population studies. *Sci. Data* 4:170001 doi: 10.1038/sdata.2017.1

<sup>4</sup> Lewis et al., (2017) The Australian Geoscience Data Cube—Foundations and lessons learned. *Remote Sensing of Environment*, doi: 10.1016/j.rse.2017.03.015



- the AURIN data portal allows access to a broad range of socio-economic data for Australia. A commonly used data source in geography is the socio-demographic information found in census data. In addition, there are property sales records, information on health risk factors and health outcomes, service accessibility (e.g. travel times) and derived datasets that measure socio-economic disadvantage and vulnerability to inflation or mortgage stress.

### Public participation GIS (PPGIS) and volunteered geographic information

Public participation GIS involves using GIS techniques and tools to empower groups of people in communities to play a larger role in shaping government policy decisions that affect their daily lives. This has been accomplished in many ways, ranging from training people in community organisations to use GIS tools to map things that are important to their own communities, to enabling ordinary people to contribute to government data sets (e.g. emergency response data sets) or scientific research through crowd-sourcing.

Crowd-sourcing invites ordinary people to participate in science and in decision-making processes, and forms an important part of what is known as volunteered geographic information (VGI). Decision-making processes often rely on government data, so the content of a dataset can often shape the decisions made. Previously, governments determined what data should be collected and how. Today, new online platforms such as [www.OpenStreetMap.org](http://www.OpenStreetMap.org) allow any user to update and modify mapped features anywhere on the globe. Such crowd-sourced data allow the inclusion of more kinds of information and more regular updates of many areas than traditional governmental processes permit, provided there are sufficient people interested in maintaining an area.

Other crowd-sourced and VGI projects include citizen science projects that take advantage of the geolocation capability that comes from the GPS built into every smartphone. For example, there are projects to map the distribution of frog populations nationally by asking citizens to record frog calls using their phones. Other citizen science projects such as EyeOnWater aim to link satellite observations with water quality field measurements taken by ordinary people with the aim to make satellite measurements of water quality more effective, efficient, and reliable. There are also tools such as Strava that allow cyclists to record their commute or training rides and upload them to publicly accessible servers.

### Data query and access to analytical tools

Tools and data analysis platforms have also come with the boom in available data. Digital Earth Australia provides a platform for processing, interrogating and presenting Earth observation satellite data to examine Australia's changing landscape and coastline. Both the ALA and AURIN provide a suite of tools to analyse their data, but there are also other

platforms such as the Biodiversity and Climate Change Virtual Laboratory (BCCVL) that allows people to integrate big data and leverage high performance computing resources without needing programming expertise. Other online tools include:

- VegMachine, in which satellite imagery are used to summarise decades of change in Australia's grazing lands
- Australia's Environment Explorer, national-scale, comprehensive information on the condition and trajectory of our environment.

This increase in accessible data and tools will have an important effect on education at both tertiary and secondary levels, as there is a decreased need for specialised software. This allows teachers and students to ask important questions across a broad range of geographic topics.

Geographic Information Science (GIScience) is the investigation of the fundamental research issues related to geographic information, and underpins the development and application of GIS to geographical problems. It spans the development of new computational methods to understanding how people work with geographic information. Current trends in GIScience research include:

- exploring the complexity generated by big data and the Internet of Things
- GeoComputation focuses on the computational end of the GIScience spectrum, including many of the tools used for big data analysis, such as machine learning algorithms. Many research techniques developed in GIScience and GeoComputation are now accessible to a broad audience due to advances in computational resources and available tools. An important component is the proliferation of free and open source (FOSS) tools and online, cloud-based platforms, which make GIS analyses more accessible than a decade ago
- providing data through distributed spatial web services and visualisation in the form of Web Map Services and associated work in Spatial Data Infrastructure
- enabling greater interoperability, broader access, and data and tool integration. Researchers are working on this integration through standards groups like ISO BIM-GIS Ad Hoc Group, OGC
- smart systems applications in which advanced analytics are used to create actionable intelligence with prediction algorithms to program automated smart systems. This includes merging cameras, scanners and wireless sensors for value-added applications in health, agriculture, sustainable cities and transport, and natural resource management.

