GEOGRAPHY BULLETIN

PLANET, PEOPLE & PROFIT

The Geography Teachers Association of NSW & ACT Inc.

Volume 52 No 1 2020

IN THIS ISSUE:

PROJECTS • REPORTS • RESOURCES • ARTICLES • REVIEWS

EXECUTIVE 2020

GEOGRAPHY BULLETIN

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Covers: Plastic pollution is a major issue for marine environments and wildlife such as sea turtles
Source: Shutterstock

The Geography Bulletin is a quarterly journal of The Geography Teachers' Association of New South Wales. The 'Bulletin' embraces those natural and human phenomena which fashion the character of the Earth's surface. In addition to this it sees Geography as incorporating 'issues' which confront the discipline and its students. The Geography Bulletin is designed to serve teachers and students of Geography. The journal has a specific role in providing material to help meet the requirements of the Geography syllabuses. As an evolving journal the Geography Bulletin attempts to satisfy the requirements of a broad readership and in so doing improve its service to teachers. Those individuals wishing to contribute to the publication are directed to the 'Advice to contributors' inside the back cover. Articles are submitted to two referees. Any decisions as to the applicability to secondary and/or tertiary education are made by the referees. Authors, it is suggested, should direct articles according to editorial policy.

GEOGRAPHY BULLETIN

Volume 52, No 1 2020

EDITOR: Lorraine Chaffer

CONTENTS

EDITORIAL

EDITORIAL

Welcome to the first edition of the Geography Bulletin for 2020. The theme of this edition is Planet, People and Profit. The articles selected to fit this theme are:

Planet

- ***Bushfires*** by Dr Grant Kleeman, a factual summary of the features of bushfires for primary teachers. This article links to the Primary Geography Alive resource on the GTA NSW & ACT Website.

People and Planet

- ***The Problem of an Aging Global Population*** by Katie Jones (Visual Capitalist) examines the social and economic consequences of ageing.
- ***Liveability Assessment Task*** by Drew Collins is an 'Investigative study through fieldwork into the liveability of a local area' for Stage 4
- ***Biomes Assessment Task*** by Alex Damo requires students to 'Create a sustainable ratings system for food or clothing'.

People, Profit and Planet

- ***How big should the economy be?*** by Jason van Tol looks at 'economic growth as a fundamental driver of the human actions that have not only initiated the degradation of many environmental functions, but continue to do so, since growth is enshrined worldwide in national government policy'
- ***Fight for the Bight*** by Linley Hurrell argues for the protection of the Great Australian Bight from oil drilling.

The remaining articles are linked to Planet, People and Profit through skill development and career pathways.

- ***Skill Development Using Graphic News*** by Lorraine Chaffer contains student activities for analysing a set of infographics GTA NSW & ACT is licensed to publish.
- ***Spatial Technologies Inside and Outside Your Geography Classroom*** by Lorraine Chaffer (originally published in the Centre for Professional Learning Journal) examines the requirement to incorporate Spatial Technologies into Geography K–10 classrooms
- ***Getting students excited about geography's real-world applications*** investigates surveying as a career pathway for geography students
- ***2019 Australian Geography Competition*** contains results by state and an analysis of NSW and ACT competition results.
- Australian Geography Competition Sample paper 2018

The Geography Bulletin Features

Appendices – Since 2019 student activities relevant to selected articles in each edition are provided as appendices published with each edition as PDF and editable Word documents. Members login to access full bulletins, separate articles and the appendices.

Hyperlinked articles – you can find hyperlinked articles by topic from past editions in this document on the GTA NSW & ACT website. Save time searching and download just the article you are looking for at https://www.gtansw.org.au/bulletin/a-guide-to-geography-bulletin-resources/

Lorraine Chaffer, Editor

COMING EVENTS

WEBINARS in TERM 2

Tuesday 9 June – STEM and Geography
Presenter: Kimberley Parnis

Thursday 18 June – Primary School Geography
Presenters: Gail Braiding and Theone Ellas

ONLINE LEARNING

Geography 102: Concepts 2 – A self-paced and timed professional learning opportunity. Flyer and registration link here https://drive.google.com/file/d/1LvHtUqDl_n4gnYYHu_DpzjS646cbuAbV/view

ANNUAL CONFERENCE

The Geography Learning Journey – 21, 22 and 23 May

Attend 1, 2 or 3 days for workshops and presentations for Primary, Years 7–10 and Stage 6. Visit the conference website for more details at https://ptcnsw.eventsair.com/2020-gta-conf/

GTA NSW & ACT have made the decision to postpone the Annual Conference. This is based on advice from the Australian Government against organised, non-essential gatherings of large groups in response to COVID-19. A new date will be set based on advice from health authorities as it becomes available. The venue may also need to change.

In the meantime, GTA NSW & ACT continues to offer support for Geography teachers through our website, journal, webinars and social media accounts.

Many thanks to the following organisations for supporting the Annual Conference 2020 through sponsorship.

Sydney Olympic Park (Conference tote bag and teacher scholarship), Sydney Water (Conference water bottles) and Australian Mobile Telecommunications Association (Thursday Keynote speaker)

NOTE: It is anticipated that most of the original program on the following pages will transfer to the new date and venue.

Please check the conference website for conference news, updated program and registration details https://ptcnsw.eventsair.com/2020-gta-conf/

EDITORIAL

DAY 1 THE GEOGRAPHY LEARNING JOURNEY: Shaping futures ANZ STADIUM, Sydney Olympic Park

Time	THURSDAY MAY 21st						
7.45 – 8.30	**REGISTRATION**						
8.30 – 8.45	Conference welcome and opening **GTANSW & ACT President**						
8.45– 9.30	Keynote address: **Associate Professor Rod Lane and Dr Jeana Kriewaldt: The Innovative Geography Educator** Brock Rowe and Jeff Conolly Award Presentation by sponsor (Australian Mobile Telecommunications Association)						
Movement break							
Presentations & Workshops	**Room tbc**	**Room tbc**	**Room tbc**	**Room tbc**	**Room tbc**	**Room tbc**	**Outdoor locations**
Session 1 60 minutes **9.40 – 10.40**	**1a. The Design Thinking process: Making real world connections with a capability driven curriculum** Manvir Singh, Nagiha Sahyouni, Chrystal Gonzalez: Doonside Technology HS	**1b. Unpacking the Geographical Tools Continuum in Programming and Assessment.** Alexandria Warnock GTA, Hunter Valley Gr.	**1c. Understand your world with Google MyMaps** Chris Betcher Google Australia	**1d. Adapting and preparing for a changing climate using the sustainable action process (SAP).** Julie Ann Sheridan Dr Aaron Coutts-Smith	**1e. GIS in the classroom: How to give your students the geographic advantage** Jake Lovejoy ESRI	**1f. Exploring 'Water in the World': a new research-based learning resource for Stage 4** Dr Kay Carroll Western Sydney Uni.	Early Morning Tea **1g. Fieldwork in Urban and Natural Environments at Sydney Olympic Park** Danielle Leggo This is a 3 hour in the field session to develop your fieldwork skills and capabilities. Return for lunch for your Session 4 choice Travel by bus to Bicentennial Park. Do not select a session 2 and 3 option
10.40 – 11.00	MORNING TEA						
Session 2 60 minutes **11.00 – 12.00**	**2a. Understanding environmental functioning: the key to management.** Lorraine Chaffer GTA	**2b Classroom Drone Essentials** Dr Karen Joyce She Maps Max 30 **This is a 2-hour practical workshop** Do not select a session 3 option	**2c Remove the walls of your classroom with Google Earth** Mr Chris Betcher Google Australia	**2d Surveying offers geography students a new horizon** Narelle Underwood Surveyor-General of NSW	**2e Using Geospatial Tools at a Regional and Global Scale** Mick Law Contour Education	**2f Challenging thinking and creating dialogue about Geography and STEM** Susan Caldis GTANSW & ACT	
Movement break							
Session 3 60 minutes **12.10 – 1.10**	**3a. The Design Thinking process: Making real world connections with a capability driven curriculum Rpt** Manvir Singh Nagiha Sahyouni Chrystal Gonzalez		**3c. Creating effective and engaging assessments through fieldwork** Donna Elias Willoughby Girls High Jaye Dunn Epping Boys High	**3d. Integrating Virtual Reality Teaching Tools into the Geography classroom –using ForestVR K-10** Ms Beth Welden Forest Learning	**3e The Big Issue Classroom: Discussions About Homelessness and Disadvantage** Melissa Kophamel Big Issue Classroom	**3f. Using GeoSTEM in a Project Based Learning Context** Kimberley Parnis Paramatta Marist High School	
1.10 – 1.50	LUNCH						Return for lunch
Session 4 60 minutes **1.50 – 2.50**	**4a. The revival of Aboriginal Cultural Burning practices to care for Country** Den Barber Koori Country Firesticks Aboriginal Corporation	**4b Map my school** Dr Karen Joyce She Maps	**4c Human wellbeing as a hands-on topic for kinaesthetic learners** David Proctor GTA, Willyama High School	**4d Fieldwork for a liveable, resilient and water sensitive city** Louise Roberts Sydney Water	**4e Storytelling with maps: An introduction to Story Maps** Jake Lovejoy ESRI	**4f Practical ways to incorporate numeracy skills into your geography lessons.** Cath Donnelly GTA Literacy & numeracy strategic Advisor, DoE	
Movement break							
Plenary 3.00 – 3.30	**GTA NSW & ACT President**						
Social event 4.30	Meet for drinks						

Continuous session Movement Break Main breaks – Morning tea and lunch Repeated session

DAY 2 THE GEOGRAPHY LEARNING JOURNEY: Shaping futures ANZ STADIUM, Sydney Olympic Park

Time	FRIDAY MAY 22nd						
7.30 – 8.30	**REGISTRATION**						
8.30 – 8.45 Members Room	**Conference opening and welcome** Day 2 **GTA NSW & ACT President**						
8.45– 9.30 (45 min) Members Room	**Keynote address: Sally Lawrence: Shaping the future: Building Cultural Capability within Teachers**						
Movement break							
Presentations & Workshops	**Room tbc**	**Room tbc**	**Room tbc**	**Room tbc**	**Room tbc**	**Room tbc**	**PRIMARY STREAM** Participants select stream Also suited to Special Education K-10
Session 5 60 minutes **9.40 – 10.40**	**5a Pedagogy Masterclass - 8 Aboriginal ways of Learning** Sally Lawrence Black Cockatoo	**5b. The revival of Aboriginal Cultural Burning practices to care for Country (Rpt)** Den Barber Koori Country Firesticks Aboriginal Corporation	**5c. Environmental change and different perceptions of land management.** Adam Harris Taronga Zoo	5d **Smart Farming and Sustainable food production in the digital age** Lee Hancock St Pauls College	**5e Environmental Children's Books- holistic assessment in the modern age.** Chris Tejcek St Columba Anglican School	**5f Collecting geospatial data in the field - there's an app for that!** Mick Law Contour Education	9.40 – 10.40 **Making Geographical Inquiry fun** Gaye Braiding Field of Mars Environmental Education Centre & NSW Schoolhouse Museum of Public Education Theone Ellas HSIE K-6 Advisor | Early Learning and Primary Education
10.40 – 11.00	**MORNING TEA**						
Session 6 60 minutes **11.00 – 12.00**	**6a Designing Great Learning** Summer Howarth The eventful Learning Co. **This is a 2-hour practical workshop** Do not select a session 7 option	**6b Urban Planning in the Classroom** Isabel Virgona Young Planners Committee (Planning Institute of Australia)	**6c Environmental change and different perceptions of land management. (Rpt)** Adam Harris: Taronga Zoo	**6d Rehydrate Australia! Landscape management practices using schematics and practical demonstrations** Peter Hazell The Mulloon Institute	**6e. Making Geography Sexy. Cross Curricula Project Based Learning** Lynne Strong PYIA Kris Beasley Centre of Excellence in Agricultural Edu.	**6f. Google Expeditions: The Next Best Thing to Being There** Mr Chris Betcher Google Australia	11.00-11.30 **Embedding Aboriginal Pedagogies into your Professional Practice - Uncle Ernie's Framework and Our Land, Our Stories** Sally Lawrence: Black Cockatoo
							11.30 – 12.00 **Using geospatial in the Primary classroom - it's easier than you think!** Mick Law: Contour Education
Movement break							12.00 – 12.30 **Practical ways to incorporate more numeracy into geography lessons** Catherine Donnelly: Literacy & Numeracy Strategy Advisor DoE
Session 7 60 minutes **12.10 – 1.10**		**7b. Factors which influence pedagogical practice amongst pre-service Geography teachers** Susan Caldis GTANSW & ACT Macquarie University	**5c Fieldwork in school grounds: focus on 8 ways of learning for place and liveability** David Proctor GTA, Willyama High School	**7d. Soils Alive! Regenerating soil and landscape processes for both farm production and environmental outcomes** Luke Peel The Mulloon Institute	**7e The Big Issue Classroom: Discussions About Homelessness and Disadvantage (Rpt)** Melissa Kophamel Big Issue Classroom	**7f Liveability: A topic to connect us all** Adrian Shipp Trinity Grammar School	12.30 – 1.10 **Resources & Opportunities** Sydney Water Hawksbury Nepean Resource PYIA
1.10 – 1.50	**LUNCH (all participants will attend the afternoon session)**						
Members Room 60 minutes **2.00 – 3.00**	**Keynote address: TBC** **APA Awards Presentation for First Place competition winners**						
3.00 – 3.30 Plenary	**GTANSW & ACT President**						

DAY 3 THE GEOGRAPHY LEARNING JOURNEY: Shaping futures NOVOTEL, SYDNEY OLYMPIC PARK

Time	**SATURDAY MAY 23rd**		
8.00 – 8.30	**REGISTRATION**		
8.30 – 8.40	**Conference opening** and Welcome Day 3 Stage 6 **Susan Caldis: GTA NSW & ACT President**		
8.40– 9.30	**Keynote address**: **Ivan Motley. Id. Population experts: Higher Density Living, Australian Cities Grow Up.** Top 10 HSC Examination Achievers Presentation by Ivan Motley		
9.30 – 9.50	**MORNING TEA**		
Presentations & Workshops	**HSC Marking, assessment & Skills Workshops**	**By teachers, For teachers Stream**	**Expert Stream: For deeper knowledge and understanding**
Session 60 minutes OR 2 x 30 minutes **9.50 - 10.50**	**1a. HSC Marking Practices and Skills** GTA Team led by Sharon McLean **This is a 2-hour practical workshop**	**1b. Embedding spatial technologies into your Stage 6 Geography course - now is the time!** BYOD Mick Law: Contour Education	**1c. Climate change and the Anthropocene** Dr Jessica McLean: Macquarie University *All topics
Movement break		**Movement break**	**Movement break**
Session 2 60 minutes OR 2 x 30 minutes **11.00 – 12.00**	Max 30 participants Do not select for session 2	**2b. Introduction to Stage 6: Double presentation** **a. Introduction to Stage 6 for new Geography teachers** Rex Cooke / St Ignatius College Riverview **b. Quality Assessment and feedback in Stage 6 Geography**. Cath Donnelly: GTA & DoE	**2c. Earths Biomes and Climate - Integrated Systems thinking and why Geography is the key to solutions** Luke Peel: The Mulloon Institute *Biophysical interactions *Ecosystems at Risk
12.00 – 12.45	**LUNCH**		
Session 3 60 minutes OR 2 x 30 minutes **12.50 – 1.50**	**3a. Trouble shoot your Stage 6 skills** GTA Team led by Drew Collins / Newcastle Grammar School Small group or 1 on 1 assistance using a specially prepared Skills Workbook	**3b. Teaching Year 11: Double presentation** **a. Teaching and Assessing the Senior Geography Project** Alexandria Warnock GTA / Hunter Valley Grammar **b. Population Geography and Development Geography**: **Connected Learning** Paul Batten GTA / Waverley College	**3c. Techniques in Geography** **Making informed decisions and being influential** Ivan Motley: id. (informed decisions) *Population *Urban Places
Movement break	**Movement break**	**Movement break**	**Movement break**
Session 4 60 minutes OR 2 x 30 minutes **2.00 – 3.00**	**4a. Using RAP data for evaluating teaching and learning and modifying teaching practice** GTA Team led by Alex Warnock / Hunter valley Grammar School	**4b. Teaching Year 12: Double presentation** **a. Lining up your HSC Case studies with a difference** Matt Carroll & Ana Riley: Cranbrook school **b. Evaluating sustainability** Louise Swanson: GTA / Sydney Secondary College	**4c. Seaweed production as a socio-economic enterprise aligned with the principles of a circular economy** Dr Pia Winberg: Venus Shell Systems *Economic Activity *Economic enterprise *Development

PRESIDENT'S REPORT

Welcome everyone to a new year of teaching Geography. I am sure that recent environmentally focused events occurring across Australia together with events focused on the human and more-than-human species have provided much to consider with our students in the context of appropriate action and possible, predicted and preferred futures.

As the incoming President for GTANSW&ACT in 2020, I would like to use this report to acknowledge key people and events, and to also set the scene for the year ahead with the Association.

The 2019 Annual General Meeting (AGM) occurred on 27 November and a couple of changes to the Executive and Council occurred. The full list is available within the Bulletin and on the Associations' website, however, there are some points requiring particular mention.

At the AGM, Lorraine Chaffer was constitutionally required to step down from her role as President, having completed a 3 year term (Oct 2016 – Nov 2019). Personally and professionally I'd like to thank Lorraine for her vision, leadership, and her tireless work in making the vision become a reality for the Association and for geography education in NSW. All on Council and all who are involved in the teaching of Geography have benefitted from Lorraine's wisdom and expertise regardless of our career stage and context.

It is a privilege to lead the Association as President and to do so for the second time (having previously held this role from Oct 2013 – Oct 2016). I am very much looking forward to the work ahead in progressing the profile of Geography within schools and beyond. It is exciting to be able to share this work with the GTA NSW&ACT Executive and Council who are an inspiring and hardworking group of Geography educators, held in high regard by their peers.

The GTA NSW&ACT Council remains strong with reach across the ACT and regional NSW, including the Far West, Riverina and Hunter regions. New Councillors were welcomed to the team for 2020, Katerina Stojanoski and David Proctor.

You may have noticed by now, the abbreviation used for the Association has changed slightly. In January, notification came through about the formal change of nomenclature for the Association: the *Geography Teachers Association of NSW and ACT* (GTA NSW&ACT). Michael da Roza is the ACT representative and work is underway to determine how the Association can more specifically cater for ACT members.

December and January also provided a key moment of consideration as to how best the Association can respond to and act upon the unprecedented bushfire activity occurring across Australia but particularly across NSW and ACT. On 16 January 2020, the Association released *A public statement of support to NSW and ACT Geography teachers in fire affected communities;* the statement is available from our website and was circulated via social media and email. Within the statement there is an outline of assistance the Association intends to provide throughout the year together with a reminder about how the study of geography contributes to a reasoned understanding about the occurrences of such events and their effects on communities. I would like to extend specific thanks to the Executive: Sharon MacLean, Louise Swanson, Lorraine Chaffer, Dr Grant Kleeman and Alexandria Warnock for working with me on this important piece during the holiday period.

The Hon. Sarah Mitchell, Minister for Education and Early Learning with Lorraine Chaffer, recipient of the prestigious PTC NSW Exceptional Service Award for 2019.

PRESIDENT'S REPORT

Alexandria Warnock receives her Outstanding Professional Service Award from Dr Denis Mootz, President of PTCNSW

February marked a significant occasion for two members of our Council. At the Awards Night of the Professional Teachers Council of NSW (PTCNSW): Alexandria Warnock received an award from GTA NSW&ACT for *Outstanding Service to the Profession;* and Lorraine Chaffer received an award from the Board of PTC NSW for *Exceptional Service to the Profession*. Both Alexandria and Lorraine have contributed their time and expertise to the Association and geography education within and beyond their school gates. Acknowledging and celebrating the success of colleagues is important and it is wonderful to see their work recognised.

In looking ahead, whilst it is important to ensure the Association caters specifically for the needs of Geography teachers in NSW and ACT, it is also important to ensure we do so in alignment with the bigger picture of and for the discipline of Geography. The Decadal Plan for Geography, Geography: Shaping Australia's Future released about 14 months ago by the National Committee of Geographical Sciences, offers a framework for engaging research, teaching and industry that aligns strategically with contemporary social, economic and environmental challenges of our region. Chapter 13 is targeted at Geography in Australian Schools and there are key recommendations to ensure the future of Geography flourishes within the school education context. A couple of the recommendations will become a particular focus for the Association over the next 12 months, and whilst I am not permitted to elaborate at the current time, I am hopeful to be able to provide further clarity and direction within the next issue of the *Geography Bulletin*. In the meantime I encourage you to download and read Geography: Shaping Australia's Future https://www.science.org.au/files/userfiles/support/reports-and-plans/2018/geography-decadal-plan.pdf as part of your professional reading and if time is tight, please ensure you have a read through Chapters 1, 2 and 13.

Wishing you all an enjoyable Term 1 and I look forward to our paths crossing in various forms.

Susan Caldis

President, GTA NSW&ACT

NESA ENDORSEMENT

Geography Teachers Association of NSW & ACT through the Professional Teachers' Council NSW – is endorsed to provide the NSW Education Standards Authority (NESA) Registered Professional Development for teachers accredited at Proficient, Highly Accomplished, and Lead levels.

Completing the **GTA NSW & ACT Annual Conference 2020 Day 1**, on **21 May 2020** will contribute **5 hours 30 minutes** of NSW Education Standards Authority (NESA) Registered PD addressing **6.2.2; 7.4.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

Completing the **GTA NSW & ACT Annual Conference 2020 Day 2**, on **22 May 2020** will contribute **5 hours 30 minutes** of NSW Education Standards Authority (NESA) Registered PD addressing **6.2.2; 7.4.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

Completing the **GTA NSW & ACT Annual Conference 2020 Day 3 Stage 6**, on **23 May 2020** will contribute **5 hours** of NSW Education Standards Authority (NESA) Registered PD addressing **6.2.2; 7.4.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

Bushfires

Dr Grant Kleeman, GTA NSW & ACT

Introduction

Humans have always tried to control the environment. With the aid of technology people can move mountains, clear vast forests, change arid lands into fertile fields and alter the flow of rivers.

There are, however, elements of our surroundings that remain beyond our control. From time to time, nature reminds us of its power. Extreme events within natural environments can devastate whole communities, disrupt communications and cause economic hardship.

We cannot control these forces, but we can study the processes that cause them. This allows us to better predict extreme events and enables us to develop ways of better coping with their effects.

Natural disasters

As we go about our daily lives it is easy to forget that our natural environment contains threats to human life and property. These extreme and unusual events are called natural hazards. They include major disturbances in the atmosphere and on the earth's surface. Australia's most common natural hazards include storms, cyclones, floods, droughts and bushfires. When natural hazards affect people, they are termed 'natural disasters'.

Defining bushfires

'Bushfire' is an Australian word used to describe any fire burning out of control. In other countries the term 'wildfire' is used to describe such an event.

In Australia, bushfires occur as forest fires (bushfires with the trees, undergrowth and litter on the forest floor as the main fuel) and grass fires (bushfires with grass as the main fuel). Large areas of Australia suffer from the threat of bushfires, especially in the eucalypt forest and woodlands of the south-east and south-west corners of the continent.

Disasters, such as those listed in Table 1, have placed bushfires high on our country's list of natural hazards.

Table 1: Australia's five deadliest bushfires

Bushfire event	Loss of life and property
Gippsland fires and Black Sunday February–March 1926	60 people killed
Black Friday (Victoria) January 1939	71 people were killed and 650 homes destroyed
Black Tuesday (Tasmanian) 1967	62 lives lost and over 1,300 homes destroyed
Ash Wednesday (Victoria and South Australia) February1983	75 people and 2,500 homes were destroyed
Black Saturday (Victoria) February 2009	173 killed and more than 2000 homes destroyed.

Figure 1: Bushfire risk zones in Australia

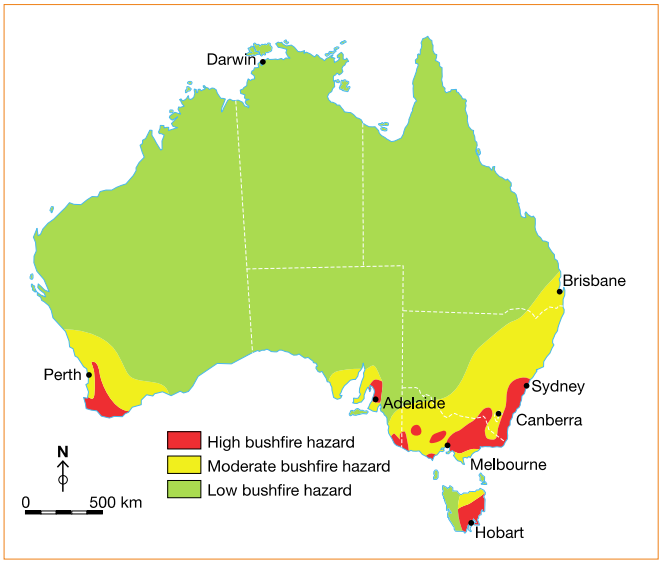
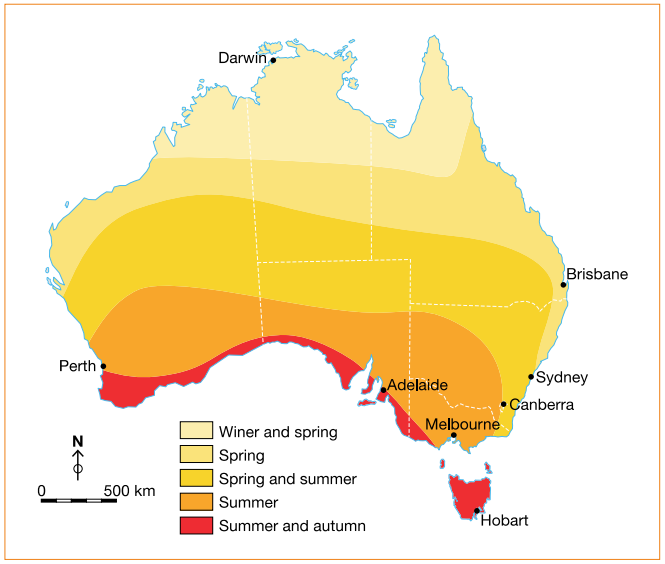


Figure 2: Bushfire seasons in Australia



The conditions under which bushfires occur

Fuel and ignition

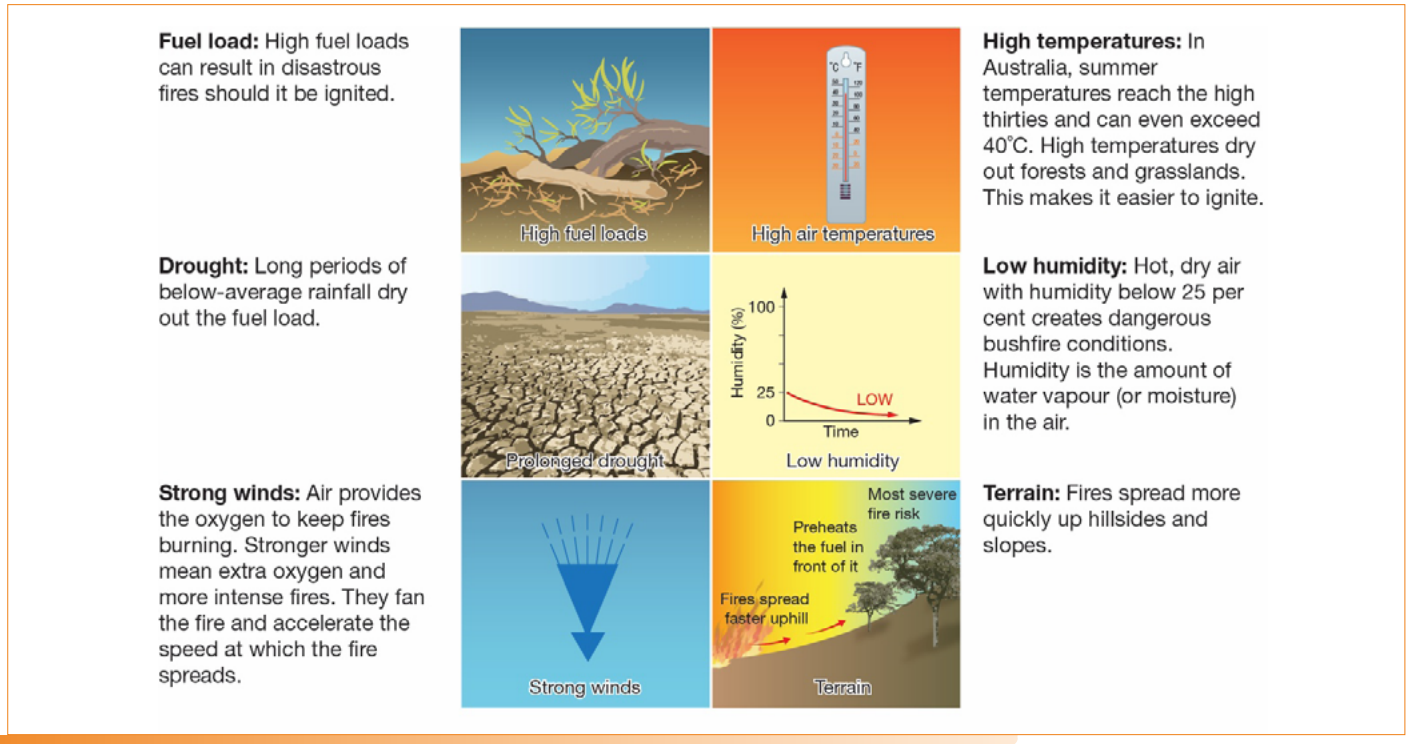
For a bushfire to start there needs to be material that can burn (referred to as fuel), and a source of ignition:

- **Fuel:** The fuel is the material that builds up in the bush over time as eucalypt trees shed their bark, branches and leaves. In the cooler months 'hazard reduction' burns are used to reduce the amount of fuel on the forest floor.
- **Ignition:** Bushfires are a natural event in Australia and can be triggered by a lightning strike. They can also be lit deliberately (called arson) or be the result of an accident.

