GEOGRAPHY BULLETIN

Spatial Technologies

The Geography Teachers Association of New South Wales Inc.

Volume 55 No1 2023

IN THIS ISSUE:

PROJECTS • REPORTS • RESOURCES • ARTICLES • REVIEWS

EXECUTIVE 2023

GEOGRAPHY BULLETIN

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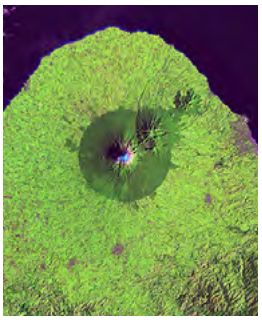


Front cover: Egmont National Park in New Zealand. Snow-capped Mount Taranaki surrounded by green farmland. Source: usgs-kpFnfVi8qp0-unsplash.jpg

Back cover: The Lena Delta Reserve , Sakha Republic, Russia is the most extensive protected wilderness area in Russia. Source: https://unsplash.com/photos/qTV6c2pjbBo

The Geography Bulletin is a quarterly journal of The Geography Teachers' Association of NSW & ACT Inc. The 'Bulletin' embraces those natural and human phenomena which fashion the character of the Earth's surface. In addition to this it sees Geography as incorporating 'issues' which confront the discipline and its students. The Geography Bulletin is designed to serve teachers and students of Geography. The journal has a specific role in providing material to help meet the requirements of the Geography syllabuses. As an evolving journal the Geography Bulletin attempts to satisfy the requirements of a broad readership and in so doing improve its service to teachers. Those individuals wishing to contribute to the publication are directed to the 'Advice to contributors' at the back of this issue.

GEOGRAPHY BULLETIN

Volume 55, No 1, 2023
EDITOR: Lorraine Chaffer

EDITORIAL

EDITORIAL

Welcome to Edition 1 of the Geography Bulletin for 2023. Many thanks to those who contributed to another journal full of ideas and strategies for the Geography classroom.

The core content of this edition is Spatial Technologies – an integral component of contemporary geography education as well as an essential tool for classroom use. The following articles represent a variety of tools useful for the classroom as well as applications for spatial technologies in the wider world.

- In *What is Geospatial*, Paul Mead from She Maps, outlines the essential tools, skills, and applications of GIS for those with limited understanding of the place of geospatial education in Geography.
- Jennah Williams from ESRI Education Australia, illustrates the use of ArcGIS tools in *GIS for Education.*
- Mick Law, from Contour Education, continues to generously share his toolbox of spatial technologies with NSW educators in *My Top Geospatial tools from 2022*.
- In *Using StoryMaps to invigorate the Geography classroom*, Katie Vidal, from She Maps, extols the virtues of this tool to communicate data and findings from geographical inquiry. Katie also shares links to existing StoryMaps for all topics in Geography 7–10.
- The value of spatial technologies extends to careers and real-world applications such as environmental management. Ann Crosby, from GEONADIR, provides examples of geospatial applications in *How drones are changing environmental monitoring*.
- Little has been written about assessing geospatial knowledge and skills. This makes *Developing and assessing students spatial thinking skills when using GIS* by James Hickman, Geographical Association UK, an interesting read. James suggests a framework for assessing student progress.
- In *Earth Observation Big Data and it's application* in the classroom Chris Jenkins and Kevin Davies provide an insight into one teachers' experience building skills in the use of spatial technologies.

Other content in this edition has been shared by practicing classroom teachers:

- An innovative Cross Curriculum initiative from Santa Sabina College to integrate Aboriginal and Torres Strait Islander themes in History and Geography classrooms is explained by Kate Corcoran in *An Integrated Approach to Aboriginal and Torres Strait Islander Themes*.

Ideas for enhancing literacy and numeracy including:

- *Teaching strategies to build visual literacy* from Jane Boland.
- *Using directive terms* from Drew Collins.
- *The story of bottled water: Guided reading* from Rebecca Sutcliffe.
- *Incorporating numeracy in fieldwork* from Kathy Jones.
- *Literacy and numeracy: Using scaffolds, frameworks and templates* from Katerina Stojanovski and Christina Kalinic.
- *Transects in geography* from Martin Pluss

Lorraine Chaffer

NOTE: there are four appendices that supplement this edition of the geography bulletin on the GTA web site. They accompany the article Using Scaffolds, Frameworks & Templates.

Appendix 1: Landforms and Landscapes: Queenscliff Beach

Appendix 2: See Think Wonder Photo interpretation

Appendix 3: See Think Wonder Template

Appendix 4: Thinking sheet Urbanisation

NOTE

Edition 2 of the Geography Bulletin for 2023 will be dedicated to Stage 6. The edition will contain an analysis of the key components and requirements of the NESA Stage 6 Geography Syllabus 2022, and include advice and ideas for programming, resourcing, and teaching to meet syllabus requirements.

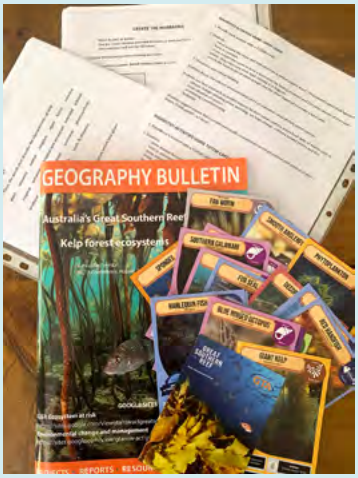
A printed copy of this edition will be available for those who attend the **2023 Stage 6 Conference: Plan early, Plan well, Plan together** on Friday 5 and Saturday 6 May at the Aerial Function Centre, UTS, Sydney. Members will have access to the PDF version on the GTA website as for other editions of the Geography Bulletin.

A summary of ideas and issues discussed at the conference will be sent to all members after the conference.

Lorraine Chaffer

Resources for sale (Available until sold out)

GTA NSW & ACT is selling a **Resource Pack for the Great Southern Reef / Kelp Forest Ecosystems**. They are surplus stock from the 2022 AGTA Conference in Hobart being sold at cost. Each pack contains:



- A quality printed Bulletin Edition 4 2021 (60 pages – Case study only)
- Printed TOTEM / FOOD WEB CARDS (Set of 31 cards) and suggested activities
- Google site links for Stage 6 (Ecosystems) and Stage 5 version. Access via QR Code.
- Recorded PPT of the presentation on Kelp Forests / Great Southern Reef from 2022 AGTA Conference in Hobart. Via downloadable Vimeo link.
- Packaging (Folder, card pocket, mail satchel)

Register here – GREAT SOUTHERN REEF RESOURCES

EDITORIAL

From the President

Katerina Stojanovski

It is with immense excitement that I commence my first year as President of the GTA NSW & ACT. I am fortunate to be supported by a committed team of Geographers all working together to support Geography teachers in NSW and ACT.

The GTA Team for 2023 are:

President
Katerina Stojanovski

Vice President (Immediate Past President)
Dr Susan Caldis

Vice President and Editor
Lorraine Chaffer

Vice President and Minutes Secretary
Rebecca Sutcliffe

Honorary Treasurer and Public Officer
Dr Grant Kleeman

ACT Representative/ Councillor
Michael Da Roza

Councillors
Stephanie Boden
Kieran Bonin
Drew Collins
James Harte
Christopher Jenkins
John Lewis
Alexandra Pentz
Martin Pluss

Co-opted
Amy Freshwater
Ben Terrell
Stephanie Vardas

Welcome to new Councillors, Ben Terrell and Stephanie Vardas, your contribution to Council initiatives throughout this year will be greatly appreciated.

Thank you to councillors stepping away from GTA in 2023 for their generous contribution to the work of the association over many years: Karen Bowden, Keith Hopkins, Grace Larobina, David Latimer, Sharon McLean, Katherine Simpson, Alex Warnock. We wish you all the very best in the future. Your consistent effort and work in projects including conferences, the Geography Bulletin, competitions and webinars has made a big difference to geography education in NSW & ACT.

I hope you enjoy reading through the various articles and teaching resources in Edition 1. The resources for Literacy, Numeracy and Spatial Technology will be extremely useful in the geography classroom.

Our program for 2023 is underway. The "Unpacking the 2022 HSC Exam" will be held in Term 1. The two online events will be held on Tuesday 28 February, 4.00 – 5.30pm and Wednesday 8 March, 4.00 – 5.30pm. The accompanying NESA accredited anytime online PD opened on Wednesday 1 February. Thank you to James Harte and the e-learning team for the development, implementation and administration of this event.

We look forward to our Stage 6 Conference on Friday 5 & Saturday 6 May which will be an in-person event to support the recent release of the NESA 2022 Stage 6 Geography syllabus. GTA is preparing to support teachers through this change in preparation for the implementation of the new syllabus in 2024. Further details about the conference will be emailed to members with a registration link and posted on our website, Facebook page and HSC group as soon as details are finalised. The conference programs will comprise a mix of unpacking each Focus Area of the syllabus supported by expert speakers, and opportunities to share, discuss and collaborate with peers on ideas and resources. Thank you to Lorraine Chaffer for leading the conference organisation. It will be a fabulous event.

Martin Pluss received Life Membership to GTA NSW & ACT at the AGM in recognition for his significant contribution and active service to the GTA NSW & ACT and geography education over many years. Thank you Martin for the many years of service to the GTA and for your efforts in advancing geography education.

Judging of the Young Geographer Competition is almost completed and winners will be notified during Term 1. I would like to extend my thank you to all students who were entered into the competition, the standard has been excellent and GTA were very pleased to receive entries from primary school students in 2022.

GTA are awaiting the release of a Draft Geography Syllabus for 7–10 for feedback. GTA members will be consulted during this process.

I wish everyone a smooth start to 2023 and I look forward to meeting you in person at our Stage 6 Geography conference this year.

This conference is designed to support the implementation of the NESA Geography 11–12 Syllabus released in late November 2022.

Link https://curriculum.nsw.edu.au/learning-areas/hsie/geography-11-12-2022

Each day will consist of THREE sessions. Each session will include:

- **analysis and insights for each content Focus Area (Friday Year 11, Saturday Year 12)**
- **expert speaker(s) following each content focus area analysis**
- **group round table discussions to share and record ideas, resources, experiences, and opportunities and planning, programming, and implementation in your school.**

A support team comprising GTA councillors, fieldwork providers and spatial technology experts will work with groups to discuss ideas, resources, and opportunities for the integration of fieldwork and spatial technologies.

NOTE: Teachers wanting to discuss particular programs can visit fieldwork and spatial technology exhibitor tables during breaks to discuss specific programs and support.

Exhibitors: Guest fieldwork and spatial technology providers and conference sponsors.

Confirmed speakers

- Professor Richard Kingsford, UNSW
- Simon Kuestenmacher, The Demographics Group
- Catherine Kerr, Office of Energy & Climate Change, NSW Treasury
- Minderoo Foundation, Fire and Flood Resilience
- Alex Webb, Marine Stewardship Council Australia
- Karen Davids, Circular Economy Consultant. MRA
- Alison Jose, Sustainable Textile Supply Chain / Circular Centre Pty Ltd
- Andrew Toovey, Mount Annan Christian College; UNSW

Cost

Members $300 / day; $600 2 days plus GST
Non-members $350 / $700 plus GST.
Members Earlybird $550 both days – February only
Pre-service teachers $120 per day plus GST.

Registration is available for 1 or 2 days. *Both days are recommended as a wholistic approach to Stage 6 will be taken across both days.

NOTE: Detailed program will be available mid-February when all presenters are confirmed.
Save the Date – Registration opens soon

An integrated approach to Aboriginal and Torres Strait Islander themes

"Connecting to Country" workshop on Gadigal tools

Kate Corcoran, Santa Sabina College

Rationale

The study of Geography provides important opportunities for students to understand and value the rich culture and history of Australia's First Nations People and the role that First Nations knowledge systems play in ensuring a more sustainable, just and reconciled future for Australia. Along with the broader inclusion of Aboriginal and Torres Strait Islander themes as a cross-curriculum priority, the NSW Geography Curriculum recognises the importance of this area of knowledge by explicitly embedding Aboriginal and Torres Strait Islander content across a range of topics in the mandatory and elective courses. But it is often a challenge to address this content in such a way that students develop a deep understanding and appreciation of the history, culture, politics and present-day issues faced by First Australians.

A New Approach

In our attempts to achieve more successful learning outcomes, we decided a more sustained focus on Aboriginal and Torres Strait Islander histories, cultures and contemporary issues was required. So, a few years ago, we trialled a more interdisciplinary approach that involved the concurrent teaching of the relevant themes across Geography, History, English and Religious Education.

Gadigal Country" workshop with Gadigal artist Kate Constantine

"Coming Together in Country" - Discussion on Reconciliation led by Yolngu Elder, Djapirri and Culture College facilitator, Maeve.

During this trial, we were thrilled to discover how quick students were to make connections between the ideas being addressed in each of these subjects and the robust and respectful discussions that ensued. It was also during this trial that we realised the many ways that the History *Rights and Freedoms* and the Geography *Human Wellbeing* topics overlap and that a natural sequence of events could be created by reshuffling and integrating these topics. With this goal in mind, the Geography and History faculties came together to create a program that integrated the relevant components of these two topics.

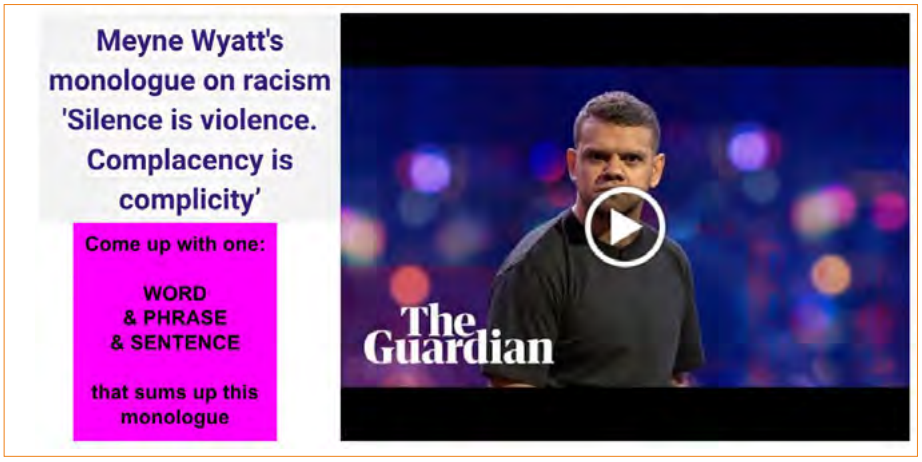
Here is a summary of this 7 Week Program:

CONTENT	TEACHING AND LEARNING ACTIVITIES
The origins & significance of the Universal Declaration of Human Rights (UDHR), including Australia's involvement in the development of the declaration (ACDSEH023) • outline the purpose of the UN and describe the origins of the UDHR, including Australia's involvement • explain the significance of the UDHR	Using resources on the UDHR site, students consider the origins of the UN, the declaration and the meaning of human rights. Students choose one UNHR article to create a classroom poster to show an understanding of this right. They present their findings briefly to the class
Spatial variations in human wellbeing (ACHGK077, ACHGK078, ACHGK079) • investigate causes, issues & consequences of spatial variations in human wellbeing **Human wellbeing in Australia** (ACHGK080) • investigate the reasons for and consequences of spatial variations in human wellbeing in Australia	Students are introduced to the Closing the Gap Campaign and ABS data to identify indicators & consider reasons for the current gap in Indigenous wellbeing Students evaluate the success of the campaign and examine the revised National Agreement approach Students use media reports to assess current political views on the First Nations issues
Background to the struggle of Aboriginal and Torres Strait Islander peoples for rights and freedoms before 1965, including the 1938 Day of Mourning and the Stolen Generations (ACDSEH104) • explain the purpose and significance of early twentieth-century Aboriginal activism including the 1938 Day of Mourning protest for Aboriginal & Torres Strait Islander peoples • outline the rights and freedoms denied to ATSI peoples pre-1965 & the role & policies of the Aboriginal Protection Board • using a range of sources, describe the experiences of Aboriginal and Torres Strait Islander peoples who were forcibly removed from their families (Stolen Generations) • describe the effects of the assimilation policy for rights and freedoms of Aboriginal and Torres Strait Islander peoples	Students are pretested using a stimulus-based thinking routine stimulus showing historical statues now considered offensive by some Students use stimulus to consider two perspectives on Australia Day Teacher uses the Black Lives Matter Movement short clip to find parallels between the struggle of African Americans and First Australians Students use a range of sources to investigate the experiences of First Contact and the policies of Protection & Assimilation (Stolen Generations) Teacher uses clips from the Genocide by Another Name (documentary) to ponder big questions around historical perspectives.
The significance of the following for the civil rights of Aboriginal and Torres Strait Islander peoples: 1962 right to vote federally; 1967 Referendum; Reconciliation; Mabo decision; Bringing Them Home Report (the Stolen Generations); the Apology (ACDSEH106) • outline the background, aims and significance of key developments in Aboriginal &Torres Strait Islander peoples' struggle for rights & freedoms	In small groups, students create a **5-minute** presentation on the significance of one activist/ event including: – Aboriginal Day of Mourning and Protest (1938) – Right to Vote (1962) and Equal Pay (1968) – Freedom Ride (1965) – Wave Hill Walk Off (1966) – 1967 Referendum – Aboriginal Tent Embassy (1972)

Methods used by civil rights activists to achieve change, and the role of ONE individual or group in the struggle • outline common methods used by activists • investigate and explain the role of ONE individual or group in the struggle	After pretesting, students complete a timeline on the Mabo Decision, Native Title and the Land Rights Movement using Reconciliation Australia Factsheet
The continuing nature of efforts to secure civil rights and freedoms in Australia and throughout the world, such as the Declaration on the Rights of Indigenous Peoples (ACDSEH143) • evaluate the methods and effectiveness of ONE campaign for civil rights and freedoms in Australia or another country	Students use media reports on the Uluru Statement from the Heart to outline the origins, goals and the working committee current standing and national referendum
Improving human wellbeing (ACHGK081) • investigate initiatives to improve human wellbeing in Australia & other countries	Students engage in a small group inquiry into a past or current program to address one of the National Agreement targets (including evidence of success criteria and showing learnings from past failures).

Examples of some learning activities

Racism and Indigenous Australians



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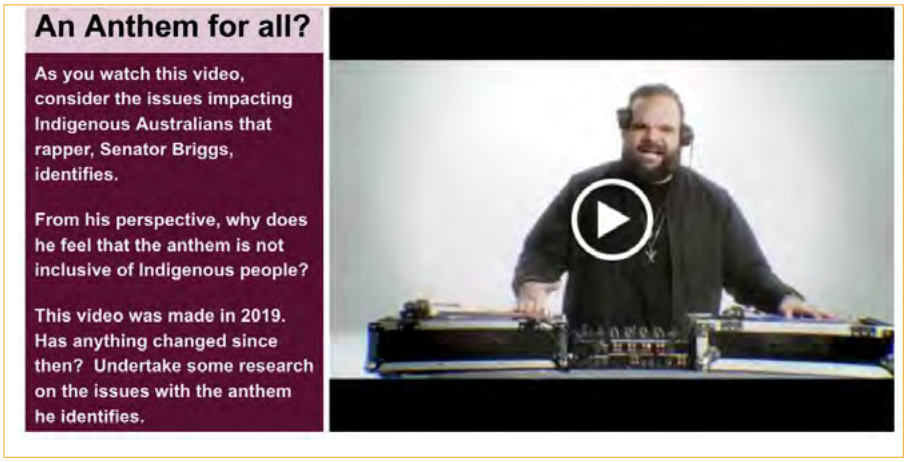
Perspectives on Australia's National Anthem



Source: https://docs.google.com/presentation/d/1vzub_CX6SMAWJwiNqaclcR43-nvolPb20ymPR7RmARo/edit#slide=id.

Variations in Wellbeing – What is this Gap?

Use the Australian Government Close the Gap Report and the links below to add data to the table

Statistics/Indicators	Ingigenous	Non-indigenous	Possible reasons & implications
Child mortality	2 x rate of non-indigenous		Poor maternal health (mother's diet, obesity, diabetes)
School attendance			
Literacy/numeracy			
Year 12 attainment			
Employment			
Life expectancy			
Incarceration rate			
Substance abuse			
Domestic violence			

In pairs discuss and record any conclusions you can make from this data about indigenous vs non-indigenous social and economic wellbeing.

Challenges

Putting together two syllabuses not designed for integration was never going to be a seamless process. It was useful to consolidate areas where content overlapped, and it made sense to move content around so that the topic could be addressed in chronological order to ensure students had some background to the events and issues being addressed. However, given that the History component was more prescriptive and detailed, we did have to find ways to consolidate ideas and take a more conceptual approach in order to get through the content.

There were also some logistics to sort through. Our semesterised approach to the mandatory HSIE courses allowed teachers to keep their current classes and there was plenty of collaboration between the Geography and History teams to ensure teachers were comfortable delivering content outside of their subject area. We also needed to allow time to cover the global component of Human Wellbeing along with some global elements of the Rights and Freedoms topics not addressed here.

Teachers were given some flexibility with the summative assessment task where two options were available:

1. A more traditional style test that included opportunities for source analysis, graphing skills and short answer responses
2. Group inquiry and presentation which included graph and source analysis and a viva voce.

While this flexibility created some complexity around report time, we were able to find both common and subject specific outcomes to report on.

Successes

An important contributor to the success of the unit was the *Country as Teacher* Incursion Day which was held in Week 6 of the program. This immersive experience was created in partnership with Culture College who helped develop and deliver a range of activities designed to engage students in the stories and cultural practices of the local Gadigal and Wangal people. While students had a lot of fun participating in and learning about some of the customary dance, art, spiritual and recreational practices of the traditional owners, it was the storytelling and conversations they had with the presenters that students were eager to discuss when they returned to class.

"Connecting to Country" workshop on ceremonial dance
Photos supplied by K. Corcoran

The feedback from the teachers involved was overwhelmingly positive. For the Geography and History teachers, we gained a greater understanding of each other's course content and skills and could see firsthand the deeper learning and engagement that came about as a result of a more sustained and sequential approach to this topic. The English and RE teachers saw greater depth and sophistication in their class discussions and in student's formative and summative assessments across all four subjects.

Next time

Given the importance of hearing firsthand the perspectives and knowledge of First Nations People, we are keen to forge more partnerships with the local Gadigal and Wangal communities. This partnership would also be invaluable in helping to build the knowledge base of teachers as well assisting with further program development and delivery. We would also hope to explore more opportunities to take students to sites that allow more authentic learning on country.

We are keen to get more subjects involved. While we found that integrating Geography and History content provided a valuable opportunity to teach Aboriginal and Torres Islander themes and content in a deep and meaningful manner, we also saw the benefits of teaching relevant concepts simultaneously across subjects.

