GEOGRAPHY BULLETIN

RESOURCES and ACTIVITIES … for Stage 6

The Geography Teachers Association of New South Wales Inc.

Volume 52 No 3 2020

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PROJECTS • REPORTS • RESOURCES • ARTICLES • REVIEWS

GEOGRAPHY BULLETIN

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

GEOGRAPHY BULLETIN

Volume 52, No3 2020
EDITOR: Lorraine Chaffer

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EDITORIAL

Lorraine Chaffer, Editor

EDITORIAL

Welcome to the third edition of the Geography Bulletin for 2020. This edition is dedicated to Stage 6, although many of the materials would be useful in stages 4 and 5 geography classes.

Thank you to the teachers who contributed to another bumper issue and for your willingness to share teaching strategies, ideas and resources with colleagues.

An **Edition 3 Supplement** contains full sized templates and activities that might be reproduced / printed for students. A PPT containing visual images used throughout the bulletin can be used by students to complete activities and skills or by teachers.

Articles have been organised into groupings:

In the classroom

This is an interesting collection of articles that relate to classroom practice and pedagogy.

- In **Building confidence and success in Stage 6** Khya Brooks explains her approach to building a culture of student responsibility.
- **Revision strategies and activities** by Alex Pentz contains a collection of proven 'retrieval' practices for exam preparation..
- In **Formative Assessment** Grace Larobina explains an approach used at Hills Grammar based on peer assessment and feedback.
- Lorraine Chaffer's **Revision using HSC Exam questions** provides a template requiring students to assess the level of difficulty of selected past HSC questions before making a selection of questions for practice.
- In **Building literacy capabilities** David Proctor provides strategies and scaffolds to improve student writing in the HSC exam.
- Jaye Dunn shares **HSC essay scaffolds: Topic sentences**, a strategy she developed to assist students struggling to 'get started' when required to write HSC responses.
- **Half a crossword** by Katerina Stojanovski is a clever and different way to revise topic terminology and conceptual knowledge.
- David Proctor has shared two **HSC revision crosswords** that can be adapted to match the case studies taught in a school.

Year 11: Biophysical Interactions

- In **Exploring the Cryosphere** Lorraine Chaffer reflects on the dilemma created by overlapping content created by the new 7–10 Geography Syllabus and the older Stage 6 syllabus. 'An approach that uses a study of the cryosphere to draw out student knowledge of biophysical interactions is outlined.'
- **Understanding Sea Levels: Ask NASA Science Blog** is for teacher enrichment and could be used to differentiate the curriculum for the most capable students.
- **Teaching for Deep Understanding*: 'How I teach – Global Atmospheric Circulation Model'*** is a blog entry from Team Geography that illustrates how lessons can be structured to reinforce key concepts.

Year 12: Ecosystems at Risk

These two articles develop understanding about coral reef resilience and coral bleaching.

- **Great Barrier Reef – Resilience and change** by Lorraine Chaffer
- **Great Barrier Reef – ABC Catalyst activity** by Justin Mahoney

Year 12: People and economic activity

Covid-19 has impacted most economic activities and enterprises.

- In **Economic activities and COVID-19** Lorraine Chaffer uses stimulus material to focus student thinking on the impact of the pandemic on the activity and enterprise they studied.
- In **Global Tourism update** Grant Kleeman examines the status of the tourism industry in 2020, including the impact of Covid-19.

Year 12: Urban Places

- Matt Carroll has provided a detailed, structured approach to teaching Megacities in **Busting the bands in Urban Places**.
- **COVID-19 and the future of cities:** An article from *Economics Observatory* and comments by the Editor
- **Teaching in and listening to the COVID-19 City:** Exploring lived experience in pandemic times by Susan Caldis
- Observatory Hill Environmental Education Centre outlines the **Virtual fieldwork** webinars developed to replace real fieldwork that many schools are unable to attend.

Stage 6 Skills contains a selection of stimulus material collated by Lorraine Chaffer and associated skills activities. The activities can be found in the Edition 3 Supplement and images in the PPT.

In the skills section there are infographics for tourism, The Great Barrier Reef, Dharavi slum and the cryosphere as well as photographs and news reports.