Factors affecting the spread of bushfires

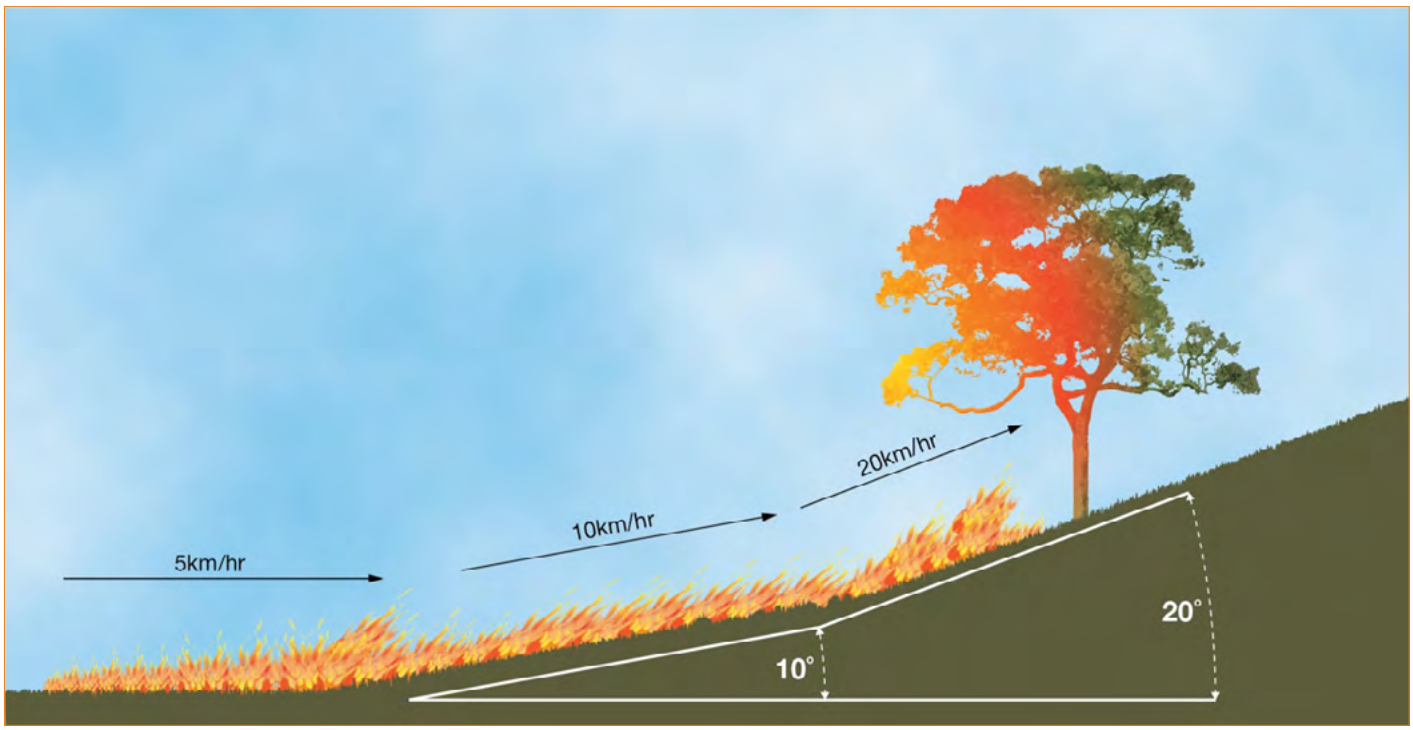
The speed at which a bushfire spreads is determined by a number of factors. These are shown in Figure 3. A combination of these factors has resulted in 'blow-up days' when Australia's most severe bushfires burn out of control and spread rapidly.

Figure 3: Factors affecting the spread of bushfires



The relationship between slope and the speed of bushfires

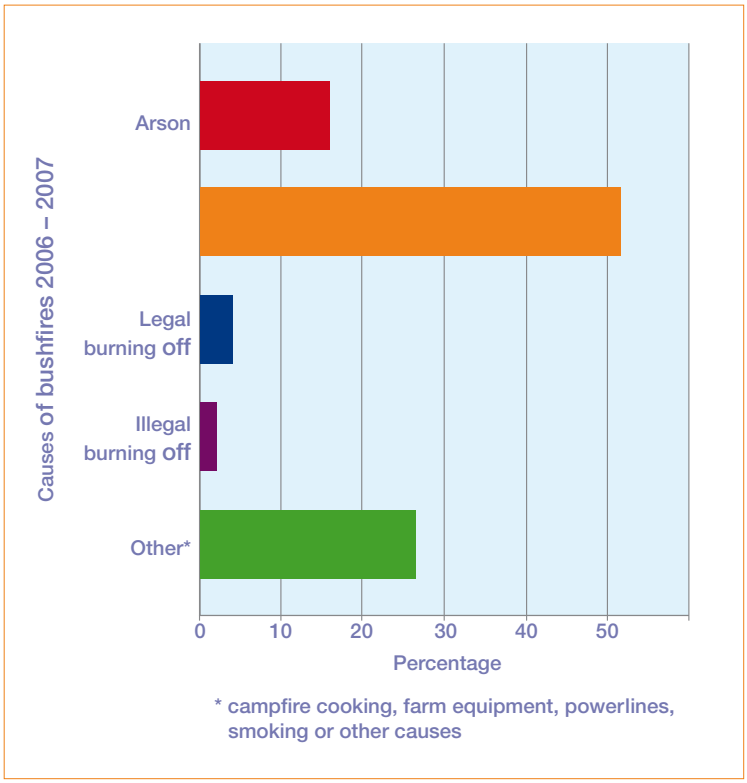
Figure 4: The speed of a fire increases with the steepness of a slope



Bushfire causes

Figure 5 shows the causes of bushfires in Australia. Lightning strikes are the main cause followed by 'others' (campfires, fallen power-lines and cigarette smokers). Arson (the deliberate lighting of fires) is the third most common cause.

Figure 5: The causes of bushfires

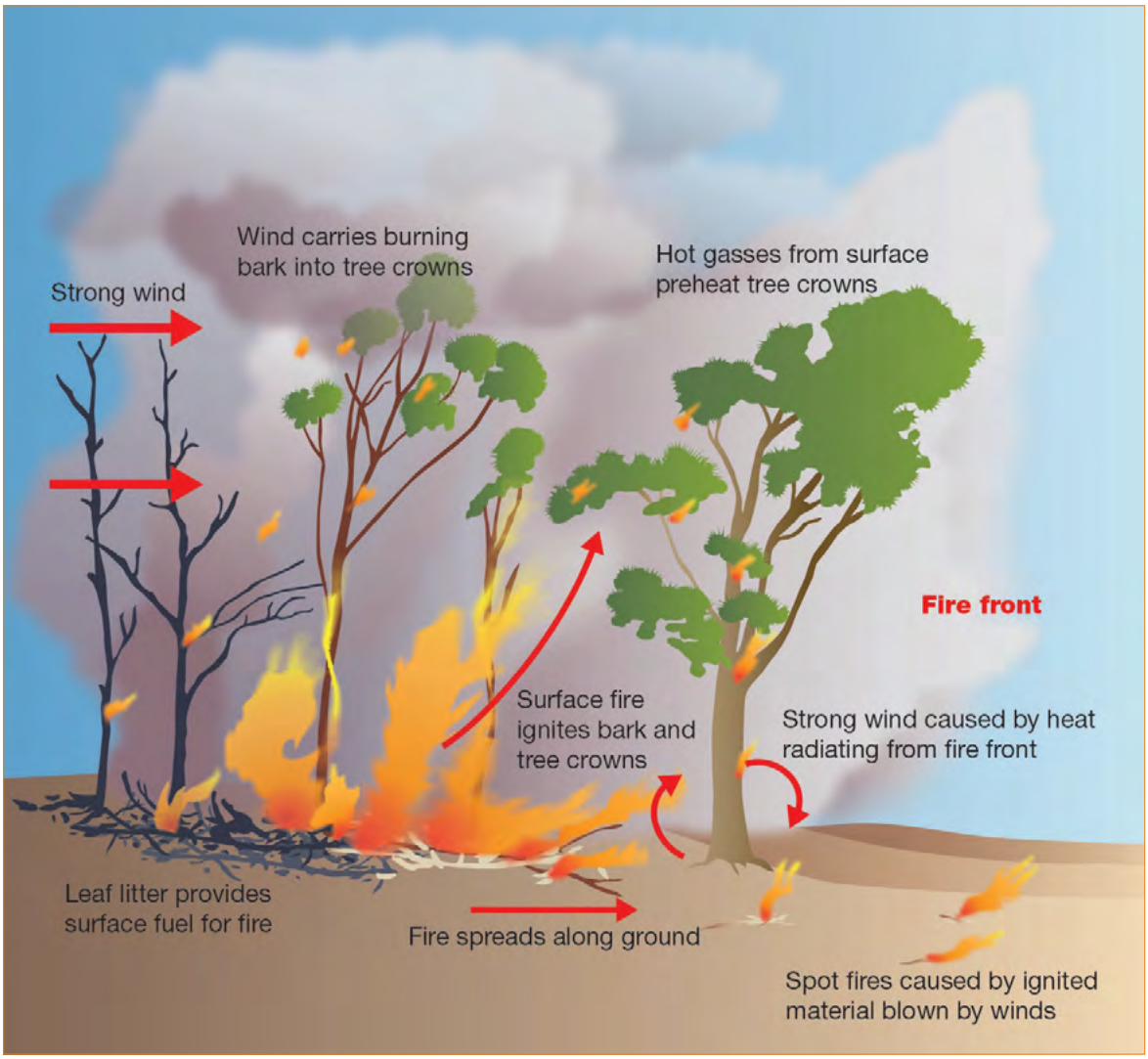


Xanthorrhoea (grass tree) during fire event Source: Wikimedia Commons

The way bushfires move

Figure 6 shows the way in which bushfires move across the land. Study the diagram carefully to identify the key factors driving the progress of the fire.

Figure 6: The movement of bushfires



Fire front moving across a mountainous environment towards a settlement. Source: Shutterstock

BUSHFIRE ATTACK

Bushfires are a threat to life and property in a number of ways, these include:

- **The fire front.** The flames of the fire front (the leading edge of a blaze) ignite anything flammable with which it comes into contact. The most dangerous of all fire fronts is one that burns in the crowns, or tops, of trees (called a running crown fire). In eucalypt forests, bushfires can advance at alarming speeds through the upper layers of the forest. The tops of the trees often appear to explode as the fire roars through. On hot days the oils in eucalypt leaves pass into the atmosphere as a vapour. This vapour is quite flammable. The trees themselves do not explode; instead, it is the oil-rich vapour given off by the leaves that ignites in a fireball.

Figure 7: Fast moving fire front

- **Ember attack.** Even if the fire front itself never reaches where you are, spot fires can break out well ahead of the advancing blaze when hot embers fall from the sky. Embers are burning leaves, bark, and small pieces of wood from tree branches. They can be carried great distances by strong winds. Ember attack can occur before or during a fire and for a long period after the main fire has passed.

Figure 8: Ember attack and spot fires

- **Heat.** The amount heat coming from a large fire can be extreme. It can melt metal and boil water in tanks. It may last for only a few minutes as the fire front passes, but can last much longer when large logs, branches, grass tussocks and stump holes continue to burn and smoulder.

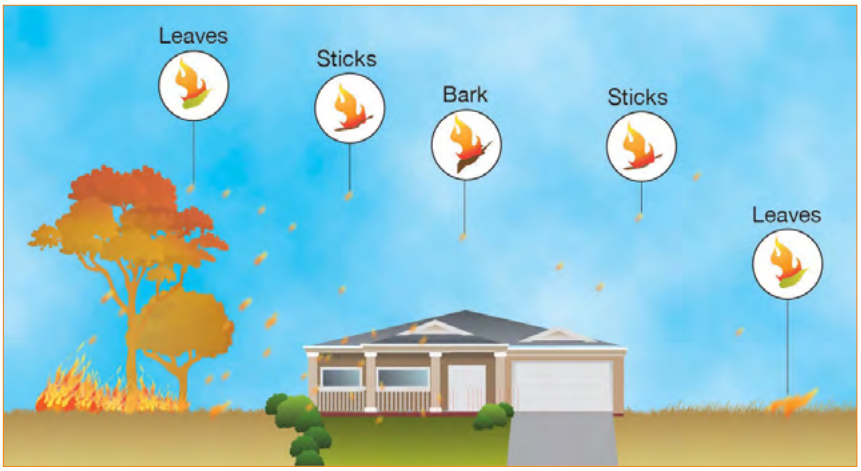


Figure 9: Radiant heat can kill living things and damage property

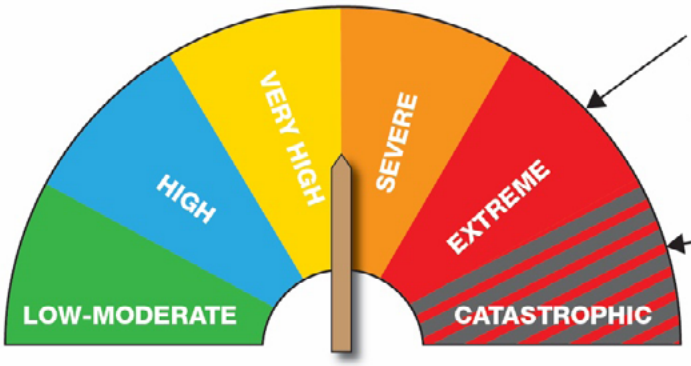
- **Wind.** Strong winds usually accompany a bushfire. They fan the fire by delivering more oxygen to it, as well as carrying the embers of the fire over great distances.

Fire Danger Ratings

The Bush Fire Danger Ratings are based on possible impacts of a fire, if one was to start.

Fire authorities base the rating on forecast conditions such as temperature, humidity, wind and the dryness of forests and grasslands.

The higher the fire danger rating, the more dangerous the conditions.



These are very hot, dry and windy conditions for a bush or grass fire. If a fire starts and takes hold, it will be unpredictable, move very fast and very difficult for fire fighters to bring under control. Spot fires will start and move quickly. Embers may come from many directions.

These are the worst conditions for a bush or grass fire. If a fire starts and takes hold, it will be extremely difficult to control.

What you should do

- For your survival, leaving early is the only option.
- Leave bush fire prone areas the night before or early in the day – do not just wait and see what happens.
- Make a decision about when you leave, where you will go, how you will get there and when you will return.
- Homes are not designed to withstand fires in catastrophic conditions so you should leave early.

- Leaving early is the safest option for your survival.
- If you are not prepared to the highest level;, leave early in the day.
- Only consider staying if you are prepared to the highest level – such as your home is specially designed, constructed and modified, and situated to withstand fire, you are well prepared and can actively defend if a fire starts.

- Leaving early is the safest option for your survival.
- Well-prepared homes that are actively defended can provide safety – but only stay if you are physically and mentally prepared to defend in these conditions.
- If you're not prepared, leave early in the day.

- Review your bushfire survival plan with your family. Keep yourself informed and monitor conditions. Be ready to act if necessary.

Surviving Bushfires

It is not always the flames or the smoke that presents the greatest danger in a bushfire. The scorching radiant heat is often just as deadly. This invisible heat surrounds the flames and scorches plants, animals and people caught in its path.

Some of the best ways to increase your chances of survival if you are caught in the path of a rapidly approaching bushfire are listed in Figure 10.

Figure 10: Bushfire survival guide

Personal survival (indoors)

- Wear as much cotton or woollen clothing as possible; avoid wearing cloths made from synthetic-fibres.
- Crouch or lie down on the floor of a room that is away from the approaching fire; the air close to the ground contains less smoke.
- Take as many of the precautions shown in Figures 12 or 13 as is possible in the time available.
- The fire front and its radiant heat usually pass in two to four minutes. Even if the house is set alight, it is safer to stay indoors until the fire front has passed.

Personal survival (outdoors)

- Don't panic. Find the clearest or most open area. Move across-slope, away from the fire-front, then down-slope towards the rear of the main fire front. Don't try to outrun a fire, or go uphill, or through even low flames unless you can clearly see a safe area close by.
- If possible, lie down in a depression in the ground, a pond or dam, or cover yourself with loose earth or rocks. Thick, woollen clothing or a woollen blanket offers some protection from the radiant heat. DO NOT take shelter in a tank of water.
- If in a car, park by the roadside in the clearest area possible. Stay in the car, wind up the windows and put on the headlights. Crouch down and shelter under a rug, floor mat or anything similar that is available. See Figure 11.

Figure 11: Bushfire survival in vehicles

Position the car to minimise exposure to radiant heat. You can do this by parking away from dense bush – try to find a clearing; parking behind a barrier such as a wall or rocky outcrop if one is available; and face the car towards the oncoming fire front.

Park off the roadway and turn hazard lights on. Car crashes are common in bushfires due to poor visibility.

Turn the engine off.

Call Triple Zero 000. Give them your name and location.

Stay in the car, and tightly close windows and doors.

Drink water to prevent dehydration.

Shut all vents and turn the air conditioning off.

Curl into a ball and get down on the floor – below the window line. Cover up with woollen blankets if available.

Once the fire front has passed you need to get out of your vehicle. Move to burnt ground, but stay close to your vehicle and wait for help.

Protecting your home

There are also steps you can take to prepare your home in the case of an approaching bushfire. These are shown in Figures 12 and 13.

Figure 12: Protecting your home – a suburban property

1 Clear leaves from gutters and cut back overhanging vegetation

2 Seal any openings under the house or eaves. Fit wire screens to doors, windows.

3 Keep lawns and shrubs trimmed. Rake up leaves.

4 Install a non-electric-driven sprinkler system that uses water stored in swimming pools and/or tanks.

5 Ensure that hoses are in good order and long enough to reach all parts of the property.

6 Wear clothing as described in Figure 10: Bushfire Survival Guide.

7 Block downpipes and fill gutters with water. Hose down the house and surrounding areas.

8 Maintain a minimum two-metre gap between your house and tree branches. Make sure that no trees overhang the house.

9 Turn on sprinklers. Remove all flammable substances, such as gas cylinders and paints, from around the house.

10 Make sure that everyone (including pets) is inside.

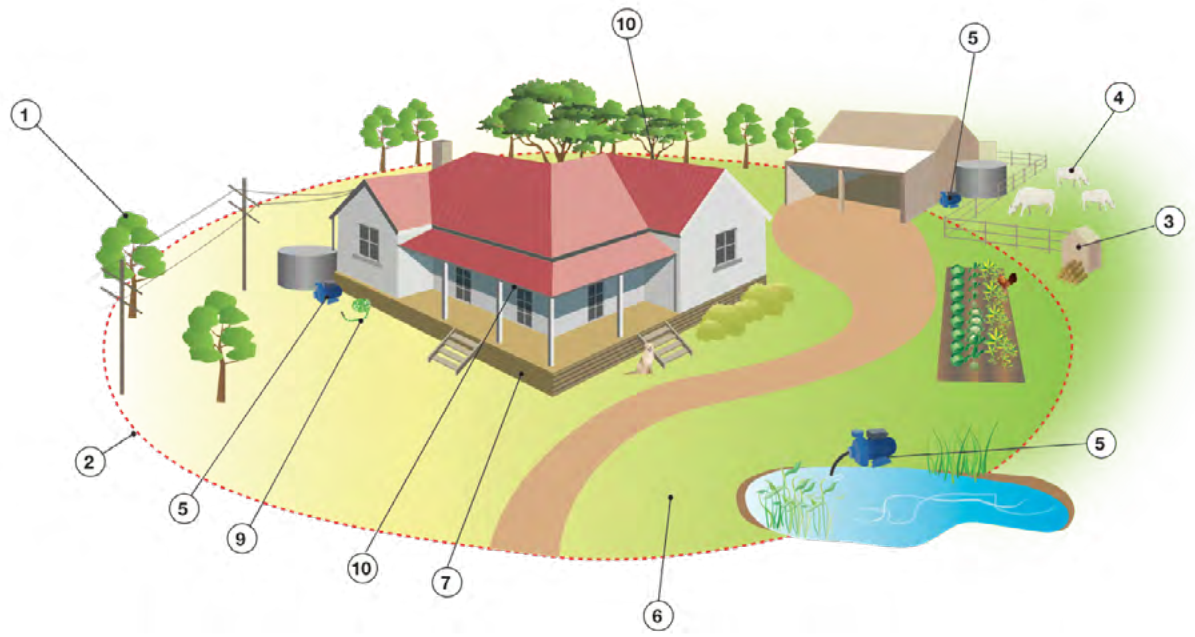
11 Put wet towels against spaces under doors. Close all windows, curtains, blinds and doors. Fill buckets, basins, baths and sinks with water to put out spot fires.

12 Install metal (rather than timber) fencing that shields the property from an advancing fire-front.

13 Store wood, gas, petrol and oil-based paints well clear of the house.

14 Keep ladders handy for roof access (inside and out).

Figure 13: Protecting your home – a farm-based property



1 Trim tree branches away from power lines
2 Create a firebreak around the homestead and other farm buildings
3 Store firewood, petrol and gas well away from the house
4 Move livestock to a well grazed paddock
5 Use a diesel powered pump to access water from farm dams, water tanks and swimming pools
6 Keep lawns short and shrubs away from farm buildings
7 Seal underfloor spaces to prevent embers entering
8 Install gutter guards and keep gutters clear of leaf litter
9 Have a hose ready to put out spot fires
10 Block downpipes and fill gutters with water. Hose down the house and surrounding areas.

Being a responsible citizen

There are things you can all do to make sure that we act as responsible citizens in times of bushfire emergencies.

These include:

- making sure that you obey all total fire bans. At all other times, never light a fire without adult supervision
- checking to see that your family has a bushfire emergency plan
- leaving the house when advised to do so by authorities
- ensuring that any elderly and/or disabled neighbours are taken care of.

Community information campaigns

Community awareness is critical to any bushfire emergency. During a bushfire emergency community briefings are held on a regular basis. Letterbox drops of Community Information Updates are also used to keep people informed. Phone-based warning systems are activated and the media is used to provide the public with information.

Note from the Editor

A teaching program and series of lessons on Bushfires using this material is a part of the GTA NSW & ACT resource ***Primary Geography Alive.***

This resource can be found on the GTA NSW & ACT website and is freely accessible to all primary teachers, as is membership of GTANSW & ACT – www.gtansw.org.au

How to Make Change

A Whitlam Institute Civics Education Program

The Whitlam Institute's civics workshops combine a "unique understanding and practice of civics education with the philosophy of positive social change". PROFESSOR MURRAY PRINT, UNIVERSITY OF SYDNEY

In a complex, rapidly changing and technology-rich world, students are increasingly exposed to local challenges as well as those facing Australia and the world.

How to Make Change equips high school students with the skills to engage with democracy, to empower them to take their place in democratic society and meet challenges with confidence. Through a series of thought-provoking and interactive activities, students are encouraged to reflect on their civic rights and responsibilities, and critically and creatively consider how they can become active and informed citizens.

Compelling contemporary examples of civic participation help students to gain an understanding of the value and importance of their voice in contributing to social change.

How to Make Change is available as an incursion, delivered offsite at schools, or by attending onsite workshops in our dedicated learning space at the Whitlam Institute in the Female Orphan School at the Parramatta South campus of Western Sydney University.

Workshops are available as both a full or part day program, consisting of multiple modules that can be selected and adapted to suit individual school or class needs. A sample workshop could include:

Rights & Responsibilities
Students discuss universal human rights and the things we need to thrive in a society. Exploring the Universal Declaration of Human Rights, they consider Australia's role in upholding human rights nationally and globally.

Secret Ballot
Students explore democratic processes and the importance of enfranchisement by participating in an anonymous vote on contemporary issues.

Public Vote
Students practice their political skills by participating in a group debate to express their opinions and attempt to persuade their peers on a range of issues.

Curriculum Connections

How to Make Change supports the Australian Curriculum Civics and Citizenship content for stage four and five, and the NSW 'learning across the curriculum' objectives for Civics and Citizenship.

Australian Curriculum Key Inquiry Questions:
What are the freedoms and responsibilities of citizens in Australia's democracy?
What are the features of a resilient democracy?
How is Australia's democracy defined and shaped by global context?
How are government policies shaped by Australia's international legal obligations?
NSW Curriculum Links:
Stage 4: ACHCK052, ACHCK056, ACHCK062, ACHCS074, ACHCS074
Stage 5: ACHCK076, ACHCK079, ACHCK094, ACHCE098, ACHCS102, ACHCK091, ACHCK099

Program cost: Full day rate $15
The Whitlam Institute seeks to maximise access to this program, and can work with your school on the arrangements for your visit. As a not-for-profit organisation, we consider student numbers and other program elements to facilitate access for students.

WESTERN SYDNEY UNIVERSITY

Whitlam Institute
WITHIN WESTERN SYDNEY UNIVERSITY

whitlam.org/education
civicseducation@whitlam.org
02 9685 9210

Inspiration waits in the Female Orphan School (1813)

Students attending How to Make Change workshops on-site wi l enjoy exploring the home of Whitlam Institute, the Female Orphan School.

Built in 1813, this building has a tumultuous history. First opened as the Female Orphan School, it became the Protestant Orphar School, before becoming Rydalmere Psychiatric Hospital. After decades as a mental health facility the building was left abandoned and fell into disrepair, but was painstakingly restored to become the home of the Whitlam Institute.

Students will be fascinated by the tour of the building's history, when they will be invited to put themselves in the shoes of those people who passed through this building.

A Changing Australia: The Time of Gough Whitlam

Our on-site exhibition explores the election and achievements of the Whitlam Government, a time of rapid social change in Australia.

Students will find out how many of the building blocks of life in modern Australia – like a Medicare card, or sewerage in Western Sydney – came about through Whitlam Government policy changes.

Images, audio, video and items from the Prime Ministerial Collection help immerse the students in this brief but frenetic period of social change, highlighting the ways in which the issues that they as citizens care about can influence the election of governments - and those governments can enact change.

"Insightful and highly relevant to the students, it allowed them to reflect on broad societal issues and make meaningful connections to their experience."