## Future directions

The five biggest trends in the area of GIS technology are centred on making data more accessible and creating context to visualise this data in an age when fast, easy access to information is taken for granted. The future research should consider location-based services, advanced analytics, big data analytics, real-time GIS and mobility. GIS research opportunities that will benefit Australia must align with Australian Science and Research Priorities, the 2016 National Research Infrastructure (NRI) Road Map and themes from Dangermond's (2017) GIS Trends in a Changing World. Research questions and opportunities include:

- 1.** How can geographic information science and technology enhance our understanding of big data? Specific questions include:
  - How can GIS technology connect us to the ever-increasing network of devices providing data in real time?
  - How can it make that data more accessible and more understandable?
  - How can we maximise the use of maps as the graphic communication tools to convey knowledge gathered to inform decisions?
- 2.** Space and time are ubiquitous and essential to all scales of geography as well as to exciting new areas of research described in the other chapters, such as big data, the Internet of Things, smart and connected communities, and self-driving cars. As space-time is at the core of GIS research, there are ample opportunities for GIS researchers to make significant contributions to these exciting research areas that can transform ways of living in future generations.
- 3.** How can GIS contribute to the emerging research directions identified in the 2016 National Research Infrastructure Road Map in terms of environment and natural resource management, big health data, enhanced understanding of cultures and communities, and national security?
- 4.** The Australian Government has developed a set of Science and Research Priorities, and corresponding practical research challenges: food, soil and water, transport, cybersecurity, energy, resources, environmental change and health. Cross-cutting issues related to the priorities present challenges in their own right and will be addressed through a whole-of-government strategic approach. These include big data and the application of GIScience and GeoComputation. Australian geographers should play a key role in these emerging areas of research.









NORTHERN TERRITORY  
Newcastle  
Wabers  
Normanton  
Croydon  
Innissailo

QUEENSLAND  
Tennant Creek  
Camooweal  
Cloncurry  
Hughenden  
Dajarra  
Winton  
Clermont

AUSTRALIA  
Alice Springs  
Longreach  
Simpson Desert

QUEENSLAND  
Charleville  
Birdsville  
Quilpie  
Cunnamulla  
Goondiwindi

SOUTH AUSTRALIA  
Maree  
Collarenebri  
Bourke  
Walgett

NEW SOUTH WALES  
Leigh Creek  
Dubbo  
Orange  
Newcastle

WALLEN  
Sydney  
Wollongong  
Goulburn

VICTORIA  
Adelaide  
Wagga Wagga  
Albury  
Canberra, A.C.T.  
Cooma  
Mt. Kosciuszko

Melbourne  
Traralgon  
Wilson's Promontory  
TASMANIA

# 13 Geography in Australian schools

## What does geography contribute to the education of young Australians?

Geography builds a sense of national identity and Australia's place in the world. To understand Australia and ourselves we need to understand its geography—our vast area and relatively few people, the diversity of our landscapes and climates, our natural resources, the movement of peoples to and within Australia, our distance from Europe and North America and our closeness to Asia and the Pacific. We learn to understand that different cultural groups, for example, Aboriginal and Torres Strait Islander peoples and the vast waves of immigrants that enter our shores, all engage with the land differently. We also recognise the changing nature of community and identity in Australia, influenced by waves of migration, rapidly changing information and communication technologies, increased mobility and attitudes to globalisation and our myth-making.

Geography helps students make decisions about the big issues affecting the quality of their lives and environments. It is impossible to read a newspaper without finding reports on current issues that are studied in geography—climate change, coping with floods and droughts, liveable cities, ageing populations, engagement with our neighbours in Asia and the Pacific, and the world beyond. Geography students are encouraged and guided to observe, to seek information, to record what they find in order to understand the processes behind these issues. In doing so, they draw relevant conclusions and evaluate possible solutions.

Geography nurtures students' natural curiosity in, and appreciation of, the world's people and places. Thinking geographically and developing their innate geographical imaginations helps young people think about their own lives and their own communities, as well as people, places and environments throughout the world.

While geographical knowledge and understanding may come from students' innate interest in the world around them, the study of geography nurtures this awareness. It helps us to us to understand our place in the world. More importantly, it

develops student competencies to think, reason and act in a rapidly changing world. It also fosters an environmental ethic fundamental to Australia: caring for place—caring for country.

Geography studies phenomena from the natural world, the social world and the humanities, and integrates them through the discipline's perspectives of place, space and environment. This helps students to see the interconnections between different types of knowledge, and to become open to a wide range of ways of understanding and explaining the world they observe and experience.

Finally, geography helps students to think about the future. Geography teachers develop teaching strategies that emphasise the application of geographical understanding in realistic decision-making contexts. In doing so, they give young people opportunities to acquire, develop and apply a range of key geographical ideas and principles. Ultimately, geography students are empowered to make judgments that are informed by extensive descriptive knowledge about the world; knowledge that is enriched by theory and deepened by abilities to think about alternative futures for people, places and environments.



CREDIT: ŠTEFAN ŠTEFANČIK / UNSPLASH / PUBLIC DOMAIN



## Geography in the Australian school curriculum

Geography is a mandatory subject in Australian schools from Foundation (Kindergarten, Prep, Reception) to Year 8. In primary schools, it may be taught as a specified sub-strand in a combined humanities subject, while in secondary schools geography is a separate subject and compulsory up to Year 8, 9 or 10, depending on the jurisdiction. It is otherwise offered as an elective in Years 9–12.