UPCOMING PUBLICATIONS AND EVENTS

- TERM 3: Special Edition Geography Bulletin – Stage 6 Case studies
- TERM 4: Geography Bulletin 4
- TERM 4: Professional learning digital package: Plan for 2021 (Coming soon)
- 2021 SAVE THE DATE: Annual Conference 6 and 7 May. Venue TBC
- 2021 SAVE THE DATE: Australian Geography Teachers Association Conference in Hobart 29 September – 1 October.
- New Open Learning Courses for flexible Professional Learning

Lorraine Chaffer

Editor

Vice President GTA NSW and ACT

EDITORIAL


GTA
GTA NSW & ACT Annual Conference 2021
THE GEOGRAPHY LEARNING JOURNEY: Shaping futures
SAVE THE DATE:
Thurs 6 & Fri 7 May 2021
Venue to be advised


PLAN for 2021
Digital Professional Learning Package
Coming in Term 4


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PRESIDENT'S REPORT

Welcome everyone to the never-ending story of change and pivot in our practice. This year is certainly presenting challenges alongside key moments of contemplation and learning about the way in which we choose and enact our pedagogies; and in how we also illuminate the relevance of geographical understanding in our classrooms.

Although for accreditation purposes we work towards demonstrating the Professional Standards for Teachers across the domains of professional knowledge, professional practice and professional engagement, it is important to remember there is also a Geography-specific set of standards which provide support and direction for the teaching of this subject. The *Professional Standards for the Accomplished Teaching of Geography* (Hutchinson & Kriewaldt, 2010; www.geogstandards.edu.au), also referred to as the GEOGStandards, provide an important evidence-based tool for personal reflection about the key features of best-practice in Geography teaching. Two GEOGStandards emerge strongly within this edition of the Geography Bulletin:

- GEOGStandard 8: Progressing professional growth and development
- GEOGStandard 9: Learning and working collegially

It is wonderful to see so many contributions from the community of Geography educators. We often engage with each other through FaceBook groups and Twitter hashtags; the willingness of the learning community to support each other through the sharing of resources and stories of lived experience is ongoing and reciprocal. To see more formal sharing of resources and strategies in the journal not only continues to benefit others, it is also an important capture of the era in which we are working. The more formal sharing and communication of resources and strategies through the development of a journal article also demonstrates active engagement with the professional community to enhance student learning and improve teaching. As we all know, the subject of Geography is dynamic, therefore we as Geography teachers need to be prepared to have our practice and ideas evolve with the subject to show its connection to the time we live in.

In closing I would like to thank Lorraine Chaffer, the journal editor, for tirelessly encouraging members and friends of the Association to contribute an article and thereby bring the 'by-Geography teachers-for- Geography teachers' mantra to life. May you all continue to learn from and be inspired by the events, activities and ideas emerging in each other's Geography classrooms.

Wishing you all a productive journey throughout the remainder of Term 3 and I look forward to our paths continuing to cross in various forms.

Susan Caldis
President, GTA NSW & ACT
STEM Ambassador, Science & Technology Australia

GTA NSW & ACT resource sharing platforms

- **GTA NSW & ACT Website – www.gtansw.org.au**
- **GTA NSW & ACT Facebook – facebook.com/GTA.NSW**
- **GTA NSW & ACT Scoop.it – www.scoop.it/topic/nsw-senior-geography-current-syllabus**
- **GTA NSW & ACT Teachers of HSC Geography Facebook Group**
- **GTA NSW & ACT Twitter – @GTANSWACT**

JPL JOURNAL OF PROFESSIONAL LEARNING

Published in the Journal of Professional Learning – Semester 2 2019

Building Confidence and Success in Stage 6

www.cpl.asn.au/journal

Khya Brooks suggests an approach to the HSC which can reduce everyone's anxiety...

On the day my first HSC classes' results were released, I was nervous and excited. However, I did not expect the reactions that I witnessed.

Many people turned to me and said "Congratulations. You did so well", as though I had just sat the tests myself. Meanwhile, some of my colleagues were sitting with their head in their hands saying "I didn't even get one band 6. What happened?" The rest of the day was spent listening to colleagues criticise their own practice and try to justify their classes' outcomes to themselves; "Oh, I should have focused more on this area in the syllabus…" and "If only I had thought to revise this case study more thoroughly".

