

GEOGRAPHY BULLETIN



The
Geography Teachers' Association
of New South Wales Inc.

Volume 48 No 1 2016

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GEOSCAPES: Landscapes, waterscapes and cityscapes

PROJECTS • REPORTS • RESOURCES • ARTICLES • REVIEWS

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GEOGRAPHY BULLETIN

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The
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of New South Wales Inc.

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Cover: Hong Kong skyline by David Liff. Image source: Wikimedia Commons, License CC-BY-SA 3.0

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 particular emphasis on the area of the Pacific basin and its near neighbours and 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' on the preceding page. 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.

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GEOGRAPHY BULLETIN



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STUDENT
CONTENT



Lorraine Chaffer, Editor

EDITORIAL

This issue of the journal focuses on three different areas of geographical study relevant to the new and existing 7–10 Geography syllabuses. I have referred to these as GEOSCAPES based on their key content – landscapes, waterscapes and cityscapes.

Susan Bliss's article '*Mongolia: Grassland landscape and biome*' looks at the features, uses, changes to and management of grasslands. It is relevant to Stage 4 Landscapes and Landforms and stage 5 Sustainable Biomes in the new NSW Geography Syllabus 7–10. In '*Groundwater resources and depletion*' Lorraine Chaffer investigates the status of groundwater resources globally and in Australia. This study has links to Stage 4 Water in the World and Stage 5 Environmental change and management.

The third article of a series titled '*Canada; beautiful, liveable but vulnerable*', looks at Canada's water resources and associated natural hazards. The purpose of these articles is to provide studies linked to the new NSW Syllabus 7–10 content that can be used for comparative analysis with other places in the world, including Australia.

Tim Kelleher's '*Hong Kong as a large city study*' provides an alternative case study for HSC Geography students for Urban Places. This cityscape is an interesting contrast to other large cities in the developed world usually studied for this topic, including Sydney.

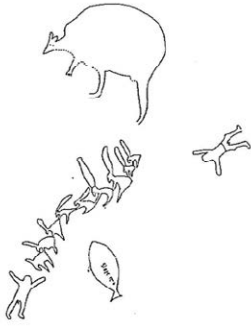
Term 1 in 2016 has been a very busy time for GTANSW with the **Annual Conference** and awards ceremonies at Sydney Olympic Park on Thursday 7th and Friday 8th April. The conference was moved from the usual timeslot of August to support primary and secondary teachers prepare for the implementation of the new Geography K–10 syllabus in 2017. Feedback from the conference will guide the provision of follow up events for the remainder of 2016 and throughout 2017.

Three events held annually in term 1, the **HSC Examination Review**, the **HSC Geography Examination Top Achievers Awards** and **Arthur Phillip Fieldwork Awards** were successfully integrated into the conference program this year. The change enabled country teachers attending the conference to hear feedback from HSC markers on the 2015 Geography examination. The conference showcased the fieldwork awards and 2015 winners in front of a large audience of teachers, friends and family. See separate reports on each of these events.

ANNUAL CONFERENCE REPORT



The **Novotel at Sydney Olympic Park** proved an ideal venue for the 2016 conference, enabling GTANSW to provide a choice of on-site fieldwork activities and workshops as well as Keynote speakers. Almost 200 participants attended each day's events and provided very positive feedback.



David Lardner, Curriculum Officer from AECG presented a thought provoking Acknowledgement to Country challenging participants to reflect on the meaning of country by thinking about the landscapes and landforms they had travelled over to get to Sydney Olympic Park that morning and the cultural heritage they carried in their dilly bags. The unique features of Aboriginal maps were highlighted during the acknowledgement. Later in the day, Dave present two 1/1/2 hour workshops based on water resources and Aboriginal sites of significance.

Darren Tayler, HSIE Inspector at BOSTES presented an overview of the NSW Geography Syllabus K–10, particularly for participants who had not yet studied the syllabus in preparation for programming. Darren emphasised the key component of geographical inquiry and the importance of fieldwork for gathering primary data and engaging students with the real world.



GTA councillors Catherine Donnelly, Lorraine Chaffer and Will Inveen being MDB critters and the inflatable Earth participants fell in love with.



Will Inveen from the Murray Darling Basin Authority presented the keynote address on Thursday. Will gave an historical overview of water management in the Murray Darling Basin, explained the resources available to teachers on the MDBA website and engaged participants in practical demonstrations and games to engage students in the classroom. Not long after Will's presentation Questacon sold out of 91 cm inflatable Earths, so keen were participants to replicate Will's game back at school. Will generously donated 5 kits containing resources on the MDB including all of the balls for the water on Earth activity. For teachers wanting to create the kit themselves the sizes and the volumes of water they represent are shown here.

Left: Murray Darling Water Resources learning activity using different sized balls to represent water resources at different scales

EDITORIAL



Dr Jane Hunter from UTS was the second Keynote speaker. Jane's real world stories demonstrating the use of technology and inquiry based learning to create High Possibility Classrooms was interesting and thought provoking. Participants were encouraged to follow Jane's blog to learn more about High Possibility Classrooms in Geography. See Dr Hunter's presentation on the GTANSW website.

Conference Workshops

Dave Lardner from the NSW Aboriginal Education Consultative Group presented two very interesting workshops on Aboriginal perspectives: Water for stage 4 and Aboriginal and Torres Strait Islander sites of significance. Dave had teachers thinking about country and significance of aboriginal sites and provided practical ideas for integrating geographical inquiry and skills into their lessons. Aboriginal and Torres Strait Islander histories and cultures is an across the curriculum priority in the new Geography Syllabus K–10.

Clare Kinanne, in her workshop The classroom without Boundaries: Teaching, learning and assessing online, impressed participants with a wide range of tools to integrate technology into classroom practice and teacher assessment. See Clare's presentation with embedded links on the GTANSW website.

Julie Regalado examined the use of the Quarantine Station at North Head for inquiry-based Geography fieldwork in stages 2– 4. For many participants, this workshop was an engaging eye-opener to the history and geography surrounding the site and an opportunity for hands on experience with historical artefacts.

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With its exceptional natural beauty, original historic buildings and a poignant history, the historical Quarantine Station offers a unique and diverse range of stimulating, interactive education programs for primary, secondary and tertiary students.

Tweets by @QSEducation

Sharon McLean up skilled primary and untrained or new teachers to Geography in tools and skills using hands on activities easily transferrable to the classroom. A fun and practical workshop, many delegates left ready to use Sharon's strategies such as using bread to explain landforms, contour lines and cross sections and using floor sheets to learn location and direction skills on topographic maps. Look for Sharon's article in the next Geography Bulletin.



Teachers engaging in Sharon McLean's skills activities –mapping it out on the large floor map

Milton Brown's experiences in running a surfing competition in China provided teachers with a "never seen before" case study in his presentation 'Interconnections: Surfing links between China and Australia'. Milton touched on many aspect of the 7–10 geography syllabus including urbanisation in China, environmental change and management as well as the interconnections (Stage 4) between people, places and environments through recreation, travel, tourism and trade. Milton showcased the integration of geographical tools and skills into his presentation. Milton's case study will appear as an article in the next Bulletin.



Source: <http://www.smartshanghai.com/articles/activities/surfing-china>

2. Dr Jane Hunter: High possibility classrooms

Contents Editorial Reflections Teaching & learning **Research** Curriculum support Share this Resource reviews

High Possibility Classrooms: Creating *i*Historians and *i*Geographers



New opportunities for student engagement
The newly released *NSW syllabus for the Australian curriculum: Geography K-10*, based on the Australian Curriculum for Geography E-10, sits alongside the syllabus developed by the NSW Board of Studies Teaching and Educational Standards (BOSTES) for History K-10. Both documents open up captivating possibilities for re-imagining how History and Geography are taught in NSW schools.

The notion of *i*Historians and *i*Geographers
The new Australian Curriculum, and the NSW syllabuses for the Australian curriculum in History and Geography, provide opportunities for rich technology-enhanced learning.

Dr Jane Hunter is an early career researcher in the Centre for Educational Research at the University of Western Sydney. Her professional background is in pedagogy, technology enhanced learning, teacher professional learning, and curriculum. In this article, Jane explains how the High Possibility Classrooms model can provide a framework for meaningful integration of technology into the NSW syllabuses for the Australian curriculum for History and Geography.

NEALS Scan 2015 Volume 34, Issue 3 20

3. Will Inveen (MDBA): Water education using MDBA resources




Murray-Darling Basin Authority

Engaging students in water education; context and resources.


Presented by education@MDBA Director Will Inveen
GTANSW Conference
7 April 2016

MDBA Contributors: Tony McLeod, Willem Vlotman, Brian Lawrence, Monami Das Gupta, Donna Bakovski, Helen Templeton, Denise Fowler and Brayden Dykes

Largest floods in Australia's recorded history 1956



Big flood, severe drought (1923 photo)

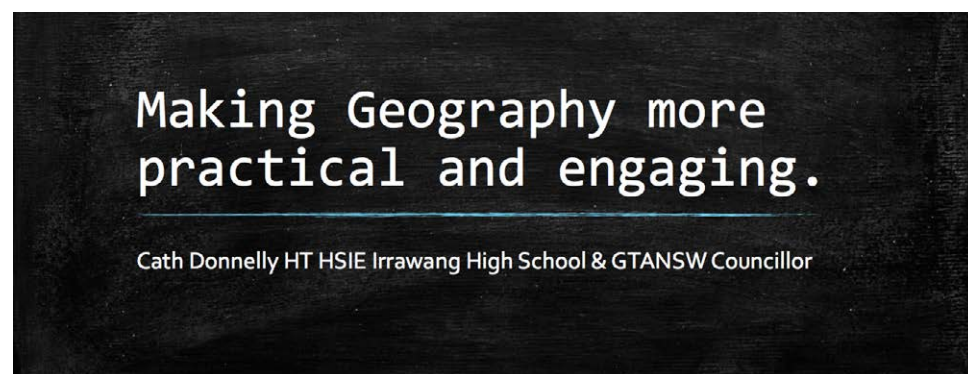


Floods and droughts

RIVER	RATIO MAX & MIN ANNUAL FLOWS
AMAZON (BRAZIL)	1.3
RHINE (SWITZERLAND)	1.9
YANGTZE (CHINA)	2.0
WHITE NILE (SUDAN)	2.4
POTOMAC (USA)	3.9
MURRAY (AUSTRALIA)	15.5
ORANGE (STH AFRICA)	16.9
DARLING (AUSTRALIA)	4705.2

MURRAY-DARLING

4. Catherine Donnelly: Engaging students with Geography



GoMAD Challenge
<https://taronga.org.au/gomad-challenge-sydney>

- The GoMAD (Make a Difference) Challenge 2016 is a collaboration between NSW Environmental and Zoo Education Centres and the NSW Office of Environment & Heritage.
- GoMAD school projects - terms 1 to 3, schools work on a project, create a video & receive external expert support
- Optional GoMAD student camps - run by your local Environmental Education Centre to support student projects
- Youth Eco Summit 2016 - 19th & 20th October - schools present projects to others and celebrate success!

5. Lorraine Chaffer: Introduction and Programming for the new syllabus

Programming Geography K – 10 for 2017

Lorraine Chaffer
 GTANSW Annual Conference
 7th- 8th April 2016

AIM

"The aim of Geography in years K-10 is to stimulate students interest in an engagement with the world. Through geographical inquiry they 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".

GEOGRAPHY K-10 Syllabus
 BOSTES

Fieldwork activities

These were conducted onsite at the wetlands, forests and town centre and offsite at Sydney Water. Teachers learned fieldwork skills and the use of equipment that would enable them to develop their own fieldwork activities back at school.



Award Ceremonies

For the first time GTA NSW's annual awards ceremonies for the HSC Geography Examination Top Achievers and the Arthur Phillip Fieldwork Competition were held in conjunction with the Annual Conference. The conference showcased the successes of Geography students from schools across the state and across all sectors. Recipients were thrilled to receive their awards before an audience of family, friends, their own teachers and 185 other teachers present at the conference. Teachers of top HSC Geography achievers were also recognised. All award winners were presented with very attractive etched glass trophies and framed certificates. Congratulations to all, GTANSW are very proud of your achievements.

Lists of award winners and a selection of photographs from the awards can be found after the final article in this journal.

A flyer for the Arthur Phillip Fieldwork Competition can be found on the GTANSW website and copies have been sent to schools. This year the competition includes a primary category. Further adjustments will be made for 2017 to reflect the new Geography syllabus.

Next Bulletin

Teachers are invited to submit articles for publication in the bulletin. Basic rules for submissions can be found inside the back cover. Any questions for clarification can be sent to the editor. The next bulletin will focus on geographical skills and tools so if you are doing something interesting or new or have undertaken a wonderful fieldwork activity GTANSW would love you to share with other teachers via the bulletin.

Lorraine Chaffer
Editor



GRASSLAND LANDSCAPE AND BIOME

Dr Susan Bliss
Educational Consultant

Afternoon light, Mongolia. Source: https://upload.wikimedia.org/wikipedia/commons/8/8c/Baga_Gazaryn_Chuluu1.JPG

CURRICULUM LINKS

Year 7: Landscapes and landforms:

Value of grassland landscapes, changing landscapes (land degradation, human interactions), management and protection.

Year 9: Sustainable biomes:

Grasslands-spatial distribution, characteristics, changing biomes to produce food and fibres (e.g. cashmere): challenges to food security

Grasslands appear as desolate landscapes with kilometres of endless grass containing a few scattered trees. Instead they are home to a rich biodiversity of species and are the primary source of food for many animals in the food web. The traditional Mongolian lifestyle is closely connected to the environment.

Below: Naadam Festival wrestlers at Kharkhorum, Mongolia (J. Bliss)



Mongolia – Grassland landscape and biome

What are grasslands?

Grasslands are:

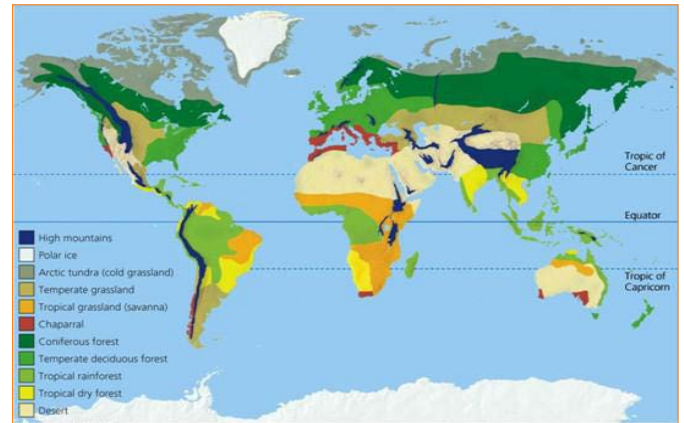
- not the same across the world but vary according to climate, altitude, landform and soil.
- referred to as 'savannas' in Africa; 'steppes' in Asia; 'prairies' in North America; 'pampas' in South America and 'rangelands' or 'savannas' in Australia.

Where are grasslands located?

Grasslands:

- cover 30% of the Earth's land.
- encompass 50% of the land area in Africa, 33% in South America and 75% in Australia and Kenya.
- generally located between forests (wetter environments) and deserts (drier environments). However, grasslands grow from sea level to high altitudes and some have the ability to tolerate saline and acid soils.
- found in semi-arid (28%), humid (23%), cold (20%) and arid (19%) biomes. Central Asia's vast grassland area is known as the Eurasian Steppe. This area extends into Mongolia, a land-locked county bordering Russia and China.