- Teacher feedback on How to Make Change

WESTERN SYDNEY UNIVERSITY

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The Problem of an Aging Global Population, Shown by Country

Katie Jones

Published in Visual Capitalist January 15, 2020

Link to online article https://www.visualcapitalist.com/aging-global-population-problem/

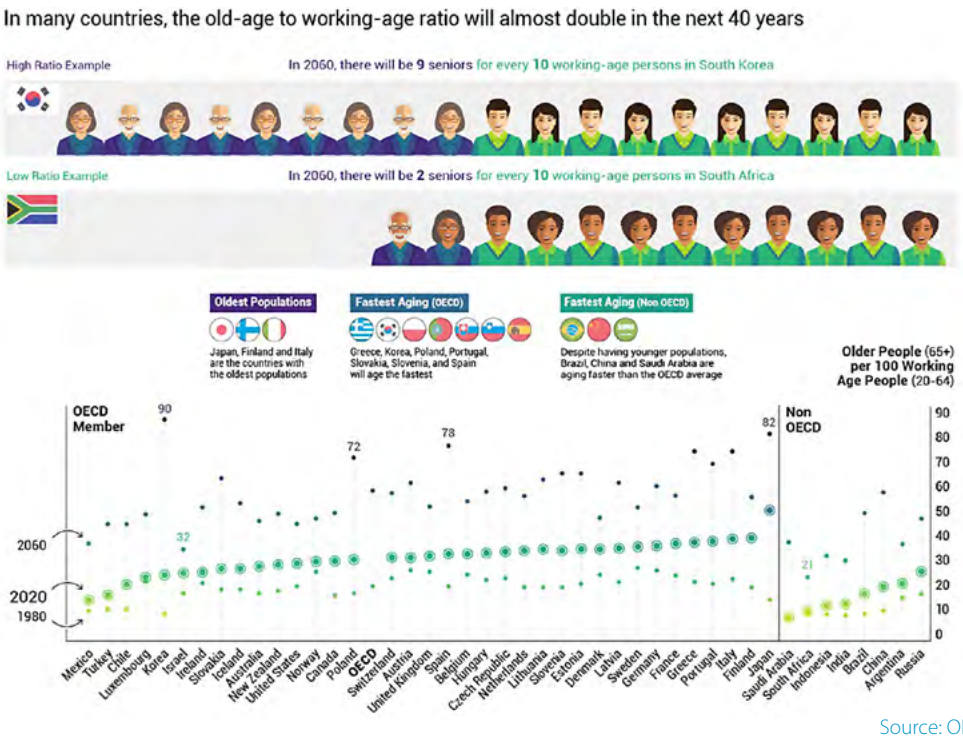
The Implications of an Aging Population

The world is experiencing a seismic demographic shift—and no country is immune to the consequences.

While increasing life expectancy and declining birth rates are considered major achievements in modern science and healthcare, they will have a significant impact on future generations.

Today's graphic relies on OECD data to demonstrate how the old-age to working-age ratio will change by 2060, highlighting some of the world's fastest aging countries.

Figure 1: The Rising Ratio



Source: OECD

The Demographic Debacle

By 2050, there will be 10 billion people on earth, compared to 7.7 billion today—and many of them will be living longer. As a result, the number of elderly people per 100 working-age people will nearly triple—from 20 in 1980, to 58 in 2060.

Populations are getting older in all OECD countries, yet there are clear differences in the pace of aging. For instance, Japan holds the title for having the oldest population, with a third of its citizens already over the age of 65. By 2030, the country's workforce is expected to fall by 8 million – leading to a major potential labour shortage.

In another example, while South Korea currently boasts a younger than average population, it will age rapidly and end up with the highest old-to-young ratio among developed countries.

A Declining Workforce

Globally, the working-age population will see a 10% decrease by 2060. It will fall the most drastically by 35% or more in Greece, Japan, Korea, Latvia, Lithuania, and Poland. On the other end of the scale, it will increase by more than 20% in Australia, Mexico, and Israel.

Israel's notably higher increase of 67% is due to the country's high fertility rate, which is comparable to "baby boom" numbers seen in the U.S. following the second World War.

As countries prepare for the coming decades, workforce shortages are just one of the impacts of aging populations already being felt.

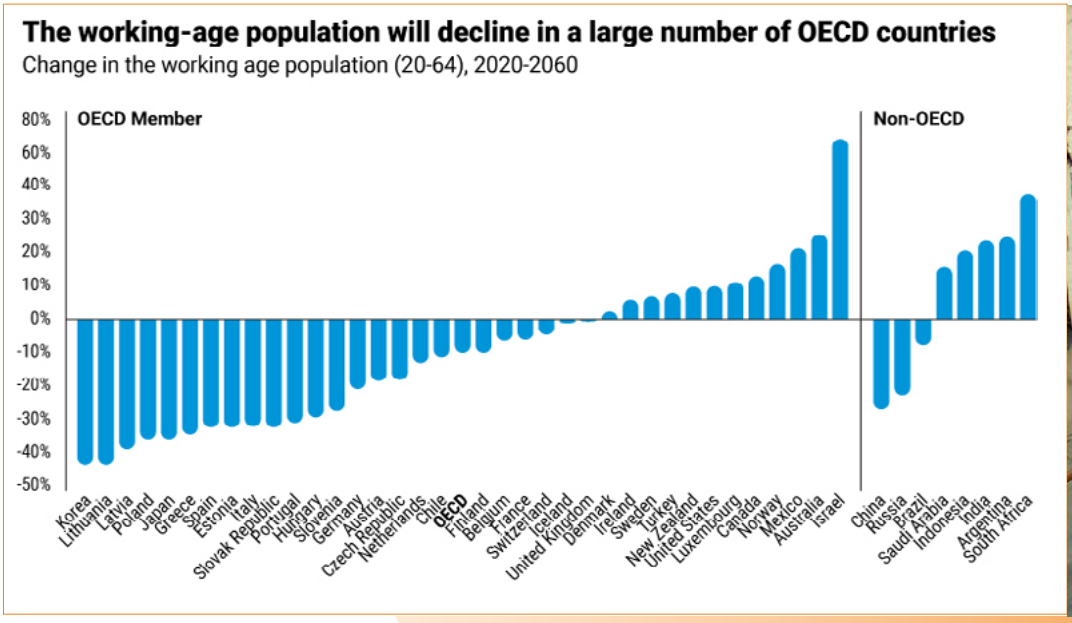
Managing the Risks

There are many other social and economic risks that we can come to expect as the global population continues to age:

- **The Squeezed Middle:** With more people claiming pension benefits but less people paying income taxes, the shrinking workforce may be forced to pay higher taxes.
- **Rising Healthcare Costs:** Longer lives do not necessarily mean healthier lives, with those over 65 more likely to have at least one chronic disease and require expensive, long-term care.
- **Economic Slowdown:** Changing workforces may lead capital to flow away from rapidly aging countries to younger countries, shifting the global distribution of economic power.

The strain on pension systems is perhaps the most evident sign of a drastically aging population. Although the average retirement age is gradually increasing in many countries, people are saving insufficiently for their increased life span—resulting in an estimated $400 trillion deficit by 2050.

Figure 2 : Working-age population decline



Pensions Under Pressure

A pension is promised, but not necessarily guaranteed. Any changes made to existing government programs can alter the lives of future retirees entirely—but effective pension reforms that lessen the growing deficit are required urgently.

Towards a Better System

Certain countries are making great strides towards more sustainable pension systems, and the Global Pension Index suggests initiatives that governments can take into consideration, such as:

1. Continuing to increase the age of retirement
2. Increasing the level of savings—both inside and outside pension funds
3. Increasing the coverage of private pensions across the labor force, including self-employed and contract employees, to provide improved integration between various pillars
4. Preserving retirement funds by limiting the access to benefits before the retirement age
5. Increasing the trust and confidence of all stake-holders by improving transparency of pension plans.

Although 59% of employees are expecting to continue earning well into their retirement years, providing people with better incentives and options to make working at an older age easier could be crucial for ensuring continued economic growth.

Live Long and Prosper

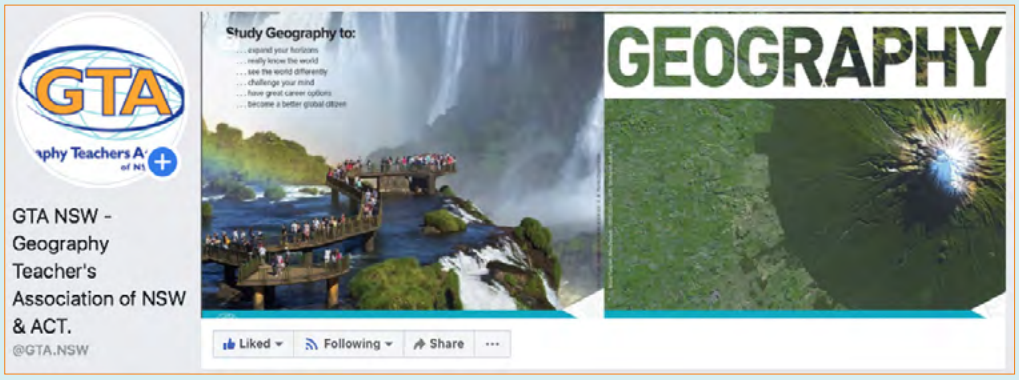
As 2020 marks the beginning of the Decade of Healthy Ageing, the world is undoubtedly entering a pivotal period.

Countries all over the world face tremendous pressure to effectively manage their aging populations but preparing for this demographic shift early will contribute to the economic advancement of countries and allow populations — both young and old — to live long and prosper.

GTA NSW & ACT Facebook Page is used for major events and the general promotion of Geography at https://www.facebook.com/GTA.NSW/

GTA NSW & ACT has two specific support groups*:

- **Teachers of Senior Geography Group**
  https://www.facebook.com/groups/841307156040600/
- **Primary Geography Teachers Group**
  https://www.facebook.com/groups/194177714663053/?ref=share



* Admission to these groups is on request and requires questions to be answered before approval is given.

Twitter
@GTANSWACT

Scoop.it
GTANSW and ACT

Instagram
Coming soon

Newcastle Grammar School

Assessment Task

Geography Year 7– 20%

Place and Liveability

Investigative study through fieldwork into the liveability of a local area.

Context

During this activity students will be investigating factors influencing their perceptions of the liveability of their local area including:

- environmental factors
- social factors
- cultural factors
- economic factors
- infrastructure factors.

Criteria for assessing learning

Students will be assessed on their ability to:

- demonstrate geographical knowledge and understanding relevant to the liveability of their local area
- provide evidence of their primary and secondary sources of information i.e. bibliography and/or hyperlinks
- work to a timeline to prepare a sustained, logical and cohesive report
- communicate ideas and information using geographical terminology and concepts appropriately.

Newcastle Grammar School

Assessment Task

Hand-In Task / Cover Sheet

Year Group	Year 7
Teacher Responsible	Mr Boyd & Mr Collins
Subject	Geography
Topic	Place and Liveability
Type of Task	Hand-In via Schoolbox
Task Weighting	20%

Notification Date	Due Date
7/09/2018	21/09/2018

OUTCOMES BEING ASSESSED	
GE4-1	locates and describes the diverse features and characteristics of a range of places and environments
GE4-3	explains how interactions and connections between people, places and environments result in change
GE4-4	examines perspectives of people and organisations on a range of geographical issues
GE4-6	explains differences in human wellbeing
GE4-7	acquires and processes geographical information by selecting and using geographical tools for inquiry
GE4-8	communicates geographical information using a variety of strategies

Final Mark	/	%

Assessment Task: Place and Liveability

The Task

The purpose of this assessment is for students to research, collect and analyse **the factors that determine the liveability of their chosen local area through fieldwork.**

During any geographical inquiry, geographers will ask questions, collect a range of data and information, record their findings, and represent them so they can be interpreted more easily. By following a process of geographical inquiry like this, geographers can be sure that the conclusions they reach will be accurate, useful and reliable.

Students are to present their findings by preparing a presentation using PowerPoint (maximum 10 slides) or Word document (maximum 5 pages).

Task to be submitted on Schoolbox by 8:30am on Friday 21st September 2018.

Students are to:

1. **Define** the term liveability.
2. **Map**. Identify their chosen neighbourhood/area by locating it on a map. This could be a road map or aerial photograph from a website, such as Google Maps. Decide on the limits of your local neighbourhood/area. This could be your suburb or a section of a large city (e.g. 1.5 km from where you live). Mark the limit of your local neighbourhood / area on your map and remember to include BOLTSs.
3. **Survey**. Collect data by using the Neighbourhood Liveability Survey (see attachment). You will need to be able to determine the liveability score by examining your chosen area closely. Scan in these pages - the data will be used in Step 6.
4. **Graph**. Through the use of an appropriate graphing tool, summarise your findings by averaging your scores for the five criteria. This data will be used in Step 6.
5. **Photos**. Support your findings by taking photographs of the buildings, streetscapes and the infrastructure typical of the neighbourhood, which has contributed to your determination of the neighbourhood liveability score. The images should show the extremes and average conditions of features/properties. Use the map/area identified in Step 2 to mark the location of each of your photographs.
6. **Conclusion**. Conclude your fieldwork by making a judgment about the liveability of your chosen neighbourhood/area. **Justify your judgement by analysing the data collected.** This should be a formal piece of writing (i.e. sentences and paragraphs; 15 – 20 lines).

Neighbourhood Liveability Survey

Source: Educational Services Australia and Australian Geography Teachers Association

Instructions

Think carefully about each of the factors listed below and circle the appropriate score. You may wish to discuss the factors with other members of your family to work out the appropriate score.

Liveability survey

Criteria	Liveability Score				
	Poor/low				Good/high
Environmental factors					
• Climate: Humidity/temperature	1	2	3	4	5
• Quality of urban design	1	2	3	4	5
• Architecture	1	2	3	4	5
• Streetscapes	1	2	3	4	5
• Parks and gardens	1	2	3	4	5
• Maintenance of public spaces	1	2	3	4	5
Social factors					
Law and order					
• Level of violent crime	1	2	3	4	5
• Level of petty crime	1	2	3	4	5
• Alcohol-related disorder	1	2	3	4	5
• Graffiti and vandalism	1	2	3	4	5
• Personal safety	1	2	3	4	5
Education					
• Choice of schools	1	2	3	4	5
• Quality public schools	1	2	3	4	5
• Opportunities for post-school education	1	2	3	4	5
Healthcare					
• Access to local dentists and doctors	1	2	3	4	5
• Availability of private health care	1	2	3	4	5
• Quality of public health care	1	2	3	4	5
• Aged care facilities	1	2	3	4	5

Notes

continued over …

Neighbourhood Liveability Survey

Criteria	Score				
	Poor/low				Good/high
Cultural factors					
• Places of worship	1	2	3	4	5
• Community recreational facilities	1	2	3	4	5
• Entertainment venues	1	2	3	4	5
• Public libraries	1	2	3	4	5
• Restaurants	1	2	3	4	5
• Licensed clubs	1	2	3	4	5
• Ethnic diversity	1	2	3	4	5
Economic factors					
• Employment opportunities	1	2	3	4	5
• Affordable housing	1	2	3	4	5
• Access to shops and department stores	1	2	3	4	5
• Service stations and mechanics	1	2	3	4	5
• Hardware outlets	1	2	3	4	5
• Personal services such as hairdressers	1	2	3	4	5
Infrastructure factors					
• Quality of road access	1	2	3	4	5
• Availability of public transport	1	2	3	4	5
• Transport interchanges and commuter parking	1	2	3	4	5
• Quality of telecommunications	1	2	3	4	5
• Infrastructure	1	2	3	4	5
• Reliability of utilities – water, electricity, sewage	1	2	3	4	5
• Cycle ways	1	2	3	4	5
• Maintenance of public schools and hospitals	1	2	3	4	5

Notes

Geography Teachers Association of NSW & ACT presents

GEOGRAPHY WEBINAR PROGRAM 2020

TERM 1

Tuesday 10 March

Differentiation in Geography

Presenters: Rex Cooke and Cassie Crompton

TERM 2

Tuesday 9 June

STEM and Geography

Presenter: Kimberley Parnis

Thursday 18 June

Primary School Geography

Presenters: Gail Braiding and Theone Ellas

TERM 3

Wednesday 12 August

Natural Disasters

Presenter: Tony Jarret

Thursday 10 September

Land Management and Sustainable Practices

Presenter: Adam Harris, SEO Taronga Zoo

Each webinar runs for an hour, commencing at 4.00pm.
Cost per webinar $20. Further information, **online registration** and session updates at **www.gtansw.org.au**

Sustainable Biomes: Assessment Task

Alex Damo, Assistant Principal
Teaching and Learning, St Pius X College
Chatswood

Task: Create a sustainable ratings system for food or clothing

Syllabus Outcomes

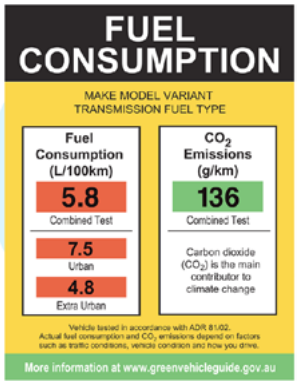
- explains processes and influences that form and transform places and environments GE52
- analyses the effect of interactions and connections between people, places and environments GE53
- assesses management strategies for places and environments for their sustainability GE55
- acquires and processes geographical information by selecting and using appropriate and relevant geographical tools for inquiry GE57
- communicates geographical information to a range of audiences using a variety of strategies GE58

Key Inquiry Questions

- How do people use and alter biomes for food production?
- Can the world's biomes sustainably feed the world's population?
- What strategies can be used to increase global food security?

Introduction

Many of the biomes where our food is produced for global consumption are not natural agricultural lands. We cannot avoid altering biomes to produce food and clothing but what are the consequences? We should be aware of the environmental impacts of the food and clothes we consume.



Fuel Consumption

Water Rating

Energy Rating

Sustainable Food

ASSESSMENT TASKS

Scenario

The Australian Government, through the Department of Agriculture and Water Resources, wishes to implement a Sustainable Food Production Rating system for all food and clothing sold in Australia.

Australian Government
Department of Agriculture and Water Resources

All consumers should be aware of the environmental impact of food and clothing they consume and be provided with simple information at the time of purchase to allow them to consider the environmental impact of their purchase.

Every food item whether grown and processed in Australia or imported must have a rating to indicate the environmental impact of growing and processing the food.

Tender

The Department of Agriculture has issued a tender inviting environmental consulting groups to devise a rating system and design a label that would appear on packaging or at the display where food and clothing is sold.

The Rating System must be devised to incorporate the following three factors:

1. **Changing Biomes**
   How has the natural biome been altered to grow/process the food/clothing?
   What has been the environmental effects of these alterations?
2. **Challenges to Food Production**
   What environmental challenges are created in growing/producing the food/clothing item?
3. **Food Security**
   How sustainable is the growing/processing of this food/clothing item for future generations?

The tender must be submitted as a report and include the following headings:

1. **Rating Label**
   A completed example of the 'Rating Label' with an extensive description. (150 to 250 words)
2. **How the rating is determined**
   Include an explanation of how a rating is determined by taking into account the three key factors. This needs to include an extensive analysis of each of the three factors supported with examples of both imported and local foods from a range of biomes. (900 words)
3. **Demonstration of a Rating**
   Demonstrate how the rating would work by rating two food/clothing items; one made in Australia, the other imported. Include:
   - An explanation of how the rating was applied.
   - Name of the environmental consultant preparing the report
   - Statement of authenticity from Turnitin

MARKING GUIDELINES	GRADE
The student has extensive knowledge and understanding demonstrated through: A very high-quality rating label' with an extensive description. Extensive explanation of how a rating is determined based on the three key factors, ***Changing Biomes, Challenges to Food Production and Food Security*** supported with three or more examples of both imported and local food from a range of biomes. Application of the rating on two food/clothing items; one imported, one local with extensive explanation Extensive use of the editing process, including structure, word choice, spelling, punctuation and grammar	**A**
The student has a thorough knowledge and understanding demonstrated through: A high-quality rating label' with a thorough description. Thorough explanation of how a rating is determined based on the three key factors, ***Changing Biomes, Challenges to Food Production and Food Security*** supported with two or three examples of both imported and local food from a range of biomes. Application of the rating on one two food/clothing items; one imported, one local with a thorough explanation. Thorough use of the editing process, including structure, word choice, spelling, punctuation and grammar	**B**
The student has a sound knowledge and understanding demonstrated through: A rating label' of sound quality with an adequate description. A sound explanation of how a rating is determined based on the three key factors, ***Changing Biomes, Challenges to Food Production and Food Security*** supported with one or two examples of imported and or local food/clothing from a range of biomes. Application of the rating on one or two food/clothing items with an adequate explanation. Adequate use of the editing process, including structure, word choice, spelling, punctuation and grammar	**C**
The student has a basic knowledge and understanding demonstrated through: A basic rating label' with a limited description. A basic explanation of how a rating is determined based on some of the three key factors, ***Changing Biomes, Challenges to Food Production and Food Security*** supported with limited examples of food/clothing from a limited range of biomes. Application of the rating on one food/clothing items with a limited explanation. Limited use of the editing process, including structure, word choice, spelling, punctuation and grammar	**D**
The student has elementary knowledge and understanding demonstrated through: A low quality rating label' with a very limited description. A very limited explanation of how a rating is determined based on some of the key factors, ***Changing Biomes, Challenges to Food Production and Food Security*** supported with a very limited array of examples of food/clothing from a very limited range of biomes. No or very limited application of the rating on a food/clothing item; with a very limited explanation. Very limited use of the editing process, including structure, word choice, spelling, punctuation and grammar	**E**

How Big Should the Economy Be?

Jason van Tol

Introduction

The aim of geography education in the junior years is, '[t]hrough geographical inquiry', to 'develop an understanding of the interactions between people, places and environments across a range of scales in order to become informed, responsible and active citizens' (BOSTES NSW, 2015, p. 11). The question upon which this article is based is, How big should the economy be? Though simple, this question incorporates all of the geographical concepts, especially scale, environment, and, as will be explained, sustainability. Under certain circumstances, which will also be described below, it is also amenable to fieldwork.

The term sustainability is defined in the K–10 Geography syllabus (BOSTES NSW, 2015, p. 20) as 'the capacity of the environment to continue to support our lives and the lives of other living creatures into the future.' It elaborates by stating that

> An understanding of the causes of unsustainability requires a study of the environmental processes producing the degradation of an environmental function; the human actions that have initiated these processes; and the attitudinal, demographic, social, economic and political causes of these human actions.

Thus sustainability is a concept of environmental capacity. Since the environment is not a static thing, it is the capacity of what the environment *does*, rather than what it is, that is the object of sustainability. This puts the focus of sustainability on environmental functions, just as described above.

As the syllabus also describes, there are a variety of human actions which degrade environmental functionality, but are some of these causes of unsustainability more primary than others? The *Australia: State of the Environment* (SoE) reports provide a detailed, longitudinal account of the condition of the Australian environment. The first of these reports, published in 1996, cautiously refers to Australia's growing population and highly concentrated distribution as possible candidates for causing unsustainable environmental changes (State of the Environment Advisory Council, 1996, pp. 10–11). Five years on, the following report contains the repeated concern that population growth and also economic activity are putting pressure on the environment (Australian State of the Environment Committee, 2001, p. 1), as well as the comment that 'Australians face major problems of living sustainably in … a society in which agriculture and industry, population and the built environment all continue to grow' (p. 22). The next report, published in 2006, gives considerable attention to the interrelated issues of population growth and increases in energy, material, and water use and the resulting increase in environmental pressure (2006 Australian State of the Environment Committee, 2006, pp. 7–14). The more recent reports state the causes of environmental change more boldly. The 2011 report states that '[t]he principal drivers of Australia's environment…are climate variability and change, population growth and economic growth' (State of the Environment 2011 Committee, 2011, p. 42), and mentions the challenge of 'decoupl[ing] national growth from increased pressure on the environment.' Most recently, the 2016 report repeats the previous warning by saying '[t]wo drivers will continue to shape Australia's environmental challenges in the coming decades: population growth, distribution and composition; and

economic activity' and goes on to say that '[g]rowth and change in our population and industries directly affect the Australian environment through the resources we use and the waste we produce' (Jackson et al., 2017, p. 9) (Jackson et al., 2017, p. 9).

Given the conclusions of the SoE reports, this article focuses on economic growth as a fundamental driver of the human actions that have not only initiated the degradation of many environmental functions, but continue to do so, since growth is enshrined worldwide in national government policy (see next section). As will be described below, economic growth is closely coupled with population growth – the other repeated concern of the SoE reports.

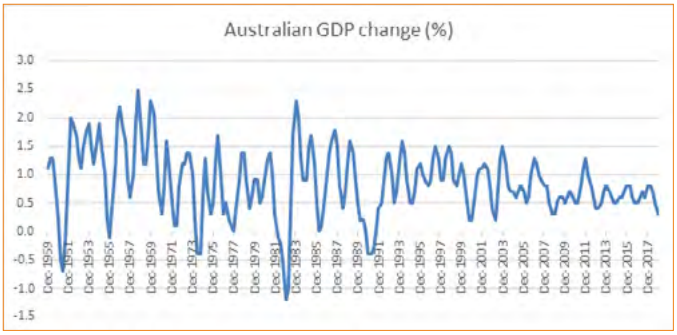
The next section surveys some basic economic theory on growth and shows how its implementation impacts the environment and opposes the goal of sustainability. Following that an economic model counter-posed to growth is presented, and in the final sections applications are made to the junior Geography syllabus with some suggestions for teaching for sustainability through an economic lens.

Economic Growth: Theory and Practice

Just about every country in the world today has growth as a core principle of its macroeconomic policy. The Australian Treasury states that 'the challenge for Australia is to raise standards of living through economic growth' and that '[w]e must maintain the growing momentum in the economy' (Australian Government Treasury, 2016). Other countries have similar policies. The EU seeks to set itself 'firmly on the path to growth' (Council of the European Union, 2015) and Goal 1 of the US Treasury is 'Boost U.S. Economic Growth' (Department of the Treasury, 2018). Meanwhile Canada has prioritised 'sustainable economic growth' (Department of Finance Canada, 2018) and the UK's first priority is 'achieving strong and sustainable growth' (HM Treasury, n.d.). The policy extends to the international arena, with Goal 8 of the United Nations' Sustainable Development Goals being 'decent work and economic growth' (United Nations, n.d.). Clearly, governments are in the business of growing the economy.

Economic growth is measured by increases in the Gross Domestic Product (GDP), the sum of the final market value of all goods and services produced within a country in one year (Samuelson & Nordhaus, 2010, pp. 370-371). It is this metric that governments are so anxious to increase year after year. As Figure 1 shows, the Australian government has been quite successful in increasing GDP, without interruption, for over the last quarter century.

Figure 1. Annual GDP change (%) in Australia, 1959–2018.

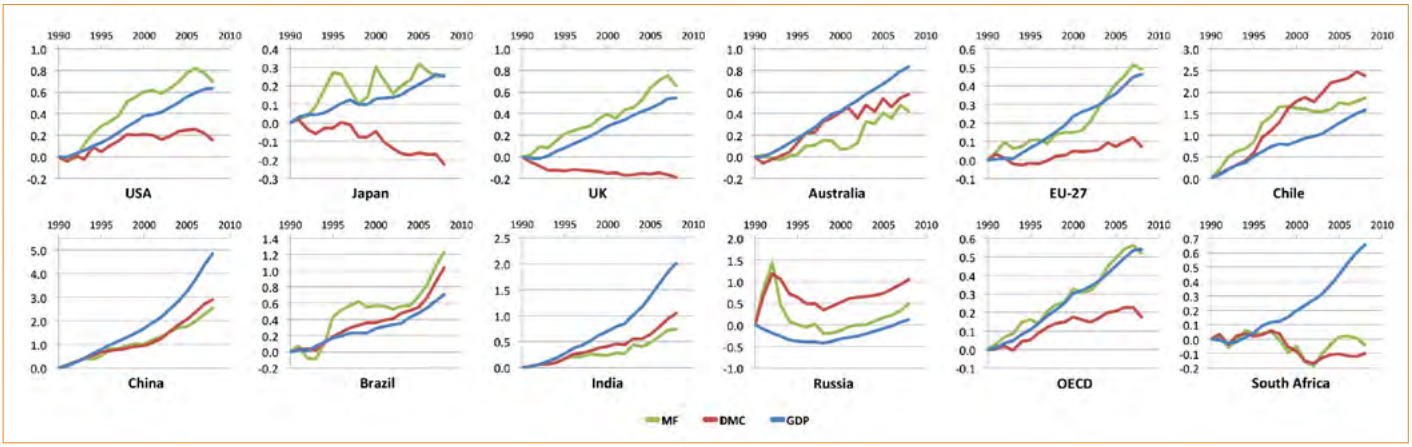


Source: Australian Bureau of Statistics (2019).