What I learnt that day was to internalise the HSC results as though they were my own. I learned that my classes' success somehow translated into how valuable I was as a teacher. The day was not spent celebrating, it was spent critically reflecting. Sure, this is great practice for long-term improvement, but what I have found is that it has also increased the pressure experienced by teachers. I have noticed that this pressure is the often transferred onto students, resulting in unnecessarily increased anxiety throughout the school.

I argue that this approach is reflective of a growing individualistic and negative culture within society and therefore teaching; which positions individual teachers rather than school systems or society more widely as solely responsible for student outcomes. This anxiety is reinforced by constant questions from the school executive, such as "Did you differentiate enough?", "Are you providing enough scaffolds?", "How many band 6s will you get this year?"

There is often too much pressure on many of the adults and, subsequently, many of the children at school. I thought school was supposed to be joyful!

What to do?

So, I decided to actively address this cultural shift. I wanted students to own their own learning, rather than assuming it was all my responsibility. I began to reshape my programs, assessments and my overall practice. The more confident and successful my students became with their skills, the more confident and successful I felt within my practice. Our collective anxiety melted away and school days became more positive.

I found this new approach enabled me to have a better range of measures to gauge my success as a teacher. Rather than relying on quantitative numbers at the end of the HSC, I established a clearer set of procedures that allowed me, and the students themselves, to better measure our progress.

Below are some practical strategies that have helped me in achieving this cultural shift in my classroom, with a view to empower learners and improve their confidence, and ultimately, their success. I will focus prominently on the strategies utilised with my Society and Culture classes, but they are strategies that are easily transferrable to other subjects.

Please note, I work in a partially-selective public school in South-West Sydney. This means I have a large range of students; from high to lower ability, from advantaged to disadvantaged backgrounds, and from the disengaged through to some 'over workers'. I have found that these strategies have assisted all of my students. For this reason, they should be applicable in almost any school context.

Strategies to develop a culture of student-driven learning

No summary, no marks

A strategy I have implemented is to withhold marks from students after they initially receive their assessments back. I encourage students to read through their feedback, and write a summary outlining what they need to work on, and how they intend to improve a particular skill in future assessments.

Once they do this, I provide them with their mark. This is a way to maximise student engagement with feedback. Also, students tend to keep these summaries and read over them before submitting future drafts.

Specific student-led feedback

I no longer accept copies of drafts from students seeking copious feedback. I found that quite often I would have read a draft several times before it came to marking it, and it was exhausting, time consuming and students generally still made similar mistakes in later assessments (indicating it was not as effective as I wanted it to be).

As a result, I developed a feedback matrix to use with my classes. The matrix outlines a three-step feedback system where I give specific feedback at set times and students are required to actively engage with it. The steps are outlined in Image 1 below.

Image 1 – Feedback Matrix

<table>
<tr><td rowspan="4">STEP 1</td><td colspan="2">Question 1:</td></tr>
<tr><td colspan="2">Response 1:</td></tr>
<tr><td colspan="2">Question 2:</td></tr>
<tr><td colspan="2">Response 2:</td></tr>
<tr><td>STEP 2</td><td>Teacher Feedback
STRENGTH</td><td>Teacher Feedback
LIMITATION</td></tr>
<tr><td>STEP 3</td><td colspan="2">Self-identified strategy
(What are you going to do to fix the limitation)</td></tr>
</table>

1. Using the marking criteria, student identifies two questions to specifically have answered by the teacher (eg: Have I effectively applied concepts?)
2. Teacher (only) reads through the draft. They answer the questions directly, and then write one 'strength' and one 'limitation' from the response.
3. Student applies feedback from the questions and then, using two different coloured highlighters, highlights examples of the strength and examples of the limitation in their response that was identified by the teacher. The student then identifies a strategy for how they are going to actively improve this limitation.

There can be many benefits to using the matrix. As students use the marking criteria to develop specific questions for their feedback, they self-identify areas they thought they were not as strong in. For teachers, this means no longer spending copious time fixing tiny issues. Instead, we are able to provide wider feedback that students then identify in their own work. Also, students can easily see if their 'limitation' was someone else's strength, and they can seek more help from one another.