Source 1: Map locating grassland biomes – tropical, temperate and cold



Source: <http://slideplayer.com/slide/3520944/>



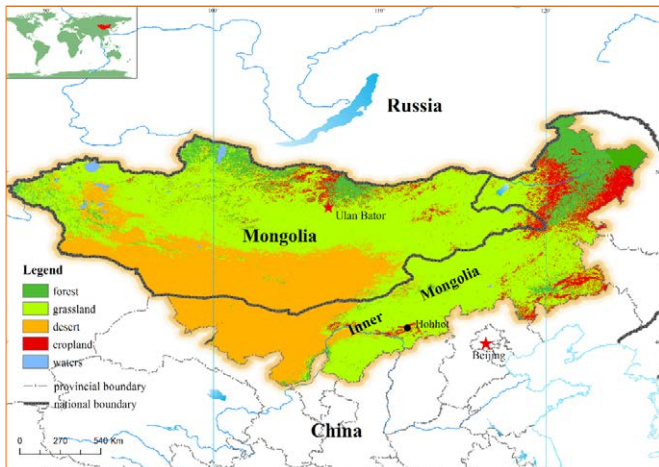
Mongolia (J. Bliss)

Source 2: Variety of grasslands across Earth according to climate and altitude

Tropical and subtropical	Temperate	Mediterranean	High altitude	Periodic floods
Serengeti in Tanzania Arnhem land in northern Australia	Mongolian – Manchurian grasslands Great Plains of USA Eastern Australia mulga shrub lands Texas prairies Patagonian grasslands in Argentina Middle Eastern steppes in Syria	Oak tree savannas in California Southwestern Australia mallee Mediterranean Basin in Spain and Greece	Australian Alps Tibetan Plateau Western Himalayan alpine shrubs and meadows in Nepal	Bogs, marshes, mangroves, fens and peats Pantanal in South America Viru Bog in Lahemaa National Park in Estonia

Mongolia – Grassland landscape and biome

Source 3: Map locating Mongolia's diverse biomes and landscapes



Source: http://www.mdpi.com/remotesensing/remotesensing-05-05193/article_deploy/html/images/remotesensing-05-05193f1-1024.png

What is the Mongolian grassland biome?

The Mongolian-Manchurian grasslands covers an area of nearly 900,00km². The biome is classified as a temperate grassland for the following reasons:

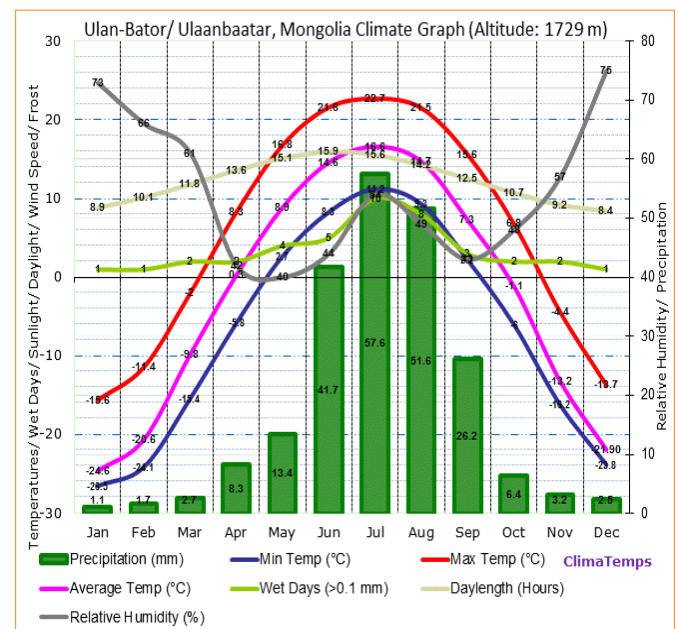
- **climate:** The Mongolian climate varies from arid to semi-arid with warm to hot short summers and long cold winters. Temperatures range from -45°C in winter to over 40°C in summer. The country is called the 'Land of the Eternal Blue Sky' as it enjoys over 250 sunny days a year. Few clouds results in little precipitation that averages 400mmpa in the east, declining to 150mmpa in the west.
- **plants:** The grasslands consist of medium to tall grasslands, dominated by feather grass. The grasses have evolved over 65 million years ago

and are connected to changes in temperature and precipitation.

- **animals:** The biome supports a variety of animals such as gazelles, wolves, foxes and pheasants. The grass is crucial for semi-nomadic herders who graze horses, goats, cattle, yaks and camels. The growth in the cashmere trade has fuelled economic pastoralism and growth in exports.
- **Net Primary Productivity (NPP)** is low for grasslands located in dry or cold regions, but is higher after precipitation.

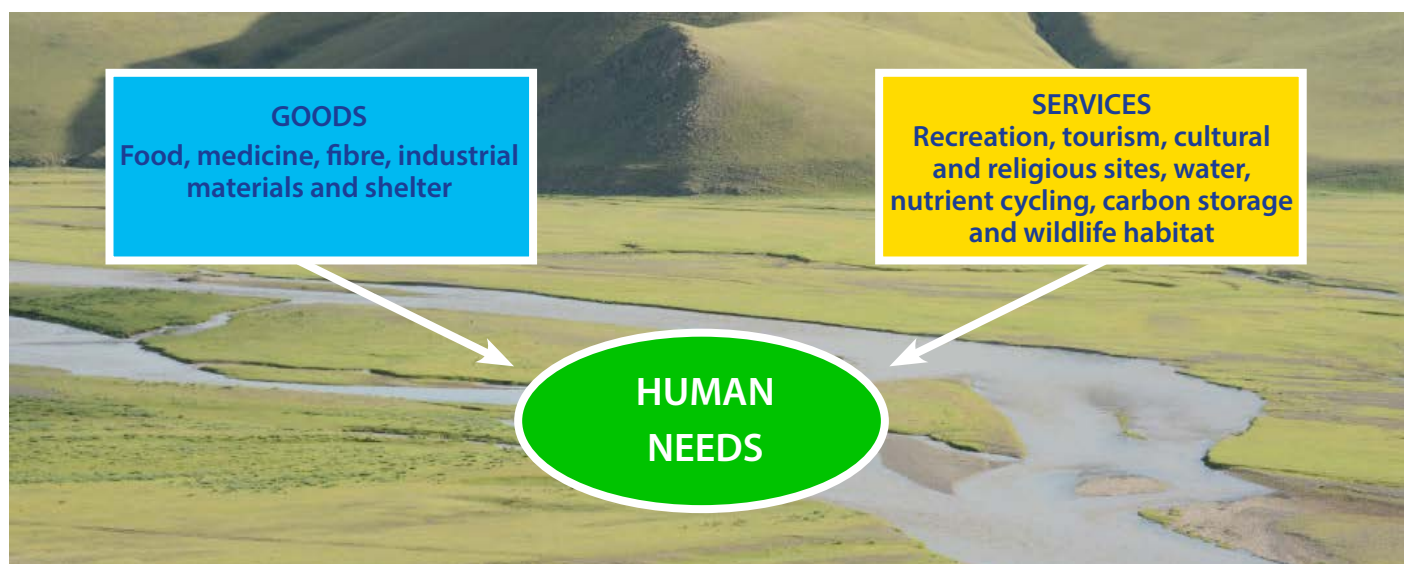
The grasslands provide a diversity of goods and services to satisfy Mongolian's needs.

Source 4: Climate graph of Ulaanbaatar, the capital city of Mongolia



Source: <http://www.ulaanbaatar.climatemps.com/graph.php>

Source 5: Goods and services provided by the Mongolia's grassland biome



Mongolia – Grassland landscape and biome



Modern brick houses built to resemble traditional yurts, near the Qinghai Lake, Mongolia. Source: Wikimedia Commons

How have humans altered Mongolia's grassland biome?

Mongolia's vast grasslands covering approximately 80% of the land area has sustained nomadic lifestyles over thousands of years. In the 13th century Mongolian leader Genghis Khan with expert horsemen, conquered these grasslands. Grasslands provide essential goods and services to Mongolians but recently their nomadic lifestyle is threatened by agriculture, settlements and climate change. Trophy hunting and the illegal trade in rare animal species has reduced biodiversity.

As a result in the decline in nomadic pastoralism, many Mongolians have changed from living in gers or yurts to living in small brick homes in villages or high rise apartments in the capital city Ulaanbaatar. The yurt is designed to be assembled in one hour to allow the easy movement of nomadic herders to travel across grasslands, a few times a year. When disassembled the yurt is loaded onto a cart.

A major cultural event each summer is the Naadam Festival, where Mongolians participate in traditional wrestling, horse racing and archery. Additionally, Mongolians are excellent dancers, singers and musicians.

What are the environmental changes and impacts?

Over time humans have restructured Mongolia's grasslands for agriculture, mining and urban functions. Land degradation from overgrazing and mining has led to environmental degradation, as well as social changes for traditional herders. For example:

- **Cashmere goats** produce quality wool, making it the most profitable source of income for Mongolian herders. Overgrazing of these goats led to land degradation and desertification.

'The danger facing [Outer] Mongolia is that its steppes may be transformed into a desert similar to the one eating away at neighbouring China. The culprit is the humble goat—and the fascination of fashionistas for cashmere.'

Jane Macartney *The Times* (UK), 2009.

Many herders have been forcibly moved from their traditional pastures while others receive government assistance to help them adapt to sustainable pasture and livestock management strategies.

- **Mining** provides wealth for Mongolia but also brings environmental changes, such as the overuse of scarce water led to the drying up of streams and lakes. Mercury used to extract gold by evaporation unfortunately found its way into nearby rivers. Additionally, loss of available pastures for mining activities led to loss in incomes for herders.

'In 2009, the Mongolian government passed the "Law of the Prohibition of Mining Operations in the Headwaters of Rivers, Protected Zones of Water Reservoirs and Forested Areas," commonly referred to as "The Law with the Long Name."

'Companies granted licenses must deposit a "rehabilitation bond" -- or 50 percent of the estimated costs to restore an ecological zone -- into a designated bank account to be managed by the local government before beginning any mining activity.'

<http://www.dw.com/en/mongolias-mining-boom-raises-environment-concerns/a-17534285>

Mongolia – Grassland landscape and biome

What is sustainable management of grasslands?

Grasslands are one of the most endangered biomes on Earth as they are constantly altered by human activities. Where soils are rich, and the land is flat and treeless, areas have been turned into farms to grow crops or graze animals. Modified biomes, referred to as anthropogenic biomes or anthromes, now cover more of the Earth's land surface than so called 'wild' or 'natural' ecosystems. The sustainability of biomes is essential to human survival and wellbeing. The biomes need be protected to meet the needs of the present without compromising the ability of future generations to meet their own needs (Bruntland Report 1992).

What are the government strategies?

The Government of Mongolia has established nature reserves and national parks to limit people's access to grassland biomes. The government has introduced an environmental policy to:

- conserve biodiversity

- create a 'green economy'
- implement sustainable land management principles
- halt environmental pollution and land degradation (e.g. tree planting campaigns to reduce soil erosion and desertification)
- create water reserves and prevent water depletion
- ensure sustainable development of animal husbandry, crop farming and the food production sector
- certify a sustainable tourism sector (e.g. ecotourism)
- implement the 'one hundred thousand solar light' program
- expansion of specially protected areas
- abatement of air pollution in Ulaanbaatar
- introduce environmentally sound technologies in mines

The Mongolian National Council for Sustainable Development aims to combat poverty, reverse environmental degradation and improve human wellbeing. The 2015 Social Good Summit in Mongolia is part of more than 100 Social Good Summits organised around the world to raise awareness of the importance of 17 ambitious goals which form the UN Sustainable Development Goals (SDG).

Source 6: Nomadic herders adapt to grassland biome



Livestock – horses, Arkhangai Province, Lake Ogii (J. Bliss)



Mongolian horse riders on the grassland plains (J. Bliss)



Umnugovi Province, Two Wells watering point. (J. Bliss)



Eastern Gobi desert steppe, watering point for goats (J. Bliss)

Mongolia – Grassland landscape and biome

Source 7: Adaption of Mongolian culture to grassland biome

Warm clothes for cold winters, keeping birds of prey like vultures and hunting animal species with bows and arrows



Vulture in Töv Province



Bow and arrow used to hunt animals, now a sport at Naadam festivals



Ulaanbaatar, National Sports Stadium, Naadam Festival, opening ceremony (J.Bliss)

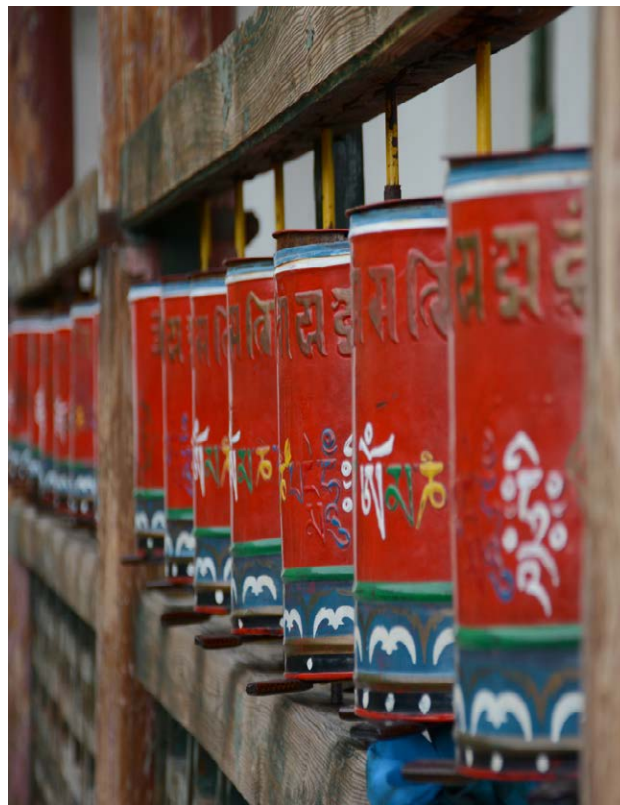


Dundgovi province, Saikhan-Ovoo district, Secret of Ongi ger camp, traditional Mongolian costumes (J. Bliss)

Mongolia – Grassland landscape and biome



Traditional Music of the Morin Khuur, UNESCO Intangible Cultural Heritage List. Morin khuur is a two-stringed instrument. Mongolians are known for their throat singing (S. Bliss)



Terelj National Park, Aryabal temple, prayer wheels (J. Bliss)

DID YOU KNOW?

- Mongolia is historic Outer Mongolia. Inner Mongolia is an autonomous region in China.
- Genghis Khan is the founding father of Mongolia. He lived his life as a nomad.
- The two humped Bactrian camel is indigenous to Mongolia
- Warm, salty milk tea is the popular drink
- Golden Eagle festival begins with a parade of eagle hunters on horseback, displaying hunting costumes and accessories.
- Mongolia is rich in natural resources such as oil and gold
- Mongolia has the oldest National Park in the world-Bogd Khan National Park dates from 1778
- Mongol Khuumii or throat singing produces two simultaneous tones with the human voice
- Ulaanbaatar, the capital city of Mongolia is the coldest national capital in the world



Mongolia – Grassland landscape and biome



Ukok Plateau is a remote and pristine grasslands area located in the heart of southwestern Siberia, the Altay Mountains region of Russia near the borders with China, Kazakhstan and Mongolia. It is part of the UNESCO World Heritage Site called the Golden Mountains of Altai
Source: Wikimedia Commons

ACTIVITIES

Knowledge and understanding

1. Describe a grassland biome.
2. Explain why grass is important to animals and nomadic herders.

Inquiry and skills

3. Source 1 and 2: List the different types of grassland biomes
4. Source 3:
 - a. List the different biomes in Mongolia
 - b. What is the dominant biome?
5. Source 4:
 - a. Calculate the average annual precipitation for the year
 - b. What is the average maximum temperature?
6. Source 5: Grasslands are productive biomes. Discuss this statement.
7. Source 6: Explain how the Mongolians adapt to the grassland biome
8. Source 7: Discuss the Mongolian culture and how it has adapted to the grassland environment.
9. Research the food web of a grassland biome. In pairs draw a food web for the Mongolian grassland.
10. In groups investigate Mongolia's environmental problems in the grassland biome, and the implementation of sustainable strategies.