Conclusion

Based on student and teacher feedback as well as assessment outcomes, there is no doubt that this more sustained and holistic approach to Aboriginal and Torres Islander themes and content has encouraged greater student engagement and a deeper understanding. From this approach we are hopeful that students will come away more engaged in relevant contemporary issues and with a greater appreciation of the significant role that First Nations knowledge systems play in ensuring a more sustainable, just and reconciled future for Australia.

Note: teachers are welcome to contact the author for further information on the program –

k.corcoran@ssc.nsw.edu.au

WHAT IS GEOSPATIAL?

Paul Mead, She Maps

What does geospatial mean? The word geospatial is made up of two parts:

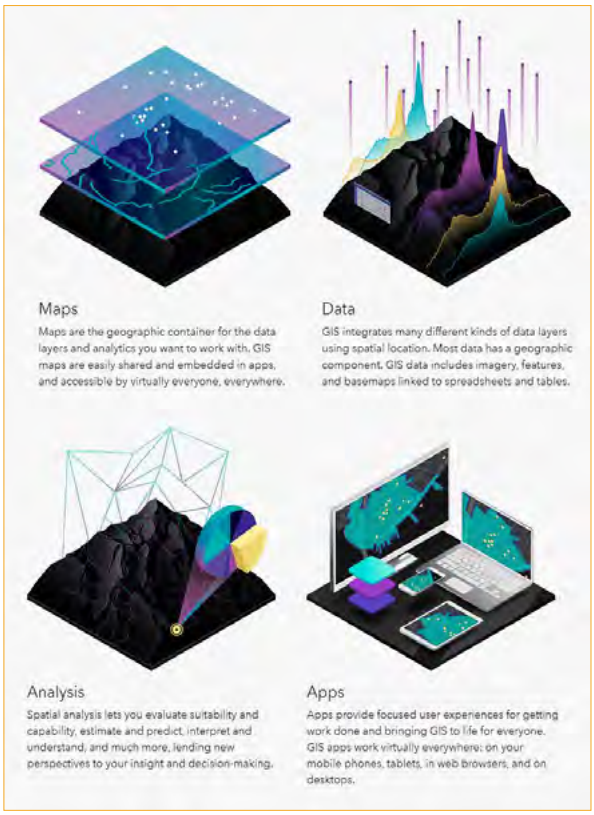
Geo – the Earth

Spatial – size, shape, and position

So geospatial refers to the size, shape, or position of something on the earth's surface.

Those in geospatial professions use tools like GPS, laser scanners, drones, and satellites to measure, map, model, and monitor features and processes on the Earth's surface.

The other term you might hear a bit about is 'GIS' or geographic information system. This is a type of database that allows us to create, store, manage, visualise, and analyse geospatial or location-based data.



What is GIS? Source: https://www.esri.com/en-us/what-is-gis/overview

The power of spatial technologies

A GIS can help us understand patterns, relationships, and geographic context between different types of information.

Geospatial information within a GIS, helps people in lots of different professions to understand complex problems, and then make data-driven decisions. Esri has a fantastic resource on GIS, and they talk about six steps within GIS that can help solve a variety of complex problems:

- Identify problems
- Monitor change
- Manage and respond to events
- Perform forecasting
- Set priorities
- Understand trend

How is geospatial information used?

Just some of the industries that use it are:

- Retail
- Urban planning
- Agriculture
- Mining
- Construction
- Forestry

The following examples provide a more in-depth analysis. Here are three examples of how geospatial information is used.

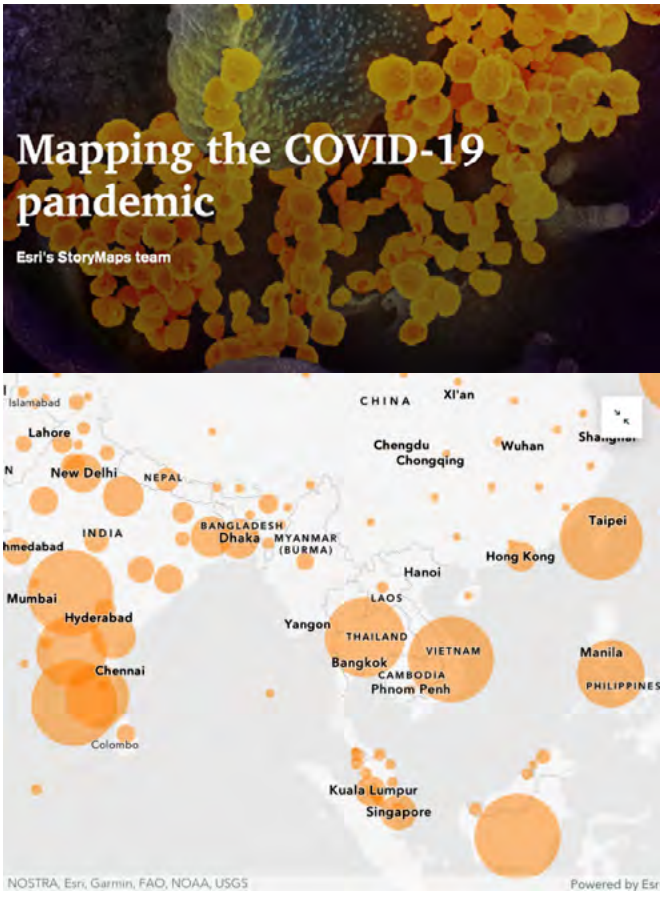
Using geospatial data in a pandemic

Let's look at a health emergency such as the COVID pandemic.

As COVID started to emerge in China, health authorities began to collect data on the number of infections, their severity, and various other demographic information. These data were combined with location data (such as postcodes), to visualise this information on a map, inside a GIS.

As more and more data was provided, and the pandemic spread across the world, scientists were able to detect patterns or trends in geographic spread. This then formed the basis of forecasts to provide information to the community, and helped governments set priorities for management.

These decisions were underpinned by geospatial information and supported by geospatial professionals who know how to handle, analyse, and present complex information.



This story was originally published in February 2020. While the maps in the story are automatically updated with latest available statistics, the text may include information that is no longer current.

View this full StoryMap on Covid 19 HERE – https://shemaps.com/blog/what-is-geospatial/

Addressing climate change with geospatial data

Another example is climate change. We have been observing the Earth for many years using satellites, aerial footage from planes and drones, and other location-based sensors. All this data has given us a very good understanding about how the climate impacts our planet and the population. We have become very good at weather forecasting, and now scientists are making predictions on how our world will change with climate change.

View this full StoryMap on Climate Change HERE – https://shemaps.

com/blog/what-is-geospatial/

Monitoring beach erosion with geospatial data

Geographic information systems have made the management of beach erosion much easier due to the ability for scientists to view geospatial data over time. For example, take a local ecosystem like a beach. We can see this location from a satellite and look back over a number of years to see how development in the area has changed, and also how seasons and storms affect the area. We are now also able to use very high spatial resolution data from drones to view how the ecosystem is changing over time in incredibly high detail.

Open data platforms like GeoNadir also mean that these types of data can be accessed and contributed by people all over the world.

View this full StoryMap on Mangrove Forests HERE – https://shemaps.com/blog/what-is-geospatial/

We can use many different time stamps of data within a GIS to visualise and measure change over time (temporal). We can combine this data with other climate data to see what impacts are evident in local ecosystems.

Local councils and governments are using these types of analysis methods to set priorities to manage at-risk ecosystems.

Geospatial data are also incredibly important for our built environment. With so many layers of built infrastructure, from tunnels, water, gas and electricity infrastructure, buildings, roads etc we need to know where these all are before we start to build something new.

Surveyors and GIS professionals are an essential part of the construction industry, as they can access and add to the planning information that tells us the exact location of all this infrastructure.

They also make sure that new infrastructure is built in the right location and is documented correctly so that future developments can access them when needed.

In the construction industry, geospatial data and GIS are being used to create 'digital twins' of infrastructure. Digital twins are a computer model that mirrors the built environment, so planners can better identify problems, manage, and respond to events, and make better decisions around the management of the infrastructure in the future.

There are many other professions that rely on geospatial information on a daily basis. In fact, you probably rely on geospatial information every day to do your job, or to get you from point A to point B in your daily life!

Geospatial information is everywhere!

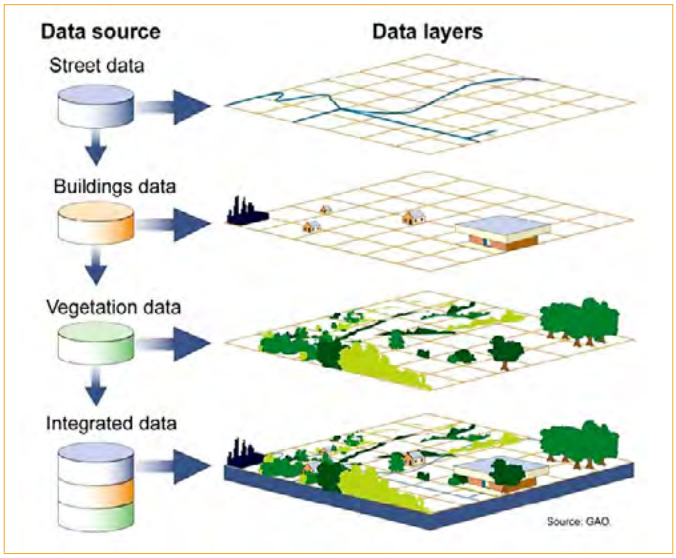
FROM THE EDITOR: READ MORE ABOUT GIS AT NATIONAL GEOGRAPHIC

Geographic information systems (GIS) are computer-based systems used to collect, store, and display data sets related to positions on the Earth's surface.

Time-lapse images

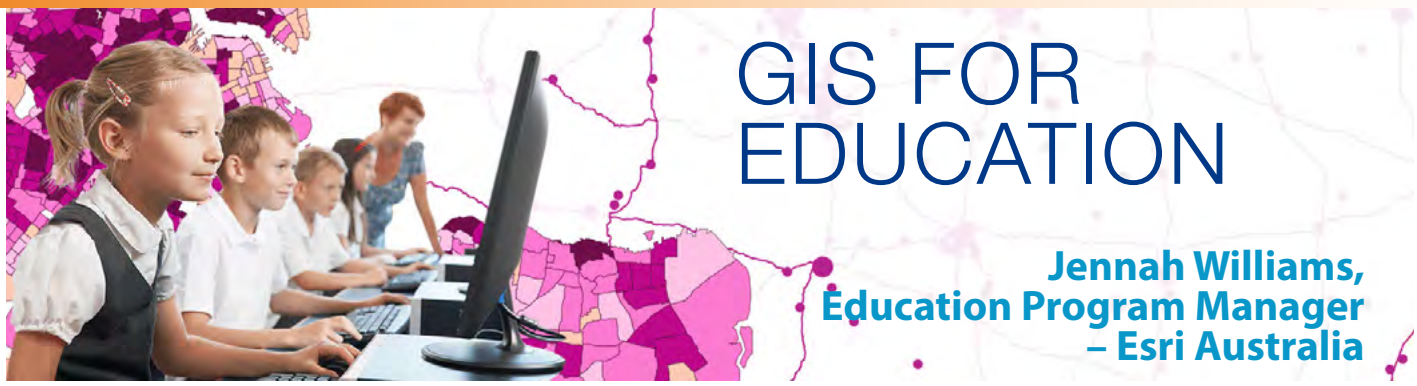
One important use of GIS involves creating time-lapse photography that shows processes occurring over large areas and long periods of time. In time-lapse imagery, individual frames of visual data can be captured at a slower rate and then combined and viewed at a faster rate.

Time-lapse images created with GIS help scientists understand complex natural and human-related processes



Source: https://education.nationalgeographic.org/resource/geographic-information-system-gis

For example, data showing the movement of fluid in ocean currents or air currents help scientists better understand how moisture and heat energy move around the globe. These convection currents of air and water regulate local weather conditions and global climate patterns as show here.
Source: https://education.nationalgeographic.org/resource/geographic-information-systems



GIS FOR EDUCATION

Jennah Williams, Education Program Manager – Esri Australia

The Program

In 2017, Esri Australia started their GIS for Schools Program, providing over 26 of Esri's most popular applications in a free education bundle, designed to enhance learning, develop 21st century skills and engage students into solving current real world problems.

The ArcGIS bundle includes applications such as Survey123, Storymaps, ArcGIS Online, Quick Capture, Drone2Map, ArcGIS Pro and more. Each of these applications can be used in unison to create a picture of your desired learning goal and identify 'where' action needs to be taken. Esri's Education Department provide an engaging training program, including workshops, seminars, and webinars to teach educators to utilise these resources and grow their skills all provided free of charge.

GIS in the classroom

ArcGIS has unlimited potential for classroom education allowing students to create sophisticated, original content that ensures outstanding results whilst providing an engaging hands on experience for the students to develop in demand skills.

Students can create choropleth maps (Figure 1) demonstrating relationships between multiple attributes at the click of a button.

Students also have the ability to create trace downstream maps, flowline maps (Figure 2) and more that can all be customised and designed for the specific needs and preferences of the students.

Figure 1 – Choropleth map example

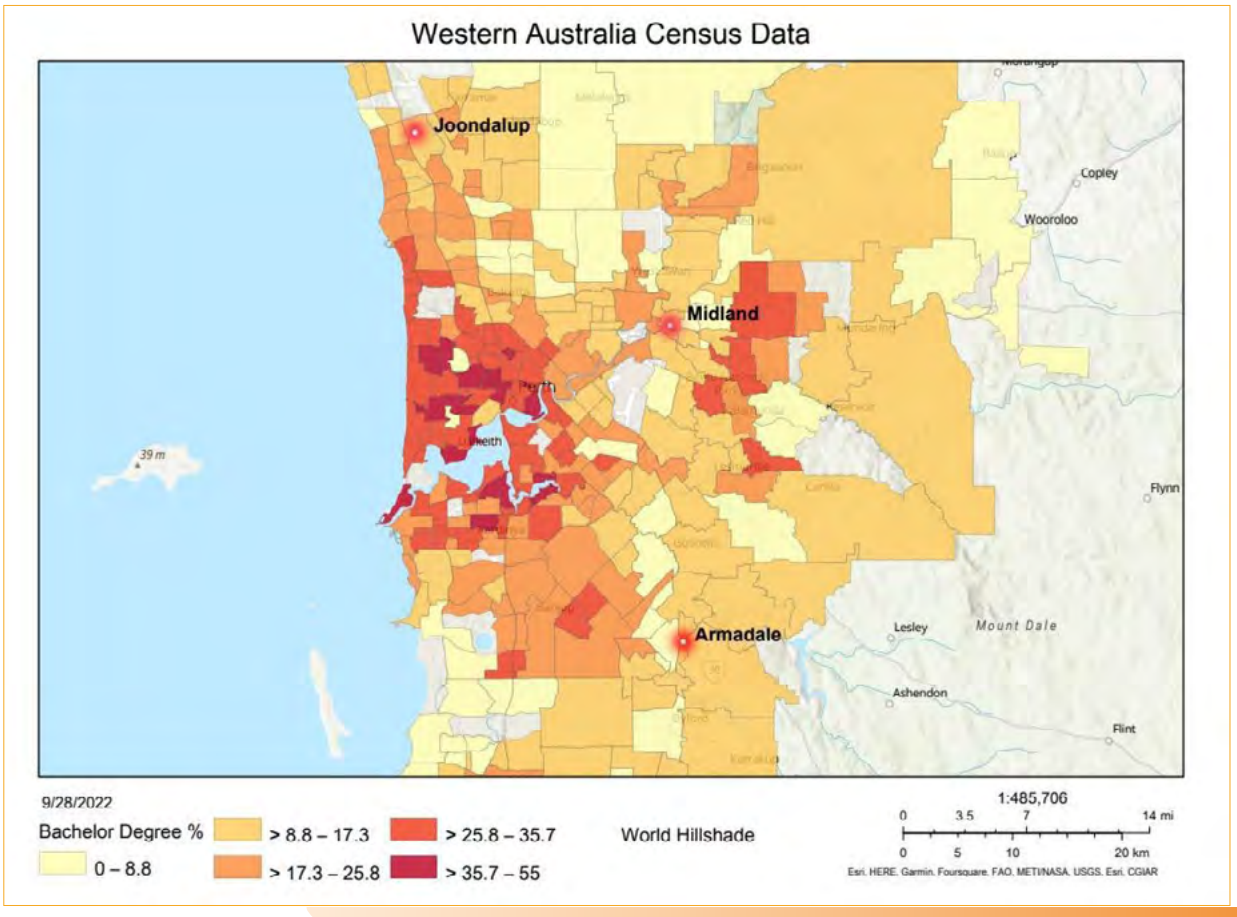
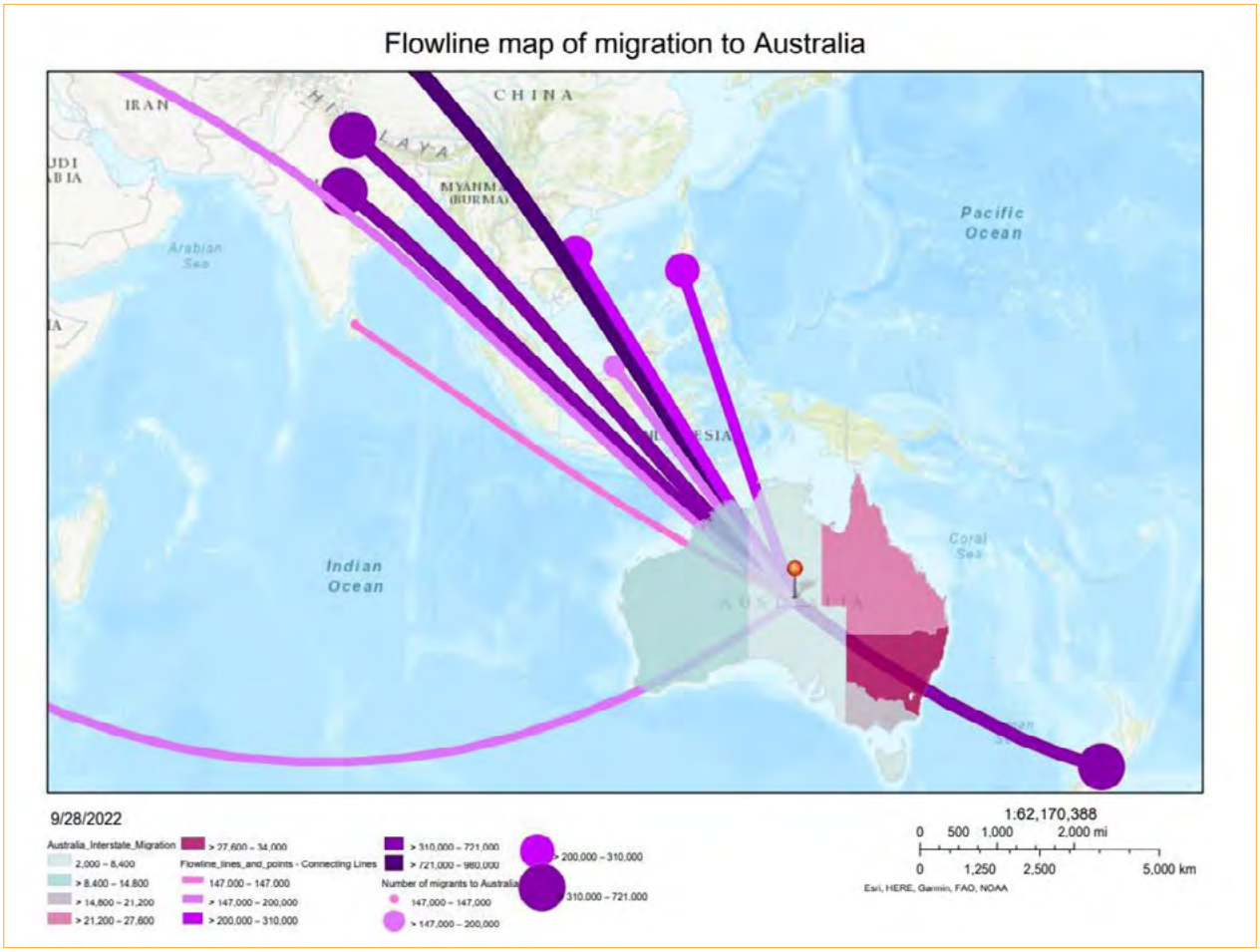


Figure 2 – Flowline map example



Finally, students can present work or educators can teach engaging content on Storymaps, an interactive and immersive application to tell your story, incorporate maps, media, data, survey results and more to tell the story of your research and present your findings or educate your students in an immersive and imaginative way that really gets people's attention. Create your own Storymaps or use some of the thousands created for your use in the Storymaps Gallery.

Esri Australia have also created a variety of classroom learning materials to allow educators to implement ArcGIS applications without the added pressure of creating lesson plans. Our ready-made lesson plans are grade and topic specific and are developed around the 5 E's strategy. Each lesson plan includes a teacher's edition, a student booklet and an activity using a GIS application, such as a Storymap or ArcGIS Online activity (Figure 3). These lesson plans are a fantastic way to introduce GIS into your classroom to allow the students and the educators to develop experience with the technology.