Grouped feedback activities

Following the submission of a formal assessment task, I allocate each student a shape based on the marking criteria. Each shape is representative of a skill they should aim to actively improve. I then dedicate a lesson to improving those skills by grouping students by shape around the room, and each 'shape group' completes an activity dedicated to improving that skill. For example, I gave a student a triangle to indicate that they needed to better synthesise their research. I then had a triangle station, where all students that received the triangle worked on an activity where they 'blended' primary and secondary information together to identify conclusions. Students then practised writing these conclusions into paragraphs, to improve this skill further.

Strategies to develop specific skills

Writing

To improve student writing, I developed an acronym (shown in Image 2 below) focussed on sentence starters. Whilst there are many popular paragraph structures around, this approach focusses on the sentence level and students tend to find this more visible. Over the course, students begin using different sentence starters, eventually utilising the acronym as an editing checklist rather than a structure. It has been hugely successful across all stages and courses and has also been adopted by various other faculties and schools.

Image 2 – Writing Acronym

PBEIHT (People Believe Exercise Is Heaps Tough)

P= Point (What is your point)
B= This is because...
E= An example of this is...
I= The impact of this is...
H= However,...
T= Therefore...

Once this acronym is introduced, I often develop an activity where students read various responses and highlight the different elements using different colours. The responses are usually related to course content, so that students actively learn relevant information through the process. We then discuss which responses were better and why, and students rewrite one of the poorer examples using the structure themselves. Often, I will then have students 'highlight' one another's responses to begin to foster a peer marking culture.

I also use the highlighting activity as self-guided feedback through the course. Students learn to highlight their responses and identify whether they have used too much description, or if they need to embed more examples.

Applying concepts

In many subjects, applying concepts is integral. I scaffold this skill in a multitude of ways.

1. The concepts are colour coded in my classroom, and are all displayed on the wall.
2. Each lesson, I have students identify the various concepts that were discussed in class. Through this, students learn that a lesson can cover elements of a concept without the teacher explicitly stating it, and so they begin to look for opportunities to make these connections themselves.
3. I provide students with paragraphs from previous responses. Students identify two concepts that would enhance the paragraph, and rewrite the paragraphs with the concepts applied. They then peer mark one another's responses.
4. Randomly, I will pass each student three cards, one with a 'fundamental' concept, one with an 'additional' concept and one with a 'related' concept. Students are then given one minute to prepare, and then discuss a key point of the case study using all three concepts. It helps to revise content, and enhances students' ability to apply concepts appropriately.

Strategies to build a culture of success in the subject

One of my biggest successes has been developing a good rapport between cohorts. This has enhanced the mentorship my Year 11 students receive each year, and has also contributed to the growing profile and number of Stage 6 classes in my school.

Year 11 markers

Each year, one week before the Personal Interest Project (PIP) major work is due, I spend a day with my Year 11 students deconstructing exemplar PIPs and marking them collectively. This is a positive and voluntary experience, and the focus is about building up each other rather than putting pressure on Year 11 to produce Year 12 level work, or, of criticising older students.

Once students feel more confident in their understanding of the requirements of each section in the PIP, I then have them 'mark' draft Year 12 PIPs. This

provides an array of advantages, such as my Year 12 students are provided with additional feedback, my Year 11 students have a better understanding of the skills required of them to achieve higher results, and I use the opportunity as a checkpoint to ensure all students have finalised their PIP at least a week prior to submission day.

Q&As

Each year I ask a number of my previous Year 12 students to come and speak to my new Year 12 students. The new group develop questions they want answered and my older group provide hints, tips and pieces of advice. Often, the older students offer to assist with PIP topics or research too.

Student developed questions

Lastly, following each topic, I have students map past HSC questions to the syllabus dot points and concepts. Students then develop a question for the topic, by mixing two dot points and adding a verb or integrating a concept. Finally, students add their question to a shared document and everyone selects three questions to respond to for practise.

This empowers students to develop their own resources for revision (I also get a bank of new question ideas). Often students will then show the question designer their response, and this suggests more collegiality between the students, as the class becomes more focussed on achieving great marks for everyone rather than personal or individual success alone.

Building up each other

It is important to note that I am very explicit with my students about the skills they learn, and how each of these strategies empowers them as learners. What I have noticed after integrating the strategies listed above is that students become less reliant on me to feed them information and are much more active about their own development. This allows each of them to feel confident and ultimately enables them to succeed as a class. It also makes it easier for me to measure how well they develop essential skills. It is this development that I value most in my teaching, knowing my students have come so far, and guiding them to continue to learn and grow more confident even when they are no longer in my classroom.