The standard model of economic growth comes from the work of Robert Solow. Although many refinements have been made to it, they all share the same premises that growth depends on three factors: capital, labour, and technological progress (see Samuelson & Nordhaus, 2010, pp. 501–518 for more detail). Despite land having been considered a factor of economic production, and thus growth, by all the classical economists, it, and the natural resources derived from it, are notably absent from Solow's model. The history of why land, and thus resources, was removed as a factor of production from economic theory is interesting and full of political intrigue, but beyond the scope of this paper (see Czech, 2013, pp. 80–101). For our purposes, a few points should be made: for one, the Solow model leads to the peculiar conclusion that because growth proceeds without physical resources, it has no limits. Also, because labour is a factor of production, having a growing population is, all else equal, good for GDP growth (though obviously not necessarily for growth per capita). And finally, it is only the *working* population that contribute to GDP. So for example, while stay-at-home mums are not good for growth, wage-earning day carers are; in fact doubly so, since both the day carer and the mum can then do paid work.

One of the confusions that arise from the measure of GDP that help misinform the argument that growth can and should continue without limit is that because GDP is a measure of value (in dollars, euros, yen etc.) it is not limited by physical constraints (Daly, 2014, p. 63). However, GDP is not simply a measure of dollars, but of dollars' worth of stuff. This is made abundantly clear by the Australian Bureau of Statistics (1998) calculations, which show that GDP is in fact a measure of the ***volume*** of goods and services, rather than value. With this confusion corrected, we are now in a position to make a biophysical analysis of economic growth. What changes in matter and energy use occur as economic growth proceeds? Figure 2 shows the change over time between GDP and the material footprint (MF) of a variety of countries, both developed and developing.

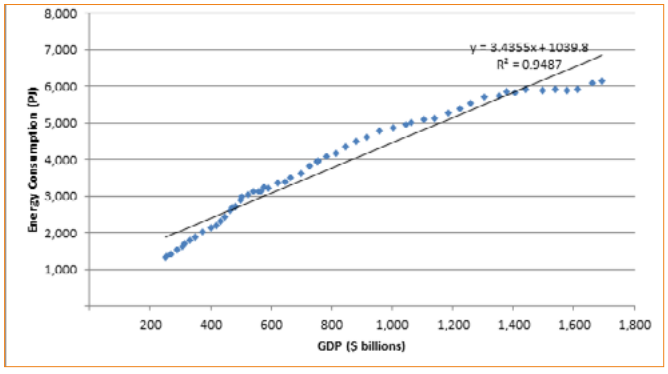
Figure 2. Relative changes in material footprint (MF), domestic material consumption (DMC), and GDP for selected countries, 1990–2010



Source: Wiedmann et al. (2015, 6274).

The MF accounts for all the raw materials embodied in a product and allocates them to the country where that product is consumed. Other resource flow accounting metrics also exist, like the domestic material consumption (DMC), which is also shown in Figure 2. However, the DMC does not capture all of the 'upstream' raw materials related to imports and exports originating from outside the country in question (Wiedmann et al., 2015, p. 6271), leading to the comforting but erroneous conclusion that some developed countries have 'decoupled' economic growth from resource use. The trend for the MF however is clear: with the exception of South Africa, every country has roughly a direct proportion between MF and GDP. That is, as their economies grow, so does the amount of material that they consume, which is what we would expect given that GDP is a measure of the volume of goods and services produced. The notable exception of South Africa is one that demands an explanation, but this has not yet been attempted in the literature (Wiedmann, 2019, personal communication). This could make for an interesting geohistorical analysis since the time frame in question begins roughly with the end of apartheid, after which tremendous changes occurred in all aspects of South African society, including its economy.

Figure 3. Energy consumption versus GDP, Australia, 1960–2017



Source: Department of the Environment and Energy (2018).

What happens to energy use while an economy grows? It too is of interest since it is a finite, physical resource. Figure 3 shows the change in Australia's energy consumption versus its GDP for the period 1960 to 2017.

Note that Australia's GDP has been growing faster than its energy use, suggesting that as the economy grows, improvements in technology and economies of scale can use energy more efficiently. A different interpretation is that the financialisation of the economy has artificially inflated the GDP (Assa, 2019; Hudson, 2015). Similar results have been found for global analyses of the same sort. See Figure 1 at https://academic.oup.com/bioscience/article/61/1/19/303944 for a graph that shows a plot of the per capita energy consumption versus per capita GDP growth for 220 countries over 24 years. Each thin line represents the data for a single country while the thick black line that for the mean.

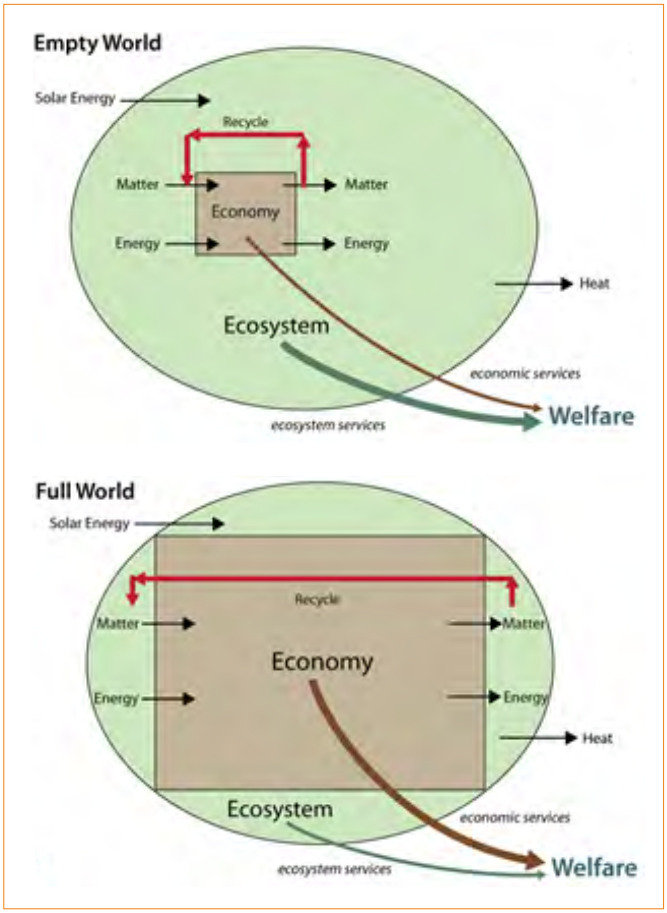
As these figures indicate, economic growth undoubtedly demands more energy use, which is, again, like the MF, what we would expect given that GDP is a physical measure of the production of goods and services. With this biophysical analysis in view, clearly economic growth cannot continue forever on a finite planet. Our affinity for growth has led from what Daly (2014) calls an empty world to a full world – where the world is now full of people and our stuff. Figure 4 helps depict these circumstances.

Notice that the economy grows into ecosystems, displacing them as it does so, and that while the services provided from the economy grow, those from ecosystems diminish. Ecosystem services are broadly defined as things that ecosystems do which benefit people (see for example Department of the Environment, Water, Heritage and the Arts, 2009; Millennium Ecosystem Assessment, 2005). As such, they are closely related to

environmental functionality as described above in the introduction. This conflict between economic growth and ecosystem services is elaborated on below.

So, since the economy cannot grow forever, we should ask the question we began with: How big should the economy be? To help refine the question, and make it more directly an object of geographical inquiry, we might pose it as: How big should the economy be relative to the containing ecosystem? The next section addresses this question.

Figure 4. Economic growth causing the transition from an empty world to a full world, diminishing ecosystem services along the way



Source: Daly (2015).

Ecological Economics and the Steady-State Economy

There is a transdisciplinary field called 'ecological economics' which draws on principles and concepts from a variety of fields including physics, biology, ecology, history, anthropology, and economics and synthesises them in its work (Costanza, 2010). Some of its seminal contributors are Nicholas Georgescu-Roegen, Herman Daly, and Kenneth Boulding. Both the journal Ecological Economics and the International Society for Ecological Economics were established in 1989 by Robert Costanza, who now works at ANU. With Geography's broad integral concepts of interconnections, sustainability, environment, scale, and change, it has much to contribute to ecological economic inquiry and vice versa.

What unites ecological economics are three hierarchical goals, the first of which is called 'sustainable scale'. The second and third goals are fair distribution and efficient allocation respectively, but they are beyond the scope of this article. Sustainable scale attempts to answer the question upon which this article is based: How big should the economy be relative to its containing ecosystem(s)? and makes suggestions for putting this answer into practice. As mentioned above, this question is completely absent in standard economics, which advises unlimited growth instead. Before answering the question just posed, we might first ask: How big is the economy? In dollar terms the gross world product is about US$80.7 trillion (World Bank, 2019), but ecological economists are interested in providing a biophysical answer to this question. One way to do this is by considering what percentage humans appropriate of the earth's potential net primary production[1] (HANPP). This is currently 25% and it may only grow to about 27–29% by 2050, but large increases in bioenergy might see it increase to about 44% (Krausmann et al., 2013).

How big should the economy be is a question that has no definite answer, but a few things can be said with some certainty. For one, two more doublings of HANPP would leave no bioenergy available for any species other than humans and our domesticated animals. Because crucial ecosystem services depend on these other species, HANPP should not grow to such levels (Daly, 2014). Also, globally over the last century HANPP per dollar has declined by more than a factor of eight (Krausmann et al., 2013), suggesting that further economic growth in dollar terms might be possible, even while HANPP remains relatively stable. However, this has occurred because of the enormous increase in the use of fossil rather than bioenergy (Smil, 2017). Not only are such non-renewables limited at the waste end by contributing to climate change, but they are increasingly limited at the source end too (Hall, Lambert, & Balogh, 2014). Because energy is an essential resource for economic production – indeed for doing anything at all – this suggests that further economic growth will soon begin to reach earth's biophysical limits. Some research suggests that this is already happening, not only in terms of climate regulation, but also in biodiversity loss and overextension of the nitrogen and phosphorus cycles (Rockström et al., 2009; Steffen et al., 2015). Thus, the precautionary

1 Net Primary Production (NPP) is the energy captured by plants via photosynthesis minus that which they use during respiration. This energy is the basis for virtually all food chains in the biosphere.

principle suggests that the economy should probably not encroach upon the biosphere anymore, and that we need to change our pro-growth policies.

For about 50 years now Herman Daly has been promoting the steady-state economy (SSE) (Daly, 1993, pp. 325–363). While there are many nuanced arguments supporting the SSE, it has four defining characteristics:

1. A constant or mildly fluctuating human population.
2. A constant or mildly fluctuating stock of human-made things.
3. The levels at which 1 and 2 are held steady are sufficient for a good life and sustainable into the future.
4. The rate of matter and energy (collectively referred to as 'throughput') which sustain 1 and 2 are kept as low as possible.

Readily apparent is that the SSE is in direct opposition to the biophysical results of a growth economy, where, as we have seen, both matter and energy increase as the economy expands. Also notable is that a zero-growth economy need not have any negative connotations; this is because development can still occur, independently of growth. Growth is specifically a quantitative, biophysical phenomenon. It occurs as throughput increases. Development on the other hand entails qualitative changes that occur with throughput held constant. These include changes in information, technology, fashion, and income and wealth distribution. A good analogy to our economy is a human body: a baby grows but eventually stops accreting matter and demanding more energy, but a grown adult can continue to develop by education and experience throughout her life without any growth at all.

Applications for Junior Geography

There are significant opportunities for the conflict between economic growth and ecological sustainability to address each of the seven geographical concepts, and as such the conflict could be used as a unifying theme throughout the study of geography. Stage 5 of the Geography K–10 Syllabus in particular lends itself to this purpose. With the understanding that the nominal reason for economic growth is to improve human wellbeing (Samuelson & Nordhaus, 2010, pp. 501–502), this can include the Human Wellbeing unit. The World Happiness Reports, the editors of which are all economists, can provide ample data for that unit. The focus here however is on the biophysical nature of the conflict, and this is perhaps most thoroughly covered in the Environmental Change and Management unit.

For that unit's Content, the first dot point is that students 'investigate the role and importance of natural environments' (BOSTES NSW, 2015, p. 76). For this, an overview of some salient ecosystem services would be helpful. These are show in Table 1 below.

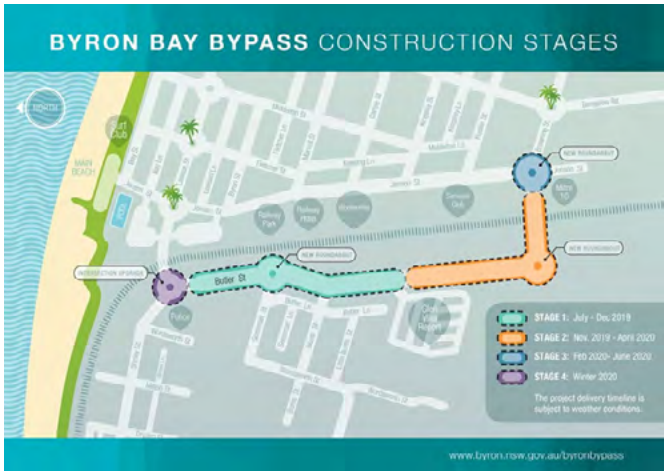
Number	Ecosystem Service	Examples of benefit to humans
1	Gas regulation	CO2/O2 balance and O3 (ozone) for UV protection.
2	Climate regulation	Greenhouse gas regulation.
3	Disturbance regulation	Storm protection, flood control, drought recovery controlled by vegetation structure.
4	Water regulation	Provisioning of water for agriculture
5	Water supply	Provisioning of water to catchments, reservoirs, and aquifers.
6	Erosion control and sediment retention	Prevention of soil loss due to wind and rain.
7	Soil formation	Weathering of rock and accumulation of organic matter.
8	Nutrient cycling	Nitrogen fixation and N, P and other mineral cycling.
9	Waste treatment	Detoxification and pollution control.
10	Pollination	Provisioning of pollinators and reproduction of plants.
11	Biological control	Predator control of prey species.
12	Refugia	Habitat for resident and migratory species.
13	Food production	Provision of crops, fruit, nuts, fish, and game.
14	Raw materials	Provision of timber, fuel, and fibre.
15	Genetic resources	Medicine and provisions for genetic research.
16	Recreation	Sport fishing, hunting, and any outdoor recreational activity.
17	Cultural	Aesthetic, artistic, educational, spiritual, and scientific values of ecosystems.

There are significant fieldwork opportunities to investigate these and other ecosystem services in students' local environment. In order to make the conflict of economic growth with ecological sustainability an object of geographical inquiry, teachers and students can choose an ecosystem service and attempt to measure any reduction in it while economic growth occurs in a particular environment. This addresses the next syllabus dot point which states that students 'investigate human-induced environmental changes across a range of scales'. Note that some ecosystem services, like gas and climate regulation, are not localised and would escape simple measurements conducted by a class in their local environment. For these, studies would depend on secondary data. Others however, like refugia and disturbance regulation, are localised and degradation of them during economic growth can be observed and directly attributed to that growth, making them amenable to primary data and thus fieldwork. Note that like ecosystem services, some economic projects are diffuse, whereas others are localised. Some projects, like the NBN network being rolled out across Australia for example, are not amenable to high school fieldwork, whereas a particular construction project is. An example of such growth and its impact on an ecosystem service comes from the author's home town of Byron Bay.

Byron Bay: A Case Study

Despite its small population of about 30,000 people, Byron Shire is one of the most common tourist destinations in all of Australia, receiving over two million visitors each year; these numbers have been growing and are projected to continue growing (Delta Pearl Partners, 2019). Such dramatic increases have resulted in, among many other problems, traffic congestion. One of the ways the local council has decided to cope with this growth has been to construct a bypass around the town centre. A map of the project is shown in Figure 5.

Figure 5. Map of the Byron Bay bypass



Source: Byron Shire Council (2020.

The cost of the project is $24 million, with close to half the money coming from a state government Growing Local Economies grant (Byron Shire Council, 2019). Naturally, this will contribute to GDP growth and thereby to the fulfilment of Australia's macroeconomic policy objectives. However, the bypass will go through wetlands which provide the habitat of a number of threatened species, including Mitchell's Rainforest Snail, Common Planigale, and Black Bittern, thereby reducing the ecosystem service of refugia for these and other species, since they will not live on or near the bypass (Lovejoy, 2019). The wetlands will be directly affected by Stage 2 of the bypass construction, as shown in Figure 5. The beginning of the existing wetlands is shown in Figure 6.

Figure 6. The beginning of the wetlands which will be affected by the bypass. Stage 2 of the bypass will extend the existing road straight ahead.

Source: Google Maps (2020).

While the conclusion that this example of growth reducing the ecosystem service of habitat provision is completely obvious, that does not make it trivial, nor irrelevant. In response to the anthropocentric worldview that we can and must afford the reduction and extinction of other species to make room for more of us and our stuff, there are many examples of trophic cascades – that is, amplification of disturbances in food chains – which demonstrate the myopia of such thinking. The reintroduction of wolves to Yellowstone National Park is one example (Ripple & Beschta, 2012), the possible rise of Lyme disease due to the human-induced extinction of the passenger pigeon is another (Blockstein, 1998; Farley, 2012). In the case of the Byron bypass, the Black Bittern is an apex predator and thus supplies biological control (see Table 1) to the trophic structure of the wetlands through which the bypass is planned. While proving that continual economic growth will cause catastrophic dysfunction of ecosystem services is probably impossible for one specific case, the precautionary principle suggests that limiting growth in

the aggregate would be prudent. This is the conclusion of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in their recent Global Assessment Report. Therein they note that about 1 million species are threatened with extinction, many within decades, and suggest 'steering away from the current limited paradigm of economic growth' (IPBES, 2019).

The investigative study of the Environmental Change and Management unit requires that students compare one type of Australian environment with one in another country. What has just been described for the Byron Bay wetlands would suffice for the 'explanation of how the biophysical processes operating in the [Australian] environment maintain its functioning', namely the ecosystem services of refugia and biological control; as well as for the 'examination of the causes…of change to the environment', which in this case is economic growth. What remains to be discussed is the investigation of 'the management of the environmental change' (BOSTES NSW, 2015, p. 77). This can be linked to the aim of junior geography education described at the outset of this article, which ends with students becoming 'informed, responsible and active citizens'.

Before moving to this final section however, worth recalling is that, as indicated in the SoE reports at the outset, economic growth is the prime driver of the decline of the state of Australia's environment. This is true not only in terms of biodiversity decline, which the Byron Bay bypass will help contribute to, but for climate change too. Why? We saw above that economic growth is coupled with increased energy usage. Despite the push toward renewable sources of energy, the global economy still relies predominantly on fossil fuels (about 81%) (International Energy Agency, 2018), and anthropogenic global warming is being driven to a large extent by carbon emissions from fossil fuel use.

Weighing against the hope that renewables will quickly replace fossil fuels in a growing economy is the fact that biofuels comprise the majority of renewable sources of energy (about 70%, or about 10% of total global energy supply); as suggested above, expanding our use of biofuels will increase the HANPP and thereby reduce the habitat for species other than humans and our domesticated animals. Also, such increases must compete with agricultural land, putting increased food pressures on a growing global population.

So climate change, biodiversity loss, as well as the hole in the ozone layer, colony collapse disorder, plastics in the ocean, and the decline of an array of other ecosystem services, are all a result of the growth economy. As described, the economy grows ***into*** these ecosystems, degrading their services as it does so and compromising the goal of ecological sustainability. No economy will survive extreme ecological disservice, much less any society.

Environmental Management and Active and Informed Citizenship

Everything that has been said has implications for our management of the environment and students' roles as active and informed citizens. As described above, the SSE is directly opposed to the growth economy. Because of the current existence of nation states, their national income and productivity accounts (from which GDP is calculated), as well as their macroeconomic policies, the transition from a growth economy to a SSE can only be made effective at a national level. As such, students can fulfil their role as active and informed citizens by pressing their representatives, as well as their fellow citizens, to adopt it. This would address the part of the investigative study which 'investigate[s] the management of the environmental change' (BOSTES NSW, 2015, p. 77). As for a 'discussion of the factors influencing the management responses in each country', teachers could lead a discussion of why there is such worldwide governmental allegiance to economic growth. Though delving into this topic is important, it is beyond the scope of this paper. Here all that can be said is that economic growth has not always been a central focus of economic policy – it is specifically a post-WWII phenomenon (see Blyth, 2002, pp. 91-95), and there is no 'natural law' which dictates that economies must grow forever. This would dovetail naturally with an 'investigat[ion of] environmental management, including different worldviews and the management approaches of Aboriginal and Torres Strait Islander Peoples'. Gammage (2011) reviews the worldview and culture of Aboriginal people which allowed them to live sustainably prior to 1788.

There is no question that the growth economy cannot continue forever, there is only the question of how it will end. Through our role as active and informed citizens, hopefully teachers and students can help make the transition a smooth, rather than abrupt one.

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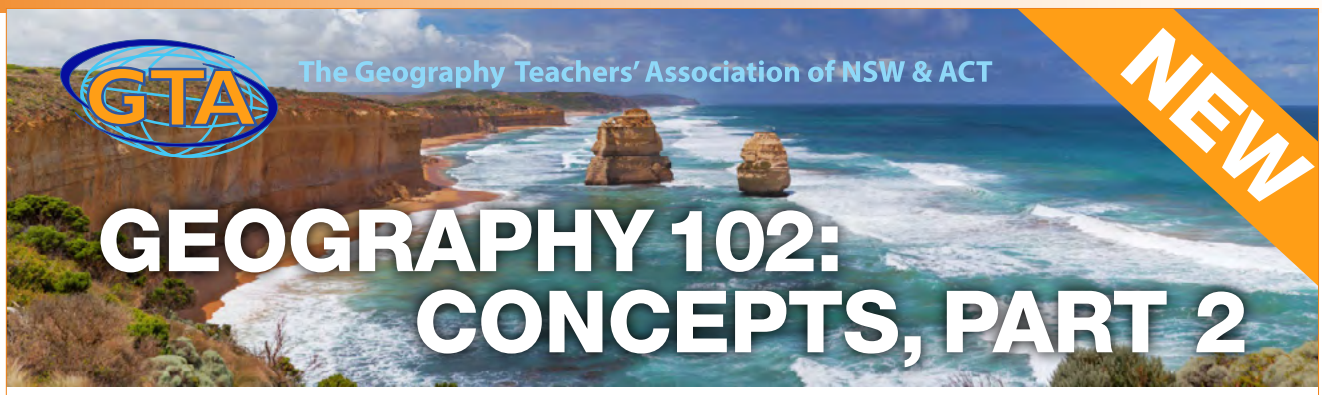

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FIGHT FOR THE BIGHT

Linley Hurrell
Patagonia Australia and The Saltwater Institute

I've been a surfer for over 20 years and a geography enthusiast for approximately 15 years, ever since I was first introduced to the subject in Year 7. I never could imagine these two passions interconnecting; my secondary teachers who told me that there were no careers in surfing definitely couldn't imagine this; but here I am writing for a teaching journal as a surfer and as a Geography teacher.

NSW Syllabus Links

- Stage 4 (Landforms and Landscapes)
- Stage 5 (Environmental Change and management)
- Stage 6 (Ecosystems at risk)

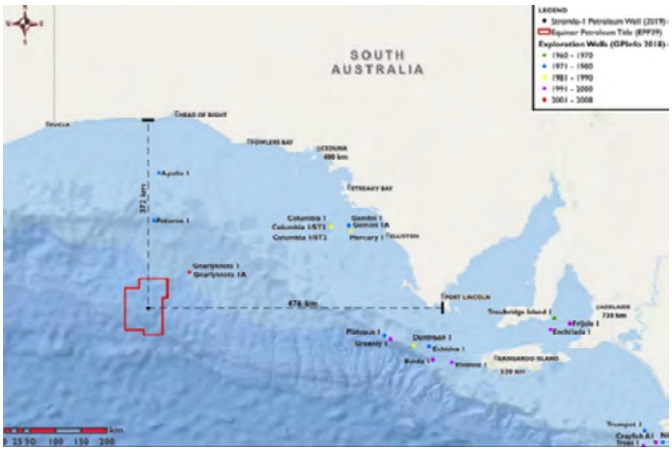
Fight for the Bight and BP's 2010 Deepwater Horizon spill in the Gulf of Mexico can be used as illustrative examples of the impacts and potential impacts of environmental change and in Stage 4 to consider the value of natural places.

The protests are an example of active citizenship.

Being a surfer, I'm deeply entrenched and engaged in the natural environment on a day to day basis. I have a love for the ocean that most people cannot understand, it has given me my health, my career and an escape from the pressures of the world; it feels like home to me. However, when that home is at risk of being destroyed by a Norwegian oil company, Equinor (formally Statoil) due to their plans to drill for oil in the Great Australian Bight. I knew I had to find a way to use my passion for the ocean and my geographic understanding to fight this proposal.

This is not a new debate. In fact, it's been ongoing in South Australia for many years, first it was Cheveron, then BP, and now Equinor who are all tirelessly trying to open up an oil field in one of Australia's (and the worlds) most pristine and ecologically diverse ecosystems, the Great Australian Bight. So far, all companies have been unsuccessful, Cheveron withdrew and BP's Environmental Plans didn't stack up; even having the gall to suggest a spill in the Bight would create hundreds of new 'clean up' jobs in Australia (ABC). Personally, I'd prefer to have my job based on a healthy coastline, then one where I'm being paid to clean up someone else's mess.

Figure 1: Location of Stromlo-1, 372km South of Ceduna and 476 km West of Port Lincoln.



Source: Equinor EP.

Years of seismic testing, that is the act of sending seismic blasts from ship to sea floor to map the underlying oil and gas deposits beneath the sea bed, suggest that the Great Australian Bight is rich for those who seek their fortunes through drilling, extracting, mining and fracking, I won't delve into the environmental issues surrounding seismic testing, that's a debate for another time.

Equinor continues to push forward with plans to drill in a location called Stromlo-1, approximately 370 km south of Ceduna. This chosen site lies in one of the most volatile areas of ocean in the world, the Southern Ocean. Planning to drill the ocean floor that sits at a depth of 2.2km, would make it the deepest drill site worldwide. Simply put this is a purely experimental endeavour. The closest land base, Ceduna is not currently set up for an oil or gas industry, and the closet clean-up crews, if there was to be a spill - is 17-days (by boat) away in Singapore (at a minimum, depending on ocean conditions).

As Geographers we evaluate positive and negative impacts on both people and the environment, however, this decision to drill in the Great Australian Bight has far outreaching negative consequences for both people and place than it does positive ones.

I will base all impacts off a 'worst case scenario' where a spill was to occur in-conjunction with large Southern Ocean storm (see projected spill map). While Equinor only plans to drill from October to May (the Bight's calmest months) the rig itself must be able to withstand (year-round) an average of 4m swells and 'persistent, moderate to high swell from the Southern Ocean' due to strong westerly winds, long ocean fetch and the depth at which the swell is generated, it's not uncommon to see wave heights reach 18 m. (Coastalwatch). Comparing this to the world's worst oil spill, the 2010 Deepwater Horizon spill, the Gulf of Mexico only sees average wave heights of 5ft/1.5m (Texas Pelagics)

Figure 2: Projected spill map from Equinor's own Environmental Plan. .

Source: Equinor EP.

Economically, Equinor suggests that there will be a 6% increase to South Australia's GDP as a result of operating out of the state and an extra 1,4000 new jobs (Equinor EP). Though the major concerns arise when you weigh up what is at stake if a spill was to occur. For South Australia this means the temporary shut-down of the largest fishing fleet in the Southern Hemisphere and a tourism industry that relies on a clean coastline that both contribute a combined $10 billion annually to South Australia's economy (Great Australian Bight Alliance). These losses looked at a larger scale to include all impacted states (Victoria, Tasmania, New South Whales and Western Australia) could spell thousands of job losses across the country. Temporarily, it's projected that clean up time for the Deepwater Horizon Spill in the Gulf of Mexico took almost 4 years to be considered to be

Figure 3: Patagonia Australia 'Big Oil Don't Surf' campaign poster using data from BP and Chevron's EP highlighting potential impact likelihood if a spill was to occur alongside a deep southern low-pressure system.

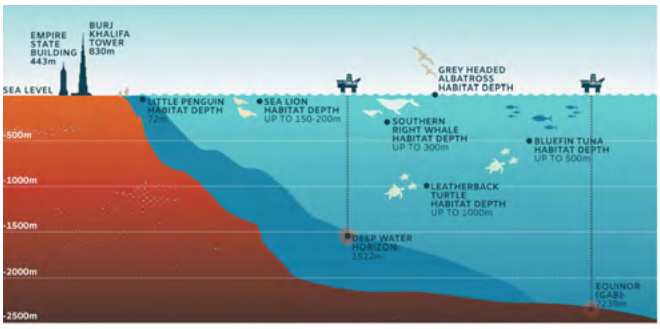
Source: Patagonia Australia

complete; it's projected that a spill in the Bight will be twice as big; so potentially 8 years of large-scale losses in two major industries. A spill would have large scale national economic consequences.