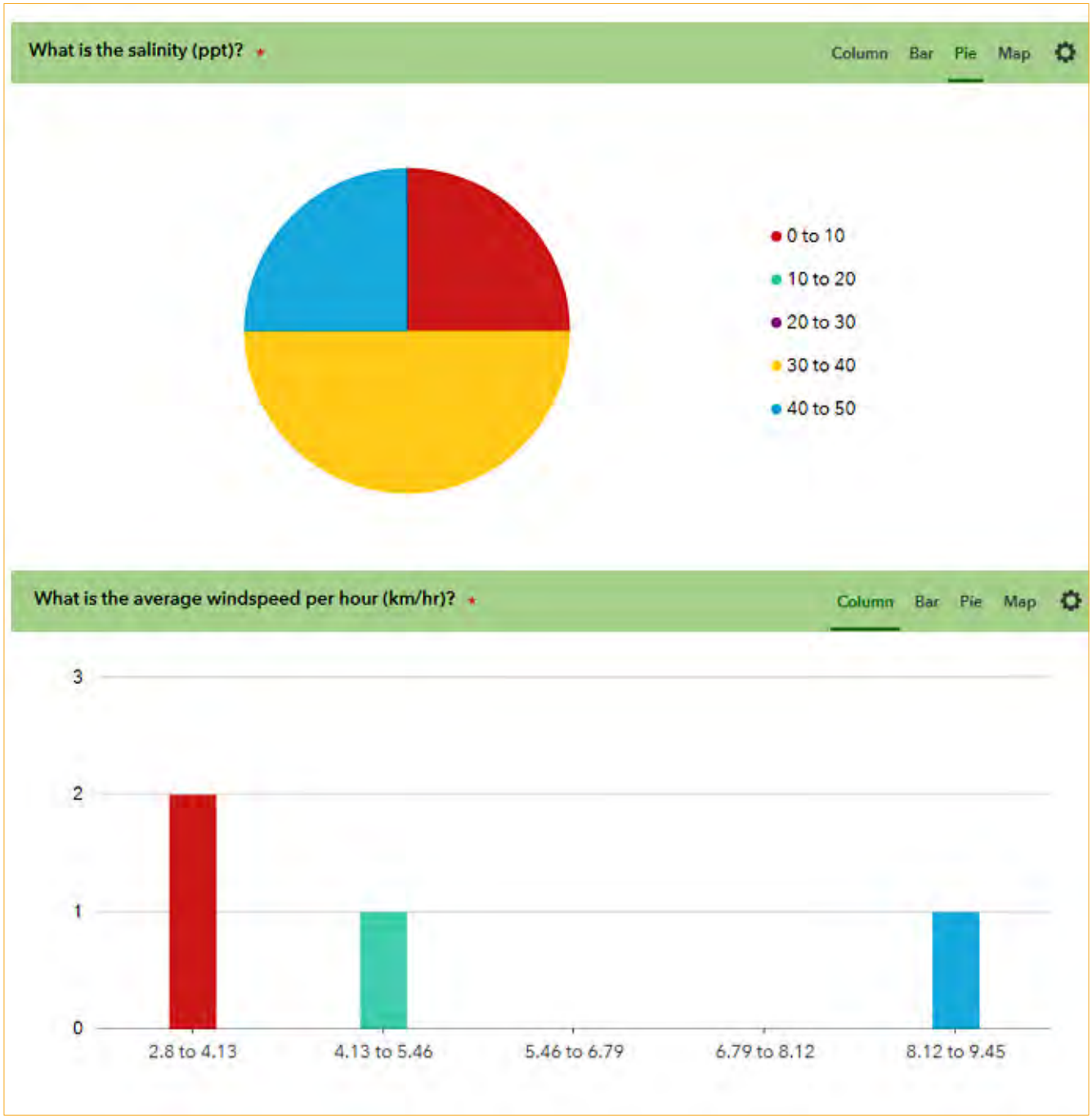
Figure 3 – Classroom Lesson Plans example

GIS in the field

Field excursions are a highlight of geography topics, they allow students to participate in real world experiences in a hands on environment. Implementing applications such as Survey123 and Quick Capture into field excursions can make the experience even better, diminishing the need for excess paper, pens, rulers and other materials in the field, students can collect professional, accurate data using just their phones, whether offline in a remote area, or online in the busy city.

By incorporating survey123 into the project you can design from the ground up and personalise a project specific survey explicit to your goals, that automatically maps your data, analyses the results (Figure 4), and produces accurate and reliable graphs and maps to clearly understand your data, which can be used over many years to create annual data sets. See Survey123 in action by a school in Queensland

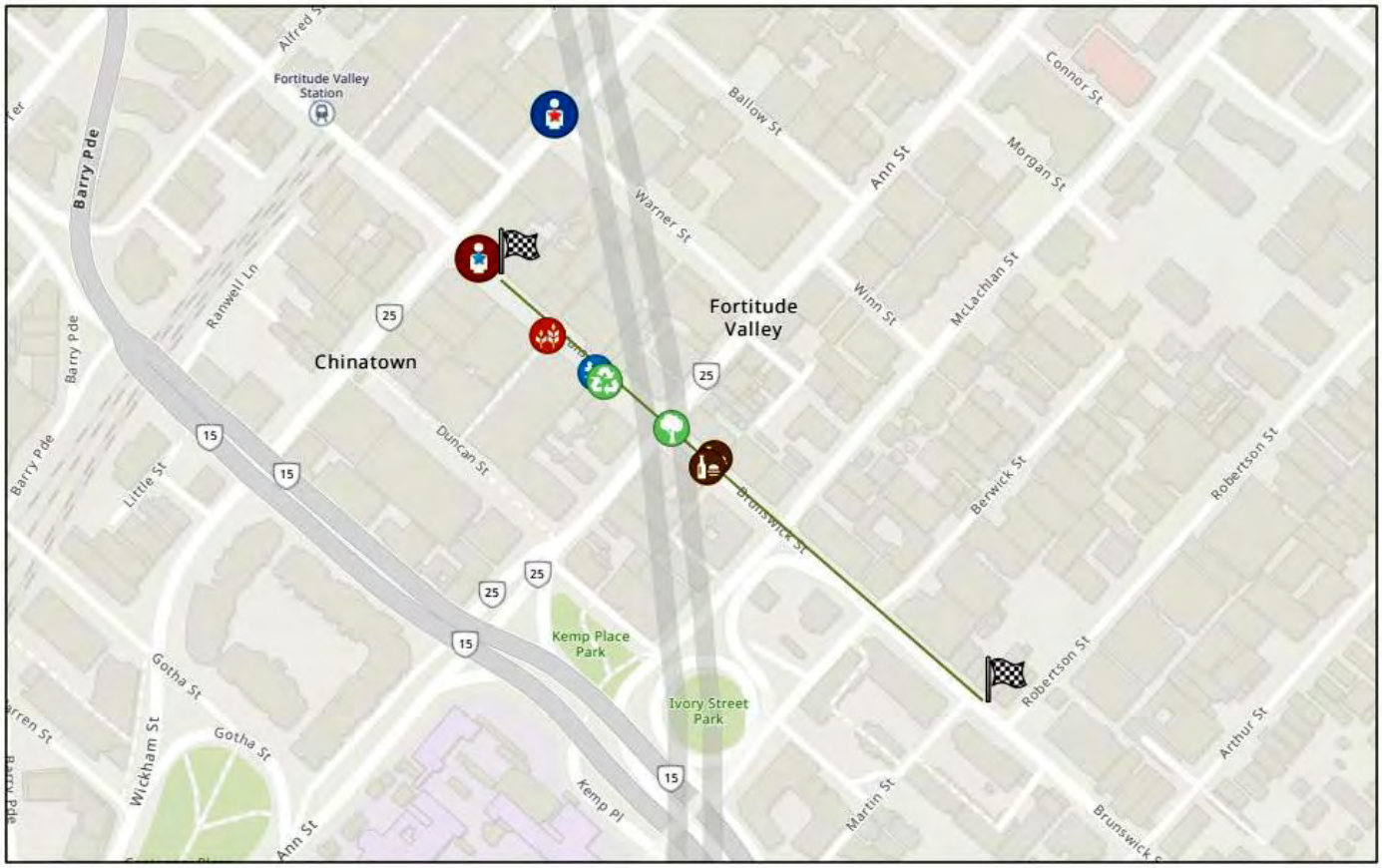
Figure 4 – Analysis of Results in Survey123 example



Another useful incorporation, specifically for locating and mapping amenities, features, and human impacts, would be combining Quick Capture, an application where the survey takers simply press an icon button to add data to their map.

This data can then be integrated into ArcGIS Online, where you can search and add multiple layers to show relationships and gaps within the data (Figure 5). These maps can be layered and designed to show multiple data sets on one map and help to visualise where your research should go next.

Figure 5 – Map displaying Survey123 and Quick Capture Field Data



For more information on using ArcGIS products in your classroom and field excursions contact – Jennah Williams on education@esriaustralia.com.au

My top geospatial tools of 2022

Mick Law, Contour Education

Every year there are more and more great geospatial tools available to teachers to help them build their students' geospatial skills. Every year I choose a list of my favourite tools of the year in a masterclass. You can find a QR code at the end of this article that will take you to this year's video if you would like more detail on the tools that I discuss.

To make the list the criteria is simple, the selected tools will:

- have caught my attention this year,
- relate to the content of the Australian Curriculum,
- be easy to use and implement in the classroom, and
- strongly engage students' interest in geographical issues.

This year I've selected five tools that I feel have met these criteria and I present a short summary of each below.

1. Google Earth Projects

Google Earth has recently moved to a browser-based version that has some useful features, data and tools. One of the best additions has been Google Earth Projects which allow you to create and save tours, or virtual field trips, when you are signed in with a free Google Account. Of course, as you are using Google Earth, your Projects will sit on top of the 3D world of Google Earth that is so familiar to students now.

Each project is made up of Features. Features can be points, lines or shapes of varying colours, shapes and sizes. You can build images and video into each feature and organise them into a specific order for your tour.

The projects are very easy to create and can be shared as a URL or presented on a large screen.

You can use Google Earth Projects to create resources for your students that contain text, questions, lists and links to other online resources. Or alternatively, your students could use Google Earth Projects to report back to you on in-class investigations or fieldwork they have undertaken.

Google Earth Projects are part of the Google Earth suite of tools by Google.

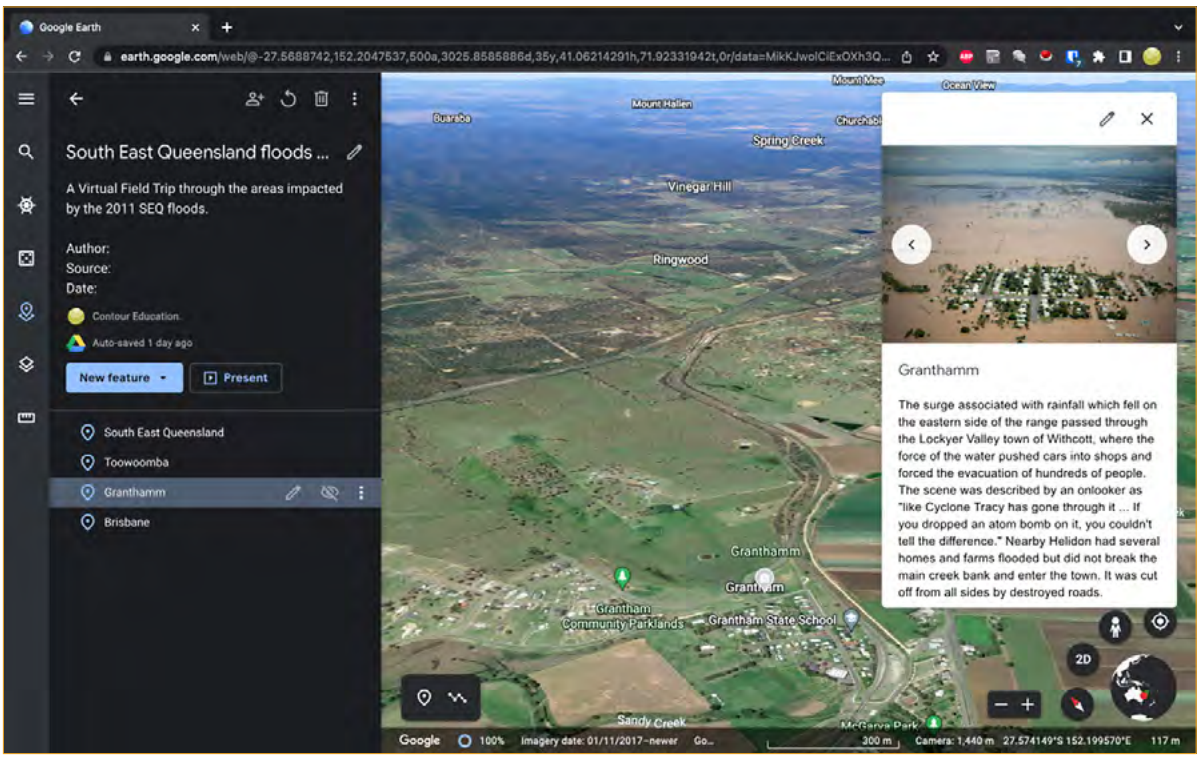


Figure 1: An example of a Google Earth Project

2. Scribblemaps

Scribblemaps offers a simple, online map interface that allows you to draw on the map. It has a few other useful features though that make it a standout among geospatial tools.

You can choose from a range of map backgrounds and draw points, lines or shapes on a map. You can draw, freehand on the map as well as overlaying images such as historical imagery or old survey plans. Text, images and video can all be embedded into your point, line and shape features. There is a neat legend tool that helps you make your legend as you are working and you can save your maps to work on later with a simple, free registration.

Use Scribblemaps to trace out the journey of a product like a coffee from the ground to your local coffee shop, quickly draw out a land use map over your local area using different coloured shapes or propose sustainable development on a vacant block of land.

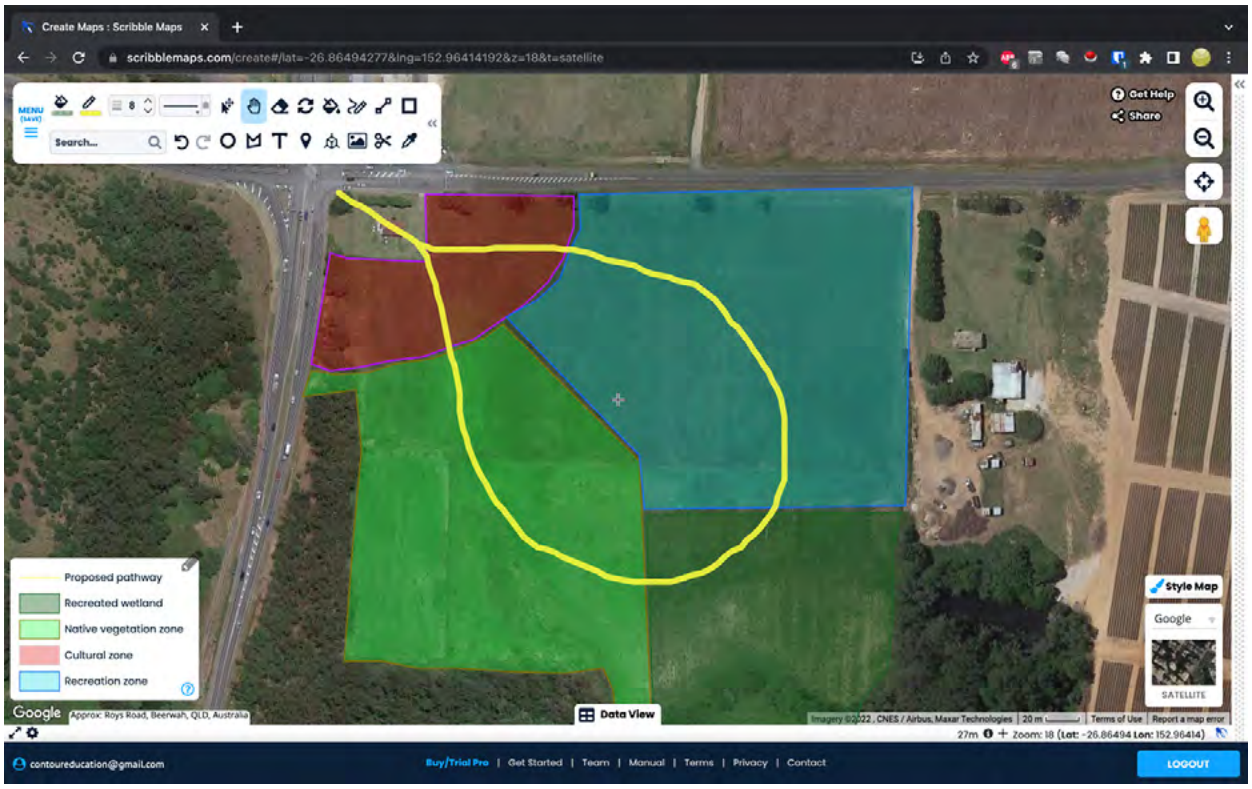


Figure 2: An example of a Scribblemap

3. Our World in Data

Not strictly a geospatial tool, Our World in Data makes the cut thanks to its overwhelming amount of comprehensive, well-presented and thorough global data on almost every geographic topic covered in the curriculum.

If you search for a geographic topic such as urbanisation, energy or water security you will be taken to a page that collects almost every piece of data on that topic in the form of text, tables, graphs and maps. There are plenty of great choropleth maps that are available in the reports. All of the data is available in all forms and can be downloaded as a spreadsheet for use in class if you want to interrogate the raw numbers.

This site could be used in almost every single unit of work in the Australian Curriculum Geography. It is a must-have for geography teachers!

Our World in Data is put together by the Global Change Data Lab which is a non-profit created and operated by academics in the UK.

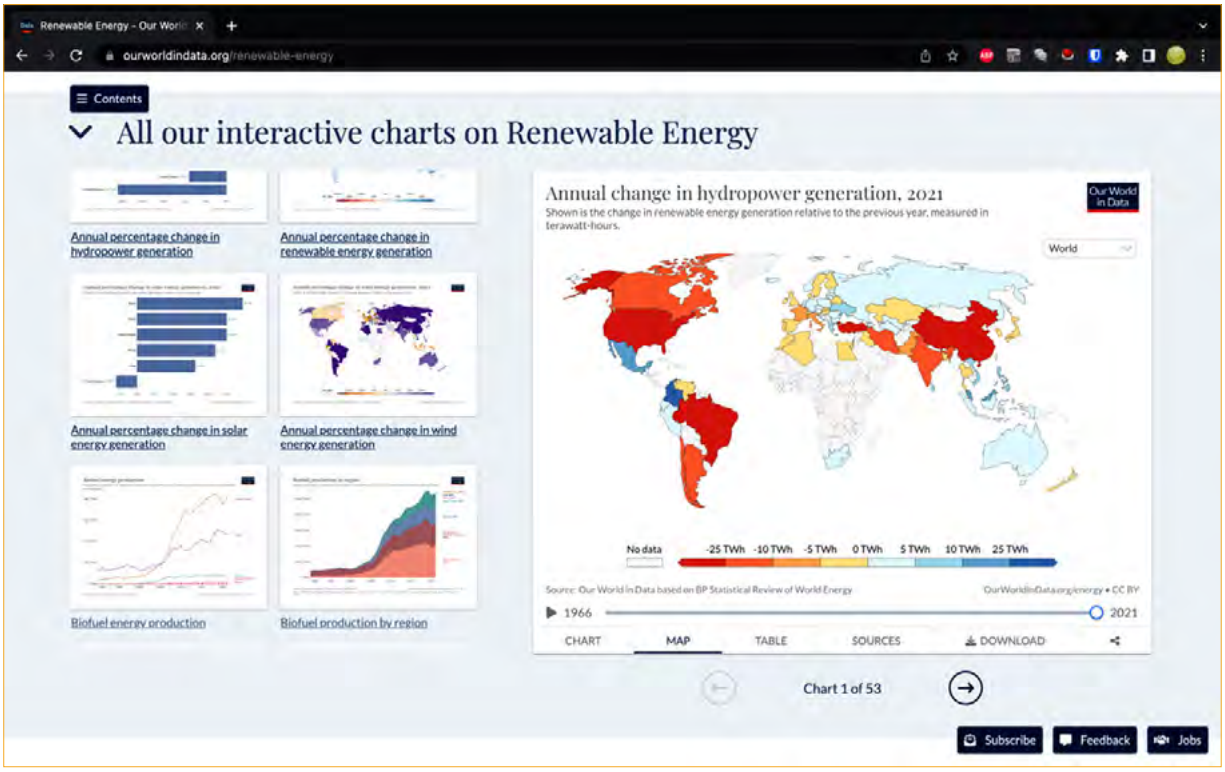


Figure 3: Some of the data available in Our World in Data

4. Maps3D

Maps3D is a very simple tool that has great power. Once in the site you select a rectangular area of anywhere on earth at any scale. You can then generate a 3D model of that area that you can navigate around from within the site. You can zoom in and out as well as rotate your model around.

The model is made up of satellite-derived elevation data with a satellite image draped over the top. At a suburb-level it looks very detailed and easy to interpret. The user can also change the elevation exaggeration, annotate the model and download a file (for a small fee) to 3D print the model which looks very exciting if you have those tools available to you.

Maps3D looks great for examining topography at a range of scales, particularly in Year 8's Landforms and landscapes unit.

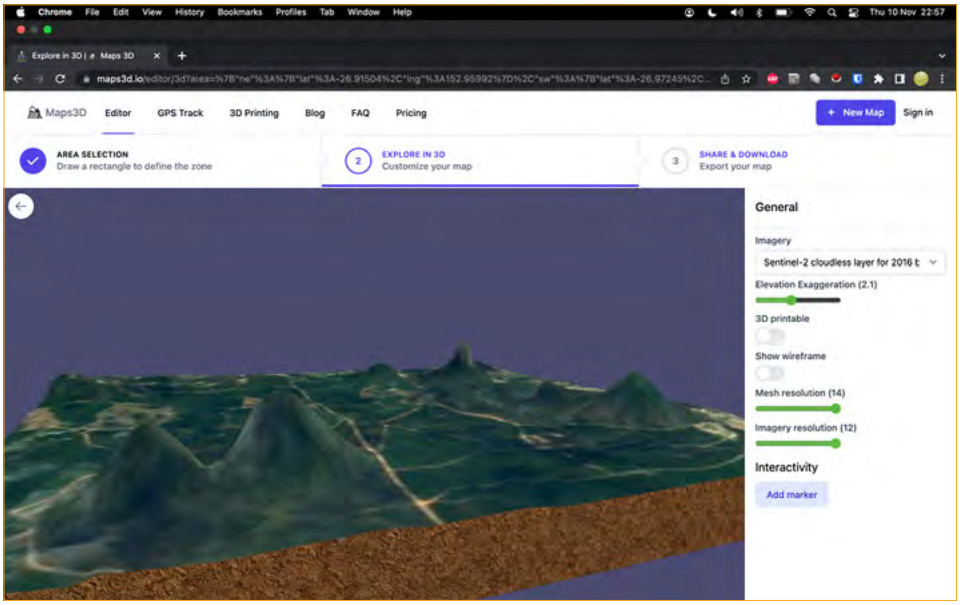


Figure 4: A 3D model made in Maps3D

5. National Geographic Mapmaker

Finally, I have nominated the National Geographic Mapmaker tool that has actually been around for a while but has recently had a revamp that has made it much more user-friendly.

You can create maps and select from a range of backgrounds. There are dozens and dozens of layers of data that you can select to overlay on your maps. These include layers like global precipitation, global temperature, human influence, volcanoes, earthquakes, plate boundaries, GDP and much, much more.

You can also annotate your maps, save them and export your maps as images for use in presentations or reports.

The National Geographic Mapmaker is a tool that could be used in almost every unit of the secondary Australian Curriculum due to the range of data. It is well worth spending time reviewing the data to see if you can include it in your work program.

National Geographic's Mapmaker has been created by National Geographic.