Khya Brooks currently teaches in Social Sciences at Elizabeth Macarthur High School. She has conducted workshops at the Australian Geography Annual Conference, worked in collaboration with local schools to develop higher-order-programs for the Australian Geography Curriculum , conducted research and had it published on behalf of the Western Sydney University EPIC (Educational Pathways in the 21st Century) program and contributed to educational podcasts. She has also contributed to the sustained growth and success of Stage 6 classes in her school. Khya is currently refining her approach to higher-order-learning strategies, and is guiding a research cycle of inquiry within her school.

Success through personal responsibility, teamwork and feedback

Revision Strategies and Activities

Alex Pentz, GTA NSW & ACT Councillor
Assistant Head of Social Science, Roseville College

Revision is an essential part of learning, particularly at the end of the year and in preparation for final exams for Stage 6 students. When undertaking revision, students are engaging in the process of 'retrieval practice' which is the "act of trying to recall something without having it in front of you" (Gonzalez, 2017).

Research into the importance of retrieval practice shows that getting information 'in' to students heads, is equally important to getting information back 'out' of students' heads, and that the latter is an incredibly important and powerful part of the learning process. In fact, recent studies have shown that retrieval practice is the most effective strategy for cementing long-term learning (Agarwal & Bain, 2019). The following strategies can help students to revise and practice retrieval strategies in class, and also independently.

The 'Hat' Game

This is a fun game for students to revise key terms, and concepts. It works very well for topics such as Urban Dynamics, or Population Geography.

In this activity, students are split in groups of 5-6. Each student brainstorms key terms and concepts from the unit in focus and writes each term on a separate slip or paper, and places them into their group's 'hat' (you can use a container instead). The teacher can also prepare terms and concepts for students to revise instead of students generating them.

The game has three rounds in which students are required to complete different tasks with the terms they pull out of the 'hat'. In each group, students take it in turns to pull a term from the 'hat'. The other team members have to try to correctly guess the term, and get a point for each one they correctly identify. Each round goes for 2 minutes.

In the first round, students have to explain the term or concept without using any words from the actual term, similar to the game Articulate. At the end of the round, all terms are put back into the hat.

In the second round, students have to draw the key term whilst the other students guess, like Pictionary.

In the third round, students have to act out the term, similar to Charades. The team with the most points at the end of the game wins.

Revision grids

This works best in small groups in class, but students can also use revision grids for independent revision and study.

Students, or the class teacher, creates a 6x6 grid of key terms or ideas from a unit, with the numbers 1 to 6 down each row and column. Students roll two dice (or roll twice), and then using the corresponding numbers on each dice and the grid select a word. Repeat the process to select a second word. To earn a point, students then have explain how the two words are connected to each other (eg. Spinning and low-pressure system).

Urban Dynamics – Revision Grid

	1	2	3	4	5	6
1	Suburbanisation	Social character	Spatial exclusion	Change	Advantage	A large city in the developed world
2	Residential land	Exurbanisation	Location	Urban renewal	Lifestyles	Noise
3	Population	Country town/suburb	Urban decay	Poverty	Growth	Economic character
4	Ecological sustainability	Disadvantage	Commercial development	Culture of place	Urban consolidation	Colour
5	Counterurbanisation	Future trends	Wealth	Streetscape	Vitality	Ethnicity
6	Architecture	Industrial development	Decentralisation	Vitality	Urban village	Street life

Create a stimulus booklet

A unique way for students to revise the HSC or Preliminary course is to have them create a stimulus booklet. This also allows students to focus on the skills section of the Senior course as they will need to think about a range of skills which can be assessed using their booklet. Students will need to include a topographic map, as well as relevant images and text excerpts relevant to the course. As a follow on to this activity students could write a set of multiple choice and short-answer questions to accompany their own stimulus material, or could swap with another class member and write a series of questions on a classmate's stimulus booklet.

Progressive brainstorm

This is a great way to revise a variety of different topics, and also pick up on gaps in student's knowledge. Write various topics, or parts of topics on the top of butcher's paper and place these around the room.

Students each choose a different piece of butcher's paper to begin with. There should be no more than 3–4 students per topic. Students have 2–3 minutes to add ideas and knowledge to one of the pieces of butcher's paper. They then move clockwise around the room to another piece of butcher's paper. The process then repeats itself with students completing a full circuit. Students cannot add items that are already on the paper but must add new and additional information each time.