Most states and territories have adopted, with some modifications, either the geography curriculum developed by the Australian Curriculum, Assessment and Reporting Authority (ACARA) for Years F–10, or the alternative humanities and social sciences curriculum for F–6, also developed by ACARA, followed by the geography curriculum for Years 7–10. In these curricula, students in Years F–6 explore local and distant places, investigate and explain places and environments, learn a little about each continent, explore the concept of sustainability, and study the world's diversity of environments, peoples, cultures and economies. In Years 7–10, students study a range of units that span and integrate the physical and human branches of the discipline. These include water in the world, place and liveability, landforms and landscapes, changing nations, biomes and food security, geographies of interconnections, environmental change and management, and geographies of human wellbeing.

In the senior secondary years, the curriculum has four units: natural and ecological hazards, sustainable places, land cover transformations and global transformations. Adoption of the senior curriculum across Australia is patchy. Western Australia and the ACT have adopted it in full, Tasmania has adopted three of the four units, Victoria has adopted two and replaced the other two with their own topics, while New South Wales, Queensland and South Australia have yet to make any changes to their existing curricula.

The learning experiences of students through school geography can be illustrated by two examples. In the first, a Year 6 class is inquiring into the differences between nations across the world. The teacher has investigated students' existing knowledge about countries, resulting from family inter-connections, personal interests and experiences. Now the students are involved in gathering statistics to measure the contrasts in wealth, health, education and quality of life between different nations. Individual students discover different sources of information, and the teacher helps them to discriminate between them, and to understand the meaning of new terms (e.g. 'per capita'). To make the statistics more vivid, the teacher draws the students' attention to websites that map data, or show how the measures they are using have changed over time.

In the second example, a class of Year 10 students is spending the day at a coastal location, mapping, recording and photographing the ways in which human use of the coast

has affected the movement of sand and changed coastal landforms. They had prepared for the fieldwork activity by looking at online digital aerial photographs of the coast taken over a number of years, and by creating a base map using geospatial technology. At the beach, they record the wave patterns, wind direction and sand movement. They photograph human alterations such as seawalls and storm water outlets. They count and record statistics relating to traffic, visitors, and different uses of the coast. After the field trip, students will use the data gathered to write a report about how and why the coast is changing, and the consequences of these changes. They are asked to include predictions about future change, and suggestions about how any negative changes could be managed.

## Geography in Years 9 and 10

In some states and territories, geography is not a compulsory subject after Year 8 or Year 9. Given the subject's importance, and its potential to shape the future, this strategic plan argues that the study of geography in schools should be made compulsory to Year 10 in all jurisdictions. The curricula for Years 9 and 10 not only further develop the qualities described above, they also teach young Australians about some important topics that they would otherwise not study. These include:

- the environmental basis of agriculture
- food production and food security
- people's connections with places throughout the world through communication technologies
- trade in goods and services, and travel
- the management of environments
- human wellbeing at global, national and local scales.

### RECOMMENDATION

The National Committee for Geographical Sciences makes submissions to the relevant ministers of education on making geography compulsory to Year 10.



## Geography teacher education and subject knowledge

Good geography teaching depends partly on the initial education and professional support provided for teachers. Teacher education involves both learning about the subject and learning how to teach it. For pre-service teachers, the latter can be assessed by the number of courses on geography teaching in education degrees, whether these courses are specific to geography, and whether there is a full-time specialist geography educator directing them. A preliminary analysis of education degrees in the 37 universities across Australia with education programs shows that:

- the most common (in 23 of 37 universities) preparation to teach geography for primary school teachers is one methodology course on all four of the humanities subjects, or on history and geography combined. Another eight universities offer two methodology courses, all on teaching humanities subjects or history and geography combined
- for teacher training for the lower secondary years, two methodology courses are offered in 19 of the 37 universities. However, the Year 8 curriculum courses are on teaching the humanities or studies of society and environment (SOSE) and its equivalents, subjects that either no longer exist in Years 7–10, or are being phased out
- only 16 universities have specialist courses on teaching senior secondary geography, and one third of these are on the humanities, SOSE, or history and geography combined, and not on geography alone
- only nine of the 37 universities have a full-time specialist geography educator, and many of the geography or humanities courses seem to be coordinated by non-geographers, and taught by sessional staff.

These results suggest that a number of university teacher education programs provide insufficient preparation for effective geography teaching.