Socially, we still have a heavy reliance on the oil industry, we need it for jobs and to build, move and grow a nation, I can't argue that. The impacts to residents along the 'at-risk' coastline are incredibly detrimental. Those who are directly or indirectly employed by either tourism or fishing will see immediate losses, that is hundreds of thousands of Australians in 5 states. If a spill was to occur, we would see population movement from affected communities to other places as those out of work search for job security. As a result of making Equinor's plans to drill public, we saw 31,000 submissions against Equinor's Environmental Plan, and over 20,000 Australian's "paddled out" in protest against drilling (Surfrider Foundation), some of the largest environmental protests in Australia's history prior to the recent Climate Strikes.

The Great Australian Bight is one of the last pristine environments anywhere in the world, 85% of species that call the Bight home are found no-where else in the world (Wilderness Society). It's hard to imagine how this disaster won't have large scale impacts on species numbers, breeding and migration patterns and ecosystem health. Much of the 'at-risk' coastline could be considered remote. Let alone whether it ever will be cleaned up considering how sparse the population is along some stretches of coastline; now imagine oil in these places, untouched for hundreds of years, stained for years to come. A report published in The Guardian on the Deepwater Horizon spill suggested that research carried out by the University of Southern Mississippi had found that 4 years after the spill had occurred that the spill drastically altered microbes and bacteria that were the fundamental base of the ocean food chain. Deepwater Horizon impacted 1,300 miles of coastline; in Australia we could see a third of our coastline impacted.

Figure 4: Drill depth comparison between the Bight and Deepwater Horizon.



Source: Greenpeace

This case study is ideal to bring into the VCE Unit 1– Hazards and Disasters curriculum, as a form of technological 'hazard', that can be easily comparable to one of the most environmentally damaging technological 'disasters' in recent history, BP's 2010 Deepwater Horizon spill in the Gulf of Mexico.

This issue has the potential to impact anyone living or working along Australia's southern coastline, with the potential to have further impacts to hinterland tourism and freshwater supply. If you or your students are concerned about this issue, I encourage you to visit either the Patagonia Australia, Wilderness Society or Great Australian Bight Alliance website for further details on how you too can Fight for the Bight.

About the Author:

Linley Hurrell's first introduction to Geography was in Year 7 at Gippsland Grammar, she went onto to complete a double degree (Arts/Secondary Education) at Monash University, with the intention to inspire her students in the same way her teachers did for her. She currently works at Patagonia Australia and The Saltwater Institute where she can combine her passions for both Geography and Surfing.

BREAKING NEWS

Equinor abandons plans to drill for oil in Great Australian Bight
https://www.abc.net.au/news/2020-02-25/equinor-abandons-plan-to-drill-for-oil-in-great-australian-bight/11997910

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SKILL DEVELOPMENT USING GRAPHIC NEWS

Lorraine Chaffer, Vice President GTANSW & ACT, Geography Education Consultant

GTA NSW & ACT is licensed to reproduce infographics developed by GRAPHIC NEWS who produce them for media publications using reputable data sources such as British Antarctic Survey, World Health Organisation and NASA.

The following set of activities are based on a selection of infographics that can be linked to Geography topics from Stages 4 to 6.

An editable Word Version of the activities can be adapted to suit your students are provided in Appendix 1. Suggested and /or sample answers are provided in Appendix 2.

Some questions require students to show knowledge and /or conceptual understanding before analysing or interpreting the infographics.

A. Ticking timebomb of global trash

1. What do you know?
    i. Define *'waste'*
    ii. Explain how waste is generated.
2. What was the total global waste generated by humans in 2016?
3. State
    i. The percentage of the world's total solid waste that was plastic in 2016.
    ii. The total predicted waste stream by 2050
4. Contribution to global waste
    i. Identify the continent estimated to produce the most waste per person in 2016
    ii. Rank the continents by their per capita contribution to the global waste problem.
    iii. Suggest two reasons for these rankings.
5. Create a pie graph to illustrate the composition of global waste. (Hint: 1% = 3.6 degrees)
6. What was one immediate result of China banning waste imports in 2018?
7. Suggest a reason why Africa could become a dumping ground for future waste.
8. Importing and exporting waste
    i. Explain the importance of the pink area on the map.
    ii. What do the countries banning waste imports have in common?
    iii. What are the implications for countries who export their waste to this region?
9. Undertake a geographical inquiry.
    i. Create an Inquiry Question on waste to investigate.
    ii. Predict the outcome of your investigation (What do you expect the answer to be?)
    iii. Undertake research. Use primary data and secondary sources.
    iv. Draw conclusions from your inquiry.
    v. Communicate your findings in a cartoon or diagram.
10. State one link between the theme of this infographic and the photograph.
11. State one link between the theme of this infographic and the photograph on the front cover of this Geography Bulletin.

12. Discussion: *Is it possible for the world stop producing plastic?*
    Put arguments for the 'yes' and 'no' cases in a table.

B. Earth's wilderness vanishing

1. Work in pairs to discuss the meaning of the term *wilderness.* Think about the qualities of wilderness areas. Contribute to a class discussion to reach an agreed definition (consensus).
2. Why does the world need areas of wilderness? (What are the values of wilderness areas?)
3. Study the world map.
    i. Use a world map to locate Russia, Canada, USA, Australia, Brazil and France on the infographic.
    ii. Describe the global distribution of 'land' wilderness areas.
    iii. Suggest reasons for the distribution of 'land' wilderness.
    iv. Kiribati, New Zealand and the UK only have areas of 'ocean' wilderness. What features do these countries have in common that would explain this situation?
4. Calculate the millions of square km of combined land and sea wilderness in Russia and Canada.
5. What are the *high seas*? Why do you think these areas are not included in the calculations of ocean wilderness for this infographic?
6. The infographic refers to the need for *"urgent international action'* to protect wild places. What might that action look like?
7. Discussion: *People and the planet need wilderness areas, even if we never get to visit them.*
8. Write a personal statement on your attitude to *'wilderness'*

C. Greenhouse gas emissions

1. What do you know about greenhouse gases?
    i. List the greenhouse gasses referred to in this article.
    ii. Tick the ones you are familiar with.
    iii. Research the ones you are not familiar with.
    iv. Why is it important to know the sources of each of the greenhouse gases?
2. Identifying trends
    i. What is a trend and how do we identify a general or overall trend on a graph?
    ii. Describe the general trend in total emissions of greenhouse gases from human sources from 1990 to 2020.
    iii. Calculate the change in total emissions between 19990 and 2018.
    iv. Which greenhouse gas experienced the greatest increase over that time?
3. Reducing emissions
    i. Suggest ONE strategy that could be implemented in each sector to reduce emissions?
    ii. Research ONE place that has implemented a strategy to address emissions in one of these sectors.
    iii. Share research findings with the class and map the locations.
    iv. Annotate the map with a brief summary of each strategy.
    v. Title your map: *Action to reduce emissions at a global scale.*
4. Discussion: *What is the link between CO2 levels and global warming?*

D. Soaring cost of climate related disasters

1. What do you understand by the term *'climate-related disaster'*?
2. List examples of 'climate-related disasters' you are familiar with. Beside each give an example of one place that has experienced this type of disaster.
3. State the minimum number of climate-related disasters that occurred globally each year since 1998.
4. Name the other category of disaster shown in this infographic.
5. Suggest a reason for differences in the number of each category of disaster (line graph)
6. Explain your understanding of the term *'economic losses'.*
7. Which three disasters caused the greatest economic losses between 1998 and 2017?
8. Global patterns
    i. Name the three countries that experienced the greatest economic losses between 1998 and 2017.
    ii. State the type of disaster that contributed to the economic losses of each of these countries.

iii. Suggest reasons for differences in the disasters causing economic losses in the three countries?

9. Investigate the economic losses associated with the Australian Summer Bushfires of 2019–2020.

10. Class discussion:

Is there a relationship between climate change and climate-related disasters?

E. Artic on the front line of climate change.

1. What do you know about the Arctic?
   i. Where is it?
   ii. What is it like?
   iii. How is the Arctic different to Antarctica?
   iv. How is it changing
2. What does the area in black on the globe represent?
3. Name four countries that have territory in the Arctic.
4. Describe the overall trend in sea ice extent between 1980 and 2019.
5. Calculate the difference in sea ice extent between 1980 and 2019.
6. Why was 2019 a year of concern for the Arctic?
7. Why is the Greenland ice sheet significant (important)?
8. Define *permafrost* in your own words.
9. How does climate change affect permafrost?
10. What happen when permafrost thaws?
11. Debate: Divide into teams for and against to debate this statement.
    A thawing Arctic can be a good thing for Arctic countries.

F. Create a Graphic News story

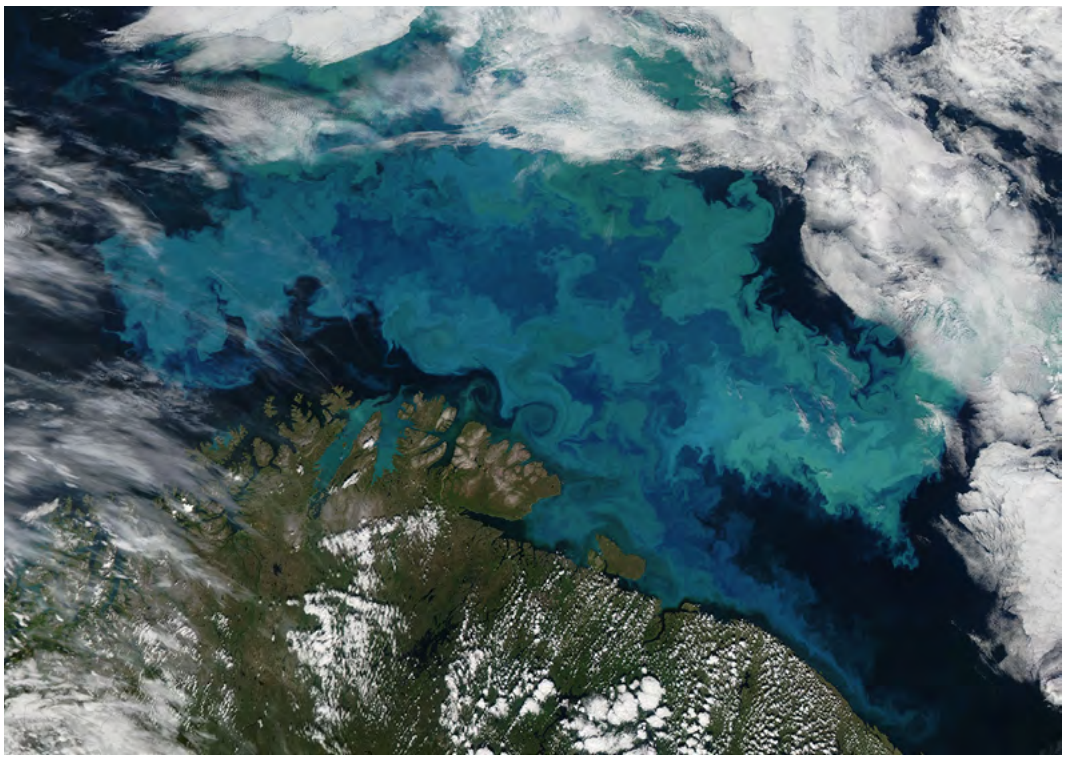
Many GRAPHIC NEWS infographics are about negative change.

1. Choose a positive news story to investigate. (See 100 Good News Stories Edition 4, 2019)
2. Create your own infographic.

   Your infographic should contain:
   - A map
   - A graph or table
   - A photograph
   - Some text.

G. Analysing an image

1. Draw a photo sketch of the photo.
2. Search for a map of the Barents Sea and add labels to your sketch
3. Describe the location of the sea.
4. Investigate the causes of phytoplankton blooms to determine of the environmental change here is a result of natural or human processes.

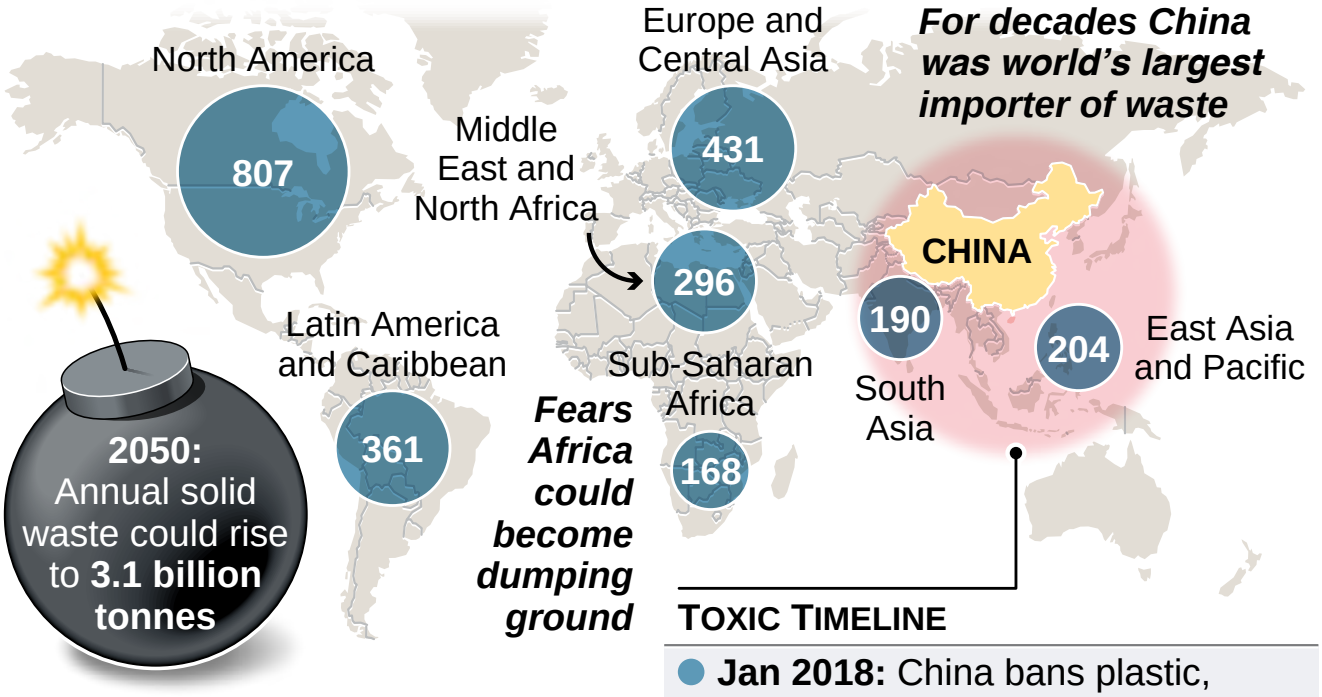


NASA image of a phytoplankton bloom in the Barents Sea. Source: https://commons.wikimedia.org/wiki/File:Barents_Sea_(6046694847).jpg

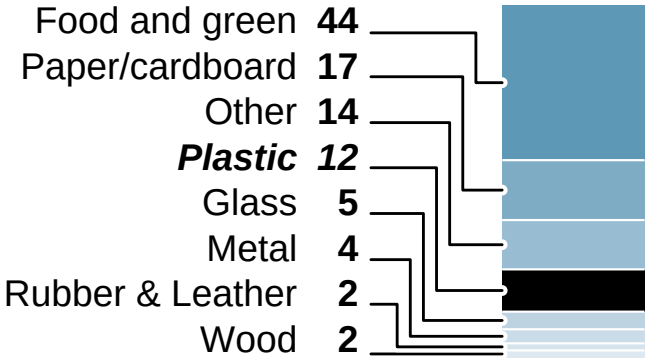
Ticking time bomb of global trash

Humans generated 1.8 billion tonnes of solid waste in 2016, including 220 million tonnes of plastic, according to the World Bank

SOLID WASTE CREATION, PER PERSON, PER YEAR *(2016 estimate, kg)*



GLOBAL WASTE COMPOSITION *(%)*



Each year, 4m-12m tonnes of plastic enters our oceans

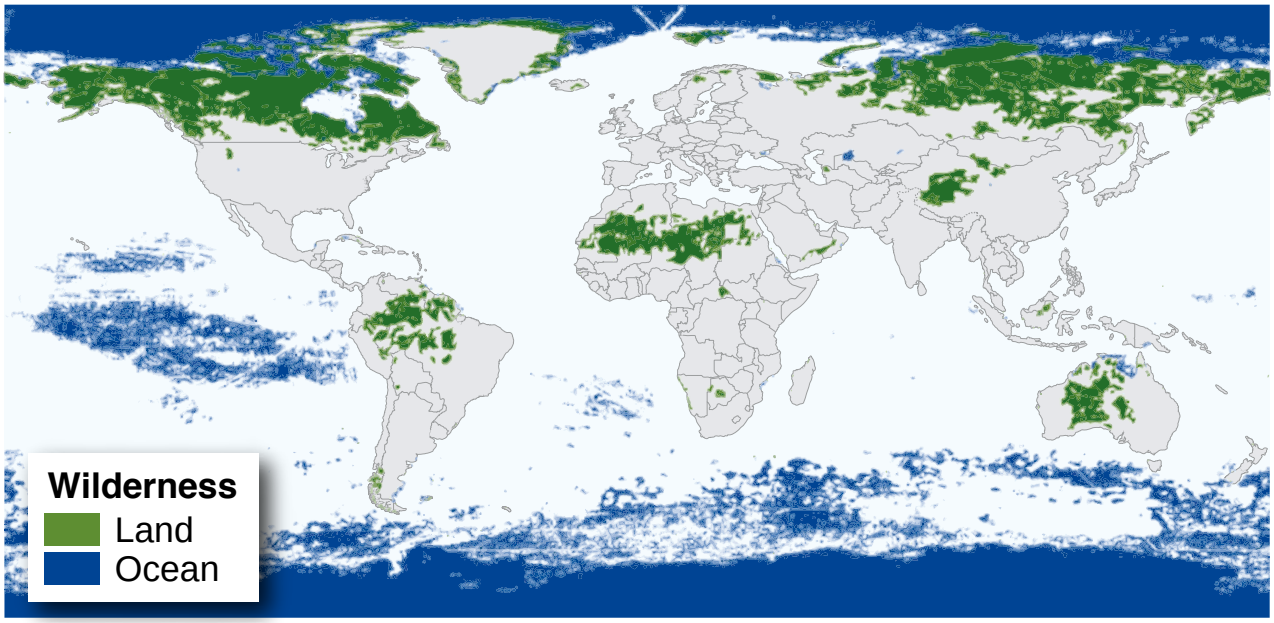
TOXIC TIMELINE

- **Jan 2018:** China bans plastic, paper and electronic waste imports. Until then, it had been taking in up to **56%** of world's unwanted plastic. ***Trash imports in Southeast Asia rise significantly***
- **Jul:** Vietnam cracks down on illegal imports of waste paper, plastic and metal
- **Oct:** Thailand stops issuing import licences for plastic waste
- Malaysia bans plastic scrap imports
- **Mar 2019:** India prohibits import of plastic waste
- **Jun:** Philippines returns 69 containers of garbage to Canada
- Indonesia tightens waste-import rules after finding falsely-labelled containers of toxic waste from U.S.

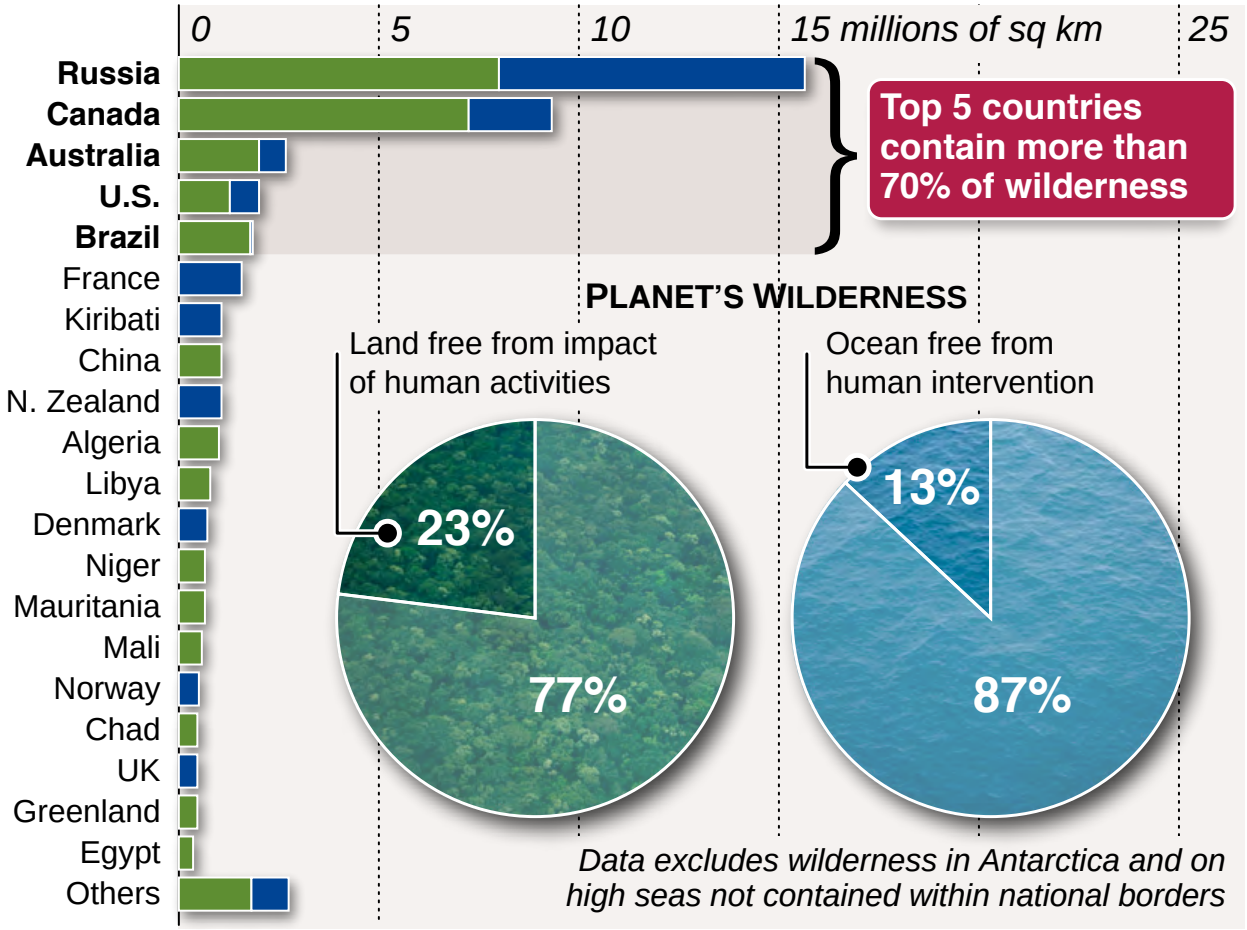
Sources: Bloomberg, World Bank Group, Deutsche Welle Picture: Getty Images © GRAPHIC NEWS

Earth's wilderness vanishing

Scientists say more than 77% of land and 87% of the ocean has been modified by human industry and warn that urgent international action is needed to protect the planet's few remaining wild places



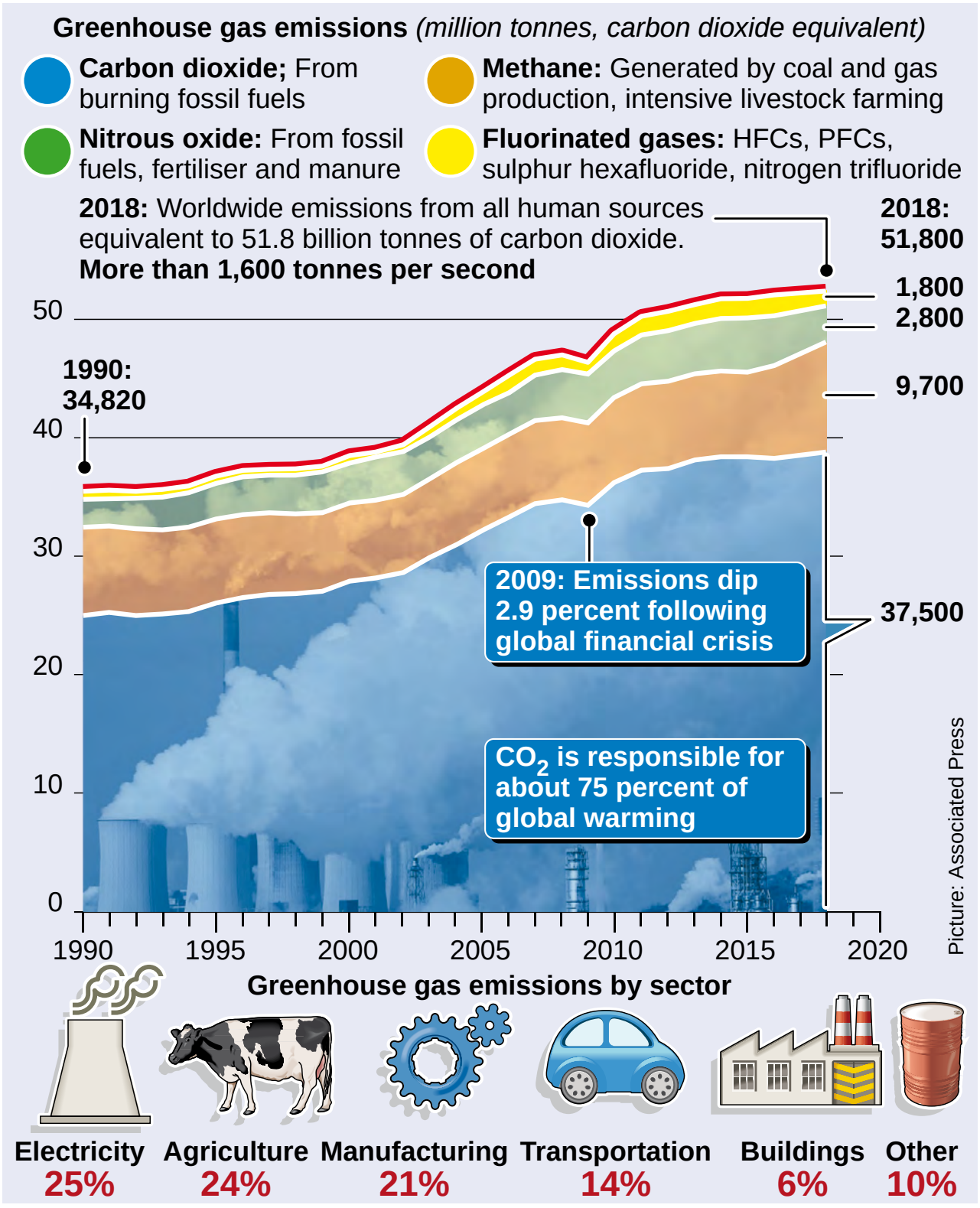
Twenty countries contain 94% of Earth's wilderness



Sources: Nature, University of Queensland, Wildlife Conservation Society

Greenhouse gas emissions

Carbon dioxide (CO_2) is the main greenhouse gas heating the planet. Six other gases are much more powerful, but less abundant. In 2018, greenhouse gas emissions reached 51.8 billion tonnes