This activity can also be done with exam-style questions. Students plan a response to the question together in 5 minutes and then move around to the next plan and review another group's response.

Classroom Trial

Split the class in two. One group of students is accused of not knowing anything about a topic, and the other group are the 'prosecutors', who come up with probing questions on the given topic. The group on trial has time to revise and prepare, whilst the prosecutors create their questions. Each group member must either ask, or answer a question. At the end the teacher can cover anything that students may have missed.

Double flash cards

Many students find making flashcards with key terms and definitions a helpful way to revise and study in Geography. In addition to having students create flashcards on key concepts, students also create another set of 'activity' flashcards.

The activity flashcards feature a range of small tasks students can do to further consolidate their understanding of the items they are revising, such as:

- Draw a labelled image of the concept
- Summarise the concept in three words
- Come up with a real-world example to illustrate the concept
- Pick another card and explain the similarities/differences between them
- Create a question about this term/concept

A similar activity can be done with a set of flashcards containing directive terms, and another set with syllabus dot points. Students can practice a variety of HSC style questions using these flashcards. This could also be done online using flashcard websites such as Quizlet.

Recall and Rank

Students recall as much information about a topic in 5 minutes as they can in small groups. Each group then has to rank the information from most important to least important. Each group then compares and justifies their rankings to another group elaborating on reasons why they ordered their information in the way that they did. This works best if students write each idea on a separate post-it-note or slip of paper so they can easily be moved around.

Write an exam and marking criteria

In groups, or individually, students create an exam on the whole course, or a single unit. It is beneficial to have students also write an accompanying marking criteria. This helps them to become familiar with the requirements of each directive term, the HSC exam packs, and also what differentiates great responses from good ones. Students can view previous marking criteria to help them to create their own. Students can then swap exams, and also have a go at marking their peers' responses based on the marking criteria they created.

Generate, Sort, Connect, Elaborate

This is a Thinking Routine generated by Harvard's Project Zero that is useful for revision. This works best in small groups in class. This activity works well for covering whole units, or large parts or the topic including case studies.

Students generate as much knowledge as they can on a given topic. Students should write each idea or fact on a separate post-it-note or a slip of paper.

In groups, students then sort all of the ideas into categories that they think are appropriate for the topic.

You can encourage students to see if they can organize it according to various parts of the syllabus. Once sorted, students can stick the slips of paper down onto a larger piece of paper or surface in the categories they have created.

As a group, students then have to draw connecting lines between each group of ideas and explain how they are connected or related. They should write their elaborations on their mind map.

Finally, students elaborate on what they recall and can add further ideas and knowledge to their mind map that may have come up in the connection stage. You can also have students check their notes to see what they may have missed during this stage and add it to their visual board.

Be the teacher!

Split students into small groups and assign them each a part of a topic. Each group is responsible for helping the rest of the class revise this topic in 10 minutes. Students can create Kahoots, games, a worksheet, a short video or may choose to re-teach the class a particularly difficult part of their assigned topic. This also works well when revising skills.

Shorter Activities

The following activities work well as small activities that can be done at the start or end of a lesson.

Celebrity Heads

Play celebrity heads but with key terms or concepts from the course. Students have to ask the class yes or no questions until they can successfully guess which concept or terms they are.

The 'Um' Game

Students have to speak about a topic for one minute without pausing, hesitating or saying the word 'um'. This can be played in small groups with students adjudicating.

Colour, Symbol, Image

This is another Harvard Visible Thinking Routine, and is a great strategy to implement at the end of a lesson to recap and recall key ideas. Students have to summarise what they have learnt by choosing a colour, symbol and image that captures the key parts of the idea or topic. Students have to justify their choices. This makes for interesting discussion, and can also help the teacher to pick up on any misconceptions in student's learning.

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Retrieval practice is a learning strategy focused on getting information out.

The act of retrieval is about recalling information and strengthening our memory for that information to make forgetting less likely.

Retrieval practice is a powerful tool for improving learning.

Image: https://mrshumanities.com/2016/10/15/3725/

A Formative Assessment approach for Year 12

Grace Larobina
Head of Geography, Hills Grammar

Introduction and context: Formative Assessment at Hills Grammar

The purpose of Formative Assessment

Formative Assessment aims to inform both teachers and students.