Subject knowledge is also vital, as research shows that this is 'a key attribute of highly effective teachers' (Weldon, 2016). For example, students often have alternative (mis) conceptions—ideas that are inconsistent with scientific evidence. These ideas need to be recognised and addressed by teachers or they will persist. It is unlikely that teachers will be able to do this if they themselves have incorrect and imprecise ideas. International research on geography teaching in primary schools also concludes that:

***a lack of content knowledge in geography can result in: selective teaching of syllabus content and narrowing of the curriculum to avoid difficult concepts; a focus on issues and impacts at the expense of geographical processes; gravitation***

***towards unstructured inquiry based approaches for teaching scientific concepts; overreliance on textbook-based teaching and the rigid use of commercial teaching units; a failure to intervene effectively during instruction to improve student learning; a focus on the transmission of factual content through teacher exposition; a reluctance to allow extended open discussion in the classroom; a desire to stick to the script regardless of student feedback; and the snowing of students with facts to compensate gaps in understanding. (Lane 2015a, pp. 210–211)***

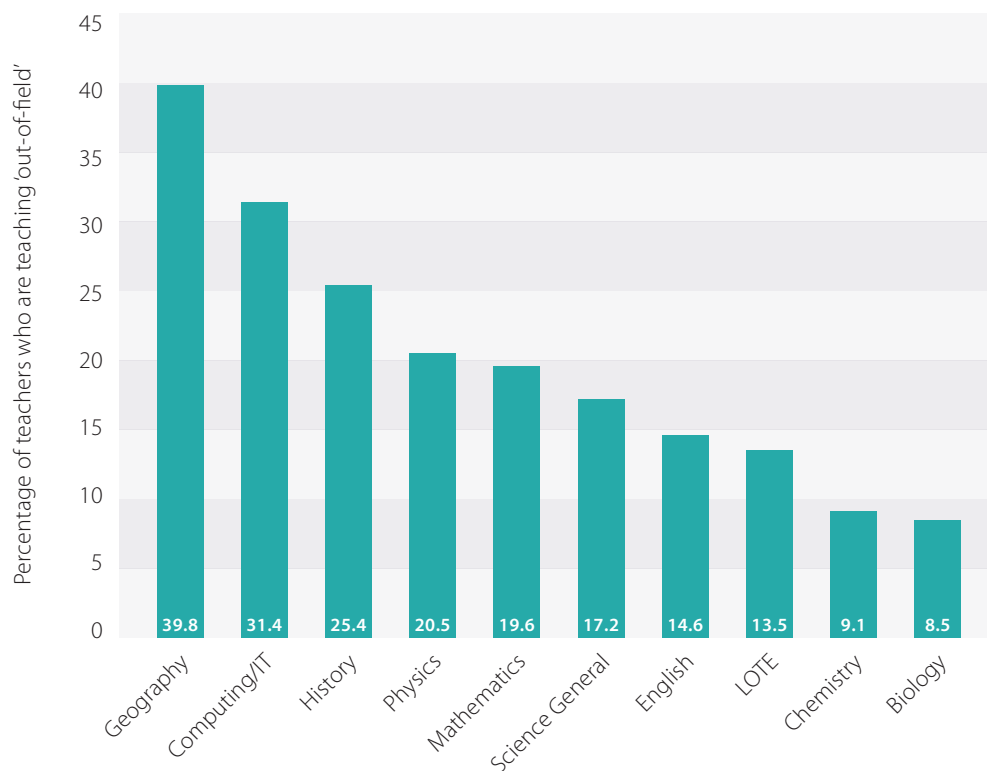
The extent to which teachers have a good knowledge of geography is difficult to quantify, but one Australian research project found that pre-service primary teachers had incorrect conceptions of weather and climate processes. Furthermore, in primary education degrees, there is little or no requirement to study geography as a subject. At the very least, primary pre-service teachers should study at least one content-based unit in each area of the core curriculum—English, maths, science, geography and history, and perhaps civics/political science and economics as well.

For secondary school teachers, the Australian Institute of Teaching and School Leadership (AITSL) specifies a minimum of six units of study in their 'first' teaching subject, with no more than two units at first year level. The adequacy of this requirement for teaching geography depends on what these units are, because while the school curriculum requires knowledge of both physical and human geography, many university geography majors do not.

### RECOMMENDATION

The National Committee for Geographical Sciences and AGTA develop a submission to university education program decision-makers about the need to improve both primary and secondary teacher training in geography.

**Figure 4. Out-of-field teaching by subject, 2013**



SOURCE: P. WELDON ET AL. (2014) / ACER / CC-BY-NC-SA 3.0

The adequacy of the subject knowledge of teachers already in the workforce can be assessed from survey data on 'out-of-field' teaching in secondary schools. This term refers to teachers who are teaching a subject they have not studied at second-year tertiary level or above, or have not been trained in its teaching methodology. Figure 4 shows the percentage of 'out-of-field' teachers by subject revealed by a 2013 survey, and shows that geography had the highest percentage of 'out-of-field' teaching. When measured by the number of classes being taught, geography again had the highest percentage. This is a serious problem for the subject, and for the education of young people in general, because research shows that unqualified teachers may devote less time to the subject, skip topics they find difficult, and fail to engage the interest of students.