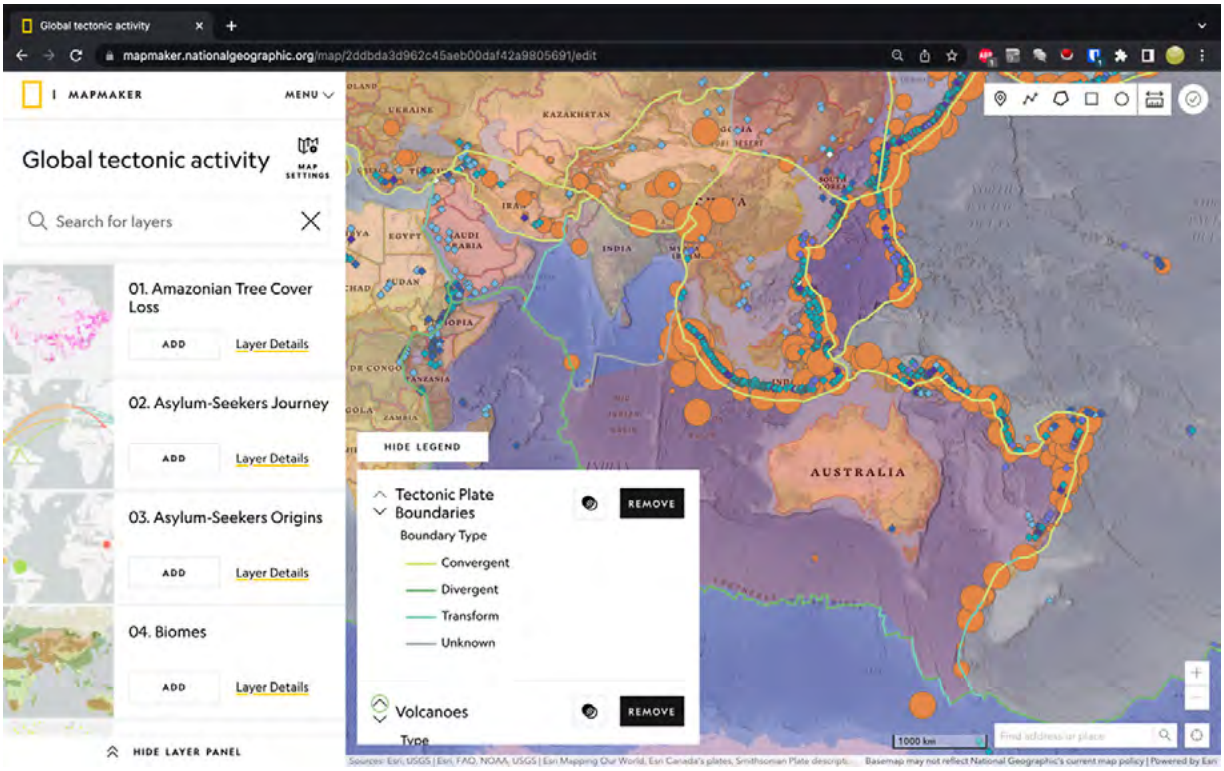


Figure 5: A map made in Mapmaker showing tectonic activity

I recently ran a masterclass where I reviewed all of these tools and gave a short demonstration of each. You are welcome to view the presentation for this masterclass using the QR code below. A link to the Youtube video of the masterclass is in the presentation.

Figure 6: QR code for Top geospatial tools of 2022 masterclass presentation

EARTH OBSERVATION BIG DATA AND ITS APPLICATION IN THE CLASSROOM

Kevin Davies & Christopher Jenkins

Source: NASA image sourced from Observer Research Foundation – https://www.orfonline.org/expert-speak/the-growing-need-for-earth-observation-satellites-to-deal-with-climate-change/

FROM THE FIELD – Kevin Davies

The observation of Earth by satellites plays a critical role in helping us to understand how climate change has impacted our natural and built environments, and for providing crucial information for modelling the severity of potential future climate change related impacts. Satellites can provide consistent and routine coverage over large spatial regions reducing the need for extensive field measurements which can be time consuming and expensive, or just not feasible over large and potentially inaccessible areas. The specific applications for satellite images in the context of climate change are numerous in both the terrestrial and marine domains. Examples include mapping land cover transformation, monitoring deforestation and forest degradation, assessing the impacts of climate shocks and stressors on agricultural productivity, and assessing the impact of sea level rise on the carbon storage potential of coastal ecosystems.

Images from space

One of the most important sources of earth observation data is the Landsat satellite program jointly run by NASA and the US Geological Survey. The first images captured by Landsat 1 in 1972 started a program that is now in its 50th year. The most recent satellite in the series, Landsat 9 was launched in September 2021, and in tandem with Landsat 8 (launched in February 2013), provides a complete set of images of Earth every 8 days. Over ten million images have now been added to the freely available archive. The medium spatial resolution of the Landsat satellite (each pixel represents 30 square metres on the ground) combined with the near-weekly capture provides a platform that is suitable for local to global scale studies of land surface transformations in the context of climate change.

Landsat is not alone in imaging Earth from space. The European Space Agency (ESA) launched the first Earth observation satellite in its Copernicus programme in 2014, while other nations such as Japan, India and China also have well established programmes. These national Earth observation programmes are generally reliable and of high quality (Landsat is regarded as the gold standard) but they are expensive with long development times (Landsat 9 cost almost $200 million AUD and took 5 years to complete). A relatively new paradigm in Earth observation known as CubeSats is challenging these traditional satellite platforms by providing a relatively accessible and low-cost alternative.

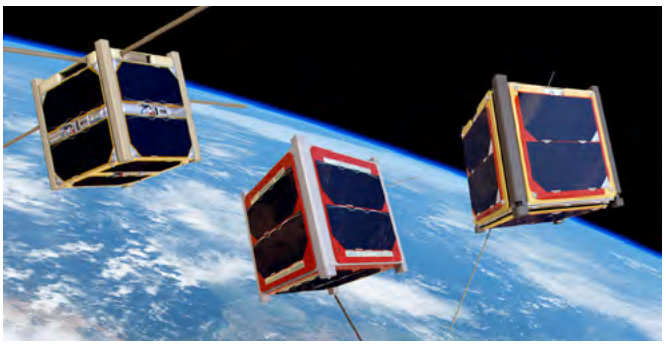
CubeSats

CubeSats are miniature satellites with a standard 10 cm cube shape (called a unit). Multiple cubes can be stacked together to make larger CubeSats as required (e.g., 3-unit or 6-unit CubeSats). The original concept of the CubeSat was to enable relatively easy access to space for researchers and educators by providing a standardised form factor, and the use of relatively inexpensive commercial off-the-shelf components

with low energy requirements. CubeSat developers can share the launch costs by combining CubeSats into a single rocket payload to reach orbit. CubeSats have opened space to researchers, educators and students. The University of Sydney's Centre for CubeSats, UAVs and their Applications (CUAVA) launched its first CubeSat satellite CUAVA-1 in 2021 which was designed and built by students and researchers in the centre. The launch of CUAVA-2 is planned for 2023. Commercial operators are also using CubeSats for Earth observation with the Planet company operating the largest CubeSat constellation. Planet has over 200 CubeSats in orbit and can provide a high-resolution image of the Earth's terrestrial surface every day.

Figure 1: CubeSats.

CubeSats tend to hitch a ride into space using extra space available on rockets, meaning lots of launch opportunities and low launch costs. They are packed in a container which, at the push of a button, ejects them into space via a spring system. A similar technique is used to deploy CubeSats from the International Space Station (ISS)



Source: European Space Agency https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/CubeSats

Data deluge

All these Earth observation programmes are contributing huge amounts of data to an already large archive of available images (the Planet CubeSat constellation alone produces over 15 terabytes of data per day). This vast number of images of our planet is an extremely valuable resource; however, this 'data deluge' can represent a significant obstacle to non-technical researchers and educators. Accessing, processing and interpreting these large collections are usually the domain of technical remote sensing and 'big data' specialists with access to significant computational resources.

In the last decade or so there has been a significant paradigm-shift in the way researchers and educators can access and work with large collections of satellite images. The move to shared cloud-based satellite image repositories, and distributed computing platforms has significantly reduced or removed some of the obstacles and barriers and widened the access to satellite image archives to non-specialist users. The most significant development in this new paradigm is by search engine behemoth Google who have created a platform called Earth Engine, a tool which has revolutionised Earth observation science research and education.

Google Earth Engine

Earth Engine is an online platform that provides users free and easy access to large collections of continuously updating satellite images from a web-browser. The platform includes the complete Landsat archive from 1972 as well as other significant Earth observation collections such as from the European Copernicus programme. The platform provides a simple web-based interface where a user can extract information from vast collections of satellite data held and processed by Google. The images are provided in an analysis-ready format, so the user only needs to concentrate on the mechanism used to extract the information they require for their application. The platform is provided free of charge to researchers, educators and government agencies and has already resulted in significant research outcomes such as global forest change and hydrological mapping. Although Earth Engine is the most significant and widely used platform for Earth observation analysis across the globe, other similar cloud-based platforms exist such as Geoscience Australia's Digital Earth Australia which focuses on serving the Australian Earth observation community.

A major goal of Google in developing and providing Earth Engine is education and outreach to school and university students. However, approaching Earth Engine for the first time still presents a significant learning curve in terms of Earth observation science, and potential users may not be comfortable with coding in JavaScript. The 'More Than Maps' initiative was sponsored by the British Council COP26 programme in 2021 with the aim of engaging high school geography students in policy discussions related to climate impacts on coastal ecosystems during the United Nations Climate Change Conference. The University of Sydney along with the University of Western Australia collaborated on developing three workshops as part of the programme, two of which focussed on using Earth Engine to map and analyse climate related impacts to coastal regions and ecosystems in Australia. The workshops are run in a 'follow me' style class where participants learn fundamental concepts in Earth observation science, and learn how to code in JavaScript in small incremental steps. The participants work towards a fully working mapping and analysis project that can form the basis for more complex exploration of Earth Engine's powerful toolset, and potentially adapted for other locations or applications. The workshops have been made freely available online for educators to use as is, or to adapt to their own application interests or better alignment with a teaching curriculum.

FROM THE CLASSROOM – Chris Jenkins

The integration of spatial technologies and Earth Observation Big Data into the classroom is both exciting and daunting. Common questions and constraints in my own planning and with my colleagues include; *what programs/tools should we use? How can we manage this in a classroom setting? How do I differentiate for my students? How do I shift it from basic spatial observations to real world analysis?* I have frequently engaged with and integrated the likes of Google Maps, Google Earth, Google MyMaps, AURIN Maps and SIX Maps into my lessons and programming to engage students in safe, but meaningful, spatial thinking. However, the data collection, collation and analysis behind that drives these spatial technologies was the missing link for myself and students and was needed to help develop a deeper understanding of how the data being presented is gathered, and how it can be manipulated in a geographic context to identify issues and support a solutions based framework to these findings.

More than Maps workshops

One of the main ways I began overcoming these constraints was to upskill myself and this is where my connection with Kevin started. I was fortunate enough to be connected with him through a mutual colleague and my journey with Google Earth Engine started. I had looked and dabbled with this before, however, my use had barely moved beyond creating an account and learning some basic functions. I was fortunate enough to participate in a ***More Than Maps*** workshops where I was able to create a fully functioning Earth Engine map that using basic programming techniques to process and analyse remote sensing images (Google Earth Engine JavaScript API) and further develop my understanding of how satellite images and vegetation indices can be used to monitor mangroves. The ***More Than Maps*** workshop was the beacon of hope that I needed, and the inspiration to take on the challenge in a structured, supported and student friendly environment. In 2021 I had a highly engaged and capable mixed-ability Year 10 Elective Geography class with 22 students. In this setting, I was able to prioritise time to have students engage with the 'safe' spatial technologies commonly integrated into my practice to build curiosity and develop their spatial thinking and reasoning. From this foundation, we pivoted into the ***More Than Maps*** program with Kevin to complete the two hour Google Earth Engine workshop to develop the technical skills to understand the process for how these maps are created, and how the data is presented. Within a 2 hour window, double session after lunch, all students moved from complete beginners, to capable novices with basic programming within the program. They understood where the data was coming from, how it was being applied within the specific context, and how to manipulate it to highlight a geographic issue and construct a narrative or story that was worth telling. Students were supported through the differentiated instructions, written, visual, and modelled on the big screen, and were able to troubleshoot on their own or with peers when the coding or data represented wasn't joining the party.

Figure 2: More than Maps workshops

For more information and to access the workshops visit the More than Maps website http://morethanmaps.earth.

Skill development and transfer

The flow on from this one isolated experience was not only the buzz myself and the students had for what we had created and now understood about spatial technologies, but the ongoing discussion about what data could be gathered and how it could be used. In the preceding weeks, students were using allocated and spare time at school and at home to work through the other workshops and some even began exploring other locations and transferred the skills they had learnt. It extended to the student-led use of spatial technologies for all school-based fieldwork and discussion on how it could be used more effectively next time. I was also fortunate to track the progression of some of these geographers into the Senior course, where the increased confidence with spatial technologies led to a more involved, insightful and meaningful integration of spatial technologies into the Senior Geography Projects.

Conclusion

So what have I learnt from this experience and what am I thinking now?

The main lesson for me, which deep down I think I had always known, is that if I want to use it I have to prioritise it. For my own practice I have consciously made the step to prioritise my own and my students' time to engage with and upskill themselves with what is available, and to then apply it to their learning once the skill has been mastered (or at least become familiar!).

Starting in one classroom, for one activity, was the safety net I needed. My Elective Geography class was the perfect environment for this and since then the expansion to a smaller capable Senior Geography group. From here, it will be the intentional, relevant and meaningful integration to build my own confidence, capability and processes to then integrate into wider programming from my colleagues. Small steps, isolated activities and a risk free setting for students is what lays before me in 2023.

I have also learnt that the support is out there and that connecting to academic and professional geographers in a range of settings begins with an email, a phone call or an introduction from a colleague or friend. When we believe in what we teach, the relevance of this for students, and the future pathways that our students can explore, we owe it to them to show and engage with those out there living and breathing what we teach in their work. Kevin is just one of these people, however, we all have that one friend or acquaintance that's out there researching an obscure frog species and mapping the habitat data, the one person we knew at university that's investigating the structure and flow of ancient riverbeds to track our changing climate.

Make 2023 your year for prioritising the integration of spatial technology, you won't regret it.

About the authors

Kevin Davies is a lecturer in the School of Geosciences at the University of Sydney. His research focuses on the use of Earth observation by satellite, geospatial analysis, and geographical information systems (GIS) to address local scale geographical issues in the context of a changing climate. Kevin's current research includes satellite-based land use mapping for improving livelihoods and natural resource management in Pacific Island Countries and developing satellite-based methods for more accurate mapping and monitoring of carbon sequestration by coastal ecosystems. Kevin also investigates the use of miniaturised satellites (CubeSats) for fine-scale environmental monitoring as part of the University's Centre for CubeSats, UAV's and their Applications (CUAVA).

Chris Jenkins is an experienced Junior and Senior Geography teacher and current Head Teacher Teaching & Learning– Stage 5, at Castle Hill High School. As a Geography Educator, Chris privileges geographical thinking in the classroom to support students to develop a deep understanding of geographical processes and content to create transferable knowledge. He prioritises showing and engaging young geographers in vocations and the application of Geography in a range of settings to create future pathways for their learning and careers. My Geography is promoting a functional understanding integrating the latest data and spatial technologies available in the field to develop deeper knowledge and understanding within our discipline, and to make clear connections between geographic thinking, concepts and its application in the real world.

Undergraduate Majors in Geosciences

School of Geosciences

The School of Geosciences at the University of Sydney tackles key issues facing society including climate change, resource management and sustainability. We provide the opportunity for undergraduate students to study a dynamic group of disciplines encompassing Geology, Geography and Geophysics. Geosciences majors can be studied in the **Bachelor of Science, Bachelor of Science and Bachelor of Advanced Studies,** and the **Bachelor of Arts** undergraduate degrees.

Sustainability

The Sustainability major coordinated by the School of Geosciences is a new interdisciplinary, undergraduate major launching in 2023. By integrating multiple perspectives on sustainability, students will learn to build personal, social and professional skills that contribute to the development of a sustainable future.

Geography

Through a Geography major, students will study the interactions between earth, environment and society. This involves consideration of such issues as climate change, population growth, hazards and environmental management. Students will have the opportunity to go on field trips to overseas locations and to rural and urban parts of Australia, as well as engage in computer-based analysis of geographic data.

Geology & Geophysics

The Geology and Geophysics major will provide students with an understanding of change on Earth and its origins, plate tectonics, surface processes, the evolution of life and geologic time. With this major, students will acquire the skills necessary for employment in all areas of sustainable exploration and management of our natural, mineral and energy resources.

Marine Science

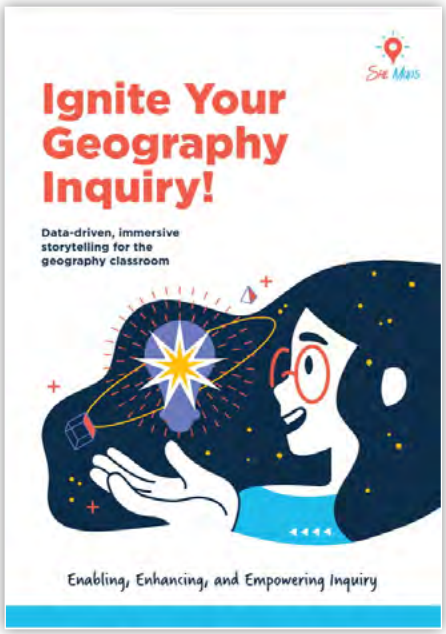
The Marine Science major draws together relevant material to create a multi-disciplinary curriculum that provides students with in-depth knowledge in a range of marine science approaches. The major is explicitly science-based but seeks to provide students with a broader range of capabilities and an interdisciplinary mind-set to service the large and growing demand for coastal and marine experts in a range of fields.

Environmental Studies

The Environmental Studies major will provide students with an understanding of the governance framework within which their professional career in the environment sector will operate, including the fundamental aspects of sustainability, environmental assessment, law, ethics, development, energy use, economics and politics.

For more information:

Faculty of Science | School of Geosciences
T +61 2 8627 1444 | **E** geosciences.enquiries@sydney.edu.au
W www.sydney.edu.au/science/schools/school-of-geosciences.html



USING STORYMAPS TO INVIGORATE THE GEOGRAPHY CLASSROOM

Katie Vidal, She Maps

This is a republished She Maps Blog from November 2021 – https://shemaps.com/blog/storymaps-for-the-geography-classroom/

This article enlightens teachers on how to use Esri StoryMaps in the geography classroom. For full access to all Story Maps create a free account

In my previous blog I introduced ArcGIS StoryMaps and outlined how they integrate narrative text, interactive maps, and multimedia content, to tell immersive stories about people, places and the environment. There are now more than one million StoryMaps published publicly by a variety of government agencies, NGO's, universities and individuals… but how do you find the best ones to use in your geography classroom?

Geography Classroom: StoryMaps as a teaching and learning tool

The essence of geography is how humans interact with their environment and **StoryMaps** are a very accessible resource for geography teachers to showcase global issues via digital storytelling to their students.

- Teachers can use StoryMaps for *direct instruction*, to display research, explore case studies, or can serve as an opportunity to promote a cause or inform about an issue.
- StoryMaps can display physical, human and environmental geography in a *visually stimulating* way to engage your students. They are mostly theme-based about places and people on a range of topics from climate change, sustainability and hazards to migration, development and urbanisation.
- Use them to *teach content or to model the variety of design features that StoryMaps can offer* before your students start creating their own. No matter what you teach or want to learn, there is likely a StoryMap that you can access. As an educator you can choose how to use StoryMaps, based on time available and the purpose of your classroom lessons.

Key geographical concepts

StoryMaps can highlight key geographical concepts of **place, space, environment, interconnection, sustainability, scale and change** and can also help students apply these concepts to a wide range of places and environments at the full range of scales, from local to global, and in a range of locations.

In the classroom, they can help students to apply these geographical concepts, synthesise information from various sources, draw conclusions based on the analysis of data and information, taking into account alternative points of view.

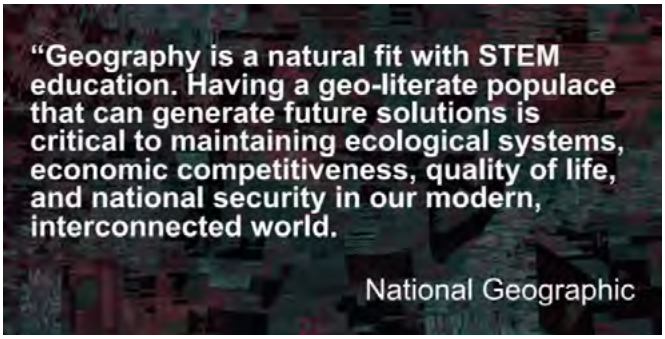
Check out Joseph Kerski's Teaching and Learning with ArcGIS StoryMaps

Syllabus objectives

Viewing a StoryMap on a chosen global issue can also help students:

- explain geographical processes by describing the features, elements and interactions of processes that shape the identity of places
- comprehend geographic patterns, recognise spatial patterns at global, regional and local scales of study and identify relationships and implications for people and places
- analyse geographical data and information by inferring how patterns, trends and relationships represent geographical data

Geography Classroom



21st century STEM skills and the inquiry approach

Geography helps develop 21st century skills that students need to prepare them for higher education, work and engagement in a complex and rapidly changing world.

- StoryMaps can promote skills such as **critical and creative thinking, ICT skills, social emotional skills and communication**.
- StoryMaps that are based on specific case studies can also promote **cultural awareness, citizenship and ethical understanding**.
- They can promote **creative thinking skills by provoking curiosity, creativity and imagination and model ICT skills** by showing students how they can be productive users of digital technology.
- They also **encourage students to explore reliable sources** of information by concluding with in-built citations and references.
- StoryMaps **lend themselves to the inquiry approach in geography** that describes the 'what' and 'where' of the issues or patterns being studied by displaying both qualitative and quantitative data.

Maps, satellite imagery and GIS

The Australian Curriculum mandates that in Year 7 to 10 Geography, spatial technology use is explicitly specified in the Geographical Inquiry and Skills strand.

StoryMaps are a perfect way to introduce your students to Geographic Information Systems (GIS) as they show different layers of information in an interactive map that is easy to explore and engage with. Exposing junior geographers to spatial technology via StoryMaps can show the array of data available in ArcGIS Online and ESRI's Living Atlas. This prepares junior geographers for Senior Geography where students need to demonstrate the use of spatial technologies to produce their own maps for assessment.

La Palma eruption teaching resources created by Jason Sawle at Esri UK, is a collection of classroom ready GIS based applications for teaching about the La Palma eruption.

To further explore the options of using GIS in your classroom have a look at Esri Australia's StoryMap on Implementing GIS into your school's curriculum and Brett Dascombe's StoryMap EduDrone – Spatial Technology toolbag for teachers.

Sustainable Development Goals

Sustainability is a key geographical concept and a cross curriculum priority for the Australian curriculum, and you will find a plethora of relevant StoryMaps about the SDGs.

SDGs Today is an excellent website that provides many collections of Story Maps about each of the 17 Sustainable Development Goals for 2030. This platform integrates a variety of tools and resources that give access to timely, geospatial data about the SDGs.

Go to The Sustainable Development Solutions Network Collection and start with the first Story Map called SDGs Today which introduces the purpose of the website and how you can access the Data Hub, Storytelling and Education pages.