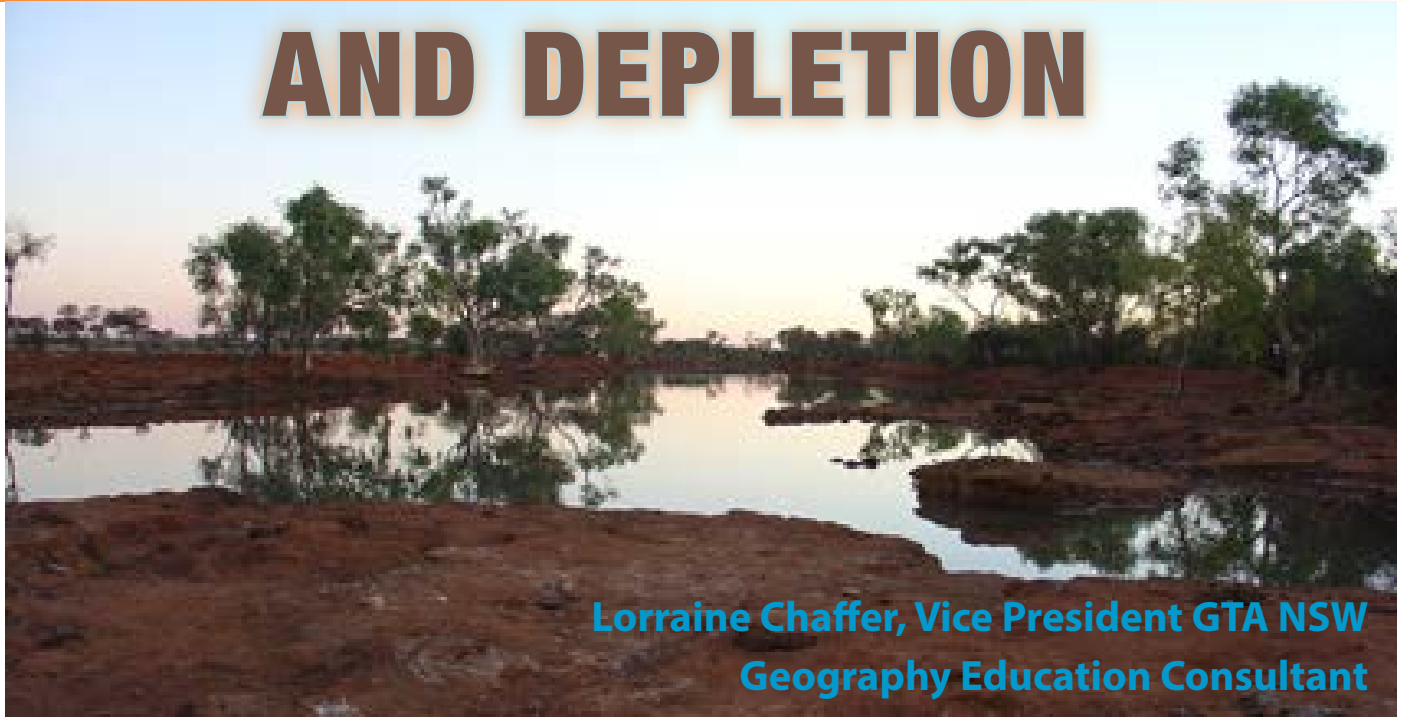
ICT

- Mongolian-Manchurian grassland – https://en.wikipedia.org/wiki/Mongolian-Manchurian_grassland
- Earthwatch Institute – <http://au.earthwatch.org/expeditions/wildlife-of-the-mongolian-steppe>
- Winds of change threaten tradition – <http://www.thehindu.com/todays-paper/tp-international/in-mongolian-grasslands-winds-of-change-threaten-tradition/article6297393.ece>
- Overgrazing turning parts of Mongolian Steppe into desert – <http://www.sciencedaily.com/releases/2013/09/130905134026.htm>
- Mongolia's Sustainable Development Agenda – http://www.undp.org/content/dam/mongolia/Publications/Rio_Sustainable%20Development_Mongolia%20report_eng.pdf
- UNFPA Mongolia – <http://countryoffice.unfpa.org/mongolia/>
- Social Good Summit 2015 in Mongolia – http://countryoffice.unfpa.org/mongolia/2015/09/30/12840/social_good_summit_2015_in_mongolia_focuses_on_the_new_sustainable_development_goals/

YouTube

- Naadam Mongolian traditional festival – <https://www.youtube.com/watch?v=RI67liJxJtQ>

GROUNDWATER RESOURCES AND DEPLETION



Lorraine Chaffer, Vice President GTA NSW
Geography Education Consultant

SYLLABUS LINKS

CONTENT:

Water in the world

- the characteristics and spatial distribution of global water resources
- how the operation of the water cycle connects people and places
- the quantity and variability of water resources – Australia and other places

(<http://syllabus.bos.nsw.edu.au/hsie/geography-k10/content/1185/>)

Also relevant to and connected with the following units in stage 5

Sustainable biomes

The depletion of groundwater for agricultural production can impact on biome productivity and functionality, and contribute to water scarcity and food insecurity in groundwater dependent countries.

Environmental change and management

Groundwater dependant ecosystems (environments) are threatened by groundwater depletion. Groundwater management to maintain groundwater to surface water links is essential for sustainable environmental management.

CONCEPTS

Aquifer – a body of permeable rock which can contain or transmit groundwater.

Biodiversity hotspot – a region with 1500 endemic plant species that have lost at least 70% of their habitat

Groundwater Dependent Ecosystems (GDE) use groundwater as part of their survival varying from partial to complete dependence to maintain their communities of plants and animals, ecological processes and ecosystem services. GDEs include caves, lakes, wetlands, rivers and vegetation.

Recharge Groundwater – recharge occurs where water moves downward from surface water to groundwater. Recharge is the primary method that water enters an aquifer.

Groundwater resources and depletion

Groundwater makes up 98% of earth's limited freshwater resources but is being depleted and contaminated at an unsustainable rate with serious consequences for:

- **Global freshwater supplies**
- **Environmental health** of aquatic environments such as rivers and wetlands and small Water Dependent Ecosystems
- **Human wellbeing** including future water and food security.

Threatened groundwater resources

NASA satellite analysis of alterations to earth's gravitational pull caused by large water storages is being used to accurately determine changes to groundwater basins due to natural and human processes such as drought, irrigation and domestic use. The data shows that 21 of Earth's 37 largest aquifers exceed sustainability tipping points resulting in depletion with 13 significantly stressed. GRACE (the Gravity Recovery and Climate Experiment) estimated a loss of 20.3 cubic kilometers of groundwater in California's Central Valley between 2002 and 2013 and 54 cubic kilometres in Northwest India where 54 trillion litres of water are extracted annually. In Bangladesh, groundwater levels below Dhaka fell by 35 metres between 1996 and 2007 due to excessive water withdrawal for the city's growing population and water hungry textile industries. By 2015 the water table had dropped to 70 metres below the city. **See Source 1 and Source 6**

Processes and connections

Groundwater is a part of the hydrological cycle. Biophysical processes determine the amount of groundwater in storage and connections to aquatic environments. These include

- **Infiltration** of rainfall or snowmelt, which is influenced by factors such as groundcover, rainfall intensity, precipitation and the presence of porous and permeable soil and rocks.
- **Recharge** from rivers and streams that occurs when the water table falls below river levels. **See Source 2**
- **Recharge** from groundwater into rivers, streams, lakes and wetlands when water levels in those environments fall below the water table
- **Underground flows** that transfer groundwater from mountain regions to oceans
- **Groundwater dependant ecosystems** (GDE) include aquifers, rivers, floodplain and riparian wetlands; karst

cave systems and mound springs such those along the Australia's Great Artesian Basin which support high levels of endemic biodiversity and sacred and cultural sites for Aboriginal peoples. Without groundwater many plants and animals would not survive periods of extended drought.

Groundwater is stored in unconfined **aquifers** consisting of porous sediment and rocks and confined aquifers trapped between **impermeable** layers of rock at deeper levels, referred to as "fossil water". Aquifers become depleted if water is extracted at rates that exceed the recharge rate (known as overdraft). The average recycling time for groundwater is 1,400 years with some aquifers taking centuries to recharge, allowing pollutants to accumulate because unlike rivers, groundwater is not flushed by precipitation events. **See Source 3**

Increasing depletion

The crisis facing groundwater storages include

- **Depletion** due to excessive withdrawal of water for domestic, urban, agricultural and industrial use particularly in places with low or variable rainfall and with water supply systems inadequate to meet human needs eg India and Mexico City
- **Reduced recharge rates** due to urbanisation covering Earth's surface with hard impervious surfaces
- **Contamination** by pollutants from natural and human sources such as arsenic containing rocks, landfill sites, industrial and agricultural runoff and overuse of chemical fertilisers and pesticides.
- **Climate change** which affects environmental processes such as infiltration and recharge rates and sources of water for human use

The environmental consequences of groundwater depletion and pollution include ground subsidence, saltwater intrusion into coastal aquifers and wetlands, reduced river flows and loss of GDE, habitats and biodiversity. In Arizona, USA 90% of desert streams are degraded or dried up and flora and fauna species in the **biodiversity hotspot** of South West Western Australia are threatened due to groundwater extraction on the Swan Plain. **See Source 4**

Management and conflict

The sustainable management of groundwater resources is difficult as many aquifers underlie multiple drainage basins and political boundaries. It also requires accurate assessments of groundwater storages to balance the competing social, economic and environmental demands. Strategies at a national, catchment or groundwater basin scales could include:

Groundwater resources and depletion

- Legislation to create management agencies and set goals
- Groundwater budgeting to ensure extraction does not exceed recharge
- Extraction limits such as the Basin Plan for Australia's Murray Darling Basin which will cap water withdrawals from aquifers from 2019
- Artificial recharge of depleted aquifers as is occurring in many countries including Egypt, Argentina, USA and Australia.
- Scientific monitoring to determine accurate groundwater levels (NASA)
- Water efficient irrigation
- Contamination prevention
- Education programs

As a response to three years of drought and escalating groundwater depletion, California enacted its first Sustainable Groundwater Management Act in 2014. The target is to achieve sustainable groundwater use by 2042 by requiring agencies to develop management plans and implement strategies such as metering, extraction limits and water fees. A large number of groundwater conflicts are a reflection of the environmental impact of California's groundwater depletion on GDE and biodiversity. **See Source 5**

Managed aquifer recharge

Managed aquifer recharge is the intentional recharge of water to aquifers for water resource recovery or environmental benefit. Water from different sources can be used in the recharge process including creeks and rivers, stormwater and treated wastewater. If wastewater is used public health considerations are addressed by the pre treatment of water to remove pathogens and threats to human health.

In Western Australia the groundwater replenishment scheme in Perth, recharges high quality recycled water into the ground to guarantee the city's future drinking water

The benefits of using managed aquifer recharge to recycle water include:

- Creating water supplies from sources usually wasted
- maintaining wetlands and other WDE such as spring mounds
- storing water to meet future needs or for periods of drought
- reducing salt-water intrusion along coasts
- increasing water availability for individuals, businesses, agriculture and the environment
- supplementing drinking water resources

See Source 7

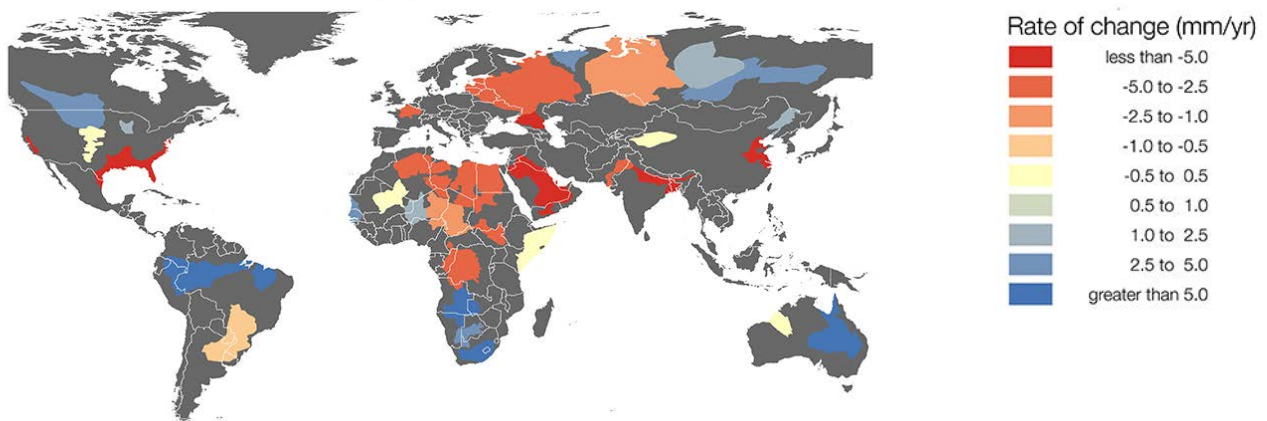
SOURCE 1: Groundwater storage trends in Earth's largest aquifers

MAP: Trends in groundwater storage

STATE OF G.R.A.C.E.

NASA's Gravity Recovery and Climate Experiment (GRACE) satellite mission, launched in 2002, measures changes in the amount of water held underground in aquifers.

Trends in Groundwater Storage, 2003 - 2013

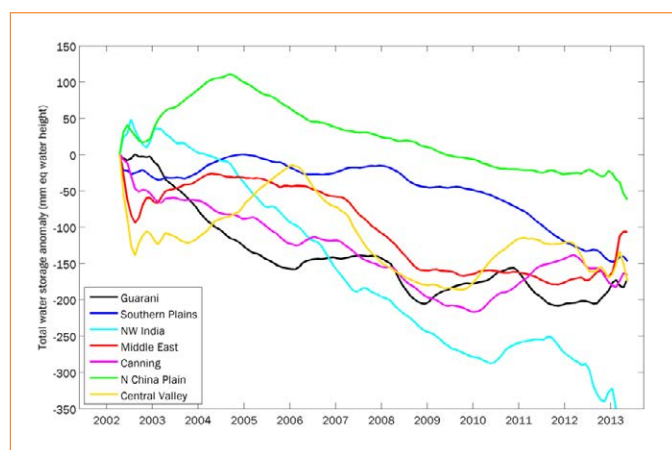


GRACE data reveal the rise and fall of groundwater reserves, though scientists do not know how much water is stored underground. Think of it as a bank account. Thanks to the satellites, scientists know deposits and withdrawals. But they do not know how much is in the account.

Source: <http://www.circleofblue.org/waternews/2015/world/groundwater-depletion-stresses-majority-of-worlds-largest-aquifers/>

Groundwater resources and depletion

Graph: Trends in groundwater storage

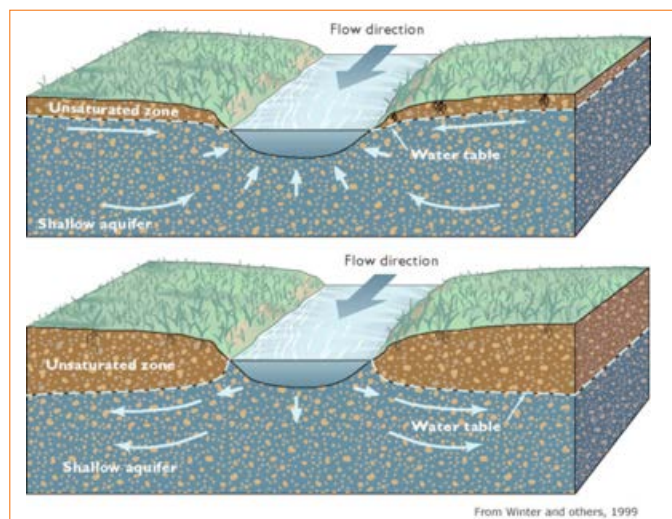


Source: <http://www.circleofblue.org/waternews/2014/commentary/editorial-in-the-circle-fresh-focus/earths-major-aquifers-trouble/>



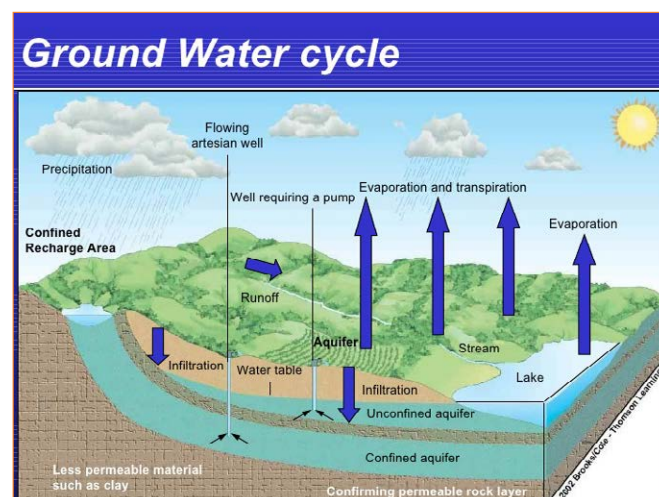
Gathering groundwater samples on a beach. CSIRO SciencImage 201. Source: Wikimedia Commons

SOURCE 2: Groundwater – surface water connections



Source: <http://coloradogeologicalsurvey.org/apps/wateratlas/chapter2page4.html>

SOURCE 3: Aquifers are an important source of water



From Water pollution in Pakistan Slideshare – <http://www.slideshare.net/hassanahmedkhan/water-pollution-in-pakistan>