#### RECOMMENDATION

The National Committee for Geographical Sciences and AGTA write to the federal, state and territory Ministers of Education about the urgency of addressing 'out-of-field' teaching in geography.

Support for teachers to further develop their geography knowledge and teaching methods is also vital for quality education. The former is currently facilitated through conferences, workshops, social media and journals such as Geographical Education. However, there may be a need for a more systematic method of distilling current knowledge into forms that teachers can readily access and use. For example, geography academics, educators and experienced teachers could be asked to review contemporary knowledge on topics in the curriculum and these reviews made available on an appropriate website.

Pedagogical skills in geography teaching are currently being promoted through an AGTA project on professional standards. This project will provide teachers with the tools to gather and present data relating to their own professional practice. The pedagogical and content knowledge of teachers could also be improved if universities became more active in the provision professional learning, and employers encouraged teachers to undertake post-graduate studies.

## Geography as a STEM subject

In the school curriculum, geography is classified as a humanities subject. This is unfortunate, because it fails to recognise that the subject is partly a science, and that its ability to span the natural and social sciences is a major contribution to education.

An analysis of the ACARA geography curriculum shows that it teaches a number of scientific concepts and ideas that are not in the science curriculum. These include:

- climate types (Year 3)
- vegetation types (Year 4)
- environmental sustainability (Year 4 onwards)
- Australia's water resources (Year 7)
- the causes, impacts and responses to an atmospheric or hydrological hazard (Year 7)
- the causes, impacts and responses to a geomorphological hazard (Year 8)
- biomes (Year 9)
- the determinants of crop yields (Year 9)
- environmental constraints on food production (Year 9)
- human-induced environmental change (Year 10)
- management of environments (Year 10).

The scientific character of geography is recognised in university degrees—of the Australian universities that offer a geography major, in the vast majority it can be taken in a Bachelor of Science degree. In Victorian schools, geography is recognised as partially a STEM subject that develops and applies distinctive STEM skills. An awareness that school geography extends beyond its humanities perspectives, and also has significant scientific content, would be greatly helped if it was nationally recognised as partially a STEM subject.

### RECOMMENDATION

The National Committee for Geographical Sciences and AGTA develop a case for submission to Ministers of Education for geography to be recognised as partially a STEM subject.

## The role of the universities in school geography

School geography would benefit from a renewed collaboration with university geographers, and university geography programs could also benefit if increased enrolments in the senior secondary years resulted in more students enrolling in university geography courses. One way of encouraging this collaboration could be to adopt the American Geographic Alliance model, in which academics from universities work with the local Geography Teachers Association to provide professional learning opportunities for teachers.

Several suggestions have already been made in this chapter on ways that university geographers could contribute to school geography. Others include:

- developing appropriate fieldwork activities for different school year levels, particularly for teachers who have not studied geography
- helping teachers to learn to use geospatial technologies in their teaching
- encouraging some of their graduates and postgraduates to consider teaching as a career
- participating in geographical education research regarding geographical education.

### RECOMMENDATION

AGTA and IAG explore ways to increase collaboration between school and university geographers.







State Library Victoria, Melbourne, Victoria.  
CREDIT: NATHANIEL WATSON / UNSPLASH / PUBLIC DOMAIN

# 14 The public geographical societies

## Introduction

The oldest geographical organisations in Australia are the Royal Geographical Society of Queensland (RGSQ) and the Royal Geographical Society of South Australia (RGSSA), both founded in 1885. They were originally branches of a national society, modelled on the Royal Geographical Society in the UK, and there were also branches in New South Wales (1883) and Victoria (1883). The Victorian branch joined with the Victorian Historical Society, while the New South Wales branch ceased functioning in the early 1920s but was replaced by the Geographical Society of New South Wales (GSNSW) in 1927. Queensland, New South Wales and South Australia remain the only states with geographical societies.

### RECOMMENDATION

The public societies and the IAG consider the feasibility of establishing public geographical societies in Victoria and Western Australia.

Unlike the Institute of Australian Geographers, whose focus is largely academic and research geographers, and the state and national geography teachers' associations, the three societies draw their membership from a wide spectrum of the community, and while their members include academics and teachers, the majority are people who are simply interested in geography. They have similar aims, summed up by RGSSA 'advancing geographical science and promoting public awareness and enjoyment of geography. The societies participate in varying degrees in the research, education and public spheres. For instance, the GSNSW and the RGSSA publish academic journals—the Australian Geographer and the South Australian Geographical Journal. The GSNSW also:

- holds an annual conference to showcase the research of honours and masters students
- funds undergraduate geography prizes at all New South Wales universities
- hosts welcome events and seminars for postgraduate students
- provides funding to support early career researchers
- engages with the New South Wales Geography Teachers Association.