JUNIOR GEOGRAPHY: THE BEST STORYMAPS

Finding the best StoryMaps that match to the geography content being taught in our secondary schools can be time consuming…so how do you find the best ones to use in your geography classroom? A good place to start is on the esri website Explore Stories but if you haven't got the time, we've done it for you! We matched each of the ACARA geography units below to some of the best StoryMaps examples that are publicly available at the moment.

Water in the World

This StoryMap will engage students with the perspectives of Aboriginal Peoples and Torres Strait Islander peoples to investigate Indigenous knowledge and water issues at Uluru (Ayers Rock) in the Northern Territory.

Other notable Story Maps for this topic::

Earth's Biggest Storms: Tropical Cyclones, The Tidal Thames and Drones, GIS and the Townsville floods, Climate: Murray-Darling Basin

Place and Liveability

This StoryMap follows a Volcano Expedition Team that travelled to Guatemala on a National Geographic-funded expedition to better forecast when eruptions will occur and support communities that live with this risk. On An Island is a collection of StoryMap lessons designed to encourage geo-literacy skill development in early ArcGIS users by exploring Caribbean landscapes and people

Other notable StoryMaps for this topic:
The Voices of Grand Canyon, Living in the heart of winter, A Story About Great Countries

Landforms and Landscapes

This StoryMap is a visually stimulating look at the research being conducted at Mt Everest in the Himalayas.

Other notable StoryMaps for this topic:
Peaks and Valleys, Australia's Black Summer, Dealing with Disasters, Seven Wonders: Natural World, Drones, GIS and bushfire recovery, Landform Regions of Australia, How Deep is Challenger Deep?, Iceland, Great Barrier Reef Hope Spot

Geographies of interconnections

This StoryMap investigates how the Global Shipping Industry should be held accountable for the extensive damage caused to vulnerable habitats and their communities.

Other notable StoryMaps for this topic:
The Human Reach, The secret life of bridges, Make Way for Whales, Seven Wonders: Engineering Feats, Spatial Change in Nike Sneakers,

Changing Places

This StoryMap explores human population density, urbanisation, transport and communication networks via globe animations, and the extent of the human footprint.

Other notable StoryMaps for this topic:

Grace and Delight, COVID-19 and refugees, The challenges facing Jakarta's future, The Changing Demographics of Australia (student report), Migration and Public Transport (student report), Urban Africa

Sustainable Biomes (including food security)

This StoryMap is a visually stunning look at the world's biomes and their distribution, importance and threats and how terrestrial and marine protected areas can save biodiversity.

Other notable StoryMaps for this topic:
Climate & Ugandan Coffee, The Cost of Beef, The Living Land, From Farm to Mess Hall, The Global lives of Indian Cotton, SEEDS for Recovery, The Diversity of Life: Atlas, (Farm) Animal Planet, The Half-Earth Project, 30X30: A movement to protect a third of our planet's surface

Environmental change and management

This StoryMap looks at how Phillip Island's iconic wildlife is being impacted by climate change.

Other notable StoryMaps for this topic:
Climate Migrants, Living in the Age of Humans, Looking below the surface, Great Barrier Reef, Hot Numbers, Plastic Pollution, Ivory Trafficking, On the brink, Improving Our Coastal Ocean

Geographies of wellbeing

This StoryMap demonstrates how CARE and their partners in 81 countries have contributed to significant change in 11 of the 17 Sustainable Development Goals

Other notable StoryMaps for this topic:
Measuring Success, Livelihoods, food and futures: COVID-19 and the displaced, An Analysis of the Global HDI Score Methodology, A New Wave of Water Champions

STORYMAPS FOR SENIOR GEOGRAPHY

Senior Geography teacher Brett Dascombe from Wavell State High School in Brisbane has just received a Teacher in Excellence Award for his use of spatial technologies in the classroom. His students are producing StoryMaps from Years 7–10 and for Internal Assessment in Senior Geography. He has recently shared this StoryMap to help his students describe, analyse and explain maps and graphs in Senior Geography – IPQE Writing for Senior Geography & the External Assessment

EDITOR'S NOTE: Katie's original blog includes StoryMaps linked to Australian Curriculum Senior Geography topics.

COLLECTIONS

And if the Esri StoryMaps team had not already made StoryMaps easier to view and build, they created collections giving authors the ability to publish a group of stories of the same theme in the one StoryMap. Here are some notable collections:

A collection of 30 StoryMaps by Mission Blue, a global coalition to inspire public awareness of a worldwide network of marine protected areas in Hope Spot StoryMaps

A collection of over 50 StoryMaps by scientists, conservationists, storytellers, and educators around the world in National Geographic Explorer Stories

A collection of 30 wildfire StoryMaps from the USA in Wildfire Maps

A collection of 21 StoryMaps about New York's remarkable water system that pipes millions of gallons of fresh water into the city every day and distributes it across its five boroughs in NYC H20 Maps

2021 ESRI StoryMaps Weekly Waypoint

Additionally, the number of items that it's possible to place in a collection has doubled from 30 to 60. This makes collections a great way to house content from your organisation and update it whenever you want, like a newsletter or a recurring status update. It's a great way to collate a series of your favourite StoryMaps with the same theme or collate StoryMaps like chapters of a book or a series of lessons for a unit of work.

So, if you like some of the StoryMaps shown in this blog you can copy their URL addresses and embed the links into your own collection on a specific theme that your students can easily access with the link. And when you come across a new StoryMap on the same theme, you can easily edit and add it to your collection.

As an example, the Esri StoryMaps team uses a collection to update enhancements, resources, and featured stories in 2021 StoryMaps Weekly Waypoint

Geography curriculum mapped to amazing StoryMaps – Teacher Resource

At its most basic, ArcGIS StoryMaps are a collection of interesting maps and stories that support various topics and themes found in the Australian curriculum. They are an interactive, engaging way to explore the world and practice geospatial skills.

StoryMaps allows students with varying levels of GIS and mapping experience (from none to substantial) to clearly express the spatial story attached to their projects or topic of study. They help foster GIS technical skills, information acquisition and data analysis, which is then used to create highly engaging stories.

ArcGIS StoryMaps can be used as a teaching tool, for student inquiry, research and is a great alternative to conventional research papers or PowerPoint presentations.

StoryMaps are easily available online, there is no need to log in or create code, and they can be accessed on any device. However, you will need an ArcGIS StoryMaps account to create your own StoryMaps. **Click here** to learn more.

To get started with StoryMaps is super easy.

We've saved you hours of time by choosing some of the best StoryMaps to showcase in your classrooms before your students start creating their own. We have chosen the best StoryMap links under each of the Year 7–10 Australian Curriculum sub-strands for geography and have popped in some other cool StoryMaps on other STEM-based topics. Keep scrolling down to find your chosen topic.

If you are interested in using more of this information and technology in your lessons, take a look at Ignite Your Geography Inquiry!

SheMaps have collated some of the best StoryMaps to help guide your students through their geography inquiry journey. We have done all the hard work to find resources that connect with the units of work specifically identified in the Australian Curriculum. Here are the topics we cover:

Here are four StoryMaps to help you to get started:

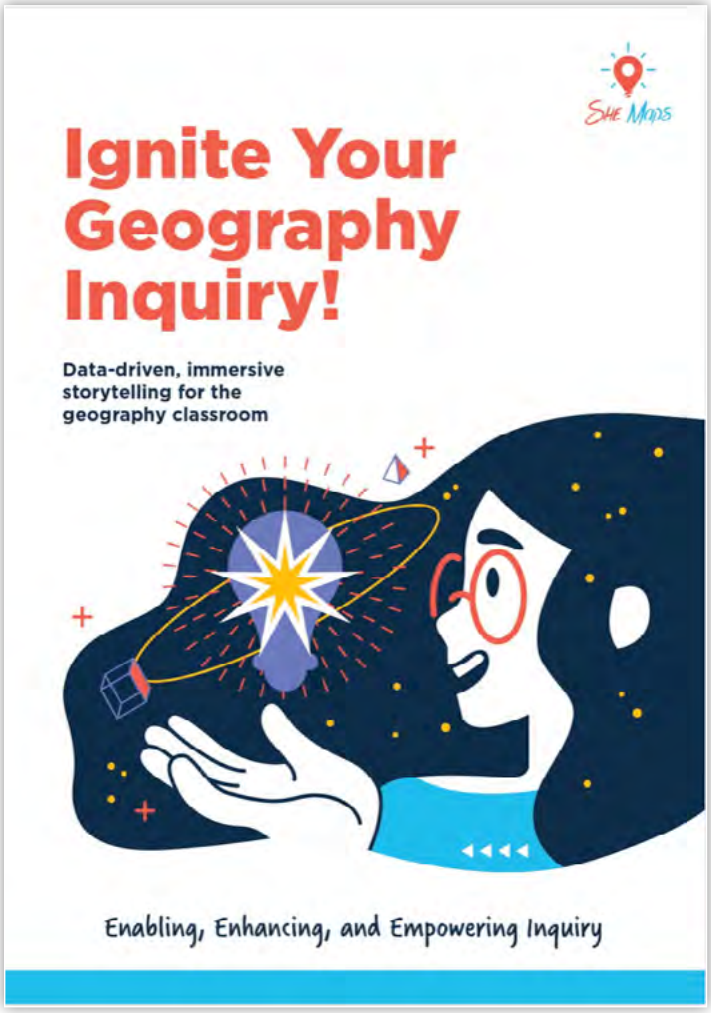
Teaching and learning with ArcGIS StoryMaps: This StoryMap explains what story maps are, why they matter, and how you can use them in education for instruction, learning, and research
Learn more

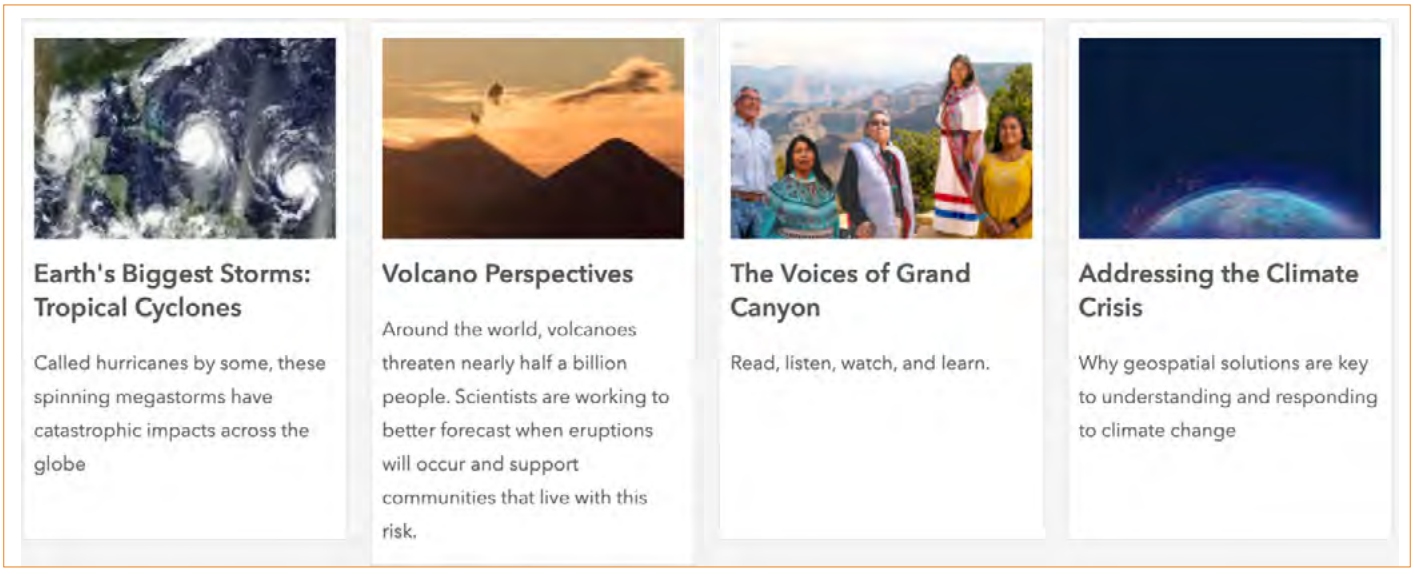
Introduction to StoryMaps: Learning how to leverage StoryMaps in the classroom
Show me how

Give your students the geographic advantage
Explore now

Nine steps to great storytelling: How to make your ArcGIS StoryMaps content sing
Read Now

Click HERE to DOWNLOAD THIS RESOURCE. – https://d1aettbyeyfilo.cloudfront.net/myacademy/26928270_1647923950323StoryMap_resource_list_for_GeoSTEM_March_2022.pdf





Examples of StoryMaps

How drones are changing environmental monitoring

Anne Crosby
GEONADIR

Image supplied by author

The impact of humans on our environment is undeniable. But as we work towards a more sustainable future, it's important for us to understand the details of where and why we are having an impact. Environmental monitoring is one way we can detect human driven change.

Yet distinguishing human impact from the natural behaviour of the environment is challenging because of nature's inherent variability. Weather, the interactions of millions of organisms, and more can all significantly affect the environment, even before humans come into play.

To detect impact well, you often need lots of good quality data. The inherent variability of nature means that to detect change, you need enough data to find patterns in amongst the noise. The more data you have, the sooner you can detect a problem and the easier it generally is to address. Traditionally, scientists have collected environmental monitoring data through either fieldwork, or satellite observations. While these methods can collect valuable information, they also face significant limitations. Drones are helping to overcome these limitations, offering a new, cost-effective method for collecting high quality monitoring data for ecosystems around the world.

How drones are supporting fieldwork

Fieldwork is the oldest form of environmental monitoring. Data collected in the field is usually high quality, since there are lots of opportunities to directly and indirectly measure many important variables. But fieldwork is also very time consuming. Researchers may have to actively traverse large areas, which can take a lot of people power and be quite expensive. Not all environments are well suited for fieldwork either. Some environments, like glaciers, can be difficult or dangerous to navigate on foot.

Glacier D'Orny, Switzerland – Mapped by Andrea Blindenbacher, images processed on GeoNadir.

Glaciers are a valuable source of water to many around the globe, an important indicator of climate change and a potentially dangerous natural hazard. Monitoring them is important, but they can be very dangerous to traverse on foot to collect data. Drone mapping offers a new, safer way to map these natural wonders.

Other ecosystems can be particularly sensitive to the disturbance that researchers would create when conducting fieldwork.

Guidadarri Bat Caves, Western Australia - Mapped by Glen Schloderer, images processed on GeoNadir

Mining in the Pilbara region has the potential to damage caves that form crucial habitat for the vulnerable ghost bat (Macroderma gigas). The caves need to be monitored to make sure no cracks or rock falls are damaging the habitat. However, the caves are difficult to access and surrounded by other delicate ecosystems. Using drone photogrammetry, surveyors can regularly map the caves and produce a 3D output. They can compare these 3D models over time to detect change, while minimising unnecessary habitat disturbance.

Drones can help researchers survey large areas, quickly collecting lots of high quality data without damaging the environment. This makes it easier for researchers to monitor larger areas in more detail more frequently, supporting better environmental monitoring.

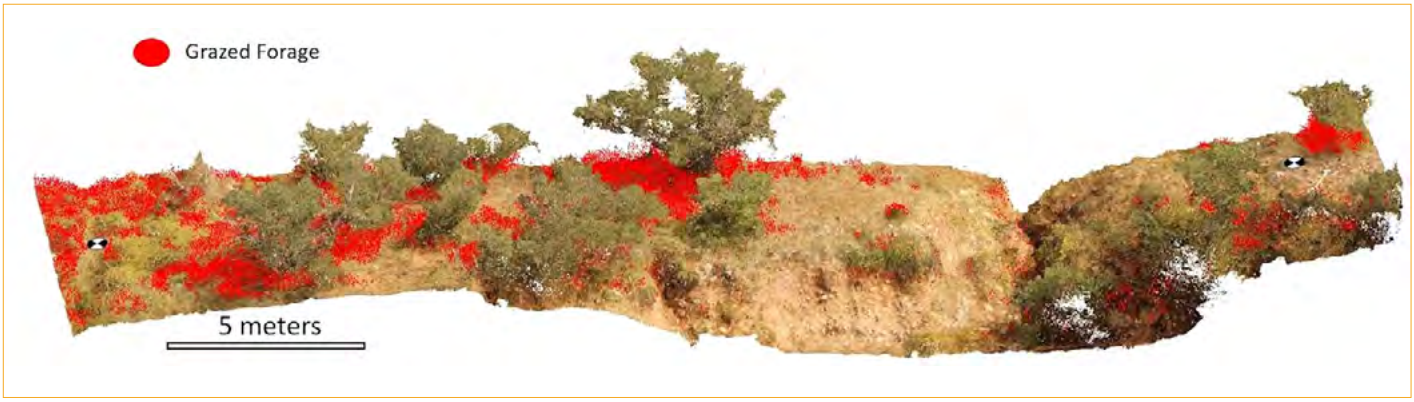
Supporting fieldwork with drone mapping for rangeland monitoring

Rangeland habitats cover over 30% of the USA, and are largely used as grazing land for stock. However historical mismanagement of grazing has led to the degradation of these ecosystems. Dr Jeff Gillan and his colleagues from the University of Arizona have tested drones as a way to map the impact on these systems and develop new management strategies. Traditionally, these ecosystems have been monitored with fieldwork. However, by mapping and creating a 3D point cloud of an area before and after grazing, his team could directly measure the amount and impact of grazing.

Other important metrics, such as the amount of bare ground can also be more accurately quantified using drones than ground-based fieldwork. However, despite the unique perspective drones can offer, they can't replace fieldwork entirely. For example, even high spatial resolution drone imagery is sometimes not detailed enough to distinguish species of grasses, an important factor when monitoring rangelands. Nonetheless, drones have proven a valuable tool for offering a new perspective on these ecosystems.

What about satellite imagery?

Unlike fieldwork, satellites can have enormous spatial coverage and offer a series of data acquired over a long period of time (Landsat has been imaging the world since 1972!). But although satellites can give us a lot of data, the spatial detail within these data can limit its applications to environmental monitoring. Free satellite imagery often has medium to coarse resolution (10 m-1 km) and although some commercial satellites now offer resolution of less than a metre, these can be expensive to access. Even when satellite imagery is high enough resolution for what you want to monitor, other factors like clouds, the tides, or even the time the satellite passes over can impact the availability or quality of the data.



A comparison of a transect before and after grazing. The red shows regions of difference between the two 3D point clouds, indicating where grazing has occurred. Source: Jeff Gillan

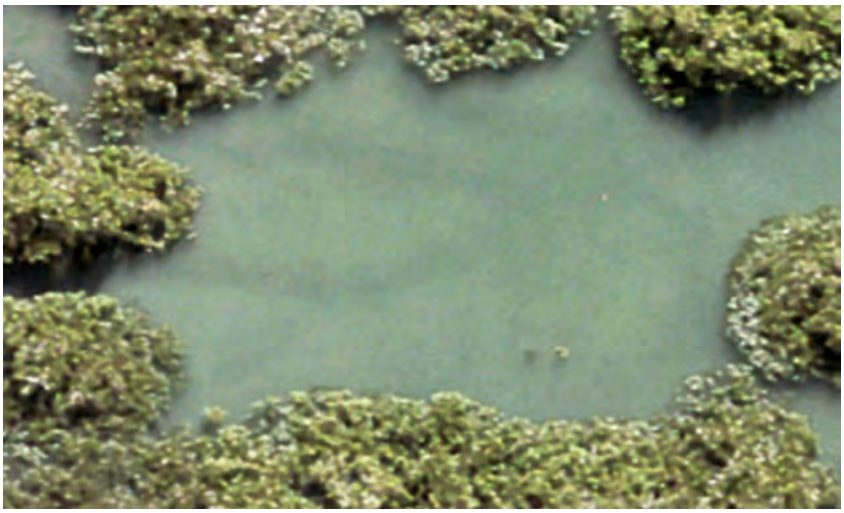
Both drones and satellites collect the same kind of data - images, usually in the visible part of the electromagnetic spectrum. Satellites can map much larger areas than drones, making them useful for detecting broad scale trends and changes. But where the spatial resolution, sensors, and overpass times of a satellite are fixed, drones are flexible. Provided the weather is suitable, an operator can fly a drone as frequently as they need to monitor a feature of interest. It is also easy for them to adjust the time they fly for when a feature of interest is most clearly visible. Drone pilots can also increase the resolution of imagery they collect by changing the camera on the drone or by flying the drone at a lower altitude. All of these characteristics give drones an advantage over satellite imagery for detailed environmental monitoring.

Drone mapping to monitor oyster reefs

Marine ecosystems, like oyster reefs, are particularly difficult to monitor, but it is important that they are monitored well. Oyster reefs provide many valuable ecosystem services, like improving water quality, providing habitat for key fisheries species and coastal protection. But they are also vulnerable to the many disturbances that often occur in heavily populated coastal regions.

In the past, it's been hard to consistently monitor oyster reefs. They can only really be monitored at low tide, when the retreat of the water makes them clearly visible. This leaves a very short window when fieldwork can be conducted, and the muddy terrain can be difficult and slow to navigate, limiting the amount of data that can be collected. The restriction of monitoring to a low tide window also limits the usefulness of satellite imagery. Earth observation satellites usually image any given area at the same time each pass over. This rarely coincides with low-tide however, so oyster reefs often aren't visible in satellite images. Oysters are also quite small making them very difficult to consistently identify even in high resolution satellite imagery.

Drones offer a way to quickly collect data across a large area in the limited low-tide window. This provides a valuable baseline to detect any future change in the oyster reef. It can also help environmental managers identify areas of concern that they might want to investigate in more detail through fieldwork.



Meola Rocky Reef Te Tokoroa, New Zealand - Mapped by Subhash Chand, images processed on GeoNadir. Open-source satellite imagery of an oyster reef in comparison with imagery captured at low-tide with a drone.

Limits of drones for environmental monitoring

Not every ecosystem or feature is going to be suitable for monitoring with drones. There are some restrictions on where you can fly drones (like near airports), and ultimately, drones only collect data on a few bands of the electromagnetic spectrum (usually visible light). While there's a lot we can directly observe or extrapolate from this data, it can't tell us everything. Direct field measurements of other variables, like species counts, contaminants or bioacoustics, are still invaluable tools for environmental monitoring. Similarly, although drones can provide better resolution than satellites, they cannot offer the same scale of coverage satellites provide, meaning satellites remain a critical tool for large scale environmental monitoring.

The value of drones for environmental monitoring fundamentally lies in their ability to affordably fill the niche between the ***scale*** of satellite and imagery and the ***quality*** and ***detail*** provided by fieldwork.

Want to learn more?

We know these stories of drones and their benefits for environmental monitoring thanks to researchers uploading their datasets to GeoNadir. GeoNadir is a free online platform for the storage and sharing of drone mapping data. Users have uploaded datasets that show incredible natural and urban landscapes across the world, from the Great Barrier Reef in Australia to landslides in Brazil.

You can read more about each of the examples in this article on the GeoNadir *Stories from Above* blog. The blog also has many other examples of the cool and innovative way drones are being used to solve problems around the world if you want to learn more! You can also explore the datasets in detail yourself by visiting the GeoNadir platform, accessible via www.geonadir.com.