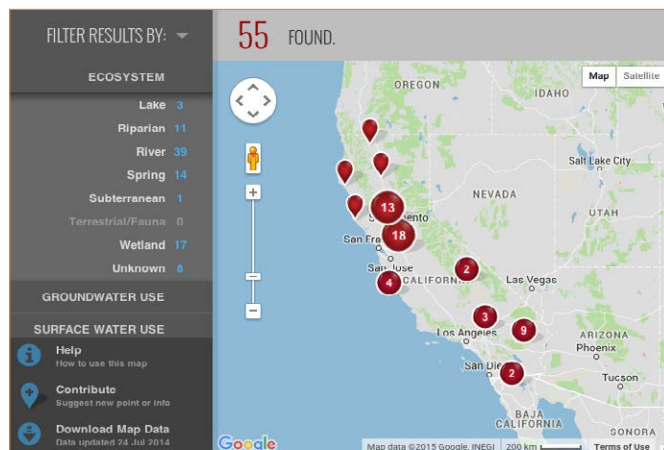
SOURCE 4: Depletion of groundwater is a global issue

13 of the planet's 37 largest aquifers studied between 2003 and 2013 were being depleted while receiving little to no recharge (NASA)	China's Yellow River fails to reach the sea for months at a time due to groundwater depletion and failure of aquifers to recharge rivers	54% of India's groundwater wells have declining water levels with 16% losing over 1 metre per year because there are no limits on groundwater extraction
Over 2 million people worldwide rely on groundwater as their primary source of fresh water for daily survival	Mound Springs around Lake Eyre, SA support rare and endangered species of flora and fauna prone to extinction if groundwater levels fall	Salt water has been detected in groundwater wells up to 8km from the California coast as a result of over pumping of coastal aquifers
In the UAE 65% of water use comes from groundwater resulting in extraction 20 times greater than natural groundwater recharge	If extraction from the Ogallala Aquifer in the Central Plains of the USA continues at current rates 6% of the aquifer will be used up every 25 years.	Parts of Mexico City have subsided by 8.5 meters due to years of groundwater extraction as the only source of water for the city's needs

Various sources

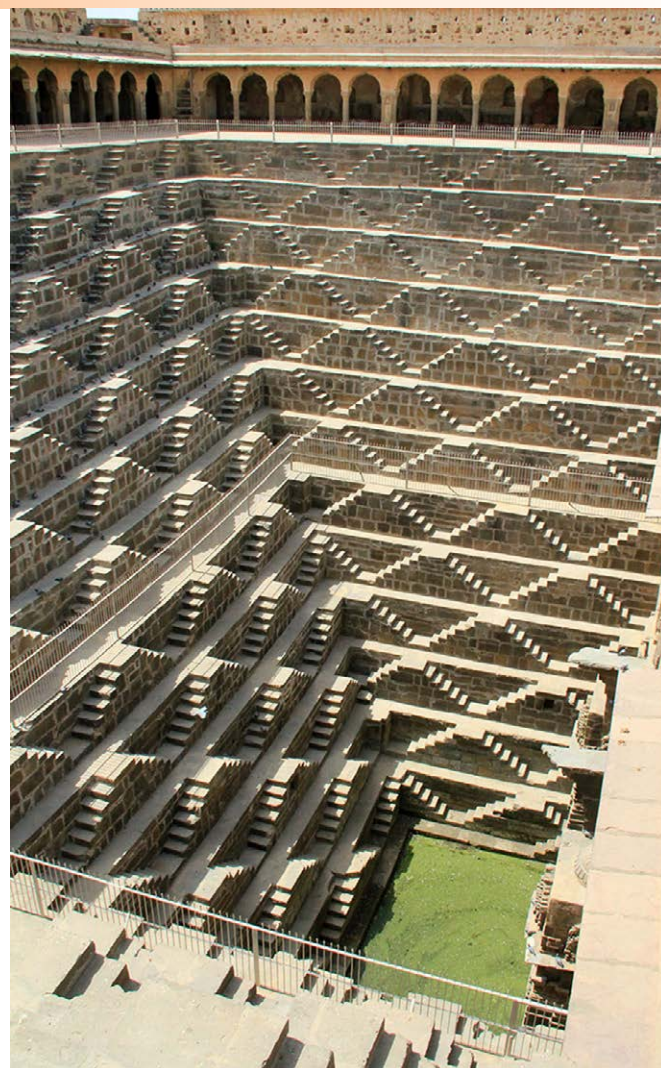
Groundwater resources and depletion

SOURCE 5: Consequences of groundwater extraction in California (conflicts in California)



Example: Environmental groups allege salmon, groundwater dependant oak forests, riparian and wetland ecosystems have been affected by agricultural and urban groundwater use and subsequent reduced river flows in the Cosumnes River

Screenshot from interactive map – Water in the West website – <http://waterinthewest.stanford.edu/groundwater/conflicts/index.html>



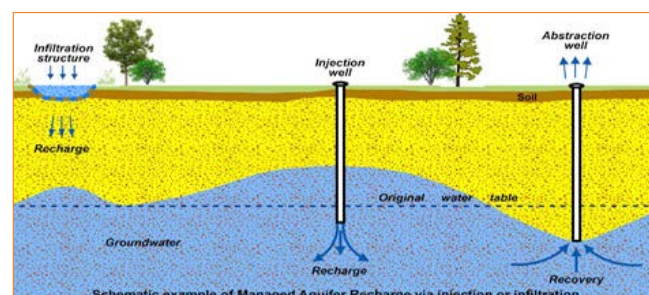
Depleted groundwater, Chand Baori (stepwell) at Abhaneri (Dausa , Rajasthan). Source: Wikimedia Commons

SOURCE 6: Groundwater levels beneath Dhaka, Bangladesh

Groundwater depletion	
Year	Water table depth, m
1996	26.60
1997	28.15
1998	30.45
1999	31.86
2000	34.18
2001	34.18
2002	37.78
2003	42.00
2004	46.24
2005	57.42
2006	59.72
2007	61.18
2015	70.00

Various sources

SOURCE 7: Managed groundwater recharge



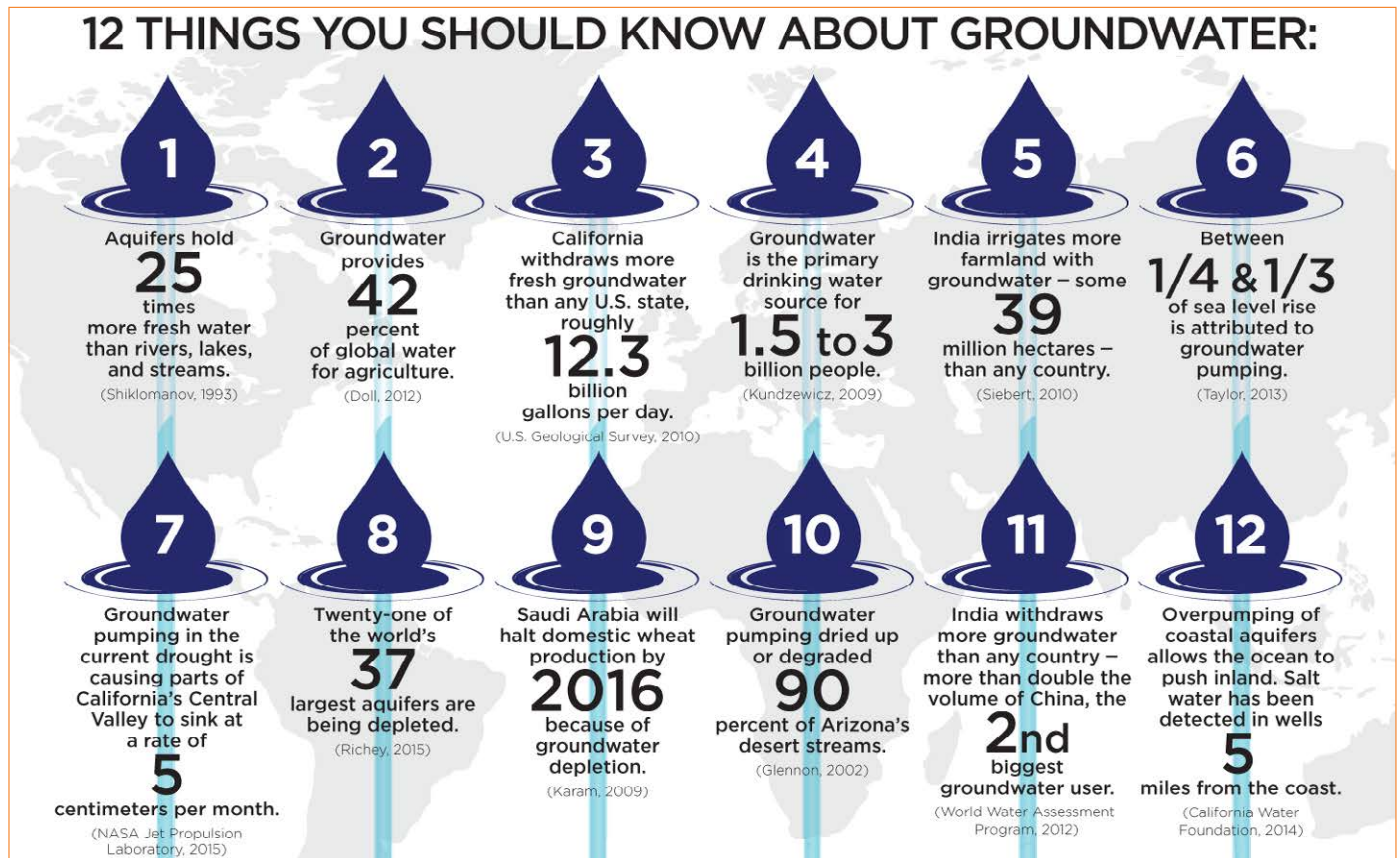
Source: <http://www.water.wa.gov.au/urban-water/water-recycling-efficiencies/managed-aquifer-recharge>

Below: Cattle at bore, Ravenswood Qld. Source: CSIRO SciencelImage 4465



Groundwater resources and depletion

SOURCE 8: Facts about groundwater



Water data – http://www.circleofblue.org/waternews/CPX/cpx_data.shtml



This NASA photograph highlights the mostly dry bed of Owens Lake and lower Owens River, located in the southern Owens Valley between the Inyo Mountains (upper left) and the Eastern Sierra Nevada (bottom). Shallow groundwater, springs, and seeps support minor wetlands and a central brine pool. Two bright red areas along the margins of the brine pool indicate the presence of halophilic (salt-loving) organisms known as archaeans. Gray and white materials within the dry lake bed are exposed sediments and salt crusts. Source: NASA Earth Observatory, Wikimedia Commons

Groundwater resources and depletion

SOURCE 9: Australia's groundwater alert

DECLINING GROUNDWATER IS A BIG PROBLEM FOR AUSTRALIA (Extract)

Groundwater is extensively used right across the Australian continent, which is why we should take very seriously a new study, which says supplies are on the decline.

The loss of groundwater stores poses serious threats to humans that need it to drink, crops that are irrigated with it, and natural ecosystems that rely on it for their survival.

That's why a new NASA study is cause for concern, particularly in a dry country like Australia.

Australia is of course a very dry country so it is no surprise to find that groundwater is extensively used right across the continent. Perth relies heavily on the Gnangara Mound aquifer for its water supply, but the water table has been dropping for the past 40 years or more because of reduced rainfall, increased extraction, and probably because of decreased recharge arising from vegetation water-use.

The Great Artesian Basin (GAB), underlying about 1.7 million square kilometres of Australia, contains about 65,000 km³ of water, but the water is up to 2 million years old so it is easy to extract this resource far faster than it is being replenished. As the water pressure in the GAB has declined and the water table drops, mound springs (where groundwater is pushed to the ground surface under pressure) have begun to dry up in South Australia and Queensland. Associated paperbark swamps and wetlands are also being lost and it gets more and more expensive to extract the groundwater for irrigation and other commercial applications.

On average, rates of groundwater extraction across Australia has increased by about 100 per cent between the early 1980s and the early 2000s, reflecting both the increased population size and commercial usage of groundwater stores.

The international study released by NASA showing declines in groundwater resources globally should alert us to the pressing need to manage groundwater resources sustainably. Australia is not immune to the challenges posed from declining groundwater resources.

Source: ABC The Drum: Opinion – <http://www.abc.net.au/news/2015-06-18/eamus-declining-groundwater-is-a-big-problem-for-australia/6556586>



Many streams and rivers are supported by the availability of groundwater.

Groundwater resources and depletion

STUDENT ACTIVITIES

1. Why are Earth's groundwater resources considered to be in a state of crisis?
2. Draw a drainage basin diagram to illustrate the biophysical processes that impact on groundwater resources
3. Explain why confined aquifers are referred to as fossil water?
4. Mind map the impacts of groundwater depletion on people, places and environments

5. Refer to **SOURCE 1**

Graph

- a. Which region experienced the largest decrease in groundwater storage between 2002 and 2013?
- b. Describe the trend for the Central Valley of California. Suggest reasons for the variations over the 11 years

Map

- a. Name the five basins that experienced large groundwater storage change between 2002 and 2013
 - b. Suggest why Australia's Great Artesian Basin is not suffering from groundwater depletion.
6. Refer to **SOURCE 2**
 - a. Describe the links between groundwater and rivers shown in the diagram
 - b. What other aquatic environments have similar connections to groundwater?
 - c. Predict the impact of disconnected groundwater in streams over an extended time period?
 7. Refer to **SOURCE 3**
 - a. Explain the difference between a flowing artesian well and a well requiring a pump.
 - b. What type of aquifer is the most accessible?
 - c. Suggest consequences of lowering the water table.
 - d. Investigate how groundwater extraction and land subsidence will impact on the potential impacts of sea level rise and climate change in coastal cities such as Perth.
 8. Refer to **SOURCE 4**

Write a 100-word paragraph describing the crisis facing Earth's groundwater

9. Refer to **SOURCE 5**

- a. How many riparian and river ecosystems were a source of conflict in California?
- b. Visit the Water in the West website and use the interactive map to outline two conflicts involving GDE.

10.

- a. Graph the statistics in **SOURCE 6**.
- b. Describe and explain the trends shown
- c. Calculate the % change in groundwater depth below the city.

11. With reference to **SOURCE 7** discuss the need to artificially recharge depleted aquifers.

12. Analyse the statement "Lakes, wetlands and streams are windows to the water table".

13. Choose ONE fact from **SOURCE 8** as the basis for a geographical inquiry. Develop inquiry questions, conduct research and communicate results digitally.

14. Identify the main message of the article in **SOURCE 9**.

RESOURCES

Circle of Blue – <http://www.circleofblue.org/waternews/2014/commentary/editorial-in-the-circle-fresh-focus/earths-major-aquifers-trouble/>

NASA: Groundwater storage trends in Earth's largest aquifers – <http://www.jpl.nasa.gov/images/earth/grace/20150616/grace20150616-16.jpg>

Water in the West (California's groundwater crisis) – <http://waterinthewest.stanford.edu/groundwater/overview/index.html>

California's groundwater conflicts – <http://waterinthewest.stanford.edu/groundwater/conflicts/index.html>

National Atlas of Groundwater Dependent ecosystems – <http://www.bom.gov.au/water/groundwater/gde/>

Groundwater Dependent Ecosystems – <http://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/aquatic-ecosystems-natural/groundwater-dependent/>

Wetland info / Groundwater Dependant Ecosystems – <http://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/aquatic-ecosystems-natural/groundwater-dependent/>

Groundwater Dependant Ecosystems/ Learning Module – <http://wetlandinfo.ehp.qld.gov.au/wetlands/resources/training/15-gde-ecology/>



Canada: Beautiful, liveable, but vulnerable

Lorraine Chaffer, Vice President GTA NSW
Geography Education Consultant
Author: Geography teaching resources

PART 3: WATER

The NSW Geography Syllabus 7–10 requires the study of places at a variety of scales from local to national and global. Some units specify a study of different countries and others require a study that contrasts Australia with one other country. Australians in general have a fondness for Canada and for many it is a destination they have visited or would like to visit in the future. The reality is that Australians know very little about the geography of Canada beyond tourist images of mountains, forests, lakes and ski fields or media reports about its liveable cities.