The RGSQ contributed to the development of the Australian geography curriculum and runs an Australia-wide geography competition for secondary-school students.

However, it is in the public sphere, particularly at the level of community engagement, that the societies are most differentiated from the other geographical organisations, and it is this role that is the focus of this chapter.

### Australian Geography Competition

The Australian Geography Competition is a joint initiative of the Royal Geographical Society of Queensland and the Australian Geography Teachers' Association, which aims to encourage student interest in geography and to reward student excellence. Each year more than 65 000 secondary school students from around Australia take part. Multiple-choice questions, many drawing on information in tables, maps and other graphics, test the students' geographical knowledge and skills.

The top male and female Year 11 students in each state and territory are invited to participate in the annual Geography's Big Week Out, a six-day event focussing on fieldwork, spatial technologies and analytical skills. Australia's team to the International Geography Olympiad is selected from the Geography's Big Week Out students. Australia has a proud record in the olympiads and in 2016 was the highest ranked team.

## Strategies

The societies use a variety of strategies to engage the community with geography. One that dates back to their establishment, and still continues, is presenting public lectures. These may be place-based, such as on Iran or the African Sahel, giving a geographer's insights into the natural and social aspects of the area. Other lectures range widely across the research interests of geographers, such as urban spatial patterns or biophysical remote sensing.



These lectures, and the diversity of topics covered help broaden the public understanding and challenge old perceptions of what geography is and what geographers do.

Another strategy takes community engagement outside the lecture theatre, with the societies organising trips with a geographical emphasis. The GSNSW has a long tradition of international study tours led by geographers, aimed at helping curious travellers understand and appreciate places that are off the normal tourist trails, such as North Korea or Yunnan. The understanding of places is also promoted by The Travellers Club in New South Wales, which hosts a program of presentations on places that geographers have visited. The RGSQ has more recently expanded into overseas trips, but the main activity for the RGSQ and the RGSSA has been regular programs of trips within Australia, ranging in length from a few hours to a few weeks. These trips have enabled participants to explore the physical and human geography of places both near and far.

A further avenue for community engagement for the societies is their publications. The RGGSA publishes a popular series of guide books for visitors to the Flinders Ranges, Barossa Valley and Kangaroo Island. These well-researched and authoritative books are ideal for tourists who seek a publication that offers greater depth than mainstream tourist guides. An RGSQ web publication, *Queensland by Degrees*, generates on-going community interest, as it provides a systematic description and visual record of the geography at the 185 points in Queensland where whole degree lines of latitude and longitude intersect, supplemented by information on the 'degree square' of which it is the centre.

The societies also maintain libraries, and the RGSSA library is one of the most significant collections of rare geographical books and manuscripts in Australia. Items from the RGSSA library are regularly displayed in exhibitions, (e.g. 'Afghanistan: a Colonial Exposure and Australia's Immigration Links from 1859'; and 'Simpson Desert Survey'). Displays aimed at broad geography promotion to the public are an occasional feature of all the societies' activities. Examples include displays and activities as part of annual National Science Week, and displays and guided walks in Brisbane's Riverfest.

The strategies discussed above reach a restricted number of people and therefore have limited success in promoting public awareness of geography and its contribution to the social, economic and environmental wellbeing of Australians and Australia. The societies have attempted to expand their reach via the mass media and social media. This is often in relation to the activities of the societies, rather than the promotion of geography per se. However, it can lead to the more general promotion of the subject, for instance, through a radio interview with an upcoming speaker about their research. Success in gaining coverage in the mass media appears to work best when all the geographical organisations in Australia, not just the societies, cooperate

with each other. An example of this was the joint lobbying to ensure geography was included in the Australian curriculum that gained good traction in the mass media.

## Coordination

It could be argued that the various geographical organisations in Australia, including the societies, would be more effective in promoting geography's value to the community if their efforts were more coordinated. A formal coordination structure could improve the ability of the geographical organisations to advance the cause of geography by drawing on their different and complementary strengths.

As a first step, regular meetings could be held where the organisations could share ideas, raise issues, discuss experiences, and identify opportunities and threats. Joint, or at least coordinated, projects could be undertaken before any formal body need be established. If a formal body was considered appropriate its structure could be minimalist, not undertaking any activities itself, or it could be a more substantial umbrella organisation, with a similar relationship with its constituent organisations as the Australian Geography Teachers' Association has with its state affiliates.