BELOW: Orthomosaic of Meola Rocky Reef Te Tokoroa, New Zealand – Mapped by Subhash Chand, images processed on GeoNadir.

Developing and assessing students' spatial thinking skills when using GIS

James Hickman, St Albans School, UK

Unsplash image by Ben Lundquist

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In this article James describes some of the benefits of using GIS to improve students' spatial thinking skills and considers a simple framework for measuring these competencies.

Spatial thinking and GIS

Spatial thinking is the ability to identify, analyse and understand the location, scale, patterns and trends of the geographic and temporal relationships among data, phenomena, and issues (Kerski, 2017). This should be inherent in the learning and teaching of geography, but spatial thinking has received little direct attention in the geography curriculum. When students think spatially benefits include problem-solving, pattern recognition, and other skills.

A GIS is a framework designed to gather, manage, present, and analyse spatial data. Examples of intuitive web-based GIS programmes include ArcGIS Online; Google Earth; Digimap for Schools and MAGIC. GIS is an established part of the UK national curriculum for geography. It is integrated into the geography curriculum from key stage 2, and by key stage 3, students are expected to

- use Geographical Information Systems (GIS) to view, analyse and interpret places and data (DfE, 2013, p. 3)

while at A level, students should

- understand what makes data geographical and the geospatial technologies (e.g. GIS) that are used to collect, analyse and present geographical data (DfE, 2014, p. 13).

This is especially important for students undertaking their independent investigation where the use and presentation of geospatial data is expected.

There is much evidence to suggest that a GIS is a useful tool for students to develop spatial thinking skills (Fargher, 2018), as well as powerful geographical knowledge (Healy and Walshe, 2019). Considerable work has documented the successful use of GIS in the classroom (see Bailey, 2018; Clark ***et al***., 2018; Walshe, 2016).

Putting it into practice

I decided to undertake a small-scale evaluation in order to assess students' spatial thinking skills using a GIS. This involved the creation of two new GIS-based suites of lessons that were structured to develop students' spatial thinking skills, based on tasks that increased in complexity as the lessons progressed. Tasks were structured around the skills that I wanted students to develop, based on the learning line proposed by Zwartjes ***et al***. (2017) from the GI Learner project (Figure 1) that suggests a hierarchy for less complex (e.g., interpreting data and collecting data from the field to present in a GIS) and more complex spatial thinking skills (e.g., creating maps and problem solving). This framework was selected as it facilitated a constructivist approach to learning that would need to take place in the lessons. This was important as many of the students had never used GIS before so needed to start with learning the basics of using the software.

Learning line level	Level descriptor	Learning outcomes
Level 1 – perception	Being able to work with digital maps and virtual globes	1. Open digital maps and virtual globes on a computer 2. Indicate the different parts of digital maps/virtual globes (navigation bar, menu, scale, map window) 3. Interpret symbols on digital maps 4. Understand the construction of digital maps as a representation of the real world (topology, layers, database)
Level 2 – analysis	Selection of the relevant geographic information	1. Work with digital maps and virtual globes: find locations, pan, zoom, orientate, make measurements 2. Access information efficiently and effectively, evaluate information critically and competently 3. Be able to gather and evaluate information from data resources or through fieldwork activities 4. Interpret content
Level 3 – structure	Look for complex connections and relationships	1. Use digital maps and virtual globes for a variety of different purposes 2. Identify and ask significant questions that clarify various points of view and lead to sustainable solutions 3. Manipulate maps by creating own maps 4. Communicate cartographic information
Level 4 – application	Thinking problem solving	1. Be aware of generalisation levels applied in different zoom levels (e.g. road density) 2. Understand the basic purpose and application of digital earth to real world problems 3. Use advanced digital earth tools for learning (starting with web-based GIS, GIS viewers to GIS software) 4. Frame, analyse and synthesize information in order to solve problems and answer questions

Increasing complexity

*Figure 1: The framework used for assessing students' spatial thinking skills (adapted from Zwartjes **et al** (2017)).*

Empowerment is key to improving students' spatial thinking using a GIS (Sinton and Bednarz, 2007), and meaningful learning can have lasting impacts on students.

I decided on the topics of deforestation and crime, as they already fitted in with the year 8 curriculum at the school. There were datasets and lesson plans already freely available on the internet for these topics that could be easily adapted to develop higher-order spatial thinking skills. As this was the first time using GIS at key stage 3, I tried to keep lessons as simple as possible and focus on the outcome. Early activities simply introduced GIS (following advice from Trafford, 2017) but by the final lessons, students were interpreting and analysing the maps that they had created.

The first intervention involved using Global Forest Watch to map deforestation in Indonesia, write a follow-up report on areas most at risk and suggest action that could be taken to reduce deforestation. The second intervention used ArcGIS Online to create local crime maps using freely available police crime data, subsequently suggesting improvements to local policing (Figure 2). An example of the type of task involved for the report can be seen in Figure 3.

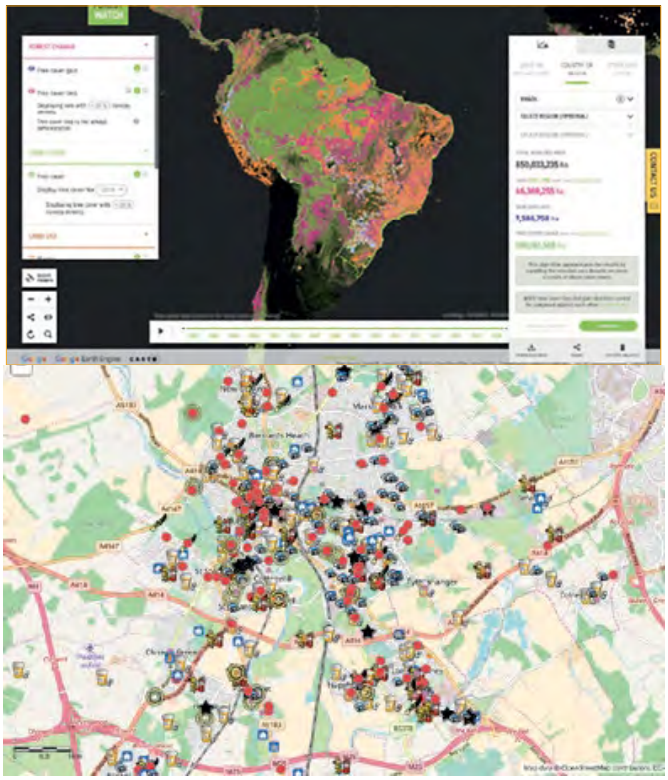

Figure 2: Examples of maps created by students using two web-based GIS programmes. The map on the left uses Global Forest Watch to show deforestation rates. The map on the right shows local crime data for April 2018 and was constructed using freely available Police data in ArcGIS online.

Introduction

Set the scene for your report. Explain what you are going to do. For example, you might like to start by saying '*In this report, I am going to investigate deforestation in [area]*'. Use a range of scales in your description (global, regional and local). Give some general reasons for deforestation but avoid giving detailed explanations in this section.

The location and size of the area

In this paragraph, you will need to use data to support our points. This is self-explanatory but ensure that you keep your units consistent.

Tree cover loss

Again, you will need to generate data using the analysis tool. Focus on the loss of trees in your area. You should suggest reasons why this is happening. Look out for patterns and clues, e.g. roads or urbanisation.

After the tree cover loss

Here you should explain what has happened after the tree cover loss, i.e. what has the response been? How have people acted? Have they done anything to complain against future deforestation?

Protected sites and conservation

In this section, you should describe and explain if anything is being done to conserve the area you have selected. Give examples to support your point of view, e.g. the names of companies or protected areas.

Conclusion

Summarise the finding of your report and avoid presenting any new ideas or data. You could start your opening sentence with '*In conclusion, I found that [area] suffered [amount of forest loss] between [year] and [year]*' Briefly explain why (reasons) and summarise what is being done (management).

Figure 3: A template for the report students had to write after mapping deforestation in Indonesia using Global Forest Watch. The objective is to elicit more complex spatial thinking.

Trial and error

While planning the interventions it was important to consider the knowledge components that engender the effective use of GIS. Koehler and Mishra (2009) distil the seven components needed to use GIS in the classroom into a technological pedagogical content knowledge (TPACK) framework (Figure 4). If any of these knowledge components are missing, teachers will struggle to use GIS effectively. Similarly, if GIS is not regularly used, then teachers are less likely to adopt it as a teaching tool (Trafford, 2017). Much recent work has been done by ITE providers, schools, and the wider GIS community to address the divide in technological competence and willingness to engage with GIS that still exists between practitioners, resulting in isolated pockets of GIS excellence (Walshe, 2016), and often prevents teachers from using GIS (Healy and Walshe, 2020; Walshe, 2017).

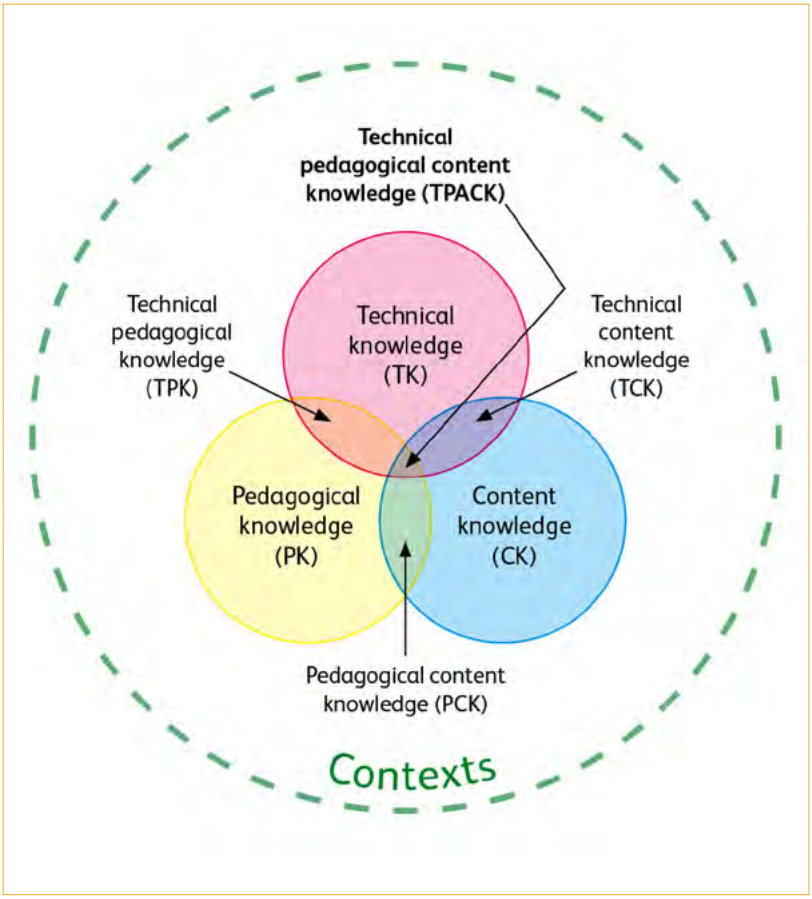

Figure 4: The TPACK framework and its knowledge components. This framework shows the challenges teachers face in order to develop the use of GIS in the geography classroom (Koehler and Mishra, 2009).

Tree cover loss

As a whole, the two islands have had a loss of 390 hectares worth of trees, from 2001 to 2016 (with >30 % canopy deficit). This converts to 8.73 % of the total tree cover area. However, it has also had a tree cover gain of 225 hectares, converting to 5.04 % of the total tree cover area. The tree cover gain is only from 2001 to 2012. As a result, the tree cover gain may be higher as it has missed a period of four years' worth of checking. Some roads are also present on the island, but I do not think this is the cause of the tree cover loss.

Conclusion

In conclusion, I have analysed my area and found that it suffered a loss of 390 hectares of trees from 2001 to 2016, but also a gain of 225 hectares from 2001 to 2012. I was not able to find out what was the cause of the loss due to the lack of information. Nothing has been done on the island, but other islands and countries have seen some activity.

Nonetheless, deforestation still remains a threat to the world's rainforests and if it is not stopped or managed properly, the total area of rainforests and their trees could decrease and bring disadvantages to the natural landscape and perhaps us as well.

Figure 5: Snippets from student work displaying level 2 spatial thinking skills after the first suite of GIS-based lessons.

Outcomes: developing spatial thinking skills

After conducting group interviews and a year group survey, the evidence was clear that, over the course of the academic year, in the two suites of lessons most students (92%) were confident that they had improved their spatial thinking skills through the use of GIS when measured against the competencies outlined in the framework proposed by Zwartjes et al. (2017). This can be seen in the work they produced. For example, as the student work in Figure 5 shows, the student is demonstrating level 2 skills of analysis and is critically evaluating the results by making links to human activities and the need for development in the area.

By the end of the second intervention, most students in the sample were demonstrating level 4 application skills. In the example below (Figure 6), it is quite clear that the student is aware where most shoplifting takes place (the High Street, according to the data) and is able to apply their knowledge to solve the problem:

Police could also patrol down the High Street to make people aware of their presence. Similarly, there was much evidence of level 3 structuring – looking for complex connections and relationships within the maps they had produced. It was evident they were able to make links between the maps and the geography of the local area.

However, not all students had improved their spatial thinking, as they struggled to master the technology and some encountered difficulty when collecting data. Therefore, good task design is paramount if students are to apply their spatial thinking skills. Similarly, much preparation had to be done before each intervention to ensure our practitioner 'TPACK framework' was complete, such as creating resources, and ensuring that teacher knowledge was up-to-date. This meant that, once the task had been explained to students, the teacher could act more as a GIS assistant.

What could be done by the police to reduce the number of crimes in St Albans?

Police could put CCTV in the areas of crime that are dark and leave people vulnerable. Police could track cars better to reduce car theft. Police could Ensure that people have working and the correct alarms to reduce burglaries. CCTV could also be put into shops to stop shoplifting. Police could also patrol down the High Street to make people aware of their presence; this would make people be scared of them are [sic] they are less likely to commit a crime.

Figure 6: An example of student work displaying level 4 spatial thinking skills after the second suite of GIS-based lessons.

Conclusion

GIS is a powerful tool that can be used to develop students' spatial thinking skills, but care needs to be taken with task design so that students can develop level 4 application skills, according to the framework proposed by Zwartjes ***et al***. (2017). Students not only developed their spatial thinking skills through undertaking work using GIS, but they were better able to think geographically when reflecting on their own learning. Students demonstrated that they could make connections between ideas as well as ask geographical questions at a variety of scales using real world data, and this has benefited students in their wider geography education. Our next steps as a department are to further research how higher-order spatial thinking skills can be developed and measured, and to further integrate the use of GIS into our curriculum.

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Online resources

To access the appendices to this article please go to www.geography.org.uk/ Journals/Teaching-Geography and select Autumn 2021.

Appendix

Student	Using a GIS		Analysing data with a GIS		Time	Scale	Presenting data with a GIS
	I can add/remove data layers using a GIS	*I can explore data using a GIS*	*I can calculate forest loss/ gain of a country using analysis tools within a GIS*	*I can analyse a specific area of a map using shape*	*I can map changes over time using a GIS*	*I can identify patterns over a range of different scales using a GIS*	*I can produce accurate maps using a GIS*
1 before							
1 after							
2 before							
2 after							
3 before							
3 after							
4 before							
4 after							
5 before							
5 after							
6 before							
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12 before							
12 after							

TEACHING STRATEGIES TO BUILD VISUAL LITERACY

Image source: Ishan Shah, Unsplash

Jane Boland, St Scholastica's College Glebe Point

There is a wealth of visual resources available to engage and integrate contemporary issues into the Geography classroom. Using specific strategies to help students apply and interpret visual content, rather than just having them watch a video and take notes is a great addition to the teaching toolkit!

A few of the strategies that we have used at St Scholastica's to build literacy skills when using visual platforms are described below. The following strategies that have been developed by teachers at the College, both past and present.

- Right angle thinking diagram
- Description from videos using screen shots
- Guessing description – from images
- Photo analysis

Strategy 1: Right angle thinking diagram (See Figure 1)

The right angle thinking diagram (Figure 1) can be adapted to use with articles or videos and goes beyond simply writing notes from a source. Whilst the first part of this activity is to write out key points from the video, it goes further by having the students come up with a series of questions that they would ask to find more about the topic or to seek further clarification. The first few times you use this with a class you may need to help prompt the class and model suggestions; however, the students will quickly become familiar with this strategy and it will help them build critical thinking skills. Initially, when using the right angle thinking diagram, it helps to model the note taking content for the students. I like to show the students the key statistics that they should include, as this can then be used as evidence in a written response. **Figure 2:** shows how you can pause the video so that students can get the points down. Watching videos with **captions on** helps students to record statistics and the correct spelling of names and or locations.

Figure 2: Watch the video with captions on to help take notes

Source: Worlds Biggest Lockdown Foreign Correspondent ABC May 2020 https://www.abc.net.au/news/2020-05-22/the-worlds-biggest-lockdown/12278678

The diagram can easily be modified and adapted depending upon the year group and or visual content you are using. The source analysis section is a great way to teach relevance, reliability, and bias from visual sources. Including a 'perfect paragraph' as part of this diagram shows students how to include specific evidence from a source in a simple paragraph response. You can adapt this to your preferred paragraph writing method (TEEL / PEEL etc). As the students have key points and facts recorded on the sheet you can get them to highlight the points of evidence they will use in their paragraph response. This right-angle thinking diagram can easily be adapted to use when interpreting choropleth maps / infographics and or data sites.

Figure 1: Right angle thinking diagram

Case Study: Migration and Covid-19 in India

QUESTIONS AND ANALYSIS

Right angle thinking diagram
Video Review worksheet

KEY CONTENT

Title: World's Biggest Lockdown

Source: ABC Foreign Correspondent, www.abc.net.au/news/2020-05-22/the-worlds-biggest-lockdown/12278678

Date (if known): 19 May 2020

Note down the five Key Ideas / Concepts / Facts of the video

1.

2.

3.

4.

5.

Note down questions requiring greater research or clarification that this video shows about urban places.

1. E.g. *What has changed since this video was released?*

2.

3.

Source evaluation
Critically evaluate the video as to its level of relevance, accuracy, reliability, and bias.

Reflection activity
What did I learn about urbanisation from this video?

Perfect Paragraph
Examine how internal migration in India has impacted upon the concentration of people in urban places?

Strategy 2: Description from videos using screen shots

This is a very useful strategy to show students different ways to use visual content from videos. It also helps reluctant readers / writers to engage as they do not seem as threatened about completing a task when it involves writing about an image. There are several ways that you can use this strategy, essentially you have students take screen shots from a video and for each image provide a caption describing the key content shown. This also teaches students to give each image a figure title and the need to specifically refer to this in the written description.

Example: Watch the clip Why Australia's suburbs are so hot (12 mins) as a class

Figure 3: Why Australia's suburbs are so hot

Source: https://www.abc.net.au/news/2022-01-16/why-australia%E2%80%99s-suburbs-are-sohot/13704522#:~:text=As%20cities%20expand%20outwards%2C%20more,degrees%20on%20a%20hot%20day.

After watching as a class, give the students a question such as, *"Explain the urban heat island effect on Australian suburbs".* As this is an explain question, tell the students that their response needs to use content from the video to show cause and effect. Set the parameters – such as their response must have at least five images with captions.

You can easily differentiate this strategy depending upon the learning needs of your students. Have some groups find other videos or research to support their response. Or simplify by having students just find one image to show cause and one image to show effects. Additionally, you could have the students use this content to create an infographic to answer the question.

Figure 4: Examples of screen shots from the video

Source: https://www.abc.net.au/news/2022-01-16/why-australia%E2%80%99s-suburbs-are-sohot/13704522#:~:text=As%20cities%20expand%20outwards%2C%20more,degrees%20on%20a%20hot%20day.

Strategy 3: Guessing description – from images

This strategy can help develop students' skills in both literacy and interpreting sources. There are a wide range of ways that this can be applied to the classroom and is a great strategy to use at any time. Provide the students with 2- 4 different images that relate to a topic that you are studying, as shown in Figures 5 and 6. Students then write a written description of the Sources. In groups, each student then chooses one of the descriptions to read out loud and see if the others can guess which source they have written about. Students can reflect on their performance and give feedback to their peers on ways to improve the detail provided. Once students are familiar with this strategy, they can then select the images to use, displaying the images to the class or group and reading their description to see if the group or class can guess which image it is they have described. This strategy works well with data sources such as population pyramids or choropleth maps, as it makes the student look closely at the source and interpret the data in their written description.

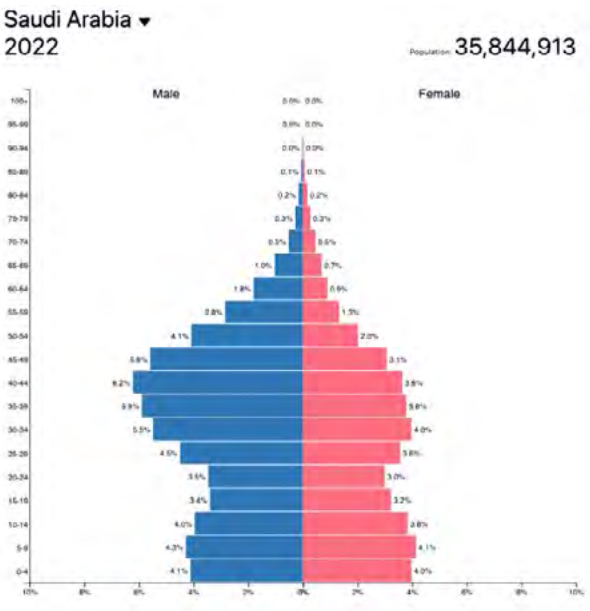
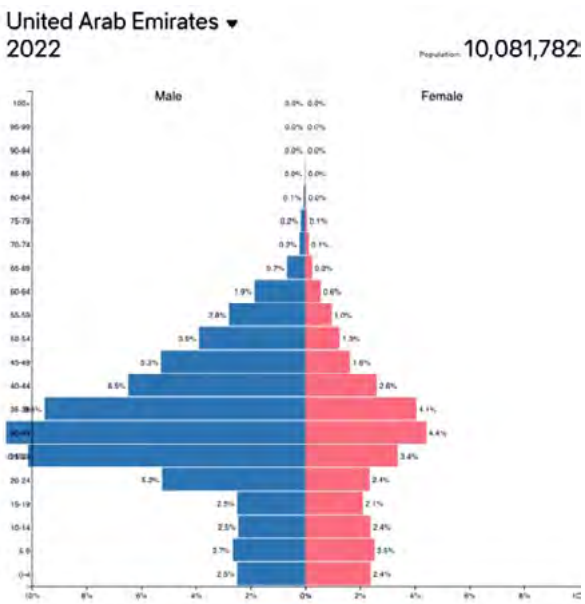
Figure 5: Sources

Source A:	**Source B:**
Description of the source:	**Description of the source:**
	

Task: In small groups choose one of your descriptions (source A or B) and read out loud to your group, see if they can work out which source you have described.