Part 1 in this series of articles 'Canada: beautiful, liveable, but vulnerable' investigated Canada's landforms, landscapes and biomes and its vulnerability to natural hazards such as earthquakes, tsunamis, landslides and wildfires.

Part 2 was a study of selected Canadian landforms, the processes responsible for their formation, associated values and the protection of those values, these articles were published in Geography Bulletin Vol 47, No4 2015.

Part 3 will investigate Canada's water resources and its vulnerability to atmospheric and hydrologic hazards such as storms, drought and flood.

Part 4 will be an inquiry based learning activity for the Bow River drainage basin. (this article will be published in a later issue of the Geography Bulletin).

SYLLABUS LINKS

CONTENT: Water in the world

(<http://syllabus.bos.nsw.edu.au/hsie/geography-k10/content/1185/>)

- the characteristics and spatial distribution of global water resources
- how the operation of the water cycle connects people and places
- the quantity and variability of water resources - Australia and other places
- the economic, cultural, spiritual and aesthetic values of water for people

Canada: Beautiful, liveable, but vulnerable. Part 3: Water

GLOSSARY (<http://syllabus.bos.nsw.edu.au/hsie/geography-k10/glossary/>)

Catchment area: The area drained by a river or water body. Also known as river basin.

Groundwater: water located beneath Earth's surface filling the spaces between grains of soil or rock.

Precipitation: Forms of water falling from the atmosphere to the Earth's surface

Spatial distribution: The location and arrangement of particular phenomena

Water cycle processes: physical changes to water that change its state and geographical location.

Climate change: A long-term change in regional or global climate patterns eg. annual precipitation, frequency of weather events

Atmospheric hazard: Hazard event originating in the atmosphere eg storms, tropical cyclones

Hydrologic hazard: event originating in the hydrosphere from changes to the water cycle eg floods and droughts

Canada's Water Resources

Canada is the second largest country in the world covering an area of 9,984,670 sq. km. It has the world's longest coastline bordering the Atlantic, Pacific and Arctic Oceans and shares an 8,892 km land border with the USA. With a large latitudinal and longitudinal extent (from 42° to 83° N and 52° to 141° W) annual precipitation varies greatly from north to south and coast to inland.

Considered as one of the world's water rich countries with an estimated 20% of the world's freshwater resources much of which is highly visible as glaciers, icefields, wetlands, rivers and lakes. Fresh water covers around 9% of Canada's total area (or 891 163 square kilometres).

Visible water resources

- Canada has over **2 million lakes, 563 of which are** over 100 square kilometres in area, more than any other country
- The Great Lakes (shared with the USA) is the **largest area of freshwater in the world** storing 18% of global surface freshwater resources
- **Average annual precipitation** (Source 1) varies across the country with the greatest concentrations on the Atlantic and Pacific coasts, reducing inland and to the north.
- About 2% of the country is covered by frozen freshwater in the form of snow, glaciers and ice fields.

- On average 36% of annual precipitation falls as snow but variations occur from north to south and from the coast to the inland. (North, 50%; Prairies, 25%; coasts as low as 5%).
- High precipitation levels and the melting of winter snow contributes to river flow (Source 4) and an average discharge of freshwater from Canadian rivers into the sea totaling nearly 9% of the world's freshwater supplies.
- The Mackenzie River (4,241 km) is Canada's longest river.
- Wetlands are found in every province and cover 14% of the country's total land area.

Precipitation and runoff

High annual precipitation (renewable water resources) results in large amounts of runoff, although runoff also varies due to slope, soils, vegetation cover and human.

Sources 1 and 2 show spatial variations in annual precipitation and runoff.

Water resources are best studied using a drainage basin (catchment) approach. In Canada, water from drainage basins empties into the Pacific Ocean, Atlantic Ocean, Arctic Ocean, Hudson Bay, The Great Lakes and Labrador Sea. It is said that 50 - 60% of the total flow of Canadian rivers drains northward into the Arctic Ocean or into Hudson and James bays, often thousands of kilometres from the water source while most of the population (85%) lives within 300 kilometres of the border with the USA.

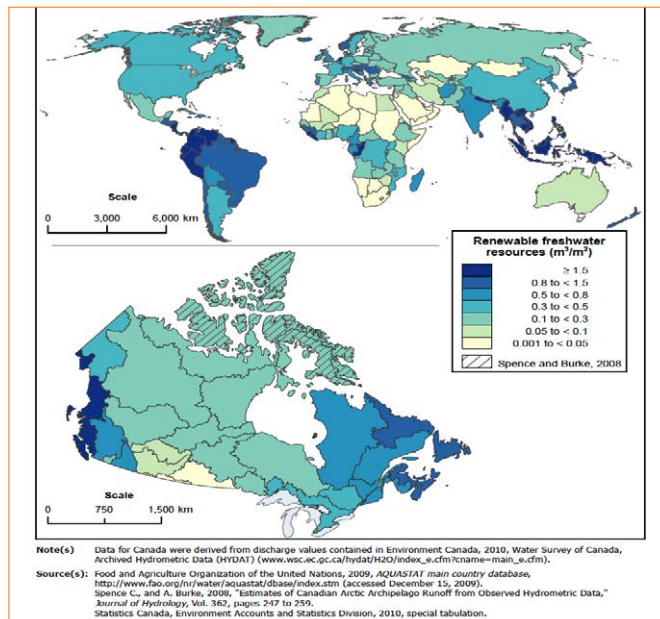
The Bow River drainage Basin for example, begins in the Rocky Mountains west of Calgary and the water

Canada: Beautiful, liveable, but vulnerable. Part 3: Water

discharges into Hudson Bay some kilometres away. Some southern catchments drain into The Great Lakes or cross the border into the USA. **See Source 3**

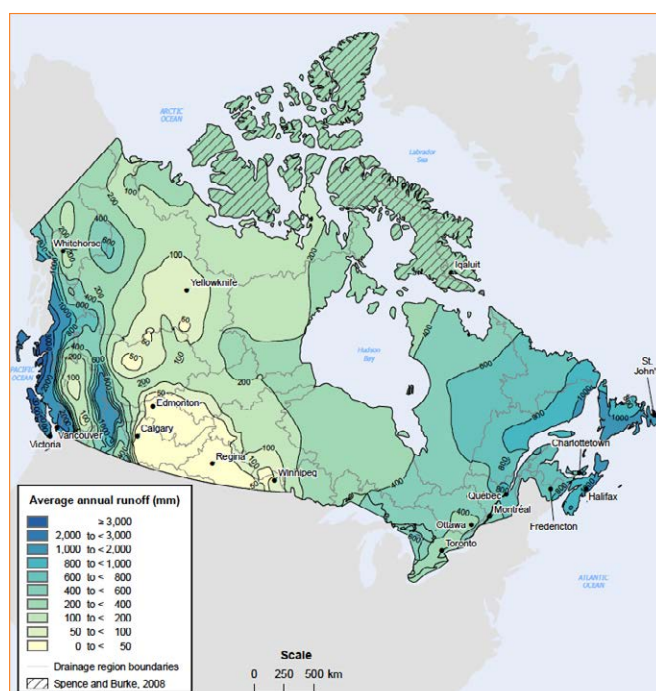
To make use of its surface water resources about 850 large dams and thousands of smaller dams have been built on Canadian rivers and streams storing water for urban, industrial and agricultural use.

SOURCE 1: Spatial variations in annual precipitation (renewable water)



From: Human activity and the environment: Freshwater supply and demand in Canada – <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2010000-eng.pdf>

SOURCE 2: Spatial variations in runoff

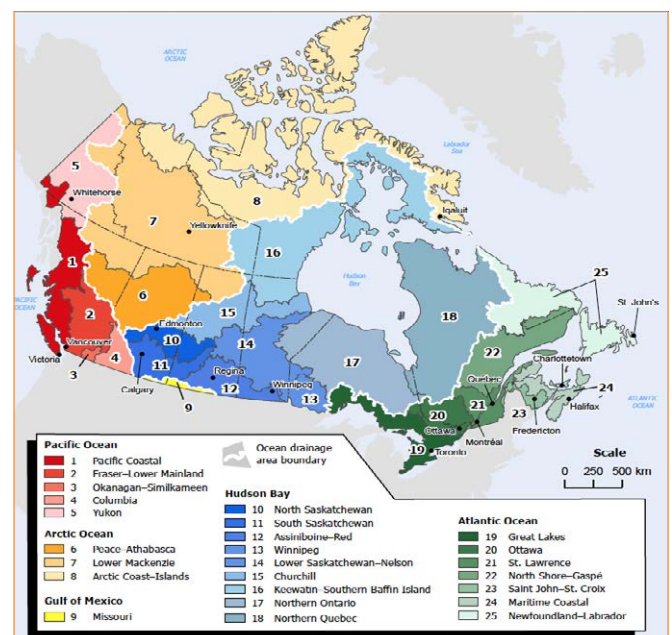


From: Human activity and the environment: Freshwater supply and demand in Canada – <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2010000-eng.pdf>



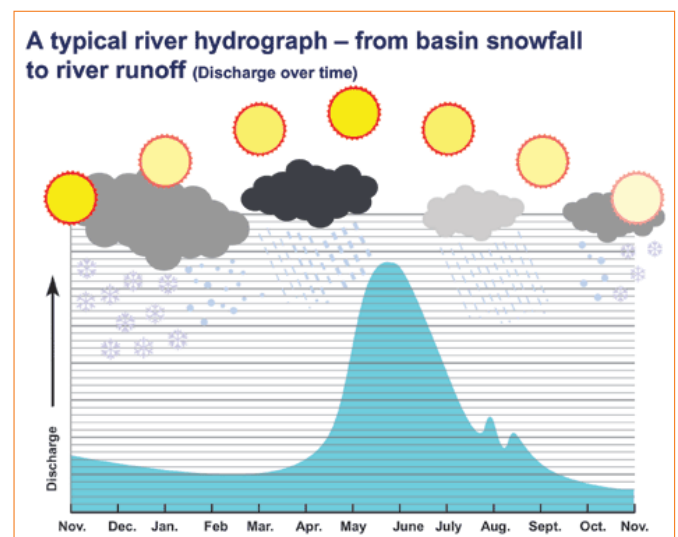
Bow River, Banff National Park. source: Wikimedia Commons

SOURCE 3: Canada's large drainage basins



From: Human activity and the environment: Freshwater supply and demand in Canada – <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2010000-eng.pdf>

SOURCE 4: The contribution of snowmelt to river flow in Canada



<https://www.ec.gc.ca/eau-water/default.asp?lang=En&n=B98C0EB3-1>

Canada: Beautiful, liveable, but vulnerable. Part 3: Water

SOURCE 5: Visible water resources include lakes, glaciers, rivers and waterfalls



Examples of visible water resources in Alberta and British Columbia (L Chaffer)

Invisible water resources

Groundwater is an important resource for inland, rural regions and more remote provinces of Canada with an estimated 25–30% of the population relying on groundwater for domestic and agricultural use. Many rural communities use wells to provide a reliable, less expensive water supply than obtainable from nearby lakes, rivers and streams. In some places groundwater is the primary source of water. Spatial variations on groundwater dependence can be seen in Source 6.

Many ecosystems are also dependent on groundwater. Wetlands, such as the Vermillion Lakes wetlands on the Bow River, support millions of Canadian ducks and waterfowl and other iconic Canadian species such as Caribou, are recharged from groundwater flows. Wetlands also store floodwater, filter nutrients to keep

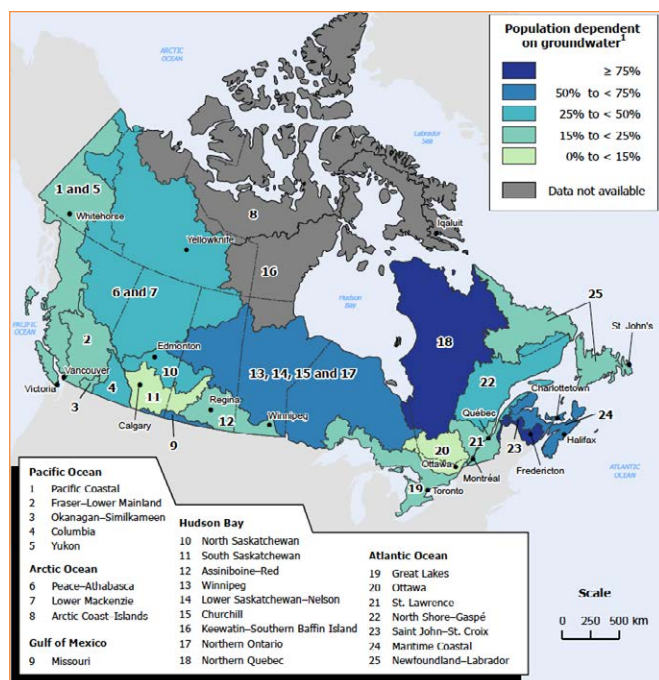
rivers cleaner and recharge rivers in times of drought as in other parts of the world. The contamination of invisible groundwater resources in Canada has become a major concern in recent years. **See Source 7**



Vermillion Lakes near sunset (Mount Rundle to left), Banff National Park, Alberta, Canada. Source: Wikimedia Commons

Canada: Beautiful, liveable, but vulnerable. Part 3: Water

SOURCE 6: Spatial variations in groundwater dependence



From: Human activity and the environment: Freshwater supply and demand in Canada – <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2010000-eng.pdf>

SOURCE 7: The Vermillion Lakes wetlands support ecosystem biodiversity



Photos: L Chaffer

Values of water resources

"Water not only slakes thirst and gives Canadians a sense of identity but supports healthy aquatic and terrestrial organisms, provides a myriad of ecological services and is the backbone for a competitive economy"

<http://www.canadiangeographic.ca/atlas/themes.aspx?id=watershedawareness&lang=En>

Aesthetic, spiritual, cultural and social values

Canada's glaciers, lakes, rivers, wetlands and waterfalls add beauty to the environment and are enjoyed by millions of tourists and Canadians every year. The snow covered mountain peaks, glaciers, lakes eg lake Louise and rivers of Banff National Park attracts 3–4 million visitors a year. Other examples include the Athabasca glacier, the Fraser River Valley, Waterton Lakes and Niagara Falls. The Great Lakes alone provide drinking water to 8.5 million Canadians.

SOURCE 8: Aesthetic value



Waterton Lake (L Chaffer)



Athabasca Glacier (L Chaffer)

Canada: Beautiful, liveable, but vulnerable. Part 3: Water



Niagara Falls – <http://www.niagarafallslive.com/images/pano2.jpg>

The First Nations people of Canada settled where water resources were plentiful such as along rivers and lakes. Water is a living thing in First Nations culture: part of the biotic rather than the abiotic environment as viewed by scientists.

SOURCE 9: First Nations value water as a living thing

“Water is a meditative medium, a purifier, a source of power, and most importantly it has a spirit. Water is alive – biotic.

The Elders believe that water has a strong spirit, which can be gentle or powerful, forgiving or angry. ‘If you don’t make offerings to the water, sometimes it can take you.’

The water is shown respect and appeased through offerings in the form of gifts of food or coins, and through prayer

‘The water is the biggest part of all our lives; without it we’d never survive. So when you go to the water and you talk to that water, that water helps you. If you go to the water early in the morning and get into it before anybody’s up or around, that water will strengthen you because your spirit cries for that water”

From: Perspectives: Journal of ecosystems and management.
“Water: A first Nations spiritual and ecological perspective” http://forrex.org/sites/default/files/publications/jem_archive/ISS1/vol1_no1_art7.pdf

Economic value

Rivers and groundwater are the lifeblood of Canadian agricultural production, urban settlement, industrial production, hydroelectric generation, transportation and trade across Canada. The Great Lakes are a vital trade highway connecting inland Canada with the USA,

coast and overseas markets through the St Lawrence Seaway.

Water’s annual measurable contribution to the Canadian economy is estimated to be between \$7.5 billion and \$23 billion, and by some estimates, 60 percent of the country’s GDP is directly dependent on water.

Canada’s hydrologic and atmospheric hazards

Winter storms and blizzards consist of heavy snowfall, cold temperatures, high winds and whiteouts. A blizzard occurs when winds are over 40 km/h and visibility is reduced to below about 400 metres because of snow falling and / or blowing for at least four hours.

Cold arctic air from the north brings blizzard conditions, which could last for days.