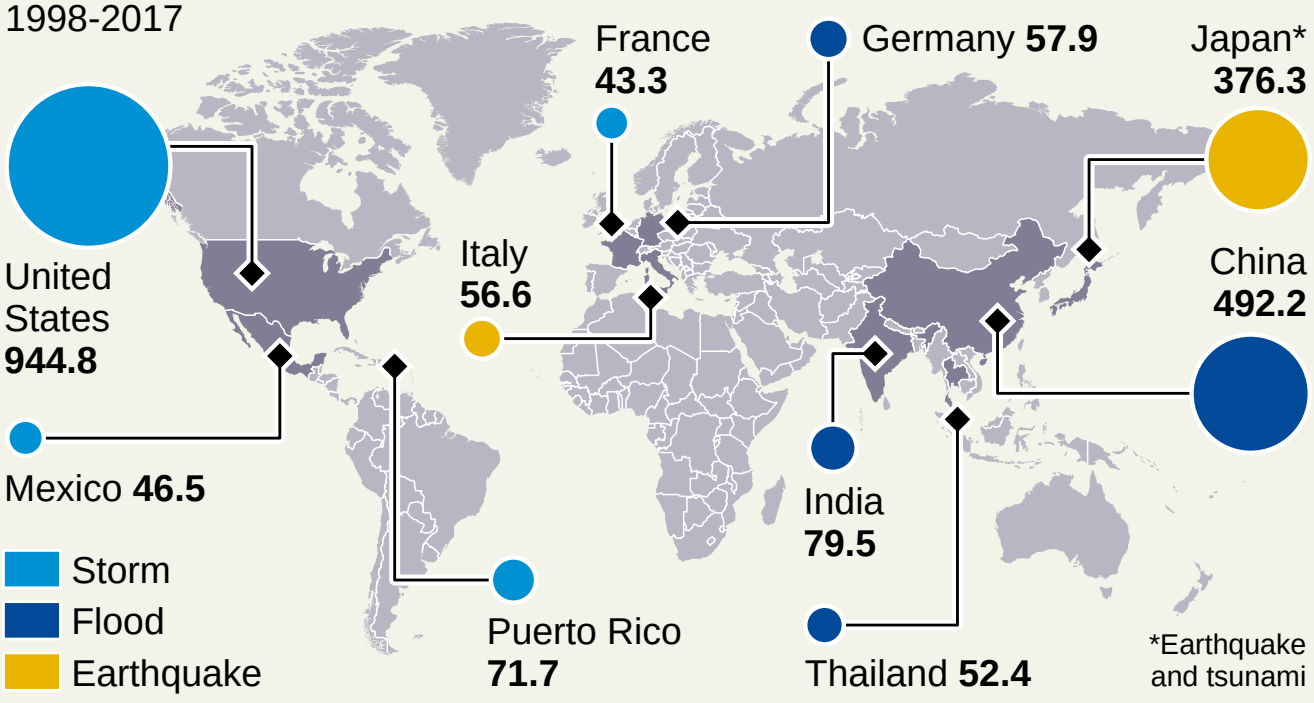


Sources: Netherlands Environmental Assessment Agency, GatesNotes

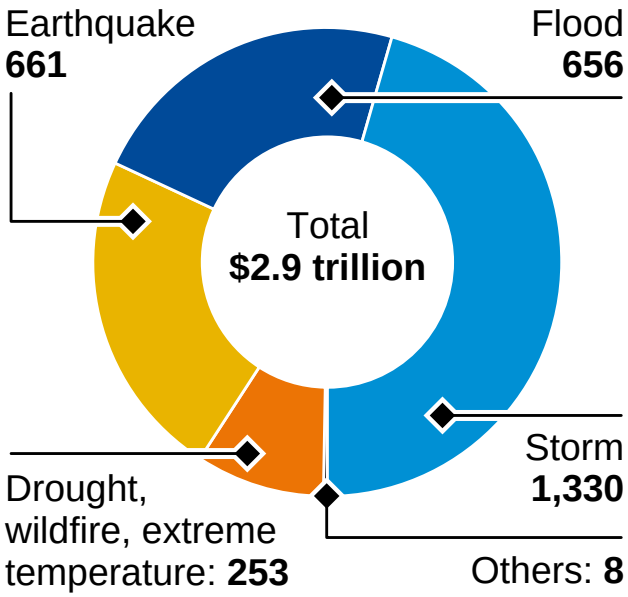
Soaring cost of climate-related disasters

Economic losses from climate-related disasters totalled $2.25 trillion over the past two decades, an increase of more than 150 percent compared to the previous 20-year period, according to the UN

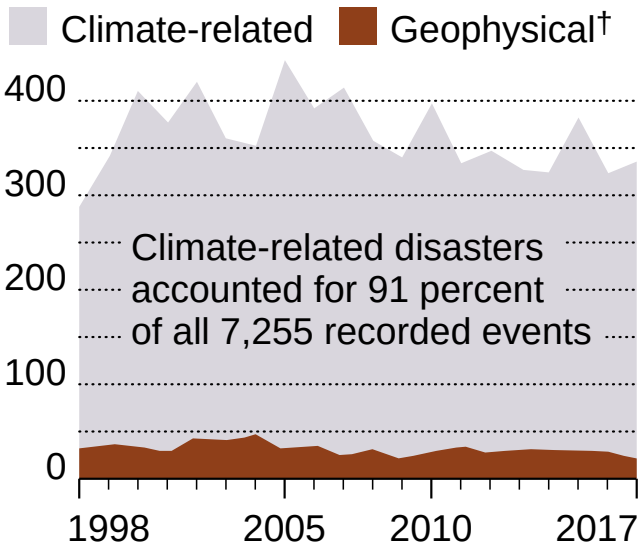
Top 10 countries / territories in terms of total losses ($ billions)
1998-2017



Economic losses by disaster type ($ billions) 1998-2017



Number of disasters by category
1998-2017

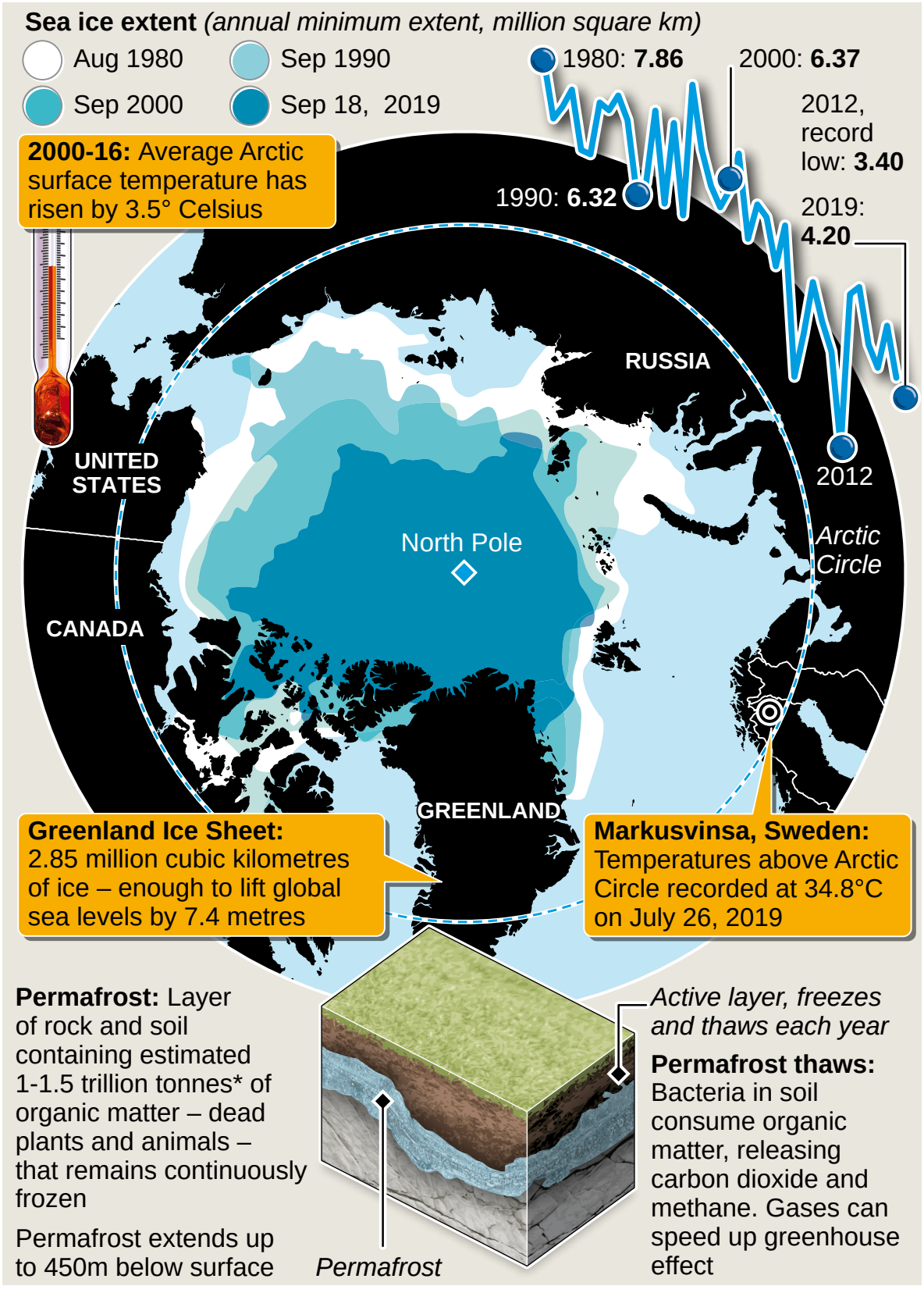


†Mainly earthquakes and tsunamis

Sources: Associated Press, UN Office for Disaster Risk Reduction (UNISDR) © GRAPHIC NEWS

Arctic on front line of climate change

The Arctic is warming twice as fast as the rest of the planet, driven by melting sea ice and thawing of carbon-rich Arctic permafrost, according to the National Oceanic and Atmospheric Administration



Sources: NOAA, NSIDC, NASA, Spiegel *1 trillion = 1,000 billion © GRAPHIC NEWS

Spatial Technologies Inside and Outside Your Geography Classroom

Image: Shutterstock

JPL JOURNAL OF PROFESSIONAL LEARNING

Written by Lorraine Chaffer for the Journal of Professional Learning 2018

https://cpl.asn.au/journal/semester-2-2018/i-want-to-get-physical-physical-spatial-technologies-inside-and-outside-your

Note: Minor updates have been made and images inserted since publication in JPL.

The Journal of Professional Learning (JPL) is an online professional journal that seeks to enhance the quality of teaching and of public education in NSW and Australia. It has been established as an adjunct to the work of the Centre for Professional Learning which is the professional development arm of the NSW Teachers Federation. The JPL will be sent electronically to members of the NSW Teachers Federation. https://cpl.asn.au/journal

Lorraine Chaffer encourages you to confidently use spatial technologies in your classroom…

What is Geography like in your classroom?

With the new K-10 Geography syllabus implemented in all schools from 2017, it may well be timely to stop and ask ourselves a couple of reflective questions such as: What have the students been doing? What have we been doing? Is it working? What should we try next?

I have been looking inside many Geography classrooms across NSW and I have noticed students using spatial technologies to create digital tours, plot information from fieldwork activities, create digital elevation profiles, contribute to citizen science projects and examine or analyse real-time data.

The students like it. Increasingly, I think their teachers do too.

Outside the classroom, governments, organisations and individuals are using spatial technologies to analyse spatial data, create visual representations and make predictions in fields as wide ranging as urban planning, disaster management, agricultural production and climate change.

'Spatial technology is creating significant and interesting employment opportunities in many industries'

Spatial technology is creating significant and interesting employment opportunities in many industries, leading to a growing demand for trained technologists with spatial analysis skills. Geography has always been the subject that is relevant to all other fields. Now, the skills of geographers in both the humanities and technical industries are in increasing demand.

Spatial technologies include any technology that enables us to collect data about a location (place) and

organise that data to show spatial patterns, usually on a map or satellite image.

We may not realise it but this technology has become an integral part of our lives through the devices we use, such as our computers, tablets and smartphones. All online programs, including social media applications, maps and games, have spatial components built into them.

Despite the prevalence of spatial technologies in our daily lives there remains a range of impediments to their use in the classroom. These include software and data access, hardware availability, computer room access and teacher expertise. This article seeks to build confidence and awareness of some of the practical applications teachers are using successfully now, whilst acknowledging that improved resources will also be essential for effective teaching of many of the positive aspects of our new syllabuses.

What does the Geography K–10 syllabus have to say about spatial technologies?

In the NSW Geography Syllabus 7-10, spatial technologies is one of the tools students use in geographical inquiry to gather, interpret, analyse and communicate geographical information.

The syllabus glossary states:

> Spatial technologies include any software or hardware that interacts with real world locations. Examples include, but are not limited to, virtual maps, satellite images, global positioning systems (GPS), geographic information systems (GIS), remote sensing and augmented reality. Spatial technologies are used to visualise, manipulate, analyse, display and record spatial data.
>
> Geography K-10 Syllabus

In the Continuum of Tools, examples of spatial technologies are listed to provide teachers with options when selecting technologies that are content and stage appropriate. For instance,

- Stages 1 to 3 – virtual maps, satellite images and global positioning systems (GPS);
- Stages 4 and 5 – virtual maps, satellite images and global positioning systems (GPS); remote sensing, Augmented Reality (AR) and Geographic Information Systems (GIS).

Over time it is expected that students will experience a range of these spatial tools in the context of asking and answer key geographical questions. By the end of Stage 5 students should feel confident enough to independently choose a spatial technology application for geographical inquiry tasks.

We still need to ask important questions

At Stage 1, students might experience spatial technologies when examining a digital map or using Google Earth to find their suburb or their house. The aim is not only to have students play with the technology but to learn its value in answering questions they have about their world. These questions may include: Where is it? How are places organised?

Continuing with this rationale in mind, by Stage 4, students could be using Geographic Information Systems (GIS) to answer questions such as: What patterns can be observed? How can these spatial patterns be explained? What relationships can you see between features?

The aim is not only to have students play with the technology but to learn its value in answering questions they have about their world.

The technology can then be used to represent their data as layers of information on a map or image. The layers can be turned on and off, allowing choices to be made about the information relevant to a geographical investigation. For example, a layer that shows areas susceptible to flooding in a local area or where rice is grown on a map of the world could help students understand and plan for questions around water as a resource or the impact of hydrological hazards.

At a basic level, a student will use data sets which already exist in an application such as the different layers in Google Earth or Geographic Map Maker. At a more sophisticated level, students will add their own data to create a layer on a map or image using programs such as Esri Story Maps or Google My Maps.

The big six spatial tools

- **GPS** is a global navigation system that uses satellites and ground monitoring stations to locate places using a system of geographic coordinates. The most common application is the use of GPS in cars.
- **GIS** is the system that captures, stores and manipulates geographical data linked to geographic coordinates. It creates data layers in a visual format, such a map, for analysis. In your car, the GPS data collected from the satellite is plotted onto a map that shows where you are.
- **Remote sensing** is a way of obtaining information about places from a distance, usually using aircraft or satellites as well as instruments such as ones, remote cameras, thermal scanners, atmospheric balloons and ocean buoys.
- **Augmented reality (AR)** provides an enhanced version of reality in which computer-generated images (virtual elements) are superimposed onto real

world views. In the Geography classroom, the use of AR allows students to obtain extra information about a place or environment from the augmented image. A good example is an Augmented Reality Sandbox in which contour lines are superimposed over landforms created in the sandbox and rain can be simulated to allow a study of runoff and river flow.

- **Virtual reality (VR)** is a digital recreation of an environment or situation. Users feel like they are experiencing the place or event. In the Geography classroom, the use of VR allows students to experience real environments they may never visit in person by using a headset (goggles) and a smartphone.
- **Real time data visualisations** show environmental change as it happens. Satellites capture and analyse global data instantaneously. This data is used to create real time visualisations. Examples include applications that show the movement of fishing vessels and container ships at sea and monitor weather systems as they occur.

Introducing spatial technologies in the Geography classroom

Confidence is the key to the successful use of spatial technologies in a classroom, but it is also the reality that many students will pick up the skills they need to use these technologies very quickly. For teachers and students, there are free online tutorials for most spatial technology applications used in Geography classrooms worldwide.

My suggestion is to select one spatial tool at a time to develop your skills, and integrate that tool into as many places in your curriculum as possible. Do not feel you need to learn everything a spatial technology tool can do at once; build your skills over time. Most importantly, have a 'Plan B' for those days the technology is not working or a problem arises during your lessons.

Importantly, student activities integrating the use of spatial technologies should have a purpose, be planned and have clear links to the syllabus content and outcomes. Use an inquiry question to focus student learning and provide clear instructions for students to follow. A planning template can be useful when developing activities that could be used as Assessments 'as' or 'for' Learning.

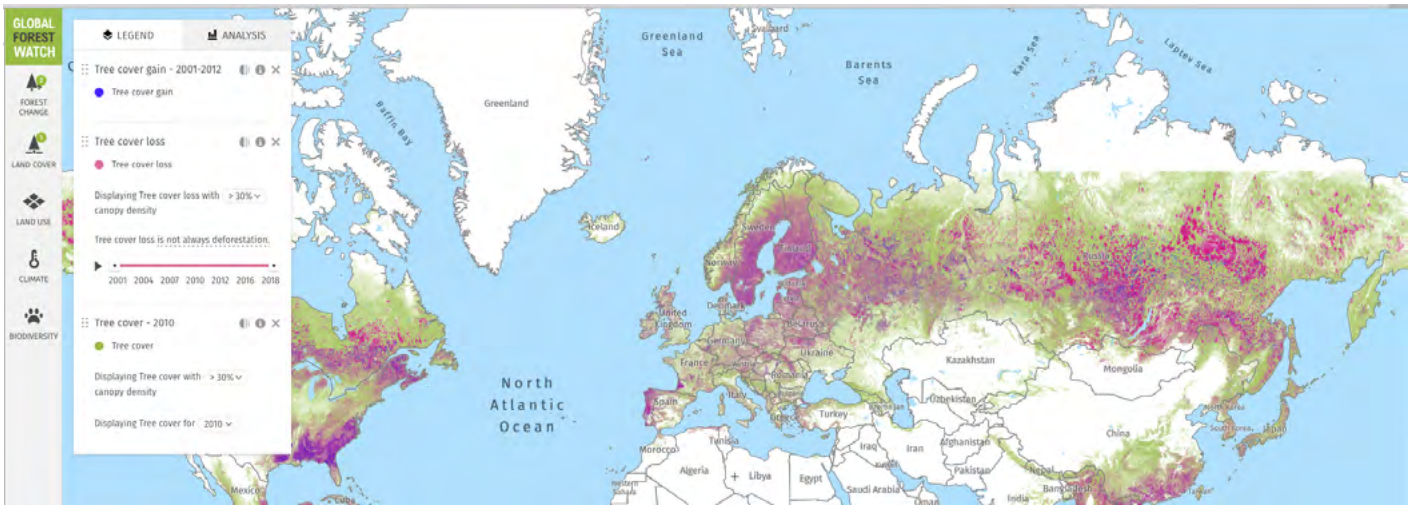
Getting started or moving forward

To develop your own confidence, try getting together with colleagues to experiment with some of the following examples, beginning with some real-time data visualisations first, then moving on to creating maps using programs with inbuilt layers of data. When your team is more confident, start using applications that require you to add your own data layers. Try one at a time and get 'bang for your buck' by trying out your new ideas across your classes for 7–10 or possibly across KLAs for K–6.

And, have some fun together!

1. Real-time data visualisations
   - Earth (global wind map)
   - Global Fishing
   - Flights / Flightradar
   - Australian Bureau of Meteorology Radar Loop

Figure 1: Global forest watch is a sophisticated database of geographical data with multiple layers that can be switched on and off to investigate specific forest issues.

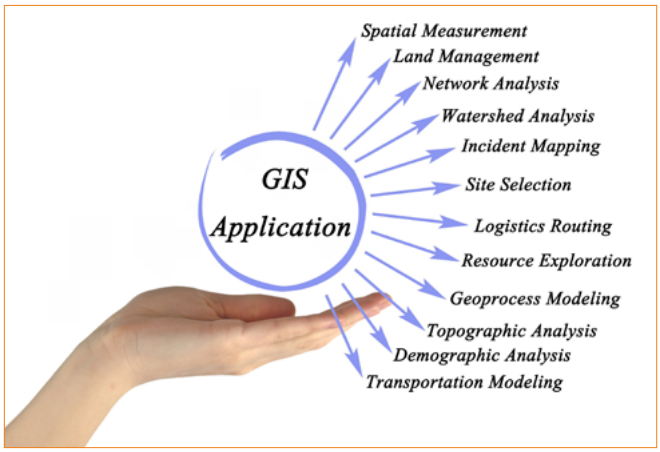


2. Applications with inbuilt layers of geographical data:
   - Google Earth, to create an elevation profile
   - Geographic Mapmaker Interactive
   - Global Forest Watch
   - The Story Map Gallery

3. Application to create a GIS map:
   - Scribble Maps
   - Google Tour Builder and Google Tour Creator
   - Story Map
   - Getting started with Story Map
   - Visualise your data on a custom map using Google My Maps
   - GIS for schools ESRI Australia

The foundations of successful Geography teaching remain a strong emphasis on inquiry and skill development to better understand and affect our world. When we keep strong pedagogy and content knowledge at the heart of our teaching, including a little new technology to investigate some very big questions could well be the next thing we should try.

Figure 2: Spatial technologies are tools with real life applications and clear links to employment and careers.



Geography has a role to play developing student ICT capabilities and spatial analysis.

Spatial technology workshops at the GTANSW & ACT Annual Conference

ICT CAPABILITIES

- **Contour Education**
  - Using Geospatial Tools at a Regional and Global Scale
  - Collecting and Mapping Fieldwork Data using Spatial Tools
  - Using geospatial in the Primary classroom – it's easier than you think!
  - Embedding spatial technologies into your Stage 6 Geography course – now is the time!
- **Forest Learning**
  - Integrating Virtual Reality Teaching Tools into the Geography classroom – useful tools, lessons, tricks and tips for all teachers, incl. a case study using ForestVR.
- **Google Australia**
  - Remove the walls of your Classroom with Google Earth
  - Understand your World with Google MyMaps
  - Google Expeditions: The Next Best Thing to Being There
- **She Maps**
  - Classroom Drone Essentials (2-hour practical workshop)
  - Map My School
- **ESRI Australia**
  - GIS in the classroom: How to give your students the geographic advantage
  - Storytelling with maps: An introduction to Story Maps

Getting students excited about Geography's real-world applications

David Massingham, Communications Specialist
Destination Spatial Queensland

For teachers – no matter what their area of expertise – one question that can come up from students and parents alike is, "what career prospects are there in this subject?"

Geography is interesting in this regard. There's a sense amongst some students that geography, whilst interesting, is not as integral to the 21st century world as it was in the past. After all, haven't we already mapped the planet's surface? What possible need could there be for geography moving forward?

Geography teachers know better, of course

When recommending career paths for students that find that passion for geography burning within them, numerous job titles leap to mind. Are they interested in being cartographer? It's a rewarding and enjoyable job, though admittedly the need for cartographers is becoming rarer in the 21st century. Town planner? The geography of the built environment is key in our modern times. Environment monitoring and management? Climatologist? Meteorologist? There is a long list of careers that geography is an integral part of. However, there is one job that avid geography students may not think of immediately.

Surveying the Lay of the Land

Surveyors define the boundaries that exist in our built and natural environment. Upon the arrive of the first fleet and subsequent European settlers, it was surveyors that mapped the complexities of the Australian landscape. Their findings and recommendations had enormous say in determining where towns and cities were built. In fact, to this day, cadastral and land surveyors are amongst the first on the ground in any construction or development project.

One might say that if the word geography means "earth writing", then surveying is about writing down the Earth's boundaries in permanent ink.

The natural geographical environment certainly has an impact on the surveyor's workload. For example, natural waterways have a tendency to change their course over time, which means that water can have great importance when determining boundaries. As a result, land surveying and geography are intrinsically linked.

Due to the central role it plays in all sorts of construction and built environment projects, surveying is not just a viable career path for a high school student interested in mapping and geography – it's also a competitive one. A current skills shortage affecting the profession means that there are a surplus of well-paid opportunities for tertiary graduates.

Roles in Surveying

For students interested in geography, surveying offers a practical outlet to the theoretical work. Surveyors engage with a variety of measurement and mapping tools, from the simple (measuring tapes and levels) to the complex (theodolites and total stations) to the extremely complex (GPS programs, 3D-scanning technology and drones). Using the data collected by these tools, surveyors can determine land measurements, examine topographical concerns, provide geospatial data integral to the maintenance and upkeep of existing structures, and lay out the foundations that other building, construction or design professionals rely on.

There are a variety of surveying roles students can pursue. A survey assistant will record measurements manually and electronically, peg out geographical boundaries, maintain the survey equipment and assist with the surveyor's tasks.

A surveying technician, meanwhile, will take a more analytical approach. Utilising software, photogrammetry and data collection equipment, not to mention extensive time out in the field (surveying

is definitely a job path that offers a variety of indoor and outdoor offices), the surveying technician role is an exciting and modern way of applying a geography student's learning.

Another surveying-associated role is the GIS technician – this stands for Geographic Information Systems. They collect location-based information and then develop it into a new format, such as a map.

With specialised training, a surveyor can become a licensed or registered surveyor: in Australia, only they have the legal authority to apply the laws and regulations regarding land ownership, map out subdivisions and distribute land titles.

Get Kids into Survey

One tool for demonstrating the connections between geography and surveying to school students is the range of Get Kids into Survey posters. The newest edition is set to feature Australia's Sydney harbour as the backdrop, making it an even more effective teaching aid.

Developed in the United Kingdom by Elaine Ball Ltd and now available in the United States and here in Australia, these posters are purposed for a primary school and young high school audience, efficiently – and literally – illustrating the ins and outs of the surveying world.

Students will learn about what surveyors and spatial specialists do, how it their work relates to other fields, what sort of projects they could work on, and more. These posters will capture the attention of students that have an interest in geography, maths, design, IT, the outdoors, or all of the above.

In fact, the opportunities that are afforded by this poster are numerous. There is a chance to promote surveying to not just a school audience, but to a primary one. With each poster filled with characters, surveying equipment and geospatial activities, students will be engaging with conversations about how human beings interact with natural and the built geography.

Get Kids into Survey is just one way of connecting the theory of geography with the real world. Copies of the first Get Kids into Survey poster can be ordered for no more than the cost of shipping via https://www.elaineball.co.uk/product-category/australasia/. For further information on surveying as it pertains to geography, you can visit www.alifewithoutlimits.com.au or email trysurveying@alifewithoutlimits.com.au.

The Sydney edition of the Get Kids into Survey poster.

2019 Australian Geography Competition

New South Wales and Australian Capital Territory

Future competition dates:

2020 Wednesday 18 March to Wednesday 1 April
2021 Wednesday 17 March – Wednesday 31 March
2022 Wednesday 16 March – Wednesday 30 March

The 2019 School Round

Over 73,000 students were entered from 788 schools across Australia. Table 1 provides a summary by State/ Territory of the number of schools and students entered in recent years.

NOTE: Copies of past Competition papers can be downloaded from the AGC website. The 2018 paper is included after this report.

Table 1: Number of entries in 2016 to 2019 by State and Territory.

State / Territory	2019		2018		2017		2016	
	Entries	Schools	Entries	Schools	Entries	Schools	Entries	Schools
ACT	2,270	21	2,358	21	2,467	22	2,306	18
NSW	27,555	284	27,386	285	25,807	269	23,313	226
NT	244	4	164	4	297	4	122	5
QLD	13,207	152	11,227	146	11,045	150	12,813	136
SA	3,391	38	3,264	34	3,800	38	3,654	42
TAS	1,029	31	1,301	30	1,025	24	816	26
VIC	14,871	153	15,038	154	15,040	134	13,221	124
WA	10,650	101	11,395	104	11,042	97	10,243	90
Other [1]	108	4	123	4	156	5	79	3
Totals	**73,325**	**788**	**72,256**	**782**	**70,679**	**743**	**66,567**	**670**

Notes: 1. Includes External Territory and overseas schools.

Source: www.geographycompetition.org.au/

Australian team at the 2019 iGeo in Hong Kong. Source: www.facebook.com/AustralianGeographyCompetition/

Table 2 provides a breakdown of student numbers in New South Wales and Australian Capital Territory from 2016 to 2019 by Year Level and Gender. The numbers provided are those that were returned by the due date for analysis and will not agree with totals provided in Table 1.

Table 2: Number of students entering by Year Level, Total, and Gender 2016 to 2019

State / Territory	Year	Year Level	TOTAL	FEMALE	MALE	NON-GENDER
ACT	2016	7	215	176	34	5
ACT	2017	7	432	220	207	5
ACT	2018	7	174	118	54	2
ACT	2019	7	165	134	29	2
ACT	2016	8	628	303	317	8
ACT	2017	8	651	284	349	18
ACT	2018	8	393	211	174	8
ACT	2019	8	449	208	230	11
ACT	2016	9	564	278	276	10
ACT	2017	9	458	226	224	8
ACT	2018	9	594	297	295	2
ACT	2019	9	642	314	322	6
ACT	2016	10	481	179	296	6
ACT	2017	10	389	146	236	7
ACT	2018	10	579	250	315	14
ACT	2019	10	590	248	328	14
ACT	2016	11	61	3	58	0
ACT	2017	11	66	14	52	0
ACT	2018	11	56	18	35	3
ACT	2019	11	101	39	59	3
ACT	2016	12	54	17	36	1
ACT	2017	12	57	6	50	1
ACT	2018	12	60	12	48	0
ACT	2019	12	59	21	38	0

State / Territory	Year	Year Level	TOTAL	FEMALE	MALE	NON-GENDER
NSW	2016	7	2679	1163	1483	33
NSW	2017	7	3122	1393	1696	33
NSW	2018	7	3654	1589	2028	37
NSW	2019	7	3604	1575	1990	39
NSW	2016	8	3732	1281	2321	130
NSW	2017	8	4215	1610	2485	120
NSW	2018	8	4422	1692	2619	111
NSW	2019	8	4648	1880	2620	148
NSW	2016	9	5271	2362	2840	69
NSW	2017	9	5666	2757	2856	53
NSW	2018	9	5492	2741	2679	72
NSW	2019	9	5839	2788	2964	87
NSW	2016	10	6743	2809	3763	171
NSW	2017	10	7454	3545	3778	131
NSW	2018	10	7436	3691	3580	165
NSW	2019	10	7144	3514	3456	174
NSW	2016	11	1188	483	698	7
NSW	2017	11	1675	764	894	17
NSW	2018	11	1662	733	906	23
NSW	2019	11	1792	825	947	20
NSW	2016	12	724	275	412	37
NSW	2017	12	911	394	491	26
NSW	2018	12	1044	412	606	26
NSW	2019	12	868	367	465	36

Table 3 provides the national average scores for each Year Level and Table 4 provides the cut-off used to categorise student marks into certificate levels.