Reflection: What details could I add to my description to improve my response

Figure 6: Source graphs

Source A:	Source B:
	
Source: https://www.populationpyramid.net/saudi-arabia/2022/	Source: https://www.populationpyramid.net/united-arab-emirates/2022/
Description of the population: *Include at least two statistics from the source*	Description of the population: *Include at least two statistics from the source*

Task: In small groups choose one of your descriptions (source A or B) and read out loud to your group, see if they can work out which source you have described. Tip, make sure when you read your description out loud not to include the name of the country for your population pyramid.

Reflection: What detail could I add to my description to improve my response?

Strategy 4: Photo analysis

A great strategy to use at any time, again to help build the skills of interpreting images. We only have the students choose **four** of the questions in the table (Figure 7) to complete as they can then think about the questions and choose the best questions that relate to the image slected.

Figure 7: Photo analysis table

1. Where could this photo have been taken? Support your answer with geographical information and a map.	2. When might this photo have been taken? What geographical evidence is there to support this?	3. What does this photo tell you about a world environment and issue?	4. What intention do you think this photo has?
5. What emotions or thoughts does this photo evoke in you?	6. Who could have manipulated this image? Think carefully about the process from the photograph being taken to the image's publication.	7. What could have led to or caused the situation depicted in the image (e.g. Environment, conflict, disease)	8. What could the photographer have excluded from the photo? What is occurring outside the frames of the photograph?

Extra: You could place the photo on a large piece of paper and draw the scene occurring outside of the photographer's frame. This scene could continue the story the photograph tells, or completely change what is perceived to be happening in the photo.

Extension: How can the media use or manipulate this image? Create two newspaper headlines expressing different explanations of what is occurring this this photograph.

Sample photo

Case Study: The Story of Bottled Water

Rebecca Sutcliffe, Roseville College

Lesson Intention:

1. Investigate the effects of the production and consumption of goods on people, places, and environments throughout the world. Case Study: Bottled Water.

Success Criteria:

a. Examine the case study of 'Bottled Water' to determine the effects on people, places and environments.

b. Describe the history of bottled water in the US.

c. Identify positive ways to change the consumption of bottled water.

Tasks: Reading for understanding

1. Watch the video: The Story of Bottled Water (8 mins)
2. Open the guided reading pdf worksheet – The Story of Bottled Water

- **Note to teachers:** Print the guided reading worksheet in advance on A3 paper, one for each student. Students write their answers directly on to the guided reading worksheet. Alternatively, students can complete a table, such as the one below, whilst reading the worksheet online.

QUESTION	Type your answer in the space below for each question. Please answer in FULL sentences.
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

3. Explore the 'Unbottle water' – story of stuff campaigns at Unbottle Water Campaign. Select and record THREE facts from any of the campaigns.
4. Reflect on how you use tap water versus bottled water... What changes can you and your family and friends make today? Write your response as a short paragraph.

- **Note to teachers:** If you are using a table for students to answer the guided reading questions, add room for answers to Questions 3 and 4.

Extension task

If there is time watch the ABC iview documentary *War on Waste* https://iview.abc.net.au/video/DO1724H001S00 Series 2, Episode 1 from 10 mins 54 secs to 30 mins (29 mins) – this episode is about bottled water vs tap water!

- *Resource created by R Sutcliffe @GeoTeacherOz with thanks to @MrHand (Twitter) for his Guided Reading template and his Google Drive of over 72 guided reading resources covering a whole variety of topics. All resources were produced by amazing #geographyteachers* ***https://drive.google.com/drive/folders/1vhBE3ix3pjgpmD07vYpAYLeQl8hxtwo1?usp=share_link***

guided READING

1 Define the term ' manufactured demand'

2 What did the soda companies do in the 1970s?

3 Identify the two well known brands of bottled water mentioned?

THE STORY OF BOTTLED WATER - HTTPS://WWW.STORYOFSTUFF.ORG/ABOUT/

Bottled water costs about 2000 times more than tap water. Can you imagine paying 2000 times the price of anything else? How about a $10,000 sandwich? Yet people in the US buy more than half a billion bottles of water every week. That is enough to circle the globe more than 5 times. How did this come to be? Well, it all goes back to how our materials economy works and one of its key drivers which is known as manufactured demand.

If companies want to keep growing, they have to keep selling more and more stuff. In the 1970s giant soft drink companies got worried as they saw their growth projections starting to level off. There's only so much soda a person can drink. Plus it wouldn't be long before people began realising that soda is not that healthy and turned back to "gasp", drinking tap water. The companies found their next big idea in a silly designer product that most people laughed off as a passing yuppie fad. "Water is free", people said back then, "what will they sell us next, air?" So how do you get people to buy this fringe product? Simple. You manufacture demand. How do you do that? Well, imagine you're in charge of a bottled water company. Since people aren't lining up to trade their hard-earned money for your unnecessary product, you make them feel scared and insecure if they don't have it. And that's exactly what the bottled water industry did. One of their first marketing tactics was to scare people about tap water, with ads like Fiji's Cleveland campaign. "When we're done," one top water executive said. "tap water will be relegated to showers and washing dishes." Next, you hide the reality of your product behind images of pure fantasy. Have you ever noticed how bottled water tries to seduce us with pictures of mountain streams and pristine nature? But guess where a third of all bottled water in the US actually comes from? The tap! Pepsi's Aquafina and Coke's Dasani are two of the many brands that are really filtered tap water. In a recent full page ad, Nestlé said: "bottled water is the most environmentally responsible consumer product in the world."

What?! They are trashing the environment all along the product's life cycle. Exactly how is that environmentally responsible? The problems start here with extraction and production where oil is used to make water bottles. Each year, making the plastic water bottles used in the US takes enough oil and energy to fuel a million cars. All that energy spent to make the bottle even more to ship it around the planet and then we drink it in about 2 minutes?

That brings us to the big problem at the other end of the life cycle. Disposal. What happens to all these bottles when we're done? Eighty percent (80%) end up in landfills, where they will sit for thousands of years, or in incinerators, where they are burned, releasing toxic pollution. The rest gets collected for recycling. I was curious about where the plastic bottles that I put in the recycling bins go.

Shiploads are being sent to India. I will never forget riding over a hill outside Madras where I came face to face with a mountain of plastic bottles from California. Now, real recycling would turn these bottles back into bottles. Instead these bottles were downcycled, which means turning them into lower quality products that would just be dumped in someone else's backyard. If bottled water companies want to use mountains on their labels, it would be more accurate to show one of these mountains of plastic waste.

Scaring us, seducing us, and misleading us these strategies are all core parts of manufacturing demand. Once they have manufactured all this demand, creating a new multibillion dollar market, they defend it by beating out the competition. But in this case, the competition is our basic human right to clean, safe drinking water. Pepsi's Vice Chairman publicly said "The biggest enemy is tap water!" They want us to think it's dirty and bottled water is the best alternative. In many places, public water is polluted thanks to polluting industries like the plastic bottle industry. And these bottled water guys are all too happy to offer their expensive solutions, which keep us hooked on their products. It is time we took back the tap. That starts with making a personal commitment to not buy or drink bottled water unless the water in your community is truly unhealthy. Yes, it takes a bit of foresight to grab a reusable bottle on the way out, but I think we can handle it. Then take the next step join a campaign that's working for real solutions, like demanding investment in clean tap water for all. In the US, tap water is underfunded by $24 billion partly because people believe drinking water only comes from a bottle! Around the world, a billion people don't have access to clean water right now. Yet cities all over are spending millions of dollars to deal with all the plastic bottles we throw out.

What if that money was spent improving our water systems or better yet, preventing pollution to begin with? There are many more things we can do to solve this problem. Lobby your city officials to bring back drinking fountains. Work to ban the purchase of bottled water by your school, your organization or entire city.

This is a huge opportunity for millions of people to wake up and protect our wallets, our health and the planet. The good news is: it's already started. Bottled water sales have begun to drop while business is booming for safe refillable water bottles. Yay! Restaurants are proudly serving "tap" and people are choosing to pocket the hundreds or thousands of dollars they would otherwise be wasting on bottled water. Carrying bottled water is on its way to being as cool as smoking while pregnant. We know better now. The bottled water industry is getting worried because the jig is up. We are not buying into their manufactured demand anymore. We will choose our own demands, thank you very much, and we're demanding clean safe water for all.

4 Do you agree with what Nestlé said? Provide a reason why/why not.

5 How much oil does it take to produce plastic water bottles in the US?

6 Identify the big problem at the end of the plastic bottle lifestyle.

7 Having identified the answer to Q6 explain what happens next in your own words.

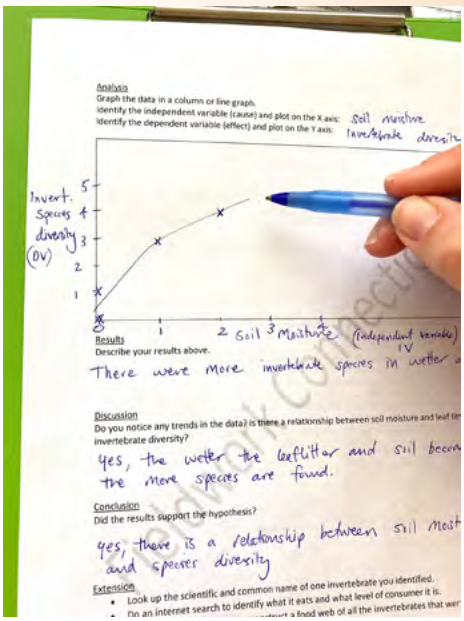
8 Describe the main way people can 'take back the tap'?

9 Identify another positive change that people can make to decrease the consumption of plastic bottles.

10 How much is water underfunded in the US?

11 Explain how else this money could be used in a positive way.

12 Identify ONE positive change YOU are going to make from today to help this cause



Geographical Numeracy: Interpreting field data and graphing skills

Kathy Jones, Fieldwork Connections

Numeracy is vital in geography. It makes up a large part of our students understanding of geographical skills such as graphs, statistics and data interpretation. Numeracy and graphing skills are very important when learning to find meaning in physical geography fieldwork.

On a recent trip to the Northern Territory I was able to visit a school and deliver a fieldwork investigation I had designed with year 10 and 11 students. Although I only had an hour with each class I wanted them to not only learn the beauty of data collection in the field but also how to interpret their data and visually represent it in the form of a graph.

My fieldwork design in physical geography is closely linked to my environmental science roots and sometimes I find the scientific method useful*. This can be helpful when collecting data and analysing results to better understand interactions between the geographical spheres; biosphere, lithosphere, atmosphere and hydrosphere.

Students need to understand their data numerically in order to graph and interpret it. When linking to science we need to understand our variables. We can simplify this into two factors as a kind of cause and effect or independent and dependent variables.

The fieldwork that was undertaken in Alice Springs focussed on the biosphere and the diversity (how many) of invertebrate species living in leaf litter around the school grounds. Species diversity was our dependent variable because it relied upon an abiotic (non-living) factor in the hydrosphere, soil moisture, which was our independent variable. At each location students collected data on the amount of soil moisture and the species of invertebrates present. By graphing this data, students were able to see the correlation between the two. When graphing results the independent variable belongs on the X-axis and the dependent variable belong on the Y-axis. The photo below shows the data graphed on the field sheet.

With the numerical skill of graphing the data, students can visually see correlations and trends and gain a deeper meaning of the data rather than just a page full of numbers. Results from this field investigation showed an obvious correlation between soil moisture and species diversity and the trend could be describes as 'the wetter the soil, more invertebrate species are present'. The graph could also be used to extrapolate the data when looking at the line of best fit.

NUMERACY IN FIELDWORK

At the end of the session I was able to discuss the results with the students. The above results were a good example of what we hoped to find, however, some groups did not find many species and all locations were dry. Results don't always reflect what you hope to find, however, we were able to discuss that if we wanted to improve the reliability of the study we could increase the sampling rate. Maybe next time, they could sample at 10 locations rather an 5.

When designing your own fieldwork to better understand biophysical interactions remember to keep it simple. Start with some observations, build a hypothesis and identify your independent and dependent variables that can be graphed. This will hopefully give students a deeper understanding of the interactions of the world around them.

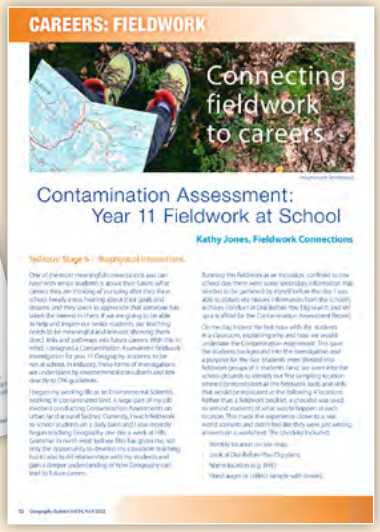
For a deeper understanding of the scientific method when designing physical geography fieldwork please read my previous article "Simplifying the Science: Helping your students to plan an SGP in Physical Geography", Geography Bulletin Vol 54, No1 2022.

Kathy Jones is the director of Fieldwork Connections, which aims to bring a deeper understanding of physical geography to students and teachers of geography in Australian schools through fieldwork. She currently teaches geography part time at a school in Sydney and also travels regionally for fieldwork opportunities. For enquiries please contact kathy@fieldworkconnections.com.au

Kathy Jones, Fieldwork Connections

Previous Fieldwork articles written by Kathy for the GTA Bulletin include:

- Connecting fieldwork to careers. Contamination Assessment Year 11. VOLUME 54, NO. 4 2022
- Simplifying the Science. VOLUME 54, NO. 1 2022



Word stock image

Using Scaffolds, Frameworks & Templates

Katerina Stojanovski & Christina Kalinic
Stella Maris College

SCAFFOLDING: AN EXAMPLE

Scaffolding involves breaking down larger tasks into small steps. This strategy is helpful for all learners and is effective method of differentiation in the classroom.

The example below illustrates how the question *"How was Queenscliff Beach formed?"* could be scaffolded by breaking down the question into small steps to assist students in writing a news report on the topic. This is a good way to incorporate primary and secondary research. A possible lesson sequence is to introduce the concepts of weathering and erosion, include a lesson of local fieldwork, followed by 2 lessons to follow up and complete the activity.

Example: Landscapes and Landforms – Queenscliff Beach

Outcomes

GE4-1 – locates and describes the diverse features and characteristics of a range of places and environments

GE2-2 – describes processes and influences that form and transform places and environments

Scaffolded activities

- **How was Queenscliff Beach formed?**

You are working for Geoscience Australia and your task is to update their website on Australian Landforms by writing a short article on "How Queenscliff Beach was formed."

The length of the article is 300 words. Include your own annotated photos and annotated sketch map and screenshot from Google Earth in your article.

In your article include the following information:

1. Describe the nature of the landscape near Stella Maris College. Include:
   a. the area's topography (shape of the land)
   b. natural vegetation
   c. the extent of the constructed environment (housing, transport, infrastructure, industry, commercial buildings and recreational spaces.
2. Include a Google Earth image of Queenscliff Beach and the surrounding environment.
3. Describe the location of Queenscliff Beach.
4. Include a field sketch / annotated photos to assist with your description. In the field sketch and photos, label the following:
   a. natural and cultural features
   b. features of erosional and depositional coastlines
5. Include annotated photos
6. Write your article for Geoscience. The title for the article is "How Queenscliff Beach was formed."

A PDF worksheet for this activity is on the GTA website with this edition.

PHOTO INTERPRETATION: SEE THINK WONDER

Photos are valuable stimulus in Geography lessons. Photographs are readily available on the internet from people all over the world to facilitate geographical inquiry and they allow for a variety of perspectives to be shown.

The website Dollar St shows how photos can be used as data to appreciate how people around the world live. It is worth exploring, especially for the Human Wellbeing Unit in Stage 5.

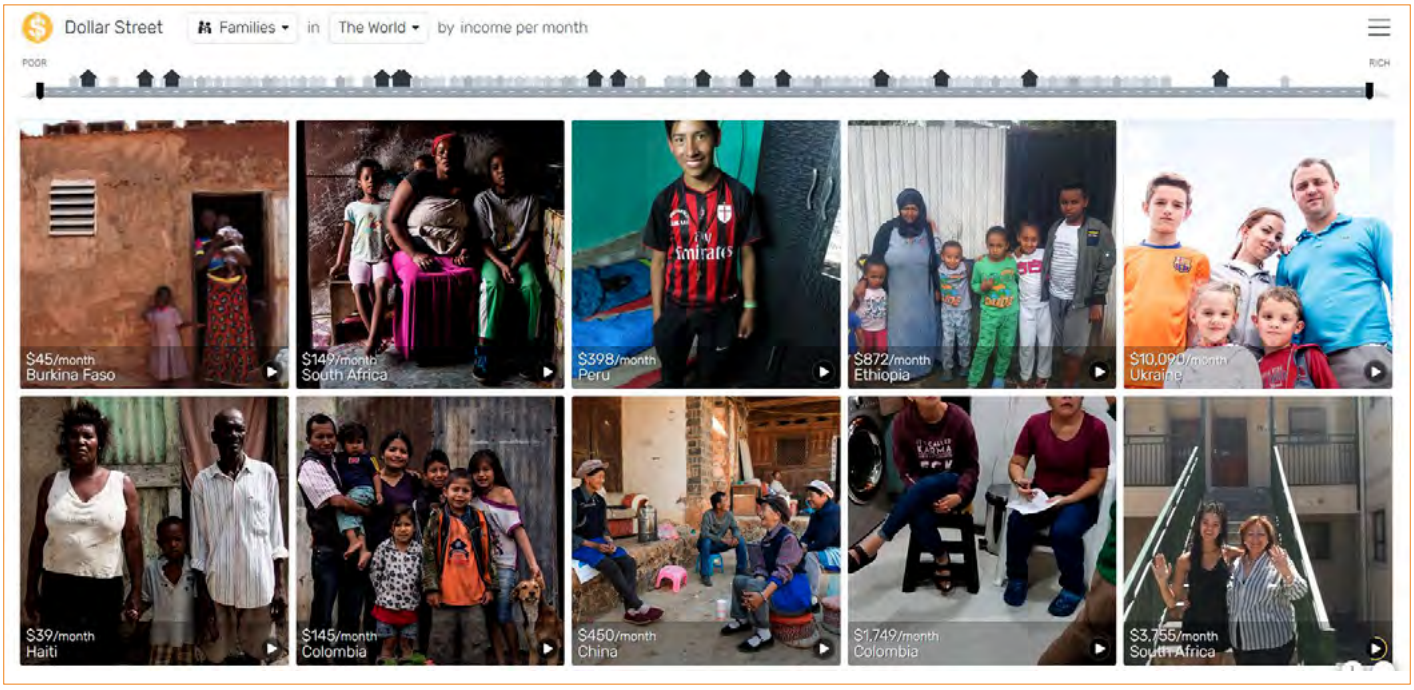


Image Source: https://www.gapminder.org/dollar-street

I have incorporated the visible learning strategy of **See-Think-Wonder** as a framework to analyse the photo of the Tropical Rainforest on page 55. Students complete the See-Think-Wonder routine, discuss with the class and then using the internet they can undertake further research to complete the paragraph response.

A THINKING ROUTINE FROM PROJECT ZERO, HARVARD GRADUATE SCHOOL OF EDUCATION

See, Think, Wonder

What do you see?

What do you think about that?

What does it make you wonder?

Purpose: What kind of thinking does this routine encourage?
This routine encourages students to make careful observations and thoughtful interpretations. It helps stimulate curiosity and sets the stage for inquiry.

Application: When and where can I use it?
Use this routine when you want students to think carefully about why something looks the way it does or is the way it is. Use the routine with a relevant object (such as an artwork, image, artifact, chart, video, etc.) at the beginning of a new unit to motivate student interest, or try it with an object that connects to a topic during the unit of study. Consider using the routine with an interesting object near the end of a unit to encourage students to further apply their knowledge and ideas.

Launch: What are some tips for starting and using this routine?
Once you present the object to your students, give them time to observe it. It may be useful to explain that they are first going to describe exactly what they see, not what they think they see. In the second step when students describe what they think about what they're seeing, you could ask them follow-up questions like, "What else is going on here?" or "What do you see that makes you say that?" These questions help move students away from giving unsupported opinions encouraging them instead to use evidence to explain their thoughts. In the third step, help students articulate what they are wondering by asking them what questions remain for them.

The routine generally works well in a group discussion. You may want to document the students' responses and post them in a place where all students can see them to encourage future consideration. When doing this as a group, you may want to ask students to try the routine quietly on their own first (perhaps documenting their own thinking in writing) before discussing in a group.

Share your experience with the thinking routine on social media using the hashtags #PZThinkingRoutines and #SeeThinkWonder

PROJECT ZERO

VISIBLE THINKING

This thinking routine was developed as part of the Visible Thinking project at Project Zero, Harvard Graduate School of Education.