Floods are the most frequent natural hazard in Canada caused by heavy winter precipitation (snow, sleet and hail) and the spring thaw. Rapid melting of ice and snow accompanied by heavy rain has historically caused serious flooding. Heavy rain also causes flash floods, especially during the hurricane season in the eastern provinces or on the steep slopes of the Canadian Rockies. The growth of urban areas such as Calgary exacerbates the extent of flooding along rivers and lakes. The worst flood in Canada’s recent history occurred in Alberta in June 2013.

Tornadoes in the summer months consist of rotating columns of wind that cause a path of destruction in inland provinces such Ontario and the Prairies in southern Canada. Canada gets more tornadoes than any other country with the exception of the United States.

Drought is less common but in 2015 record-breaking high temperatures and low rainfall brought drought western Canada, devastating agricultural production and causing widespread bushfires (**Source 11**). For parts of Alberta conditions meant the lowest rainfall in 50 years. Several Alberta counties declared states of

Canada: Beautiful, liveable, but vulnerable. Part 3: Water

agricultural disasters. Water restrictions were imposed throughout Alberta, Saskatchewan and along on the West Coast.

A contemporary natural hazard: Alberta Flood 2013

On June 20, a large weather system moved in from the southwest, dropping nearly 100 mm of rain in just over a day in some areas. The river systems and ground were unable to handle the massive amount of precipitation and rivers crested creating flooding across much of southern Alberta. The rain persisted creating devastating conditions in and around Calgary, including High River and Red Deer. Homes were washed away, people struggled to save their homes and cars,

but many were forced out of their homes. At least four people died. Many people were unable to return to their homes or businesses.

The Insurance Bureau of Canada estimated that the flooding was the costliest in Canadian history, topping off at \$1.7 billion.

- 100,000 Albertans displaced
- Closure of part of the Trans-Canada Highway
- 4,000 businesses impacted in Calgary alone
- Closure of Calgary Zoo
- Rainfall averaged 75 to 150 mm in under three days
- Almost 500,000 people across southern Ontario were left without power due to the storm

SOURCE 10: Flooding in Calgary, Alberta June 2013



Left and above: Aerial view of the flooded Calgary Stampede stadium, Calgary, June 2013.



Debris and water pours down suburban streets and across the Trans-Canada Highway



<http://globalnews.ca/news/1046844/worst-natural-disasters-in-canadian-history> and <http://globalnews.ca/news/1012584/2013-weather-year-in-review/>

Canada: Beautiful, liveable, but vulnerable. Part 3: Water

SOURCE 11 Forest fires associated with drought conditions in 2015



<http://www.bloomberg.com/news/articles/2015-08-26/snowy-canada-suffers-drought-heat-fires-as-earth-gets-warmer>



During the first week of June 2009, Sustainable Resource Alberta burned nearly 8,000 hectares of forest in Western Alberta. The forest was destroyed to bring about greater diversity, stem the spread of mountain pine beetle and to create a fire barrier for any future wild fires. Source: https://upload.wikimedia.org/wikipedia/commons/f/ff/Big_controlled_burn_in_Alberta.jpg

Sources

Canada: Environment and climate change
<https://www.ec.gc.ca/default.asp?lang=en&n=FD9B0E51-1>

Human activity and the environment: Freshwater supply and demand in Canada – <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2010000-eng.pdf>

Perspectives: Journal of ecosystems and management.
“*Water: A first Nations spiritual and ecological perspective*” – http://forrex.org/sites/default/files/publications/jem_archive/ISS1/vol1_no1_art7.pdf

Natural hazards of Canada – <https://www.youtube.com/watch?v=3U5oYr-yAZQ>

Alberta Flood 2013 – <https://www.youtube.com/watch?v=RBLZyolbvts>

Calgary Flood 2013 – <https://www.youtube.com/watch?v=KwqLYfdiqxl>

Alberta Flood 2013: How it happened – <https://www.youtube.com/watch?v=PxSfbi9vLPA>

Flood – <http://globalnews.ca/news/1046844/worst-natural-disasters-in-canadian-history/>

<http://globalnews.ca/news/1012584/2013-weather-year-in-review/>

Drought and fire – <http://www.bloomberg.com/news/articles/2015-08-26/snowy-canada-suffers-drought-heat-fires-as-earth-gets-warmer>

STUDENT ACTIVITIES

1. Explain why Canada is considered a water rich country.
2. Differentiate between visible and invisible water resources using Canadian examples.
3. Use examples to illustrate the aesthetic value of Canada's water resources
4. Compare Canada's First Nation people's perspective on water to that of scientists.
5. Explain the economic value of water in Canada using examples and statistics.
6. The Bow River Wetlands have environmental value – what does this mean?
7. Why is flooding the most common hydrologic hazard in Canada?

Inquiry activity

Choose one aspect of Canada's water resources eg. rivers, precipitation, a hydrologic or atmospheric hazard.

Conduct an inquiry to compare Australia and Canada for the selected topic.

Communicate your results using a web-based program.



Left: Vamp Creek showing damage from the 2010 forest fire Kisseynew Lake, Canada
Source: https://commons.wikimedia.org/wiki/File:Vamp_Creek_showing_damage_from_2010_Kisseynew_Lake_Forest_Fire.jpg

HONG KONG

AS A LARGE CITY STUDY

Timothy Kelleher,
International School Hong Kong

Introduction

Hong Kong presents as an excellent choice for a large city in the developed world study. Although located in China, a rapidly developing or BRIC country, Hong Kong developed its world city economy, status and characteristics under British rule, justifying its inclusion as a large city in the developed world. Its strategic position within Asia is well documented so too its meteoric rise courtesy of a burgeoning economy. Like other world cities, Hong Kong is seeking to exert itself globally resulting in changes that are as rapid as they are varied. The urban dynamics of change are easily visible throughout this city and make for an exciting investigation. With limited room when compared to other world cities Hong Kong is centered very much on urban renewal and consolidation to ensure continued development. What is evident is the wonderful mix of the old and the new and a genuine attempt to utilise the land in an ecologically sound way.

An excellent starting point for studying Hong Kong is an investigation of the land use patterns. Figure 1 illustrates the small proportion of land currently under residential, commercial and industrial usage (less than 10%). Interestingly, 2/3 of the current land use is woodland/shrub land/grassland/wetlands – a fact that few people would believe prior to exploring Hong Kong.

Urban dynamics of change

Social structure and spatial patterns of advantage and disadvantage, wealth and poverty, ethnicity

When considering this dynamic it is important to understand that Hong Kong is a city almost completely urbanised. Its urban sprawl is unlike other cities. With an average population density (as at mid-2014) of 6 690 persons per square kilometer, and Kwun Tong, with 57 250 persons per square kilometer, the city is contrasted with extreme variations of advantage and disadvantage (Census and Statistics Department 2015). Space, distance from the CBD and services, access to hospitals and schools together with the income disparities all need to be considered in this point.

The New Territories area contains 52% of Hong Kong's population and makes up 86% of its territory. This area underwent urban development in the 1960's when the government realised the need for more residential districts to meet the growing housing demand. According to Hill, NG & Wan (1989) the New Territories was designed to house 3 million people. The advantages and disadvantages of this development and the on-going urban development in the New Territories can be explored through the income levels of residents

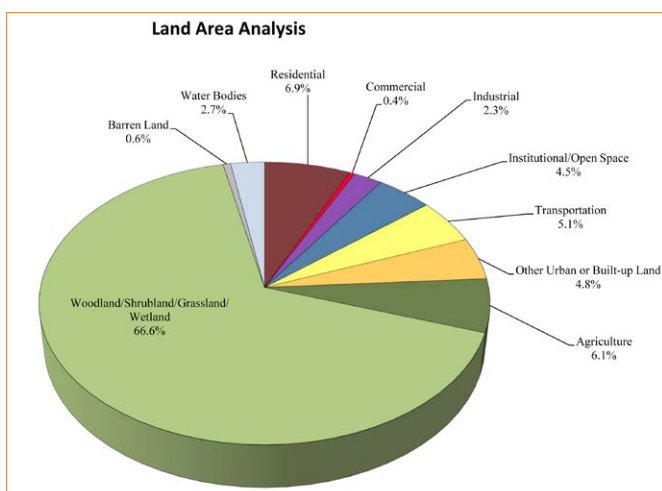


Figure 1: Land use of Hong Kong. Surprisingly more than half of the available land in Hong Kong is natural vegetation. With less than 7% of land designated residential the presence of high rise urban living is evident throughout the three urban areas of the city.

Source: <http://www.mapcruzin.com/free-world-landuse-maps.htm>

Hong Kong as a large city study

compared to those living in Kowloon and Hong Kong Island. Dwelling sizes, access to schools and universities, hospitals and places of employment are easily compared.

According to the Home Affairs Department (2015), Hong Kong is a largely homogenous society, with about 94% of its people being Chinese (ethnically speaking, Han Chinese). Results from the 2011 Population Census revealed (by way of self-identification) that there were about 451,000 non-Chinese people in Hong Kong, or about 6% of the population. Figure 2 illustrates the composition of this group. Despite the largely Han population the cultural variations within the city are quite pronounced. Here students could look at the expatriate communities that exist throughout Hong Kong, so to the remnants of the British colonial era. Further, the plight of the more than 300 000 foreign domestic helpers is worthy of consideration.



Figure 4: Thousands of school children cross between China and Hong Kong each day for school. The border is considered a necessity as school places become more difficult to obtain in Chinese schools offering English medium instruction.

(2011 Population By-census)	
Ethnicity (Self-identification)	Total number
Indonesian	133 377
Filipino	133 018
White	55 236
Indian	28 616
Pakistani	18 042
Nepalese	16 518
Japanese	12 580
Thai	11 213
Other Asian	12 247
Others	30 336

Figure 2: Illustrates the ethnic diversity for the non-Chinese portion (6%) of Hong Kong's population.

Changing economic character, nature and location of residential land, commercial and industrial development

Hong Kong is a city constantly undergoing change. This topic is well covered through a study of the industrial and deindustrialised periods of the past 70 years. The opening of China to the world's business markets in 1979 saw the emergence of Shenzhen city (Figure 3) and the subsequent decline (urban decay) of manufacturing in Hong Kong as the lure of cheap land and labour was too great for local companies. What was once made *in* Hong Kong quickly became made *for* Hong Kong. Such was the size of this industrial decline the Hong Kong government set about redefining the city as the premier financial and logistics centre within Asia. Urban renewal has been at the forefront of the governments planning since the 1980s. Former industrial areas like Kwun Tong, Kennedy Town and East Kowloon are excellent examples of such renewal (refer Figure 5).

When investigating the changing economic character of Hong Kong one must consider the relevance of the city in relation to China. Hong Kong was ceded back to China in 1997 following 150 years of British rule. At this time trade between China and the traditional western countries was in its infancy paving the way for Hong Kong to emerge as a conduit between China and direct foreign investment. The cities robust business reputation, British legal system and 'lack of red tape' were the hallmarks of its growth during the last two decades and continue to underscore its current position within the global city rankings.



Figure 3: Shenzhen Special economic Zone (SEZ). Formerly a farming district, Shenzhen was chosen as the site for one of China's Special Economic Zones. The city has developed in the last thirty years is now home to an astonishing 59 buildings over 200m tall and is considered the manufacturing heart of China. Hong Kong is situated within 30km of the Chinese border. Shenzhen is easily accessible by road, ferry or rail. Many Hong Kong workers commute to and from Shenzhen. The border crossing sees in excess of 50,000 workers crossing each day. Source: www.chinadaily.com.cn

Hong Kong as a large city study



Figure 5 New territories development Hong Kong's urban areas can be divided into three distinct areas: Hong Kong Island which contains the CBD, Kowloon and the New Territories. Lantau Island contains Chek Lap Kok airport that replaced the old airport in Kowloon and was built completely on reclaimed land. . Source: www4.comp.polyu.edu.hk

The residential land component would best be studied through both urban consolidation and suburbanisation. The government passed legislation requiring the renewal of all buildings once they reach fifty years of age. An in-depth look at the 'mid-levels' area of Hong Kong Island highlights the constant desire to build higher. Located on the edge of the CBD, the mid-levels district is within walking distance of the financial centre of the city as well as the strongly patronised nightlife district of Lan Kwai Fong. As a result demand is high and the rents exorbitant. Conversely those living in the outskirts of the city (districts within the New Territories) compromise location for cheaper rent and more space.

Culture of place as expressed in the architecture, streetscape, heritage architecture, noise, colour, street life, energy, vitality and lifestyles

Despite its modernity Hong Kong has a rich heritage that is evident in the nightlife, architecture, food, religion and lifestyles of its residents. Traditional villages are juxtaposed with the growing number of gated communities that represent the grandeur and prestige afforded to the very wealthy. (refer to Figure 8). This is an excellent example of the spatial exclusion that exists within the city. With 1/3 of Hong Kong's population living within government provided housing it is clear that the availability of resources is very much in favor of the wealthy minority.

Notwithstanding an insatiable appetite for urban renewal, the HKSAR government recognises the need

to preserve the heritage architecture that identifies with the rich past of the city. Hong Kong contains numerous examples of colonial architecture that tells a narrative of the 150 years of British rule. Examples include the PMQ (Police Married Quarters) located in the CBD. A renewal program has seen the low-rise quarters redeveloped into a modern retail space with concept stores and designers whilst maintaining the integrity of the buildings façade and open spaces.



PMQ shopping precinct Source: Wikimedia Commons

The Western Market dwelling (built 1904) is a further example of preservation. Formerly a bustling centre for tailors and cloth merchants, the building fell into disrepair in the 1980's and was subsequently renewed in 2003. The Edwardian style building was targeted by the Urban Renewal Authority (URA) to be refurbished with the aim of adaptive-reuse, the building has been brought back to their useful economic life by accommodating theme restaurant and boutique shops that turning the building and the vicinity into a place for lifestyle shopping and leisure activities.



Western Market Source: Wikimedia Commons

Hong Kong as a large city study



Figure 6: The general view of Pokfulam squatter village. What is not evident from this photograph is the proximity of the village to modern residential dwellings that serve as a stark reminder of where Hong Kong has been and the progress it has made.

Pokfulam village (Figure 6) is an excellent case study for students as it represents a squatter settlement that has resisted urban renewal and attempts to use the land for residential and commercial expansion. The village has recently been placed on the UNESCO watch list and is home to a mere few hundred residents. The streetscape and architecture of the village appears cramped and dilapidated. This uniqueness adds to the energy of this very special place.

Other worthy examples when considering culture of place include the various markets that exist within the city. The Pottinger Street markets (Figure 7), Ladies markets and Stanley markets are all examples of the distinctly Asian nature of this city. Residents and tourists alike frequent these markets for fresh produce and items at greatly reduced prices. Often cramped and noisy, these markets provide the city with vitality and colour not found in the traditional business district. The recent closure of the 160-year-old Peel Street markets in the centre of the city illustrates the pressure of urban renewal.



Figure 7: Pottinger Street in the CBD is a reminder of Hong Kong's past. The photograph on the left is an example of a Pai Dong or 'little green shop'. Small sole traders operate from these small green tin shops. The photograph on the right shows the vibrancy, colour and streetscape of the Pottinger Street markets. A popular spot sandwiched between the tall commercial buildings of the CBD.

Understanding culture of place requires also a study of the various festivals that are observed within Hong Kong. During Chinese New Year the city is alive with celebration, fireworks displays and family occasions. "It is impossible to not be caught up in the energy as you squeeze into crowded temples to pray for good fortune, browse festive markets selling auspicious foods and blooms and photograph the shock-red lanterns that adorn the city" (Discover Hong Kong 2015).

Given the cramped nature of residential space in Hong Kong people are drawn to entertaining outdoors. Eating out is commonplace for residents adding to its richness of streetscape. It is common to see people eating in the Dai Pai Dong's (open air food stalls) well into the night.



Figure 8: Walk up apartments known as Tong Lau's are a reminder of the post war period of urban development in Hong Kong. As a space deprived city there is pressure to demolish the old Tong Lau's and build taller residential towers. In this case the Tong Lau has been renewed and is considered a boutique residential space commanding \$80,000hkd/month (AUD \$13,000) for a two bedroom apartment.