An amalgamation of some or all of the geographical organisations has been suggested, but the state-based nature of their activities means that in a large country, this may limit local engagement. An alternative is to establish state-based societies in other states, and work as a confederation with the IAG. In other countries, the different roles filled by the Australian geographical organisations are not always undertaken by separate organisations. For instance, the New Zealand Board of Geography Teachers is part of the New Zealand Geographical Society, while in the United Kingdom, the Institute of British Geographers and the Royal Geographical Society merged in 1995.

As separate organisations or as one, if working together will make community outreach more effective, and improve public awareness of the valuable contributions that the study of geography can make to Australians' wellbeing, then this is a direction that should be explored.

### RECOMMENDATION

Australian geographical organisations, including the societies, explore the benefits and feasibility of working together, both within jurisdictions and nationally.





# AUSTRALIA

WESTERN AUSTRALIA

SOUTH AUSTRALIA

QUEENSLAND

NEW SOUTH WALES

VICTORIA

TASMANIA  
SEA



# 15 Future challenges and recommendations

In preparing this strategic plan, the National Committee for Geographical Sciences requested chapter authors to include a section on 'future directions' at the conclusion of each chapter. These are areas where future Australian geography research should be focused to align the discipline with the national research priorities. In the case of Chapters 1, 2, 13 and 14, recommendations are made for strategic opportunities to promote and enhance geography in Australia.

These future research directions and recommendations provide the backdrop to this final chapter that provides a summary of future challenges for Australia and our neighbouring region, and how geographers may contribute to these challenges in a productive and meaningful way. The first two challenges identify problems around which research may be focused. The final two challenges identify concerns about the level of knowledge of geography in the Australian population and how we might improve the visibility of the discipline in society at large. These are necessarily more prescriptive, as they are not evaluated in detail in the preceding chapters.



Australia has a distinctive geography.  
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## Challenge 1:

### To increase the discipline's contribution to progressing environmental sustainability

Geography's contribution to meeting this challenge should focus on research on:

- ways of understanding contemporary environmental change and human responses to it
- restoring and maintaining aquatic systems to improve water quality and riverine health
- managing the combined pressures of human activities and marine and terrestrial processes on the coastal zone
- minimising the impacts of natural hazards
- reducing land and biodiversity degradation
- evaluating the effects of future population and economic growth in Australia on the environment, and their implications.

## Challenge 2:

### To increase the discipline's contribution to the improvement of human wellbeing

Geography's contribution to meeting this challenge should focus on research on:

- reducing spatial inequalities in wellbeing in Australia's large cities
- reducing spatial inequalities in wellbeing in rural and regional Australia
- improving the wellbeing of people in the Asia–Pacific region.





### Challenge 3:

#### To raise the level of geographical knowledge and understanding within the Australian population

Geography's contribution to meeting this challenge will require a focus on:

- basic research across all fields of geography to ensure that this knowledge and understanding is accurate, comprehensive and inclusive
- persuading the relevant Ministers of Education to make geography compulsory to Year 10
- increasing the contribution of Aboriginal and Torres Strait Islander and local knowledge and ways of knowing to understandings of Australia's geography
- lobbying for recognition of geography within the science, as well as humanities, disciplines in high school education
- persuading Ministers of Education and allied portfolios that geography should be recognised as partially a STEM subject, as in Victoria
- persuading university Education programs to improve the geographical training for teachers
- lobbying federal, state and territory Ministers of Education about the urgency of addressing the high incidence of 'out-of-field' teaching in geography
- exploring ways to increase collaboration between school and university geographers
- strengthening the educational role of the public societies
- investigating the formation of geographical societies in Victoria and Western Australia.

### Challenge 4:

#### To improve the discipline's visibility and integrity

Geography's contribution to meeting this challenge will require a focus on:

- encouraging geographers to identify as geographers in their occupations and public statements
- persuading the Australian Bureau of Statistics to amend the Fields of Research and Field of Education Codes
- ensuring that the importance of geography is appreciated by university vice-chancellors in order to build and maintain vital research strengths as well as the visibility, identity and unity of the discipline
- developing a short pamphlet and online resource on the careers that geography can lead to, and distributing it to schools through the state Geography Teachers' Associations, and other appropriate channels
- encouraging geographers to write books for the general public and policy-makers
- encouraging geographers to write articles for credible online blogs, such as The Conversation, and to actively promote themselves as geographers
- encouraging nomination of outstanding geographers for fellowships of the Australian Academy of Science and other relevant academies
- lobbying to attract funding to support geography education in universities and to promote research into geography education
- preparing a position paper (with endorsement from IAG, SSSI, EIANZ) on geography as a STEM major
- assisting geographers to get involved in and contribute to major international initiatives and networks (e.g. Future Earth, UN Conventions, IPCC reports, IPBES, etc.) and to identify themselves as geographers.