Explore more Thinking Routines at pz.harvard.edu/thinking-routines

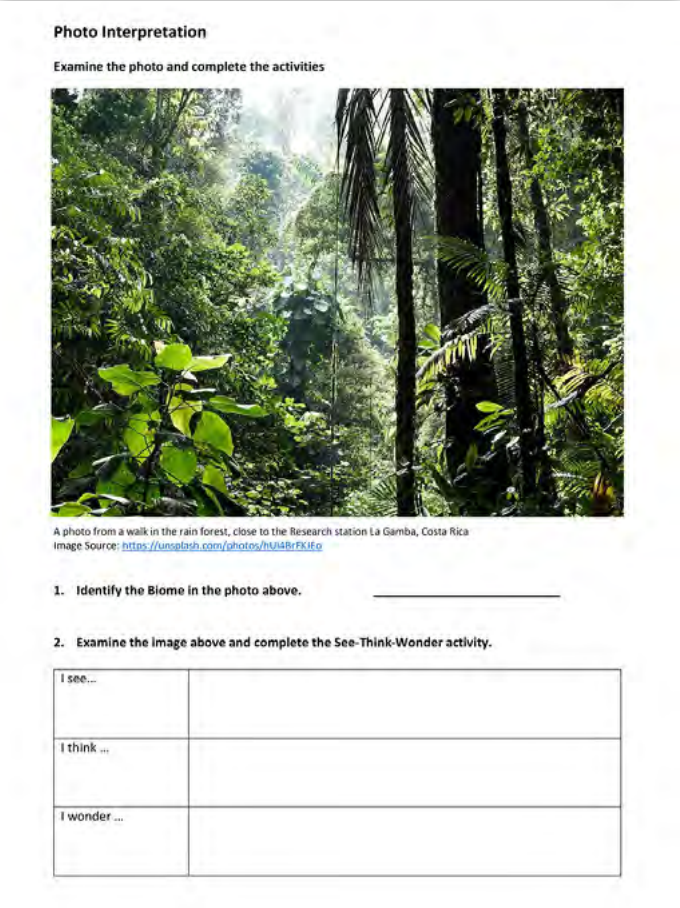


Photo Interpretation

Examine the photo and complete the activities

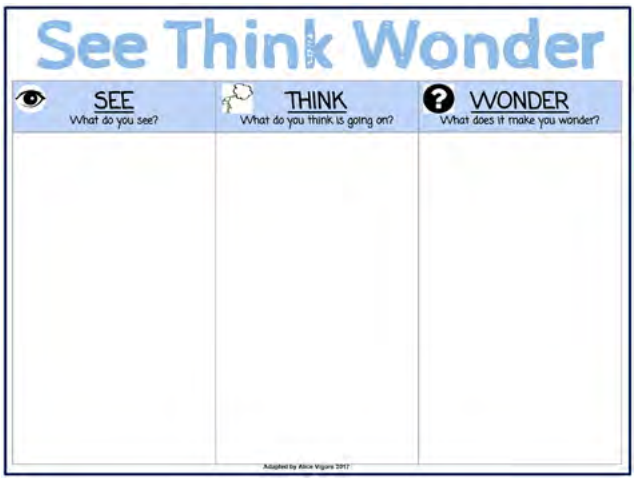
A photo from a walk in the rain forest, close to the Research station La Gamba, Costa Rica
Image Source: https://unsplash.com/photos/hUi4BrFKiEo

1. **Identify the Biome in the photo above.** _____

2. **Examine the image above and complete the See-Think-Wonder activity.**

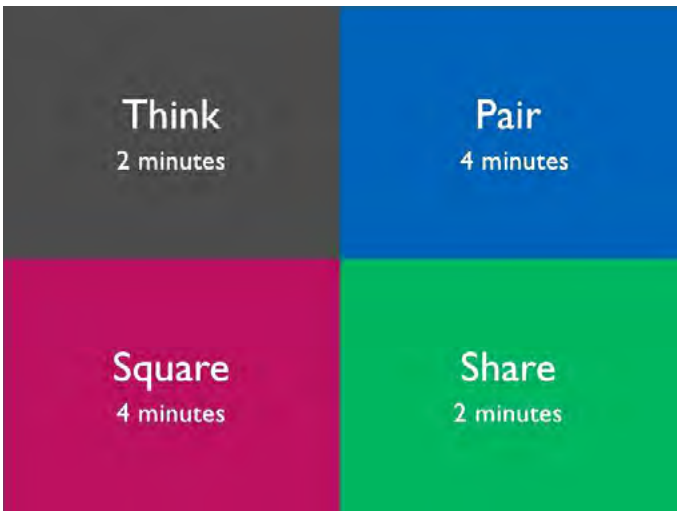
I see...	
I think ...	
I wonder ...	

This example uses See-Think-Wonder for Photo Interpretation. The PDF worksheet is included as Appendix 2 with this edition on the GTA website.



This template for See-Think-Wonder can be found on the GTA website with this edition as Appendix 3.

THINK, PAIR, SQUARE



Think-Pair-Square is a variation of Think-Pair-Share

This activity was designed to be used before introducing a new concept or topic to tap into students' prior knowledge. In this instance, it fits in with Stage 5 Changing Places – Causes and consequences of Urbanisation to ascertain how much each student knows about the meaning of the term urbanisation. With slight modification e.g., by incorporating alternate stimulus, it can be used for any geographical concept in all topics.

Image Source: https://www.pinterest.com.au/pin/385409680588180502/

Example: Stage 5 – Changing Places

Causes and Consequences of Urbanisation

Step 1

Students have time to think and jot down their initial thoughts. Then they work in pairs to share their thoughts. When pair work is complete, students join with another pair to work in groups of four to share their discussion. One person from each group can share with the class their findings.

Step 2

Students are given a piece of stimuli – e.g., a composite image of the earth and they note down how their initial thoughts have changed after viewing the stimulus.

Image source: https://earthobservatory.nasa.gov/images/79765/night-lights-2012-map

Step 3

Students write a HEAD question which is an inferential question using information from their Thinking Sheet where clues may be in their information, but the answer is not directly available.

Step 4

Students proceed to discuss strategies in how this question can be answered.

Think, Pair Square is an effective strategy as it involves lots of discussion and sharing of ideas.

The worksheet for the activity created by Christina Kalinic forms Appendix 4 with this edition of the Geography Bulletin on the GTA website.

THINKING SHEET- *Urbanisation*

INITIAL THOUGHTS:

MY THOUGHTS:	
A PAIR OF THOUGHTS:	
A SQUARE OF THOUGHTS:	

CHANGING THOUGHTS (a response to stimuli):

HEAD QUESTIONING (as a square)..

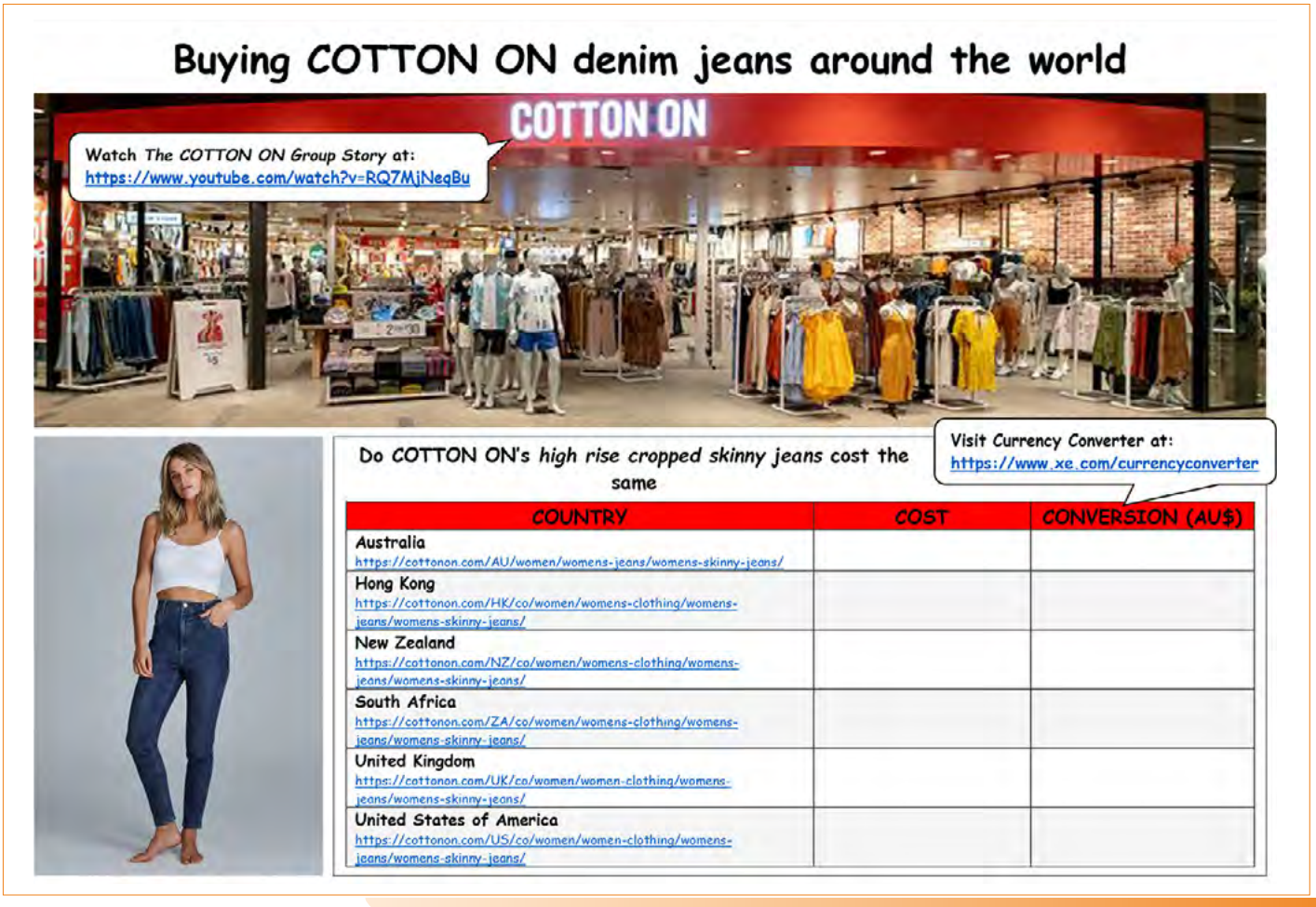
Question..

Strategies to respond to this question..

NUMERACY

There are many opportunities to embed numeracy activities into the Geography classroom by creating simple templates or frameworks.

The following worksheet created by Christina for the topic Interconnections illustrates a worksheet that embeds numeracy skills. **This worksheet and an answer sheet form Appendix 5 in this edition of the Geography Bulletin on the GTA website.**



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Transects in Geography

Martin Pluss,
Northholm Grammar School

When completing skills, it is important to outline the theory, provided instructions and then if possible provided practical examples. Transects are a good skill to leverage your local school environment to enhance understanding and incorporate numeracy.

The key NESA syllabus point is " constructing a transect between two points and describing the changes along it." This can be examined through the following activities.

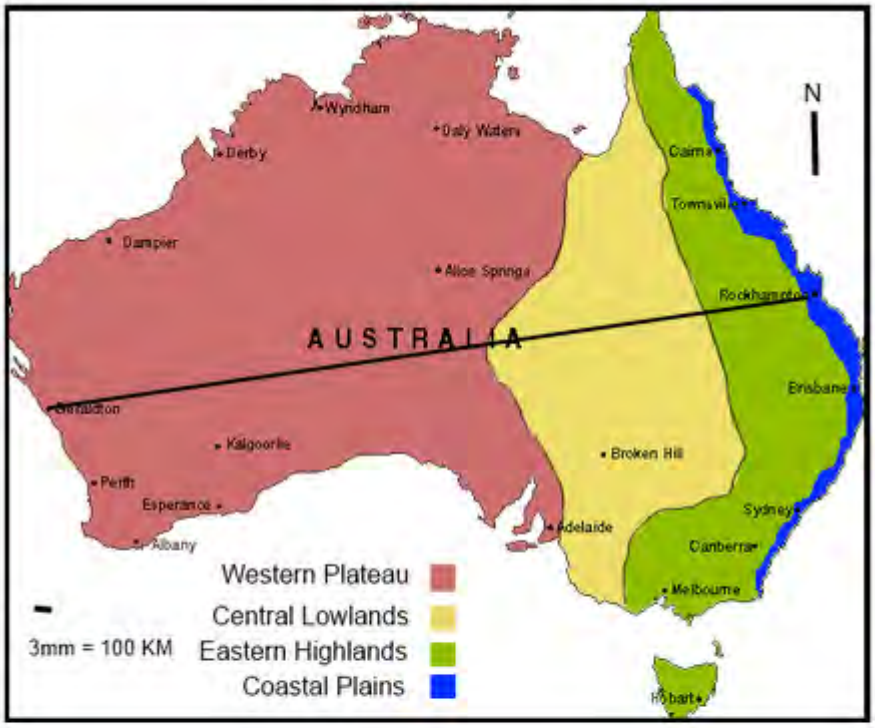
Activity 1: Transects – demonstration

How to draw a Transect https://www.youtube.com/watch?v=r399su77UJs

Activity 2 Transects – construct your own transect

Construct a Transect from Geraldton to Rockhampton using the map and rectangle below.

Landform Regions in Australia



Answer these two questions by filling in the table:

1. If you were to travel along the transect how many km would you travelled on each landform feature?

2. Time to travel each section by different modes of transport

Landform Feature	Kilometres Travelled	Mode of transport and speed km/hr	Time Taken
Western Plateau		By plane at 500km per hour	
Central Lowlands		By car @100km per hour	
Eastern Highlands		By running at 10 km per hour	
Coastal Plains		By walking at 5 km per hour	

Activity 3: A walk through Northholm Grammar

In every school, teachers should be able to construct a transect and complete a series of associated skills, here is an example which can be used as a model. This activity requires an aerial photograph, mobile phone camera and exercise book pen and pencils.

Constructing a transect from an aerial photograph

Construct a transect along the red line from the from the top left to the bottom right of the aerial photograph.

Construct a single cell table/box the length of the red line.

Mark off the different land uses and label as you proceed.

Start with the follow sequence of land uses.

- Trees
- Road
- Oval
- Gym
- Trees
- Tennis/Netball Courts
- Trees

Fieldwork walk: Now you students go into the field to investigate the transect to gather more data

Start the walk in the top left quadrant of the aerial photograph.

The focus here is to estimate the distance of each land use along the transect and outline more detail.

Take photos of each land use section (A–G)

Land use Section	Land use Activity	Distance	Photo/ field sketch/notes
A			
B			
C			
D			
E			
F			
G			

Conclusion

These activities could be completed in a couple of lessons considering theory and practical components. The task can be scaled up of scaled down deepening on time, needs of the students and the expertise of the teachers.

Martin Pluss, Head of Social Science Northholm Grammar
martinpluss@gmail.com

POSTERS POSTERS POSTERS POSTERS POSTERS POSTERS POSTERS POSTERS

The Geography Teachers' Association of NSW & ACT

GEOGRAPHY POSTERS FOR SALE

GTA NSW & ACT has printed a number of infographic posters for classroom use.

Posters are linked to topics studied in Geography K–12 for the Australian Curriculum and NSW Syllabuses.

- A **bank of questions** for individual and groupwork will be accessible via Google Drive to all schools /teachers purchasing posters.
- Posters can be purchased in **pre-packaged sets** or as **individual posters**.
- **New posters** will be added to the website throughout the year.

SOURCES AND PRICING

Posters have been sourced from organisations including the Geological Society (UK), Visual Capitalist and Graphic News. GTA NSW & ACT has also commissioned some posters. Posters are being sold in sets of 4 or 5 to make postage viable. Affordability was a key consideration when determining pricing.

Administration, printing and distribution, licensing and design costs where relevant are incorporated into the cost of each pack. Postage includes the cost of cylinders. A maximum of 5 posters will be packaged in any postage cylinder.

PACK 1: THE CARBON CYCLE – $70 includes p/h

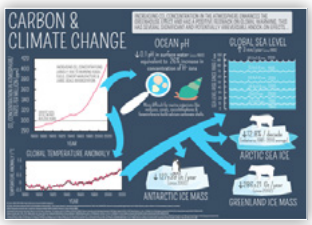
Click here to order Pack 1

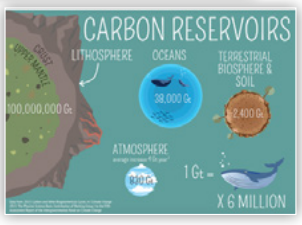
Contents:

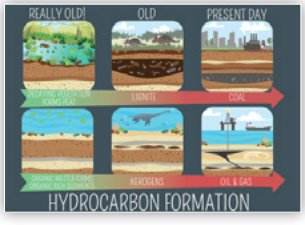
1 x A1 poster: **The Carbon Cycle**

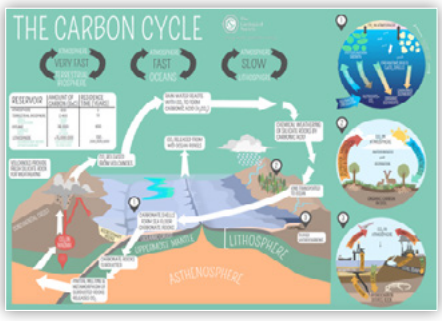
4 x A2 posters: **Carbon Set**

- **Carbon & the Greenhouse Effect**
- **Carbon Reservoirs**
- **Hydrocarbon Formation**
- **Carbon & Climate Change**









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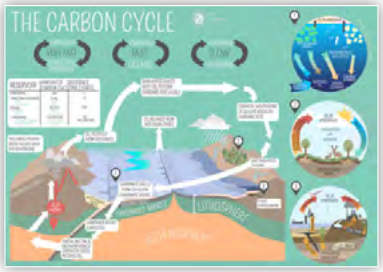
- **Minerals in a smartphone**
- **The Carbon Cycle**
- **On the Brink: The biggest threats to Earth's biodiversity**



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6 to 10 posters $30 postage (2 cylinders) etc

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- **Plate tectonics**
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- **The Carbon Cycle**
- **On the Brink: The biggest threats to Earth's biodiversity**
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- **UN sustainable development goals**

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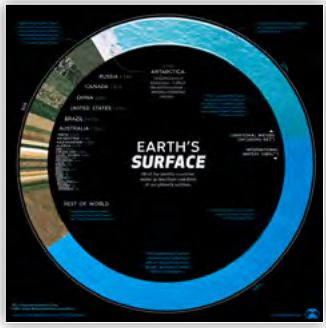

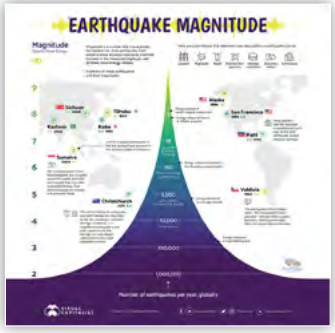

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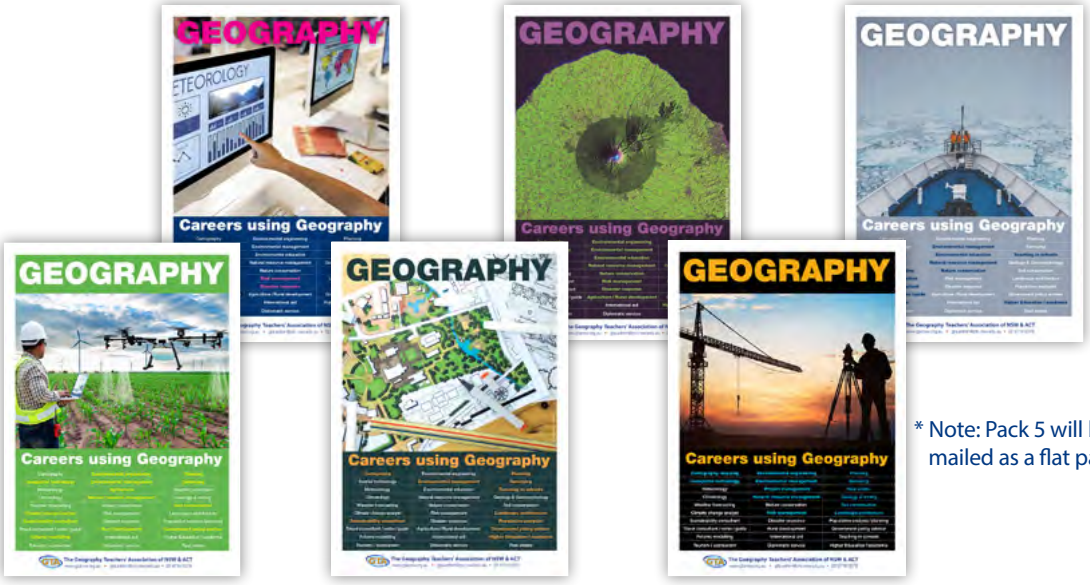

* Note: Pack 5 will be mailed as a flat pack

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

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

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

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

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

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

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

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

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

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

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

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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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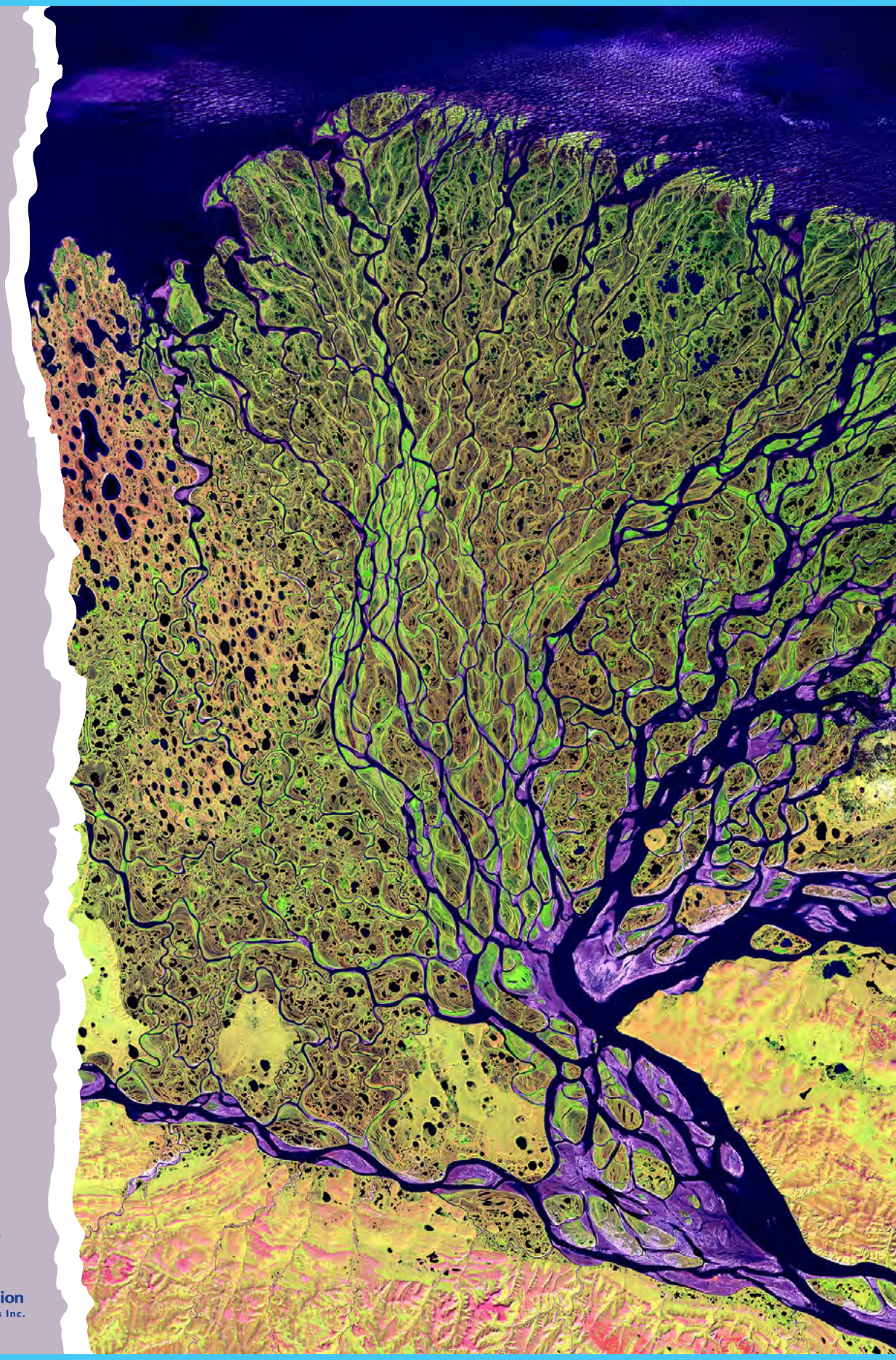

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