Growth, development, future trends and ecological sustainability

The high-density urban environment of Hong Kong is characterised by mixed land uses, a growing and ageing population, housing diversity, an efficient mass transit system together with cheap public transport, and easy access to most facilities, all typical of a compact city-state. Hong Kong presents an obverse urban layout to the more traditional sprawling cities such as Sydney, London and New York. Urban consolidation has and will continue to lie at the centre of the governments housing strategy. Limited space and growing discontent towards land reclamation projects leave little choice other than to grow vertically. Currently Hong Kong boasts 311 buildings that reach or exceed 150m. New York is a distant second with 64 fewer such dwellings. The obvious advantage yet equally its biggest challenge for the growth and development of Hong Kong is its ability to meet demand for commercial and residential space.

Hong Kong as a large city study

The future of residential space in Hong Kong is a trend towards smaller apartments. A recent development (as reported by the Wall Street Journal 2015) of 180 foot square apartments have been given the moniker “mosquito-sized units.” The units (called high space) all furniture essentially has to be made to order and described the window sill as a potential area for “entertainment.” The price tag – a staggering \$US516,000. Providing affordable housing for the growing population is a challenge that has the potential to stifle Hong Kong’s urban growth. Already 1/3 of the city’s population is living in government housing, a further 250,000 await housing and some 200,000 people live in caged homes or subdivided flats. With demand outstripping supply the future directions of the city are driven by its current and looming housing crises.

The preservation of Hong Kong’s cultural heritage (pre-colonial and colonial) is yet another challenge that must be considered within the confines of the growth and development of the city (Figure 8). The 50 year urban renewal ordinance requiring buildings to undergo refurbishment (often resulting in demolition and complete redevelopment) has seen older industrial areas gentrified. A trend that is set to continue as industry is all but phased out of the city. Prime locations such as Kennedy Town and the former Kai Tak Airport are ‘lighthouse examples’ of the successes associated with this development. Contrarily the closure of the 157 year of Graham Street markets highlights the price of modernity. The noise, vitality, colour and streetscape associated with the markets sat juxtaposed to the enormity of the cityscape surrounds. Nonetheless the removal of these markets has resulted in a disruption in the daily routines of locals and a loss of a major tourism draw card for the city.



Figure 9: Gated communities like Bel Air pictured above, offer residents an array of private facilities including clubhouses, gymnasiums, swimming pools, cinemas and beauty salons. The lifestyle supplements the lack of space and aims to provide residents with a unique culture within the confines of the estate.

Hong Kong has long considered itself the Asia’s world city. As an entrepôt for China, and a hub for the dissemination of goods, information and financial flows, the city acts as a nodal point within Asia. Decentralisation (a government policy which attempts to reduce the concentration of businesses, services and population in major city centres) has seen a second CBD project undertaken at Kowloon East and the creation of an IT creative digital community (occupying a 24-hectare reclaimed swamp site at Telegraph Bay on Hong Kong Island). The creative digital community comprises over 338 companies engaged in information and communications technology, digital content creation and mobile apps development.

Accompanying this digital community is the gated community of Bel Air which houses 10,000 residents. For Hong Kong to continue to grow it must look for new opportunities to harness the growing demands of a highly specialist region. Moving away from a traditional CBD city structure has ensured adequate and affordable space is made available for commercial ventures. Gated communities (often associated with spatial exclusion) are a bi-product of Hong Kong’s growth and development and look set to continue as new developments follow this urban model. Middle-High income residents recognise the space deprived nature of the city and seek residential offerings that provide a range of private facilities (sporting and recreational) all within a secured environment. (Figure 9)

Hong Kong’s resource consumption is equally globalised. With an ecological footprint 150 times greater than its carrying capacity, it is essentially living off the natural resources of other countries. Hong Kong’s departure from its agriculture roots has been startling. Agriculture land has gone from 13,000 hectares in 1961 to 5,100 hectares in 2011, or 5 percent of total land area. Unusually for a Chinese city, Hong Kong has had no policy to promote the local production of food since the handover in 1997. Instead it relies heavily on production bases in China that supply fresh produce exclusively to it.

In Hong Kong on the other hand, agricultural land is often seen as a reserve to be developed by private developers. Over 4000 hectares of agricultural land are now in the hand of developers and are therefore left barren, leaving less than 800 hectares actually in use for cultivation. The question that must be answered is whether Hong Kong is moving in the right direction. At a time when sustainability and food security have become pressing issues, the controversial North East New Territories New Development Areas will result in the closure of 10 percent of the remaining vegetable

Hong Kong as a large city study

farms in Hong Kong, most of which have been in cultivation for over a century. Meeting the increasing demand for space has seen every conceivable land plot either taken or slated for development. The success of the 320ha development at the former Kai Tak airport (Kowloon East) is evidence that urban renewal has a future in Hong Kong (Figure 10). With increased green space (1 km boardwalk and accompanying parks) the area has undertaken a significant metamorphosis. On the other hand, the loss of agricultural land serves only to heighten the reliance of residents on imported goods.

The government has addressed the need for more housing and employment opportunities in its planning for future development. The “Hong Kong 2030: Planning Vision and Strategy” (the HK2030 Study), completed in 2007, has revisited the need for strategic development areas in the New Territories (including Fanling North and Kwu Tung North), and recommended proceeding with some of the NDA developments to address the long-term housing demand and provide employment opportunities. Whilst this ensures much needed growth such developments will diminish the urban villages that dot the upper reaches of the New Territories. Villages that support rural lifestyles for a diminishing populous. Over 8,400 people will be displaced in the two areas, Fanling North and Kwu Tung North. Most of these are non-indigenous villagers with no land rights. These farmers will lose their livelihoods along with the farmland. Doubtless these people will be compensated and relocated but one must consider the loss of cultural authenticity when these villages are replaced by urban developments.

Hong Kong is committed to ecological sustainable living. With a highly efficient and expanding public transport system a move towards ERP (electronic road pricing) is seen as one way of reducing road congestion and improving air quality in high volume areas. In Hong Kong there are less than 50 private cars vehicles per 1,000 population, compared to more than 100 in Singapore and Seoul, more than 200 in Jakarta and over 300 in Bangkok. Only about 11 per cent of daily person trips are made by private cars vehicles while 89 per cent use public transport. ERP would see the adoption of a “user-pays” principle and would offer a more efficient, equitable and flexible means of managing the road space particularly in congested areas during busy hours.

Sustainable Development means “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” [“Our Common Future”, 1987, the World Commission on Environment and Development] The



Figure 10: The first photograph shows the construction phase of the Second CBD urban renewal project in East Kowloon. The now disused Kai Tak airport has been transformed into commercial, residential and public space. This project is the largest urban renewal project ever undertaken in the city of Hong Kong. Photograph 2 is an artists impression of the finished project. Source: www.prc-magazine.com

goal of sustainable development is to strike a balance between the needs of the environment, society and economy in order to maintain a quality standard of life for both present and future generations. The Council for Sustainable Development was established in March 2003 to promote sustainable development in Hong Kong and a Sustainable Development Fund (SDF) was established to provide financial support for initiatives that will help to develop a strong public awareness of the principles of sustainable development and to encourage sustainable practices in Hong Kong.

Nature conservation is a central feature of the Government's plans for the future of Hong Kong. Currently the city boasts 24 country parks and 22 special conservation areas. The country parks and special areas cover a total area of 44 300 hectares. The country parks comprise scenic hills, woodlands,

Hong Kong as a large city study

reservoirs and coastline in all parts of Hong Kong. Further, Hong Kong has five marine parks which cover a total area of 2 430 hectares and comprise scenic coastal areas, seascapes and important marine habitats. With urban growth reaching the very limits of available space there is an increasing need to protect the endemic species and their habitats.

The growth, development, future directions and ecological sustainability of Hong Kong is closely aligned to the urban dynamics of change. Space deprivation is met with high demand and the need for creative responses. With the full reversion to Chinese rule to occur in 2047 one can only speculate on the full impact of this.



Kennedy Town shop. Source: Wikimedia Commons

Additional resources

Hong Kong factsheets – <http://www.gov.hk/en/about/about/hk/factsheets/docs/population.pdf>

Urbanization – http://www.hko.gov.hk/climate_change/urbanization_e.htm and <http://lib.hku.hk/Press/0856560049.pdf>

Evolving urban form – <http://www.newgeography.com/content/002708-the-evolving-urban-form-hong-kong>

Hong Kong Housing Authority – <https://www.housingauthority.gov.hk/hdw/ihc/pdf/cswcs.pdf>

Urban Problems Hong Kong – http://acad.wyk.edu.hk/~pyng/7SS%202006-07/The%20Urban%20Problems%20of%20Hong%20Kong_wong_wing_chun.doc

SDS Strategy – <http://www.susdev.org.hk/susdevorg/archive2004/en/pdf/1stSDStrategyE.pdf>

Timeout: Reclaiming Hong Kong – <http://www.timeout.com.hk/big-smog/features/68418/reclaiming-hong-kong.html>

Slums Return to Hong Kong – <http://hongwrong.com/slums-return-to-hk/>

Graham Street Markets – <http://m.hk-magazine.com/article/11533/future-graham-street-market>

Ditching Mid Levels – <http://m.hk-magazine.com/article/4000/ditching-mid-levels>

Kennedy Town – <http://travel.cnn.com/hong-kong/visit/5-things-we-love-about-kennedy-town-855458/>

Country Parks and Conservation – http://www.afcd.gov.hk/english/country/cou_lea/the_facts.html

Urban Regeneration – <http://ssweb.cityu.edu.hk/download/RS/E-Journal/journal6.pdf>

Urban Renewal Authority – http://www.legislation.gov.hk/blis_pdf.nsf/6799165D2FEE3FA94825755E0033E532/9BA494475B1AC8E8482575EF001B97BF?OpenDocument&bt=0

Energising Kowloon East – <http://www.ekeo.gov.hk/en/home/index.html>

Cross-border Communities – <http://journalism.hkbu.edu.hk/feed/?p=3034>

Suburbanisation of Rural Villages in the New Territories HK – <http://ebook.lib.hku.hk/CADAL/B38632111.pdf>

Hong Kong's Disappearing Communities: Pokfulam Village – <http://www.hk-magazine.com/article/10634/hong-kong%E2%80%99s-disappearing-communities-pokfulam-village>

World Monuments Fund: Pokfulam Village – <https://www.wmf.org/project/pokfulam-village>

AGTA CONFERENCE 2017



The **2017 AGTA Conference: Geography for an inter-connected world** will be held from 9–12 January 2017 at the University of Melbourne in Melbourne. The conference organisational arrangements are being undertaken by the Geography Teachers' Association of Victoria.

Details will be available on the AGTA website including an invitation to present a workshop or lead a fieldwork trip, sponsorship options, conference accommodation, details of the pre-conference tour and conference program, earlybird registrations and conference newsletter are available at <http://www.agta.asn.au/>

2015 HSC GEOGRAPHY AWARDS





The Geography Teachers' Association of NSW

2015 HSC GEOGRAPHY



AWARDS CEREMONY

Novotel Sydney Olympic Park, Friday 8 April 2016

2015 HSC GEOGRAPHY AWARDS

The Geography Teachers' Association of NSW

Welcome

The Geography Teachers' Association of NSW recognises the achievement of the state's top HSC students for 2015.

Presented by Dr Jane Hunter, School of Education , University of Technology Sydney

The HSC Geography Award recipients are:

Eugenie Ana Taylor
Monte Sant' Angelo Mercy College

Andrew Peter John Mahler
The King's School

Eleanor Victoria June Short
Abbotsleigh

Christopher Ducklin
St Aloysius' College

Phoebe Fei Yang
Hornsby Girls High School

Liam Thorne
St Aloysius' College

Hayden Fraser
Sydney Grammar School

Sophie Jiang
North Sydney Girls High School

Clare Aisling O'Rourke
Abbotsleigh

Chun Fung Wong
Fort Street High School

2015 HSC GEOGRAPHY AWARDS

The Geography Teachers' Association of NSW

The Geography Teachers' Association of NSW recognises the achievement of the teachers of the state's top HSC students for 2015.

The teachers of the HSC Geography Award recipients are:

Vanessa Sefton
Monte Sant' Angelo Mercy College

Drew Collins
The King's School

Sean Kelleher
Abbotsleigh

Rob Marchetto
St Aloysius' College

Debra Black
Hornsby Girls High School

Kymerly Govers
Sydney Grammar School

Tony McElroy
North Sydney Girls High School

Matt Goodyer
Abbotsleigh

Rod Carritt
Fort Street High School

Novotel Sydney Olympic Park, Homebush – Friday 8 April 2016

2015 HSC GEOGRAPHY AWARDS

The Geography Teachers' Association of NSW



Dr Jane Hunter, University of Technology Sydney

Dr Jane Hunter is a Senior Lecturer in the School of Education at UTS. She is currently conducting postdoctoral research in STEM and has a background in secondary and primary school teaching and teacher professional learning. Her doctoral thesis was awarded the NSW Institute for Educational Research: *Beth Southwell Research Award for Outstanding Thesis* (2014).

A book has been published from this doctorate titled: *Technology Integration and High Possibility Classrooms: Building from TPACK* (Routledge, 2015). The theoretical framework that emerged from the research findings *High Possibility Classrooms* is being used in a number of primary and high schools in NSW and the ACT to enhance learning using technology in a design based approach to pedagogy.

Source: <http://www.uts.edu.au/staff/jane.hunter>

About HSC 2 unit Geography in 2015

2015 Geography Candidature – 4276

Percentage of total candidature achieving Band Six – 8.58%

Performance Band Six Descriptors

Evaluates a wide range of geographic sources in an integrated format. Explains complex spatial and ecological relationships and processes, establishing cause by providing details of multiple links. Applies detailed geographic knowledge and understanding from a variety of case studies at a range of scales. Evaluates ecological issues and human responses using appropriate, diverse criteria such as socioeconomic and political factors. Integrates sample studies, statistical trends, geographic models and theoretical perspectives, providing evidence of wide reading. Initiates, plans and implements geographic research and problem solving, including fieldwork, in a highly organised manner. Efficiently communicates in written form using appropriate text types, application of precise and abstract geographic terms and use of complex graphic forms.

ATTENTION – ALL GEOGRAPHY TEACHERS



Geography Teachers' Association of NSW **ARTHUR PHILLIP AWARDS**

TIME TO PREPARE FOR THE 2016 GEOGRAPHY FIELDWORK COMPETITION

The Geography Teachers' Association of NSW (GTANSW) organises an annual competition for students and schools to foster an enthusiasm for Geography through engagement and rewards. The emphasis of the competition is fieldwork and the gathering of primary data as part of authentic research in geography.

The competition is open to all primary and secondary schools, both members and non-members of GTANSW.

All categories of the competition are based on the research action plan outlined on page 17 of the Years 7–10 Geography syllabus. The steps of this research plan have also been applied to the senior Geography course for the purposes of this competition and fit neatly with the Senior Geography Project.

COMPETITION ENTRIES CLOSE FRIDAY 25 NOVEMBER 2016

COMPETITION CATEGORIES:

1. The GTA Fieldwork and Visual Presentation Competition for Years K–9
Sub-categories: Primary – Stage ES1-1 (Years K, 1 & 2), Stage 2 (Years 3 & 4), Stage 3 (Years 5 & 6). Secondary – Stage 4 (Years 7 & 8), Stage 5 (Year 9 only))
2. The Global Education Research (Fieldwork) Competition for Years 7–12
Three categories: Stage 4, Stage 5, Stage 6
3. The Dr Don Biddle Issues in Australian Environments Fieldwork Competition for Year 10 only
4. The Brock Rowe Senior Geography Project Fieldwork Competition for Year 11 only

2016 Arthur Phillip Geography Fieldwork Competition information and student entry forms are available for download from:

www.gtansw.org.au

2015 ARTHUR PHILLIP AWARDS





The Geography Teachers' Association of NSW

2015 ARTHUR PHILLIP

FIELDWORK COMPETITION



AWARDS CEREMONY

Novotel Sydney Olympic Park, Homebush
GTA NSW Conference – Friday 8 April 2016

2015 ARTHUR PHILLIP FIELDWORK COMPETITION

The Geography Teachers' Association of NSW – Awards Ceremony

The GTA NSW Fieldwork and Visual Presentation Award

First place

Marissa Petrakis

Year 9, Meriden

Synopsis: A Weebly presentation showing the Earlwood Community. The aim of the presentation was to investigate a community we belong to and consider the factors causing change.

Teacher: Anita Kondichetty

Second place

Daisy Hannaford

Year 9, Meriden

Synopsis: A Weebly presentation showing the Annandale Community. The aim of the presentation was to investigate a community we belong to and consider the factors causing change.