Table 3: Average score for each competition level, 2016 to 2019.

Year	2019	2018	2017	2016
7 and below	13.25	13.96	14.5	14.78
8	14.46	15.06	15.77	16.06
9	20.18	20.97	21.61	22.20
10	20.98	22.04	22.53	23.12
11	17.73	19.34	18.68	20.16
12	18.46	20.91	20.07	21.49

RIGHT: 2019 Australian Medalists, at iGeo Hong Kong: BRONZE – Alex Shierlaw, St Peter's College, SA, Stefan Simic, McKinnon Secondary College, Vic, Eleanor Smith, Kilvington Grammar School, Vic and GOLD – Jacob Thai, Sydney Grammar School, NSW

Table 4: 2019 cut-off scores for the certificate levels by age.

Year	Participation	Credit	Distinction	High Distinction	Top 1%
7	0 – 14	15 – 16	17 – 18	19 – 22	23 – 30
8	0 – 15	16 – 17	18 – 19	20 – 24	25 – 30
9	0 – 21	22 – 24	25 – 27	28 – 32	33 – 40
10	0 – 22	23 – 25	26 – 28	29 – 33	34 – 40
11	0 – 18	19 – 21	22 – 24	25 – 29	30 – 35
12	0 – 19	20 – 22	23 – 25	26 – 30	31 – 35

In 2019, prizes were awarded to 53 students and 7 schools across Australia, excluding selection for Geography's Big Week Out.

Congratulations to the New South Wales and Australian Capital Territory students who came first in their Year Level.

Table 5: New South Wales winners by Year Level for 2019

Student	Year Level	Award	School
Michael Hue	7	Equal first in Australia	Sydney Grammar School
Sidharth Manoj Kumar	8	Equal first in Australia	North Sydney Boys' High School
Evan La Fontaine	9	Equal first Australia	Normanhurst Boys' High School
Elliot Moy	9	Equal first Australia	Baulkham Hills High School
Rachel Frecker	10	First in Australia	Santa Sabina College
Brendan Tate	11	Equal first in Australia	Caringbah High School
Noah Gong	11	Equal first in Australia	Sydney Grammar School
Will Segalla	12	First in New South Wales	Arndell Anglican College

Table 6: Combined Territories (ACT, NT and External Territories) winners by Year Level for 2019

Student	Year Level	Award	School
Rosemary Norton	7	Equal first in Combined Territories	Canberra Girls Grammar Senior School
Name withheld	7	Equal first in Combined Territories	Alfred Deakin High School, ACT
Adam Liu-O'Dowd	7	First in Combined Territories	Cocos Islands District High School
Thomas Lin	8	First in Australia	Canberra Grammar School
David Stocks	10	Equal first in Combined Territories	Radford College, ACT
Andrew Kerr	11	First in Combined Territories	Radford College, ACT
Daniel McCormack	9	First in Combined Territories	Canberra Grammar School
Otto Power	12	First in Combined Territories	Canberra Grammar School

Highest scoring schools are provided in Table 5 and Table 6. Currently the school score is determined by adding the results of the five best students from Years 8 to 12.

Table 7: Highest scoring schools for each State and Combined Territories

State/Territory	School
Australia	Sydney Grammar School
Queensland	Brisbane Grammar School
South Australia	Pembroke School
Tasmania	St Michael's Collegiate School
Territories (ACT, NT, External Territories)	Canberra Grammar School, ACT
Victoria	Presbyterian Ladies' College
Western Australia	Perth Modern School

Table 8: The ten highest scoring schools in Australia

Place	School
1	Sydney Grammar School, (NSW)
2	Sydney Boys High School (NSW)
3	Northern Beaches Secondary College – Manly Campus (NSW)
4	Canberra Grammar School (ACT)
5	Knox Grammar School (NSW)
6	Perth Modern School (WA)
7	Presbyterian Ladies' College (VIC)
8	Ryde Secondary College (NSW)
9	St Aloysius' College (NSW)
10	Camberwell Grammar School (VIC)

Geography's Big Week Out (GBWO)

High-scoring Year 11 students are selected from the Competition to take part in the GBWO which is a week of geographical activities focussing on fieldwork including spatial technologies. Year 11 students, one male and one female from each State and the Combined Territories, and the next two nationally highest scoring female and male are invited to participate in the GBWO. Australia's team to the **2020 International Geography Olympiad** in **Istanbul, Turkey** will be selected from participating students.

The **GBWO** will again be held on **Kangaroo Island** from Sunday 15 to Friday 20 December 2019. The 2017, 2018 and 2019 GBWOs have been organised by the Geography Teachers' Association of South Australia (GTASA) under the leadership of Liam Sloan and Simon Roos-Freeman. Table 9 provides the list of 2019 GBWO participants.

Participants in the 2018 GBWO on Kangaroo Island

Table 9: 2019 GBWO student participants.

State	Student	Participant's School
Combined Territories	Sebastian Connor	Dickson College (ACT)
	Tyra Kuan	Canberra Grammar School (ACT)
NSW	Brendan Tate	Caringbah High School (NSW)
	Elita So	Caringbah High School (NSW)
	Lauren Griffiths	Northern Beaches Secondary College - Manly Campus (NSW)
	Noah Gong	Sydney Grammar School (NSW)
QLD	Joshua Crow	The Scots PGC College (QLD)
	Taylor Timpani	All Saints' Anglican School Senior Campus (QLD)
SA	Lucy Watson	Pembroke School (SA)
	Oliver Shephard-Bayly	Pedare Christian College (SA)
TAS	William Mather	The Hutchins School (TAS)
	Katie Stanton	Launceston Church Grammar School (TAS)
VIC	Sonia Truong	The MacRobertson Girls' High School (VIC)
	Liam Morris	Melbourne High School (VIC)
WA	Eve Fleming	Carine Senior High School (WA)
	Quinlan Arundel	Scotch College (WA)

The Competition covers expenses for students participating at GBWO and is financially supported by the Australian Department of Education and Training.

Thanks goes to the Geography Association of Western Australia (GAWA) for volunteering to coordinate the 2020 and 2021 GBWOs.

International Geography Olympiad (iGeo)

The Australian students competed against 42 other countries at the **16th International Geography Olympiad (iGeo)** held in **Hong Kong, China** from 30 July to 5 August 2019. The team performed well.

The four-member Australian Team performed well at the iGeo; each bring home a medal:

- Jacob Thai from Sydney Grammar School, NSW, Gold Medal
- Stefan Simic from McKinnon Secondary College, Vic, Bronze Medal
- Alex Shierlaw from St Peter's College, Hackney, SA, Bronze Medal
- Eleanor Smith from Kilvington Grammar School, Vic, Bronze Medal

The Australian Team was placed 11th overall by a matter of decimals. Indonesia came first. These four students were chosen to represent Australia based on their performances in the Year 11 level of the 2018 Australian Geography Competition and the 2018 Geography's Big Week Out.

The two 2019 Australian Team Leaders were Simon Roos-Freeman, 2017 and 2018 GBWO Teacher and GTASA member, and Kath Berg, Australian Geography Competition Committee member.

Important 2020 Competition Dates

COMPETITION IN SCHOOLS	**Wednesday 18 March – Wednesday 1 April 2020**
Monday 2 March	Entry and payment deadline. Entry fees to the 2020 Competition will remain at $4 per Question Booklet (student)
Thursday 2 April	Schools post completed answer sheets
Monday 20 April	Completed answer sheets must be received by the Competition Office. *Note: Answer sheets received after Mon 20 April, may not be eligible for prizes, but will be accepted and students' answers will be graded and receive certificates.*
Friday 15 May	Prize-winners notified via their school
Tuesday 9 June	Certificates and results posted to schools
Tuesday 11 to Monday 17 August	International Geography Olympiad (iGeo)
Sunday 27 September to Friday 2 October	Geography's Big Week Out

The Competition organisers appreciate the support of New South Wales and Australian Capital Territory teachers in entering their students in the Competition and welcome feedback teachers may have. Please do not hesitate to contact the Competition Office if you have any queries.

Australian Geography Competition: Background

The Australian Geography Competition is a joint initiative of the Australian Geography Teachers' Association Limited (AGTA) and the Royal Geographical Society of Queensland Incorporated (RGSQ) and is currently managed and run by the RGSQ under a Memorandum of Understanding between both parties. The AGC is overseen by a committee of five voting members: two from AGTA; two from RGSQ; and, one independent approved by both AGTA and RGSQ. The Committee is chaired by the AGC Coordinator who is not a voting member of the Committee.

There are three AGC associated events:

- The **School Round** is school based with the AGC Office providing both question booklets and answer sheets as ordered by the school. Completed answer sheets are returned to the AGC Office where they are scanned, converted to text files, pre-processed and analysed. All legible returned answer sheets are marked and categorised (top 1% in Australia, high distinction, distinction, credit and participated). The AGC Office has the certificates and results for each student printed and returned to the school for distribution to their students.

  Students sit the 35-minute Competition within a two-week period. One Question booklet with 50 questions is provided. Students in Years 7 and 8 answer the first 30 questions; Year 9 and 10 students answer the first 40 questions; and, Year 11 and 12 students answer questions 16 to 50.

- **Geography's Big Week Out** (GBWO) is a six-day field-based event focusing on fieldwork and spatial technologies. Sixteen high performing Year 11 students who have sat the Competition are selected to participate in the week. The Competition covers expenses for student participating at GBWO and is financially supported by the Australian Department of Education and Training.

  GBWO is circulated between States/Territories generally on a two-year bases through the generosity of the local Geography Teachers Association organising and coordinating the activities.

- Australia's team to the **International Geography Olympiad (iGeo**). Four students from the GBWO are selected to represent Australia at the iGeo. The AGC covers expenses for student participating at iGeo and is financially supported by the Australian Department of Education and Training.

  Organised by the International Geographical Union's (IGU) Olympiad Task Force, the iGeo is a prestigious annual competition for 16 to 19-year-old students selected through a national geography competition. To challenge the best-performing geography students from around the world, the iGeo program involves three tests - a written response test, a multi-media test and a substantial fieldwork exercise requiring observation, cartographic representation and geographical analysis. The program also included poster presentations by teams and a cultural session.

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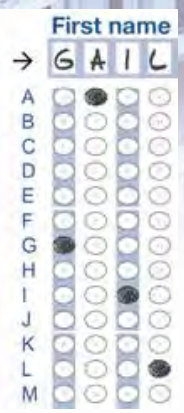
Question Booklet

2018 Australian Geography Competition

INSTRUCTIONS

1. Use a 2B pencil to complete the answer sheet. You will need a clean eraser to erase your mistakes.

   YOU MUST FILL IN THE REQUIRED OVALS. The answer sheet is computer marked and all the ovals you fill in are recorded. See the left side of the Answer sheet for instructions on how to fill in the ovals correctly.



2. **Before the start of the test**

   Fill in your name by writing the letters of your name in the required boxes. Then fill in the corresponding ovals beneath the letters of your name. See the **First name** example to the right. You must do this for both your **First name** and **Last name**.

   On the lower left of the Answer sheet, please print your school's name where asked. Write the numbers your teacher will give you in the **School Code** and **Postcode**.

   On the bottom of the Answer sheet, fill in the oval beside your **Year level**.

   If you are in **Year 11**, fill in the oval beside your **age at 30 June 2018**.

   Fill in the oval beside your **Gender**.

   If you need to, your teacher will advise you to fill in an oval under **School assigned**.

3. **Answer** each question by filling in only one oval that corresponds to the most appropriate answer choice for that question. If you change your mind, you must erase the wrong answer completely so that only one oval is filled in for each question.

   If you are in **Year 7 or younger**, or **Year 8** answer Questions 1–30.

   If you are in **Year 9** or **Year 10** answer Questions 1-40.

   If you are in **Year 11** or **Year 12** answer Questions 16-50 (starting on page 5).

4. Do not mark the front or back of the answer sheet in any other way as this can lead to errors in the computerised marking, or to you not getting a result.

5. You have **35 minutes** to answer the questions.

An initiative of

The Royal Geographical Society of Queensland Inc

Australian Geography Teachers' Association Ltd

Proudly supported by

The University Of Queensland AUSTRALIA — School of Earth and Environmental Sciences

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Australian Geography Competition 2018

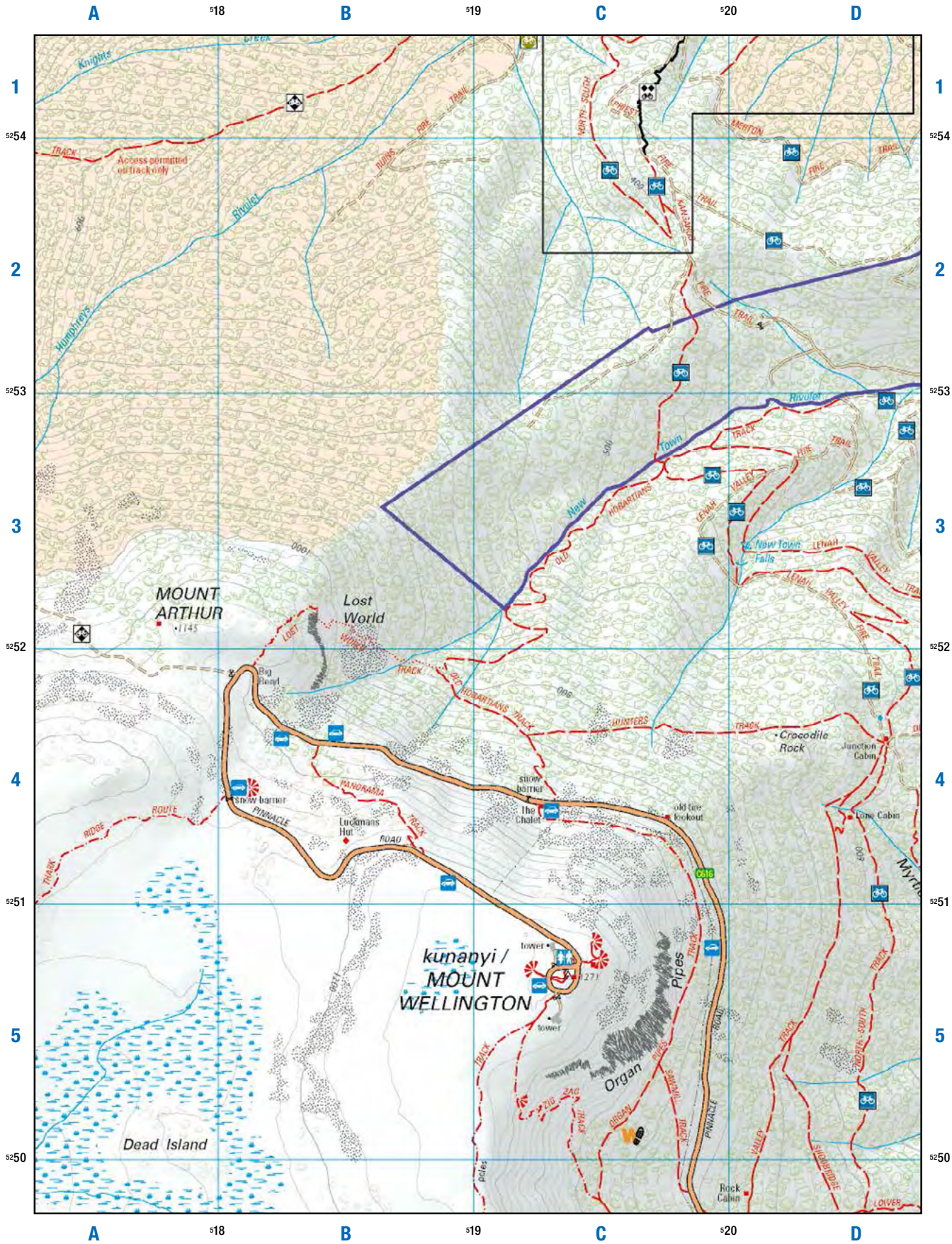


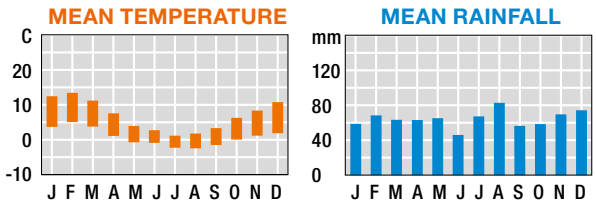
Figure 1. *Extract from: Wellington Park Recreation Map, Tasmania*

Base map reproduced with permission of TASMAP (www.tasmap.tas.gov.au) © State of Tasmania

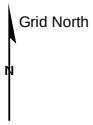
Legend

ROADS
Major road with route marker B64
Other public road .....
Restricted use
Formed .....
Vehicular track with gate/barrier .....
WALKING TRACKS
Formed: high quality; may be locally rough ...
Unformed: clear and rough; marked or cairned ..
Mountain bikes only; Great Short Walk .....
SHARED USE WALKING/CYCLING TRACKS
Easy; Moderate; Difficult; Very difficult .....
Wellington Park boundary; other reserve boundary
Transmission line .....
Public toilets; Picnic area: Car park; Information .
Lookout; Waterfall; Trig station; Spot height ..... • 324
Buildings - Public; Private; Ruin .....
Swamp; Landslide/Rock scree; Cliff .....
Dense-medium timber; Scattered trees & scrub .
Contours (20 metre interval); Quarry 700
Built up area .....
Restricted area (public access on nominated tracks only)

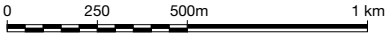
Roads and tracks on this map do not necessarily indicate a public right of way. Some tracks on private property are not shown, as requested by landowners. Walking tracks shown within Wellington Park are those approved by the Wellington Park Management Trust.



Weather station: MT WELLINGTON elevation 1260.5m



SCALE 1:20000



PROJECTION: Universal Transverse Mercator
HORIZONTAL DATUM: Geocentric Datum of Australia 1994
VERTICAL DATUM: Australian Height Datum (Tasmania)

Contour Interval 20 Metres

Start at Question 1 if you are in Year 10 or younger. Start at Question 16 (on page 5) if you are in Year 11 or 12.

1 Using Figure 1, the area around the building on Mount Arthur (A3) is mainly:

A built up area
B cliffs
C dense-medium timber
D rock scree
E swamp

2 The direct distance between the building on Mount Arthur (A3) and Luckmans Hut (B4) is approximately:

A 1 km
B 1.1 km
C 1.3 km
D 5.6 km
E 5.8 km

3 What is the approximate height above sea level of Luckmans Hut (B4)?

A 1125 m
B 1170 m
C 1230 m
D 1275 m
E 1350 m

4 Using the graphs in Figure 1, when is Mount Wellington's monthly mean rainfall the highest?

A April
B August
C December
D February
E July

5 Based on the graphs in Figure 1, which type of climate does Mount Wellington have?

A arid
B equatorial
C polar
D temperate
E tropical

Fold this page back on itself to see the map at the same time.

6 If you walked from Luckmans Hut (B4) to the carpark at the end of the road (C5) you would mainly be travelling:

A north
B northeast
C northwest
D southeast
E southwest

7 Which of these tracks should be the flattest to walk along?

A Lost World Track (B3)
B Old Hobartians Track (C3)
C Organ Pipes Track (C5)
D Sawmill Track (C5)
E Zig Zag Track (C5)

8 How is the Aboriginal heritage of the area recognised in the map (Figure 1)?

A Aboriginal ceremonial sites are marked.
B The Aboriginal name for Mt Arthur is given.
C The Aboriginal name for Mt Wellington is given.
D Aboriginal rock art sites are marked.
E Tracks follow Aboriginal trade routes.

Figure 2. *Rock formation* *© Stefan Karpiniec, CC-BY-2.0*

9 In which grid square in Figure 1 was the photo in Figure 2 taken?

A A4
B B2
C B5
D C3
E C5

10 How was the rock formation shown in Figure 2 created?

A Block faulting caused the joints.
B Columns developed as magma cooled and contracted.
C Deposited sediments built up in layers and then tilted.
D Existing rocks were changed due to heat and pressure.
E A glacier scratched striations on the rocks.

11 A significant <u>cultural</u> value of an area such as Wellington Park would be:

A endangered ecosystems
B endemic flora and fauna
C geodiversity of the landscape
D historic bushwalkers' huts
E source of good quality drinking water

12 With a map scale of 1:20000, which distance does 1 cm on the map represent on the ground?

A 20 cm
B 20 km
C 20 m
D 200 cm
E 200 m

Table 1. *Local liveability survey*

Indicator	Score				
	Poor	< . . . . . >			Good
Climate comfort	1	2	3	4	5
Air quality	1	2	3	4	5
Urban design	1	2	3	4	5
Public transport	1	2	3	4	5
Personal safety	1	2	3	4	5
Vandalism and graffiti	1	2	3	4	5
Quality of schools	1	2	3	4	5
Opportunities for post-school study	1	2	3	4	5

13 Which important indicator category is missing from the survey in Table 1?

A education
B environment
C health
D infrastructure
E law and order

14 A liveability index designed for overseas students coming to Australia, gives increased emphasis to:

A access to medical specialists
B aged care facilities
C choice of primary schools
D plenty of entertainment options
E all of the above

15 Which of these is a spatial strategy to improve liveability?

A changing a city's zoning regulations to enhance sustainability
B controlling a city's population growth
C investing more in public transport services
D providing funds for community development initiatives
E upgrading recreational facilities for young people

Start at Question 16 if you are **in Year 11 or 12**. Other students continue answering questions.

16 Using Figure 3, between 1984 and 2014 the surface area of the water in Lake Urmia:

A decreased by approximately 30%
B decreased by approximately 50%
C increased by approximately 70%
D decreased by approximately 90%
E stayed the same

17 What are the most likely reasons for the changes seen in Figure 3?

A decreasing evaporation, more hydroelectric dams
B decreasing humidity, less farming land
C decreasing rainfall, more water diverted for irrigation
D decreasing temperatures, greater surrounding population
E decreasing wind speeds, less local industry

Figure 4. *Lake Urmia in 2015*

18 Which impact of the change in water level is best illustrated in Figure 4?

A Farmers have easier irrigation access.
B Migratory birds have increased nesting areas.
C Shipping on most of the lake has halted.
D Tourist numbers to the lake have decreased.
E Villagers have more land to build on.

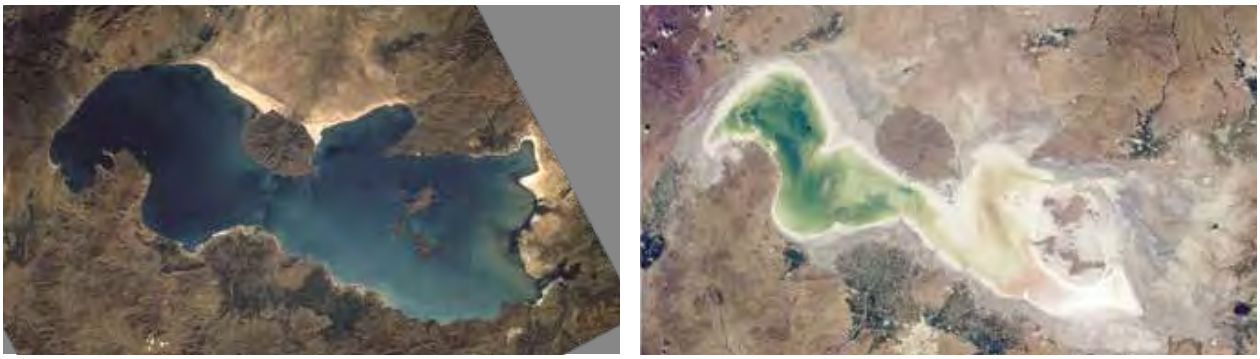


Figure 3. *Astronaut photographs of Lake Urmia, Iran, taken from the International Space Station in 1984 (left) and 2014 (right); the photographs are approximately the same scale* *Source: NASA Johnson Space Center*

Australian Geography Competition 2018

19 A realistic management plan to improve Lake Urmia's condition should include:

A balancing water use and environmental protection
B building resorts to increase tourism
C melting icebergs to supplement the water level
D pumping water into the lake from the Caspian Sea
E stopping all irrigation around the lake

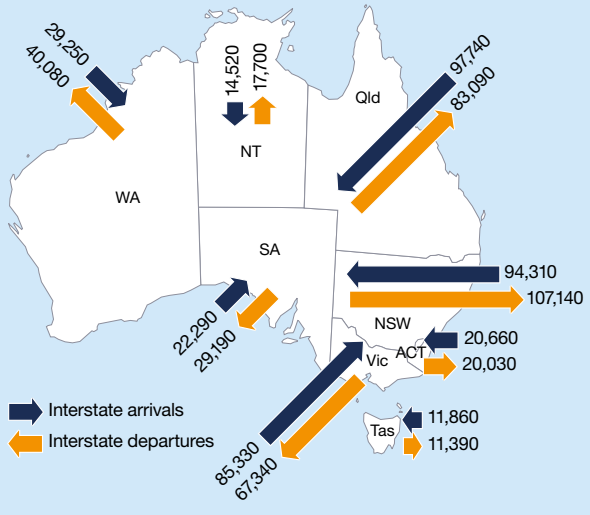


Figure 5. *Interstate migration in Australia, 2016*

Data source: ABS

20 From Figure 5, which state had the highest number of interstate arrivals in 2016?

A New South Wales
B Queensland
C South Australia
D Victoria
E Western Australia

21 Using Figure 5, which state had the highest net gain of people through interstate migration in 2016?

A New South Wales
B South Australia
C Tasmania
D Victoria
E Western Australia

22 A significant reason why Western Australia lost people through interstate migration in 2016 was that:

A baby boomers are retiring to coastal WA
B jobs associated with the mining boom have ended
C Perth's house prices are lower than Sydney's
D WA's cost of living is less than Victoria's
E all of the above

Figure 6. *Migration cartoon* *© Simon Kneebone*

23 The cartoon in Figure 6 is based on which of these reasons for interstate migration?

A employment
B family
C lifestyle
D retirement
E study

Table 2. *Jumbled definitions*

Term	Definition
1. arable	A. growing a single crop, usually over a large area
2. greenfield	B. an area not previously built on that is earmarked for development
3. monoculture	C. description of land suitable for growing crops

24 From Table 2, which answer accurately links a term with its definition?

A 1=A, 2=B, 3=C
B 1=B, 2=A, 3=C
C 1=B, 2=C, 3=A
D 1=C, 2=A. 3=B
E 1=C, 2=B, 3=A

Figure 7. *Iron ore train between Bafq and Yazd, Iran*

25 Which type of vegetation is shown in the photo in Figure 7?

A desert
B grassland
C savannah
D steppe
E woodland

26 Which agent is the most erosive in the type of landscape shown in Figure 7?

A gravity
B ice
C temperature
D water
E wind

27 Which geographical concept does the iron ore train shown in Figure 7 best illustrate?

A environment
B interconnection
C place
D scale
E space

Table 3. *Percentage of Iran's land in agricultural suitability classes based on different criteria*

Data source: Mohsen B. Mesgaran et al

Suitability	Soil + Topography	Soil + Topography + Climate
Excluded	11.9%	11.9%
Unsuitable	24.4%	69.5%
Very poor	34.3%	2.2%
Poor	15.3%	5.4%
Medium	10.6%	7.6%
Good	3.1%	3.0%
Very good	0.4%	0.4%

28 From Table 3, what percentage of Iran's land is classified as good or very good for agriculture, regardless of climate?