## Recommendations

As a community, Australian geography focuses on solving issues and threats affecting the wellbeing of people and places in Australia and our Asia–Pacific neighbours. This strategic plan for the geographical sciences presents the state of geography as a discipline in Australia as well as providing a unified vision for Australian geography during the next decade as a discipline in Australia as well as providing a unified vision for Australian geography during the next decade.

As such, it offers a research, teaching and industry engagement framework strategically aligned with contemporary social, economic and environmental challenges of our region. Indeed, addressing the 21<sup>st</sup> century ‘wicked problems’ of sustainable development, climate change, regional development, environmental degradation and biodiversity loss, requires an increasingly whole of government, industry and academia approach. The breadth and depth afforded by geographical understandings to such problems places Australian geographers in a strong position to provide evidence-based research informing and advancing innovative policy and practice.

To this end, the Australian geography community invites policy-makers, senior managers in universities and research organisations, fellow academic and practicing geographers and interested members of the public to review the rich material covered in this strategic plan. Given the need for an integrated approach, we recommend the following:

- 1. Geography as a contributor to policy making.** Geography as a discipline could play a more significant role in facilitating and enabling complex, multi-sectoral policy decisions through integration of knowledge across natural and built environments, society and the humanities as well as providing unique perspectives of space, place and the environment. To enable this, it is recommended that:
  - 1.1.** The National Committee for Geographical Sciences and the IAG Council prepare a case for submission to the Australian Bureau of Statistics to amend the Fields of Research Codes and the Field of Education Codes to recognise geography as a discipline. The same parties also submit a case to the ARC for geography to be evaluated in the ERA as a single discipline, as in the United Kingdom.
  - 1.2.** Geographers work to increase recognition within politics, media, industry and universities of the significant contributions Australian geographers make to understand our environment, society and economy, and their crucial inter-relationships. Maintaining our integrated contributions across these three realms requires sustained investment in geographical research that aligns with government research priorities. We would also welcome more recognition of the work of Australian geographers in policy and strategic documents, and a greater number of scholarships for graduate geography students to pursue research in government priority areas.

**2. Geography in education and institutions.** Geography has a significant role in schools, universities, research organisations, government and industry. To enhance this role, and the contribution of the discipline to Australia's society and economy, there is an opportunity for geographers and other stakeholders to build the discipline and demonstrate its pivotal role in the wider academy, school curricula and community. To do so it is recommended that:

- 2.1. Tertiary geography programs investigate the experience of their employed graduates on the adequacy of the general capabilities they gained from their degree studies.
- 2.2. Geography academics, researchers, graduates, educators and the public geographical societies increase their collaboration to improve the visibility and integrity of the discipline.
- 2.3. The IAG Council and AGTA develop a short pamphlet and online resource promoting the various careers that geography graduates can work in, and distribute it to schools through the state, teacher associations, and other appropriate groups.
- 2.4. The National Committee for Geographical Sciences and AGTA write to the federal, state and territory Ministers of Education about the urgency of addressing 'out-of-field' teaching in geography.
- 2.5. The National Committee for Geographical Sciences work with the Academy and other stakeholders to explore the possibility of enhancing school geography education (for example, by encouraging or making compulsory geography study to Year 10).
- 2.6. Geography university degrees strive for a balance between physical and human geography and include topics that teach their inter-relationship.
- 2.7. Publicise and market the role of geography in integrating humanities and the sciences through various social and public media outlets to raise the importance of curriculum planning and funding.
- 2.8. The National Committee for Geographical Sciences and AGTA work with stakeholders to explore the options for geography to be recognised as partially a STEM subject.
- 2.9. AGTA and IAG explore ways to increase collaboration between school and university geographers.
- 2.10. Develop research capabilities to both enhance and capitalise on existing geographic skills and expertise in GIS and big data, as well as Asia-Pacific issues given the emergence of the 'China Century'.
- 2.11. The public societies and the IAG consider the feasibility of establishing public geographical societies in Victoria and Western Australia.
- 2.12. The Australian geographical organisations, including the societies, explore the benefits and feasibility of working together, both within jurisdictions and nationally.

**3. Geography in universities.** Geography is a core 21<sup>st</sup> Century discipline, but there is a lack of focus and consistency in approaches to teaching and supporting geography at tertiary levels. To address this issue and enable geography to achieve its full strategic impact, it is recommended that:

- 3.1. The National Committee for Geographical Sciences and IAG Council prepare a case to present to Vice-Chancellors on the arguments for increasing the visibility, identity and unity of geography.
- 3.2. Geography remain as a coherent unit within university structures, either within a college, or as a separate school or department.
- 3.3. The National Committee for Geographical Sciences and AGTA develop a submission to university Education program decision-makers about the need to improve both primary and secondary teacher training in geography.
- 3.4. Address the severe shortage of geographical education specialists in Australian universities.



Sea Cliff Bridge, Clifton, New South Wales.  
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