Teacher: Anita Kondichetty

Third place

Rebecca Huyuh

Year 9, Meriden

Synopsis: A Weebly presentation showing the Ashfield Community. The aim of the presentation was to investigate a community we belong to and consider the factors causing change.

Teacher: Julie Shannon

Highly commended

Leah Barber

Year 9, Denison College, Bathurst High Campus

Synopsis: A poster demonstrating the impacts of tourism on Bathurst.

Teacher: Heidi Waldron

The Global Education Fieldwork and Research – Stage 5 Award

First place

Sambavan Jeyakumar

Year 9, The Armidale School

Synopsis: The research task investigates Armidale's Air Quality and aims to determine the effectiveness of the measures to mitigate air pollution.

Teacher: Fiona Taber

Second place

Jake Sheader

Year 9, Denison College, Bathurst High Campus

Synopsis: A poster demonstrating the impacts of Water use in Bathurst in relation to water consumption and levels in dams.

Teacher: Heidi Waldron

The Dr Don Biddle Issues in Australian Environments Fieldwork Award

Equal first place

Julia Devitt

Year: 10, Smiths Hill High School

Synopsis: A study of the Wamberal Lagoon including water quality and management. A further analysis included an evaluation of the management strategies to overcome the environmental issues discovered.

Teacher: Graham Clarke

Amy Worsfold

Year 10, Smiths Hill High School

Synopsis: A study into the Wollongong Harbour outlining the issues with decline. A further analysis of the stakeholders including suggestions for change.

Teacher: Graham Clarke

Equal second place

Samuel McIntyre

Year 10, Merewether High School

Synopsis: A Research Action Plan of the water quality issues in the discharge of the Glendale catchment. Skilful use of both primary and secondary sources.

Teacher: Rob Berry

Hailey Van Vreumingen

Year 10, Smiths Hill High School

Synopsis: A Research Action Plan investigating the impacts and management of feral animals in Kembla Grange. Clearly integrated both primary and secondary sources to support the investigation.

Teacher: Rodney Perkiss

Equal third place

Nicola Barlow

Year 10, Trinity Catholic College Lismore

Synopsis: Is my household waste management effective? An investigation and evaluation of household waste, in particular the use of cling wrap and the disposal of green recyclable waste.

Teacher: Richard Pawlak

Isabella Monardo

Year 10, Kincoppal Rose Bay

Synopsis: Wanda Beach Cronulla, Coastal Management Report exploring the dune system and strategies to protect the natural coastline. A focus was also placed on the impacts of the development project Green Hills Beach Estate.

Teacher: Renee Galea

2015 ARTHUR PHILLIP FIELDWORK COMPETITION

The Geography Teachers' Association of NSW – Awards Ceremony

Highly commended

Lizzy Mee

Year 10, Merewether High School

Synopsis: A Research Action Plan discovering the urban decline of Hunter Street. Excellent use of both primary and secondary sources to show the changes. Included active citizenship strategy – a letter to Newcastle City Council showing concern about the impacts.

Teacher: Rob Berry

Abby Wilkins

Year 10, Model Farms High School Baulkham Hills

Synopsis: The changing infrastructure within Bella Vista and the impact on the community.

Teacher: Steve Weingarth

Chantelle Winter

Year 10, Tara Anglican School for Girls

Synopsis: Camden Local Government Area Research Action Plan exploring the impact of urban sprawl with a clear focus on changing nature of dwellings and the development of services and infrastructure.

Teacher: Robyn Wood

The Brock Rowe Senior Geography Project Fieldwork Award

First place

Isabella Jean Todd

Year 11, St Mary Star of the Sea College

Synopsis: This SGP was an investigation into the effects of urban vegetation on urban cooling and moderating the urban heat island effect in Wollongong. The study also included a review of the benefits of urban vegetation to the community. Extensively supported with both primary and secondary sources.

Teacher: Adam Everatt

Equal second place

Sophia Bryant

Year 11, The Hills Grammar School

Synopsis: The SGP explored a comparative study of Norwest Private Hospital and the Hospital for Specialty Surgery. The investigation included a summary of the differing services and how they will need to meet the needs of a growing population in the Bella Vista and North West region.

Teacher: Grace Larobina

Rose Fuggle

Year 11, The Hills Grammar School

Synopsis: The SGP explored the quality of urban parks in the Hornsby Shire. A comparative study assessing the impacts of Council maintained Cherrybrook Duck Pond

and the lack of maintenance on West Pennant Hills Duck Pond. The study focussed on pollution levels, health of flora and fauna. Included Active Citizenship to promote the cause.

Teacher: Grace Larobina

Third place

Rebecca Nishbet

Year 11, St Mary Star of the Sea

Synopsis: The SGP was a study of the impacts of the Charles Harper Park on the local area, the comparison drew upon data gathered such as environmental, social and cultural impacts.

Teacher: Adam Everatt

Highly commended

Jade Rani Bannerman

Year 11, SCEGGS Darlinghurst

Synopsis: The SGP presented information that was collected in the field. The issue explored was graffiti in the suburb of Surrey Hills and the impacts on residents and businesses.

Teacher: Darryn Sullivan

Olivia Brodbeck

Year 11, Lakes Grammar Anglican School

Synopsis: The SGP was an integrated study of the impacts of urbanisation on water quality in Black Neds Bay. Through the investigation, data was collected to express the turbidity of the water and an evaluation of the existing management strategies.

Teacher: Nicola Mellare

Alex Brown

Year 11, Loreto Kirribilli

Synopsis: The SGP was a study about Halliday Shore Retirement Living and the needs of those in an aging population. It included feedback from residents and the integration of both primary and secondary sources.

Teacher: Fergus Stewart

Imogen Lewis

Year 11, Merewether High School

Synopsis: The SGP was a geographical study about the factors affecting vegetation in the Blackbutt Reserve. It included the impact of the local microclimates and its influences.

Teacher: Harry Kolatchew

Maddison Rarity

Year 11, Merewether High School

Synopsis: The SGP focussed on the coastal erosion hot spot, Lake Cathie. The data collected showed the

2015 ARTHUR PHILLIP FIELDWORK COMPETITION

The Geography Teachers' Association of NSW – Awards Ceremony

impacts of coastal management and how strategies could be implemented to prevent and manage the ecosystem in the future.

Teacher: Harry Kolatchew

Rachel Ward

Year 11, Merewether High School

Synopsis: The SGP explored the types of vegetation within the Dudley/ Redhead Awabakal Reserve and the human impacts on both topography and vegetation patterns. Carefully integrated primary and secondary sources.

Teacher: Harry Kolatchew

Anne Yang

Year 11, Meriden

Synopsis: The changes in the cultural makeup of Strathfield and, the impacts of History on the local makeup.

Teacher: Claire Kinane

The Dr Maurine Goldston-Morris Civic and Citizenship Award

Rose Fuggle

Year 11, The Hills Grammar School

Synopsis: The SGP explored the quality of urban parks in the Hornsby Shire. The comparative study assessed the impacts of Council maintained Cherrybrook Duck Pond and the lack of maintenance on West Pennant Hills Duck Pond. Rose sent her SGP to Hornsby Local Council as a way of creating interest and seeking answers about the difference in the

level of care shown in the Duck Ponds. This Active Citizenship strategy prompted a detailed reply from the Environmental Scientist Catchment Remediation and Natural Resources manager explaining plans for the revegetation, rejuvenation and creek remediation that will have a positive impact on the maintaining the environment through the Bio Banking Agreement.

Teacher: Grace Larobina

The Dr Maurine Goldston-Morris Teachers' Award for Excellence

Rob Berry

Merewether High School

It is clear that both Mr Rob Berry from Merewether High School has inspired a great inquiry and search for answers to the big geographic questions that surround our every day. The students have been able to present and integrate the findings from their fieldwork as both primary and secondary sources that reflect the many interrelationships. Rob clearly has a passion for encouraging a deep thinking and learning about the fascinating world of Geography. Their approach has encouraged their students to better understand the consequences of human activity in a genuine way. They show a dedicated and practical commitment to promote Geography in an authentic way.



GTANSW would like to congratulate all the winners and also commend the students and teachers who have participated in this competition.



BENEFITS OF GTANSW MEMBERSHIP

The Geography Teachers' Association of New South Wales (GTANSW) is a not-for-profit, incorporated body that represents the professional interests of Geography teachers in NSW and Geographical Education more generally. The objectives of the Association are to promote the study and teaching of geography in primary and secondary schools by:

- providing professional learning opportunities for teachers of Geography;
- advocating the interests of Geography teachers on matters in the State and National interest;
- providing forums where teachers of Geography and the wider community can exchange views;
- supporting Geographical Education through the development and dissemination of geographical resources; and
- promoting geographical research and fieldwork.

The GTA seeks to address its objectives via a yearly program of activities and events, which include:

- online publication of the quarterly Geography Bulletin a quality, peer-reviewed journal designed to serve the contemporary interests of Geography teachers and students.
- delivering Teacher Professional Learning Workshops and in metropolitan and regional locations, focussing on current issues, including in Global Education, the use of technology in the classroom, research and fieldwork skills.
- conducting an Annual Conference with keynote addresses from leading geographers on contemporary and emerging geographical issues as well as more practical sessions by geographical practitioners.
- hosting School Certificate and Higher School Certificate Reviews for teachers of Geography. These reviews are held in a number of regional areas across the state.

For further information about GTANSW activities and events go to: www.gtansw.org.au



MEMBERSHIP RENEWAL/APPLICATION FORM 2016

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*Please select **ONE** of the following membership options and complete the details*

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☐ Co-ordinator of Geography ☐ Senior Geography Teacher ☐ Librarian

School:

School address: Postcode:

School phone: School fax:

☐ **Concessional membership \$40.00** ☐ Retiree ☐ Part-time teacher ☐ Student (verification required)

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Surname: Given Name(s):

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Phone: (Mob) (Home) (Work)

Fax: Email:

School:

PAYMENT:

Membership is for twelve months commencing in January. If payment is made later in the year all back copies of *Geography Bulletin* will be forwarded. A membership reminder will be sent in December.

Please make cheques payable to: Geography Teachers' Association of NSW Inc

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Charge \$..... to my credit card: ☐ Mastercard ☐ Visa

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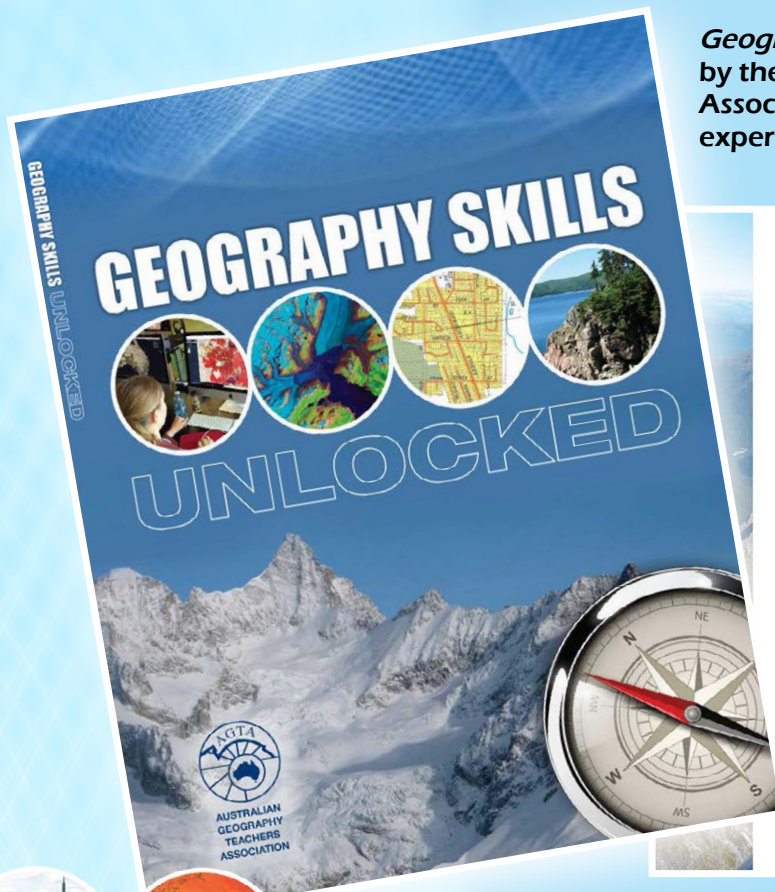
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AGTA ANNOUNCES AN ESSENTIAL NEW GEOGRAPHY RESOURCE

Geography Skills Unlocked is an exciting new skills book for Australian secondary schools

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



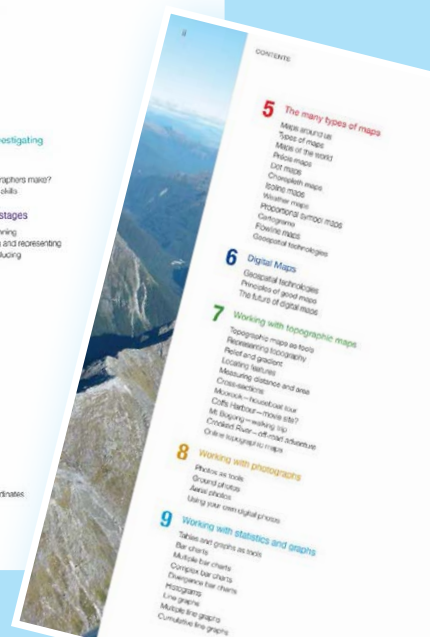
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- 1 Inquiring, questioning, investigating**
Inquiring
Investigating in geography
What kinds of inquiries do geographers make?
The links between inquiries and skills
- 2 Geographic Inquiry – the stages**
Observing, questioning and planning
Collecting, recording, evaluating and representing
Interpreting, analysing and concluding
Communicating
Reflecting and responding
Organising data in an inquiry
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Concept diagrams
- 3 Thinking Skills**
A list of thinking skills
A classification of skills
A hierarchy of thinking skills
Creative thinking
Critical thinking
Thinking skills in inquiry
- 4 The elements of maps**
Map symbols
Direction and bearings
Scale
Distance
Locating features with grid coordinates
Latitude and longitude
Time zones

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 will be published mid 2016 and will be available for purchase via the AGTA website: www.agta.asn.au/Products

ADVICE TO CONTRIBUTORS

Editorial policy attempts to:

- promote material which will assist the study and teaching of geography
- encourage teachers to share their ideas on teaching geography
- provide a means by which teachers can publish articles
- inform readers of developments in geographical education

Articles are sought reflecting research and innovations in teaching practices in schools. From time to time issues of the Bulletin address specific themes.

Refereeing

All suitable manuscripts submitted to the Geography Bulletin are subject to the process of review. The authors and contributors alone are responsible for the opinions expressed in their articles and while reasonable checks are made to ensure the accuracy of all statements, neither the editor nor the Geography Teachers' Association of New South Wales Inc accepts responsibility for statements or opinions expressed herein.

Books for review should be sent to:

The GTA NSW Council
PO Box 577
Leichhardt NSW 2040

Editions

There are four bulletins each year – two published each semester.

Notice to Advertisers

'Geography Bulletin' welcomes advertisements concerning publications, resources, workshops, etc. relevant to geography education.

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1. **Objective:** The Geography Bulletin is the quarterly journal of the New South Wales Geography Teachers' Association, Inc. The role of the Geography Bulletin is to disseminate up-to-date geographical information and to widen access to new geographic teaching ideas and methods. 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 (no minimum specification), should be submitted to the GTA Office gta.admin@ptc.nsw.edu.au or by mail to: **PO Box 577, Leichhardt, NSW, 2040** who will forward to the editor/s:
Submissions can also be sent directly to the editors: Lorraine Chaffer (lchaffer@tpg.com.au) or Dr Grant Kleeman (gkleeman27@gmail.com)
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 paper 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.
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.)
Harrison, T. L. (1973b) The Spatial Distribution of Macadamia Plantations on the Far North Coast of New South Wales, *Journal of Rural and Agricultural Problems*, 13, 4, Oct. pp. 347–359.
O'Donovan, M. J., *et. al.* (1980) "Animal life in the North Star District of New South Wales". In W.W. Murphy, (Ed.) *Readings in Regional Geography (Vol. 2)*, Sydney: Williams and Sons.
8. **Spelling** should follow the Macquarie Dictionary, and Australian place names should follow the Geographical Place Names Board for the appropriate state.





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