A 0.4%
B 0.8%
C 3.4%
D 3.5%
E 6.9%

29 Using Table 3, which factor is the most significant in classifying 69.5% of Iran's land as unsuitable for agriculture?

A elevation
B low rainfall
C saline soils
D slope
E soils low in organic matter

30 Lakes, cities and national parks are examples of areas that would be assigned to which agricultural suitability class in Table 3?

A excluded
B good
C medium
D poor
E very good

If you are in **Year 8 or younger**, stop at Question 30. Other students continue answering questions.

Figure 8. *Campaign postcard*

© T. Goswami, Equations

31 The postcard in Figure 8 is appealing to tourists to:

A be culturally sensitive
B buy local goods
C choose sustainable tourism operators
D leave their cameras at home
E take better care of the environment

32 For an Australian holidaying in India, which activity would emit the most greenhouse gases?

A eating Western-type food in restaurants
B flying to India and back
C staying in luxury hotels
D travelling around India by train
E visiting the Taj Mahal and other iconic sites

33 To protect environmentally sensitive areas in Australia, tourists visiting national parks are encouraged to:

A clean up Australia
B reduce, reuse, recycle
C switch off your lights for the future of our planet
D take nothing but pictures, leave nothing but footprints
E think global, act local

34 Which of the following is a composite indicator of development?

A CO_2 emissions
B Human Development Index
C infant mortality rate
D life expectancy
E years of schooling

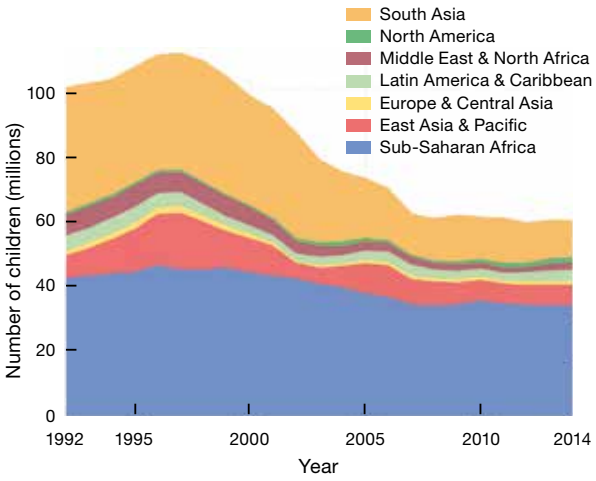


Figure 9. *Out-of-school children of primary school age*

Source: OurWorldInData.org, CC-BY-SA

35 The graph in Figure 9 is a:

A box scattergram
B compound bar graph
C cumulative line graph
D multiple column graph
E pie chart

36 From Figure 9, in which region did out-of-school children increase the most between 1992 and 1997?

A East Asia and Pacific
B Europe and Central Asia
C North America
D South Asia
E Sub-Saharan Africa

37 Which statement is supported by the data in Figure 9?

A Africa's share of out-of-school children of primary school age has decreased since 1992.
B The number of girls in primary education has increased.
C The number of out-of-school children in East Asia and the Pacific has declined steadily since 1992.
D Since 1992, the number of out-of-school children of primary school age has decreased the most in South Asia.
E There are more primary school aged children in Africa than in Asia.

38 Using Figure 9, programmes to achieve the United Nations goal of quality education for all should focus most on:

A East Asia and Pacific
B Europe and Central Asia
C North America
D South Asia
E Sub-Saharan Africa

39 The reasons why children are out of school include that:

A the children live in war zones
B some cultures have a bias against female education
C their governments cannot afford to build schools where they live
D they are child labourers
E all of the above

40 Reducing the percentage of out-of-school children in a country is usually associated with a reduction in:

A average household income
B GDP per capita
C literacy rate
D total fertility rate
E all of the above

If you are **in Year 9 or 10**, stop at Question 40. Year 11s and 12s continue answering questions on next page.

About the Australian Geography Competition

- *Open to students from Year 7 to Year 12*
- *Certificates of recognition for all participating students*
- *Major prizes for highest scoring students*
- *16 high performing Year 11 students invited each year to Geography's Big Week Out*
- *Four students chosen to represent Australia at the International Geography Olympiad each year*

2020 Competition dates: Wed 18 March to Wed 1 April – competition entry details and further information at – www.geographycompetition.org.au/

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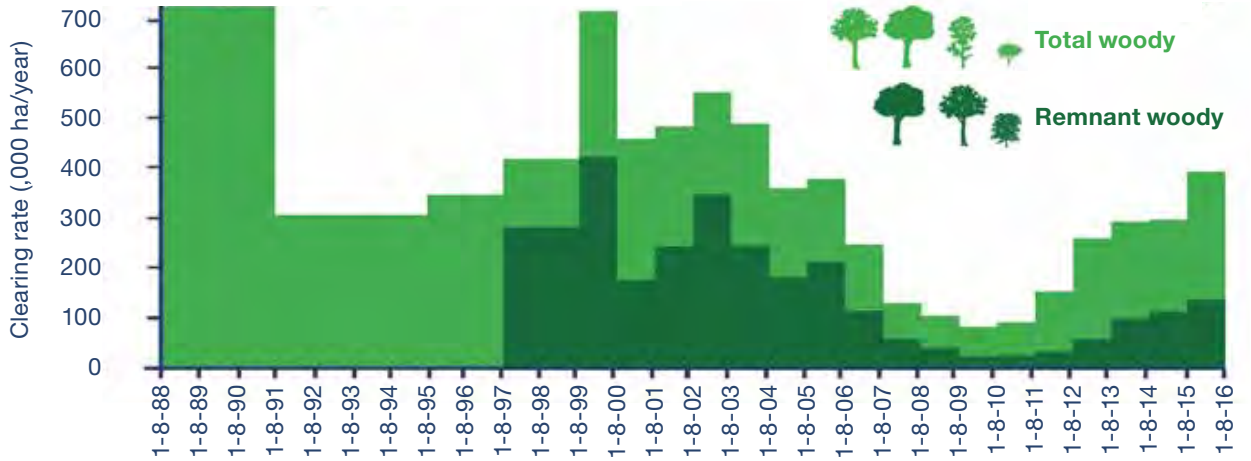


Figure 10. *Annual woody vegetation clearing in Queensland, 1988-2016; separate remnant woody data available from 1997 onwards*

Source: Qld Dept of Science, Information Technology and Innovation

Table 4. *Woody vegetation clearing by replacement land cover by Queensland drainage division*

Source: Qld Dept of Science, Information Technology and Innovation

Drainage division	Total area (,000 ha)	Rate of woody vegetation clearing (,000 ha/yr)								Estimated extent of woody vegetation in division (%)
		2014-15	2015-16							
		Total	Pasture	Crops	Forest	Mining	Infra-structure	Settle-ment	Total	
Bulloo	5185	3	3	0	0	0	0	0	3	30 ± 1
Gulf Rivers	45315	21	24	<1	<1	1	<1	<1	26	73 ± 1
Lake Eyre	51013	38	29	<1	0	0	<1	<1	29	20 ± 1
Murray-Darling	26252	119	168	2	2	<1	<1	<1	173	48 ± 3
North East Coast	45028	115	145	2	14	1	1	1	164	67 ± 2

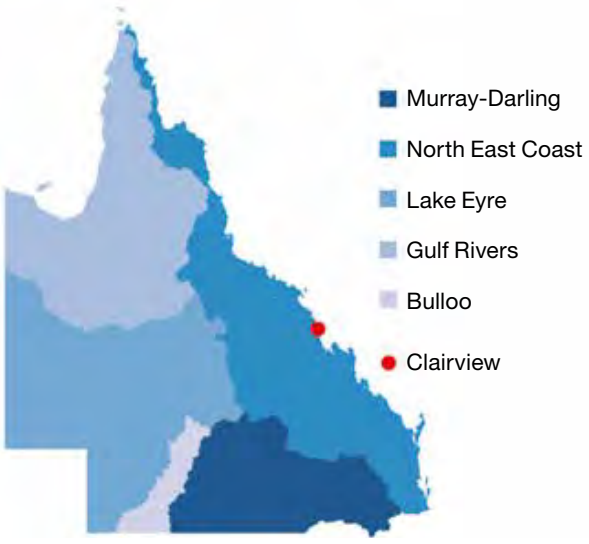


Figure 11. *Queensland drainage divisions*

41 Which is the most accurate definition of an anthropogenic biome?

A a biome resulting from sustained direct human interactions with ecosystems

B a biome that has had any form of human influence

C an entirely natural biome with no human interaction or influence

D a human settlement located in a natural biome

E intentional human activity that may result in changes to the biophysical environment

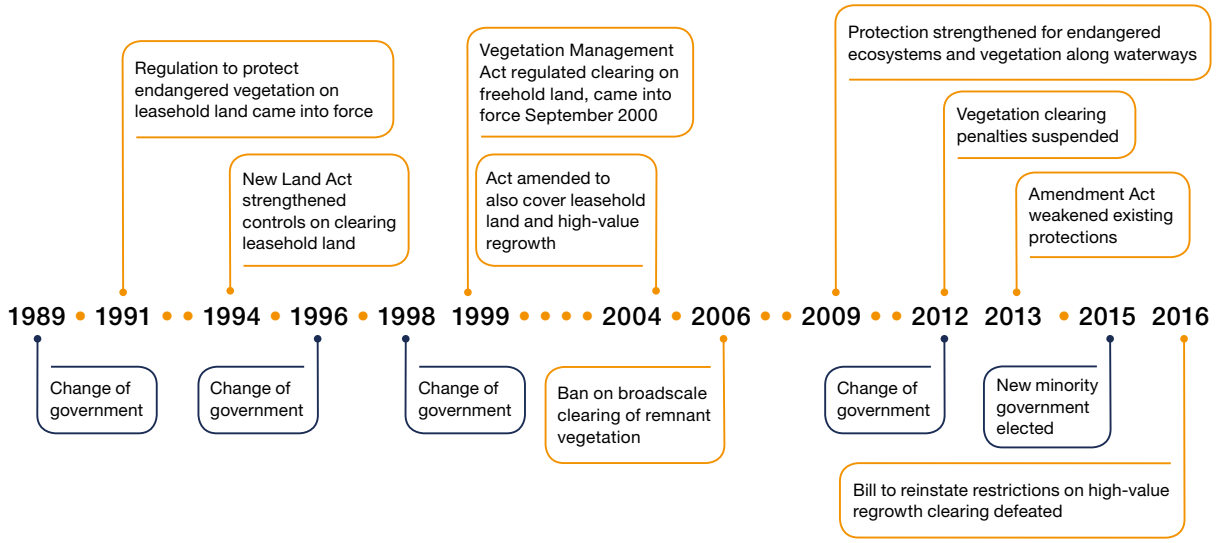


Figure 12. *Queensland government changes affecting vegetation clearing, 1989-2016*

Sources: V.J. Neldner et al; Queensland Country Life; Qld Premier's Dept

To answer Questions 42-50, use Figures 10-13, Table 4 and your own knowledge.

42 How much land with woody vegetation was cleared in Queensland in 2002-03?

A 543 ha
B 873 ha
C 343,000 ha
D 554,000 ha
E 885,000 ha

43 "Panic clearing" historically occurs when a political restriction of vegetation clearing is expected. Which of these years is the best example of this?

A 1997-98
B 1999-00
C 2002-03
D 2012-13
E 2014-15

44 Which Queensland drainage division had the largest area of woody vegetation, as at 2015-16?

A Bulloo
B Gulf Rivers
C Lake Eyre
D Murray-Darling
E North East Coast

45 The main reason why woody vegetation is cleared in Queensland is for:

A agricultural production
B mining
C plantation timber
D road construction
E urban expansion

46 Using Table 4 and Figure 11, the increase in woody vegetation clearing from 2014-15 to 2015-16 in the drainage division affecting the Great Barrier Reef, was approximately:

A 13%
B 24%
C 30%
D 43%
E 49%

47 Which statement about woody vegetation clearing in Queensland is best supported by the information in the sources?

A About 16,000 ha of forest was cleared in 2015-16.
B Government decisions have a major impact on the rate of clearing.
C Most woody vegetation in Queensland has been cleared.
D No remnant vegetation was cleared in 1992-93.
E Vegetation clearing has no benefits.

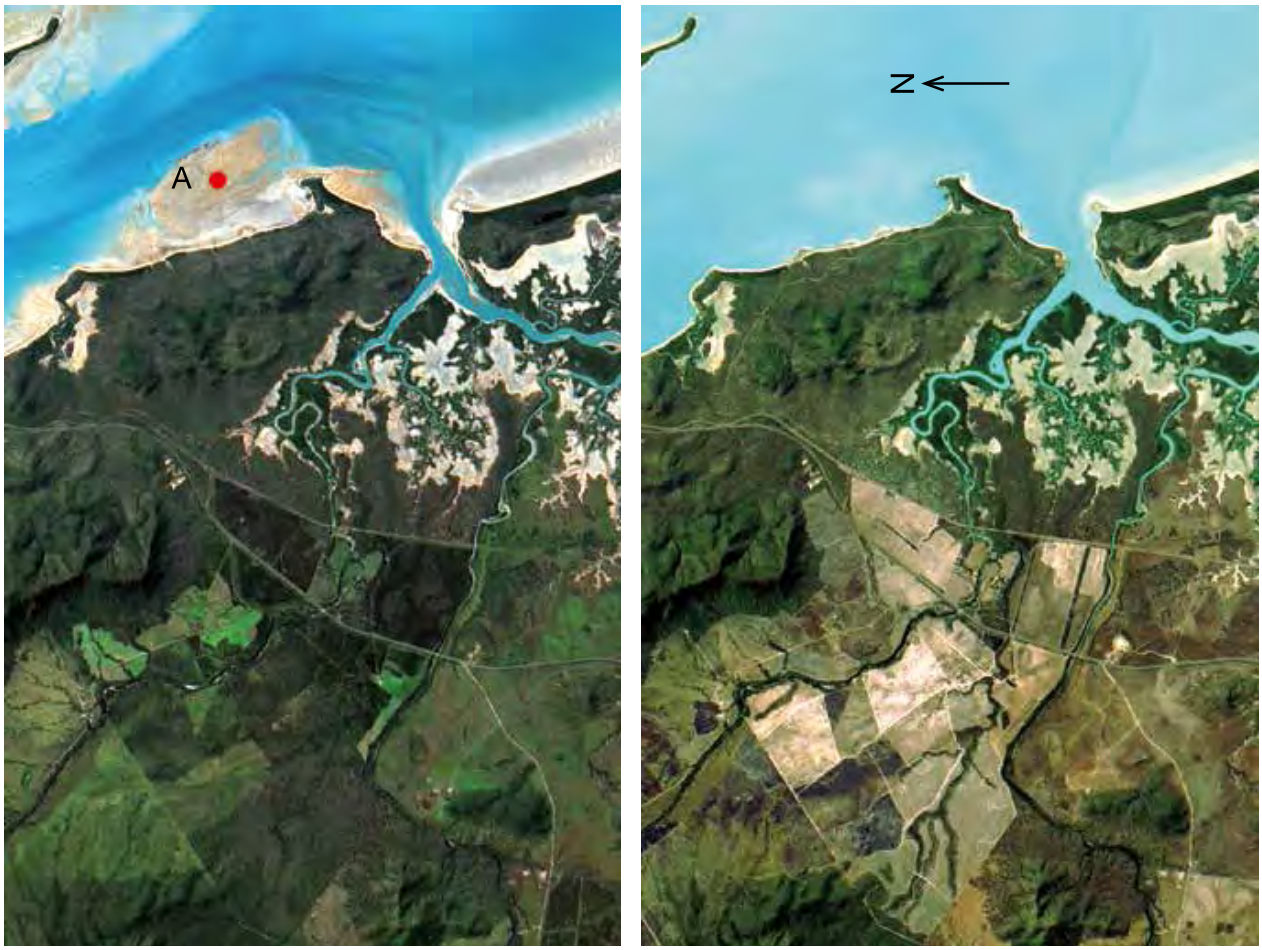


Figure 13. *Clairview area at 19 May 2013 (left) and 12 August 2015 (right); see Figure 11 for location*

48 The area around Point A in Figure 13 is:

A dumped waste from dredging the river
B land being reclaimed for development
C mangrove vegetation
D a mudflat uncovered at low tide
E a silt plume from increased vegetation clearing

49 Considering the information in the sources, which of the following statements is correct in relation to the images in Figure 13?

A Clearing has only occurred for building tourism infrastructure.
B No vegetation at all has been left along waterways.
C Selective logging has taken place between 2013 and 2015.
D There is no evidence of broadscale vegetation clearing.
E This type of clearing was less likely to have occurred in 2010.

50 Which of these is the most direct environmental impact on the Great Barrier Reef caused by the changes shown in Figure 13?

A decreased biodiversity in forest habitats
B greenhouse gas emissions due to burnt or decaying dead trees
C gully and streambank erosion in catchment areas
D physical damage to the corals from cyclones
E reduction of coral growth due to sediment

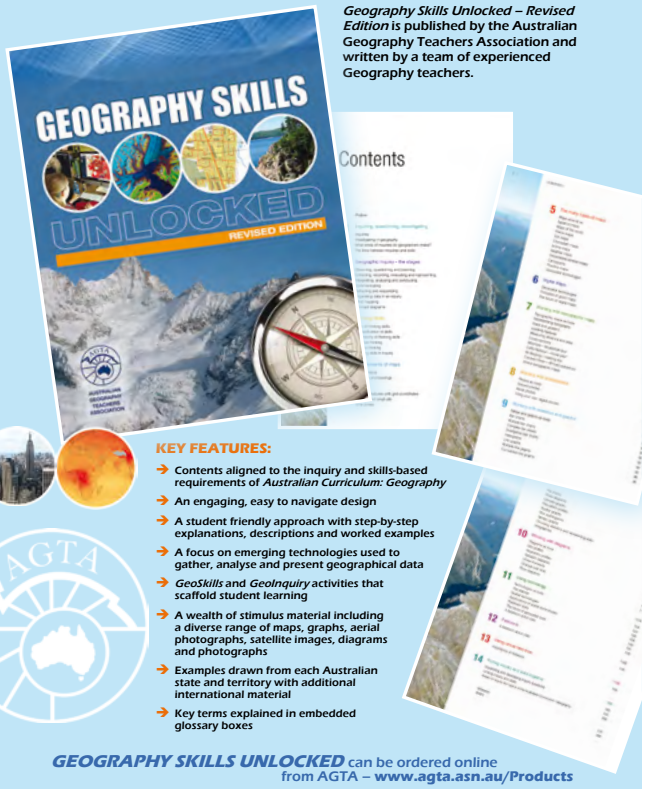
Thank you for taking part in the 2018 Australian Geography Competition.

RESOURCES

AGTA ANNOUNCES A REVISED EDITION OF THIS POPULAR BOOK

GEOGRAPHY SKILLS UNLOCKED, the essential skills book for Australian secondary schools

Geography Skills Unlocked – Revised Edition is published by the Australian Geography Teachers Association and written by a team of experienced Geography teachers.



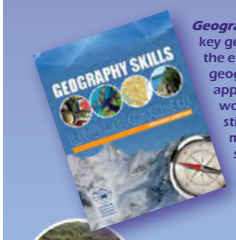
KEY FEATURES:

- Contents aligned to the inquiry and skills-based requirements of *Australian Curriculum: Geography*
- An engaging, easy to navigate design
- A student friendly approach with step-by-step explanations, descriptions and worked examples
- A focus on emerging technologies used to gather, analyse and present geographical data
- *GeoSkills* and *GeoInquiry* activities that scaffold student learning
- A wealth of stimulus material including a diverse range of maps, graphs, aerial photographs, satellite images, diagrams and photographs
- Examples drawn from each Australian state and territory with additional international material
- Key terms explained in embedded glossary boxes

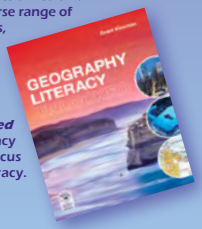
GEOGRAPHY SKILLS UNLOCKED can be ordered online from AGTA – **www.agta.asn.au/Products**

PRE-SERVICE GEOGRAPHY TEACHER STARTER PACK

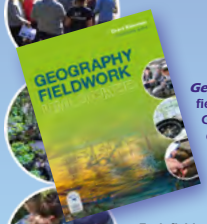
The Australian Geography Teachers Association (AGTA) offers pre-service Geography teachers the opportunity to access three essential teaching resources at a considerable discount on their recommended retail price. All three resources are available for the heavily discounted price $115.00.



Geography Skills Unlocked a comprehensive coverage of the key geographical skills including those related to the focus on the emerging technologies used to gather, analyse and present geographical data. It provides the user with a student-friendly approach with step-by-step explanations, descriptions and worked examples. The book includes a wealth of stimulus material including a diverse range of maps, graphs, aerial photographs, satellite images, diagrams and photographs.



Geography Literacy Unlocked focuses on developing the literacy skills of students. It includes a focus on written, visual and oral literacy.



Geography Fieldwork Unlocked features 33 inquiry-based fieldwork activities developed by a team of experienced Geography educators. The book introduces the reader to concept of inquiry-based fieldwork. It also provides guidance in developing fieldwork action plans, research methodologies, and data collection tools and approaches. It also provides guidance on the presentation and communication of fieldwork findings.

Each fieldwork activity is framed by one or more inquiry questions. They also feature: a statement of expected learning; a list of the equipment needed to successfully complete each fieldwork activity; a short introduction; background information that contextualises student learning; pre-fieldwork activities; and detailed step-by-step instructions on how to complete each fieldwork task.

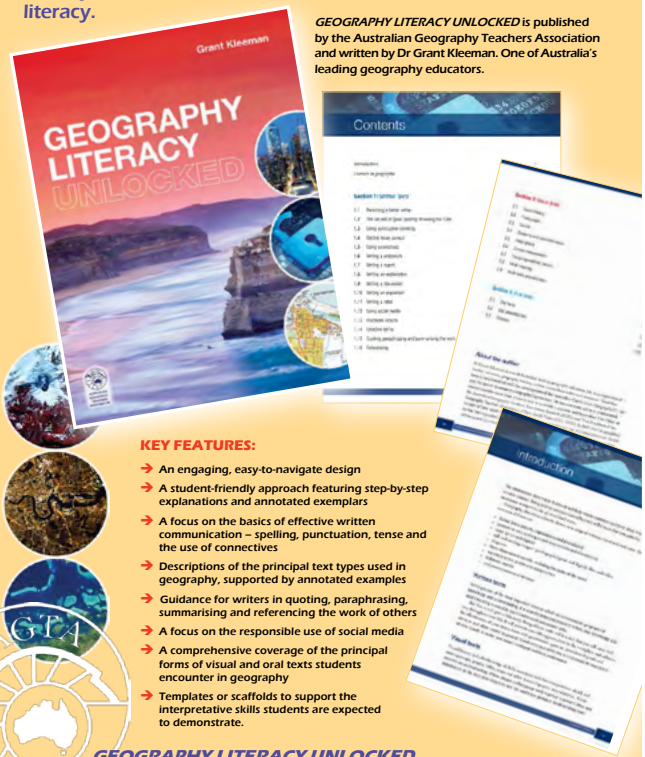
TO ORDER – Email: gta.admin@ptc.nsw.edu.au or Phone: 02 9716 0378

Find out about the AGTA Geography Unlocked series – www.agta.asn.au/Products

AGTA ANNOUNCES AN ESSENTIAL NEW GEOGRAPHY RESOURCE

GEOGRAPHY LITERACY UNLOCKED has been written for secondary geography students seeking to improve their literacy skills. It includes a focus on written, visual and oral literacy.

GEOGRAPHY LITERACY UNLOCKED is published by the Australian Geography Teachers Association and written by Dr Grant Kleeman. One of Australia's leading geography educators.



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- A focus on the basics of effective written communication – spelling, punctuation, tense and the use of connectives
- Descriptions of the principal text types used in geography, supported by annotated examples
- Guidance for writers in quoting, paraphrasing, summarising and referencing the work of others
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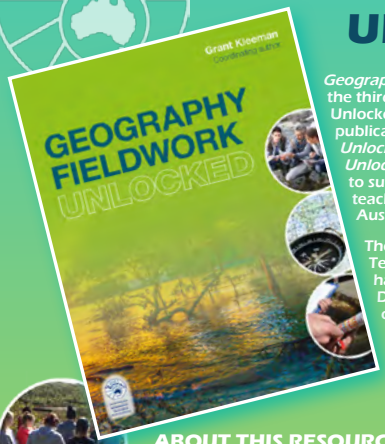
- A comprehensive coverage of the principal forms of visual and oral texts students encounter in geography
- Templates or scaffolds to support the interpretative skills students are expected to demonstrate.

GEOGRAPHY LITERACY UNLOCKED is available for purchase from the GTANSW website: **www.gtansw.org.au**

NEW TO THE AGTA GEOGRAPHY UNLOCKED SERIES

GEOGRAPHY FIELDWORK UNLOCKED



Geography Fieldwork Unlocked is the third book in the Geography Unlocked series. Like companion publications – *Geography Skills Unlocked* and *Geography Literacy Unlocked* – the resource seeks to support and enhance the teaching of Geography in Australian Schools.

The Australian Geography Teachers Association (AGTA) has published the book with Dr Grant Kleeman, one of Australia's leading Geography educators, acting as coordinating author.

➔ **NOW AVAILABLE**

ABOUT THIS RESOURCE

Geography Fieldwork Unlocked features 34 inquiry-based fieldwork activities developed by a team of experienced Geography educators

Section 1 of the book introduces the reader to inquiry-based fieldwork. It also provides guidance in developing fieldwork action plans, research methodologies, and data collection tools and approaches. It also provides guidance on the presentation and communication of fieldwork findings.

Section 2 features nine fieldwork activities for primary students (Years F/K–6). Each of these activities has been designed to develop students' conceptual understanding and the skills associated with inquiry-based learning.

Section 3 showcases 25 fieldwork activities aligned to the topics studied by students in Years 7–10.

Each fieldwork activity is framed by one or more inquiry questions. They also feature: a statement of expected learning; a list of the equipment needed to successfully complete each fieldwork activity; a short introduction; background information that contextualises student learning; pre-fieldwork activities; and detailed step-by-step instructions on how to complete each fieldwork task.

ADVICE TO CONTRIBUTORS

Geography Bulletin guidelines

1. ***Objective:*** The Geography Bulletin is the quarterly journal of The Geography Teachers' Association of NSW & ACT Inc. The role of the Geography Bulletin is to disseminate up-to-date geographical information and to widen access to new geographic teaching ideas, methods and content. Articles of interest to teachers and students of geography in both secondary and tertiary institutions are invited, and contributions of factually correct, informed analyses, and case studies suitable for use in secondary schools are particularly welcomed.

2. ***Content:*** Articles, not normally exceeding 5000 words, should be submitted to the GTA NSW & ACT Office by email gta.admin@ptc.nsw.edu.au

   Submissions can also be sent directly to the editors: Lorraine Chaffer (lchaffer@tpg.com.au)

   Articles are welcomed from tertiary and secondary teachers, students, business and government representatives. Articles may also be solicited from time to time. Articles submitted will be evaluated according to their ability to meet the objectives outlined above.

3. ***Format:*** Digital submission in Word format.

- Tables should be on separate pages, one per page, and figures should be clearly drawn, one per page, in black on opaque coloured background, suitable for reproduction.
- Photographs should be in high resolution digital format. An indication should be given in the text of approximate location of tables, figures and photographs.
- Every illustration needs a caption.
- Photographs, tables and illustrations sourced from the internet must acknowledge the source and have a URL link to the original context.

Note: Please try to limit the number of images per page to facilitate ease of reproduction by teachers.

Diagrams created using templates should be saved as an image for ease of incorporation into the bulletin.

All assessment or skills tasks should have an introduction explaining links to syllabus content and outcomes. A Marking Guideline for this type of article is encouraged.

4. ***Title:*** The title should be short, yet clear and descriptive. The author's name should appear in full, together with a full title of position held and location of employment.

5. ***Covering Letter:*** As email with submitted articles. If the manuscript has been submitted to another journal, this should be stated clearly.

6. ***Photo of Contributor:*** Contributors may enclose a passport-type photograph and a brief biographical statement as part of their article.

7. ***References:*** References should follow the conventional author-date format:

   Abbott, B. K. (1980) ***The Historical and Geographical Development of Muswellbrook*** Newcastle: Hunter Valley Press.

   Harrison, T. L. (1973a) ***Railway to Jugiong*** Adelaide: The Rosebud Press. ***(2nd Ed.)***

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