It is about building an understanding of what students learn and how students can convey this to others.

Importantly, it is about seeing how students think, the reasoning and justification for their answers.

Formative Assessment requires students to take responsibility for their learning, to set learning goals and create a plan for their development. The aim of working collaboratively with both peers and teachers is to strengthen the culture of evaluation.

Formative Assessment defined as "interactive assessments of student progress and understanding to identify learning needs and adjust teaching appropriately."

Source: OECD International Conference – Learning in the 21st Century: Research, Innovation, and Policy.

Formative Assessment Week

Hills Grammar have a week dedicated to Year 12 Formative Assessment during the third week of the mid-semester break. The timetable runs on the timetabled lines to avoid any clashes and to enable student attendance for each of the subjects studied.

The main aims include:

- Revise course work thus far and apply the knowledge and understanding of the course
- Provide an opportunity for students to sit in an exam-style setting and practice answering unseen questions under timed conditions
- Conduct targeted Formative Assessment that informs both the student and the teacher about the next steps in preparation for both the Trial and HSC
- Provide a forum for self-evaluation and peer review

Formative Assessment is ongoing throughout the year and is not limited to this developmental assessment week.

Year 12 Geography Formative Assessment Day

The following documents guide the 2020 Formative Assessment Day for Geography during Formative Assessment Week at Hills Grammar

1. Timetable – After sitting for a 2-hour practice examination, students work individually, in pairs and groups to analyse responses and reflect on their learning
2. Formative Task 1: Multiple choice self-evaluation
3. Formative Task 2: Group decision making and individual evaluation
4. Formative Task 3: Building marking criteria – paired activity
5. Formative Task 4: Building marking criteria for and completing a graphing activity
6. Formative Task 5: Peer evaluation and feedback for an extended response

image source: Hills Grammar

Hills Grammar

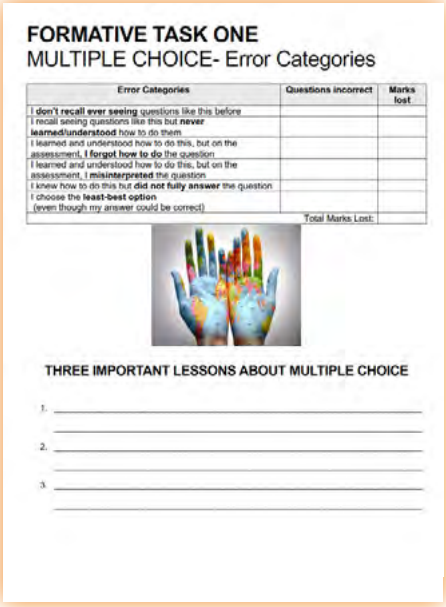
YEAR 12 GEOGRAPHY

FORMATIVE ASSESSMENT TIMETABLE

TIME	OUTLINE
10.30 – 12.30 EXAM	Complete the Formative Assessment Writing Task in quiet timed conditions [2 Hours +5 Minutes]
1.30 – 2.00 MULTIPLE CHOICE **Task 1** **Task 2**	Students work in groups of THREE to determine the correct answer Complete the Justification template
2.00 – 2.30 SHORT ANSWERS **Task 4**	Students to complete the Marking Criteria based on how they would allocate marks to the missing bands Students to read ONE script and offer to feed up to peers Use colour-code provided to highlight parts of the Rubric
2.30 – 3.15 EAR RESPONSE 40 Minutes **Task 3** **Task 5**	Students to read ONE script and offer to feed up to peers Use colour- code provided to highlight parts of the Rubric
3.15- 3.45 PEER and SELF EVALUATION 30 Minutes **Task 6**	Students will self-evaluate their writing and thinking concerning the suggested marking criteria Complete the self-evaluation
3.45 – 4.00	Discussion – Where to from here?
Over the Holiday	Submit ONE response in Week 1 Term 3 incorporating all the 'feed up' so you can "bust up the Bands"!

FORMATIVE TASKS

Full page templates can be found in the Edition 3 Supplement.



FORMATIVE TASK ONE

MULTIPLE CHOICE- Error Categories

Error Categories	Questions incorrect	Marks lost
I **don't recall ever seeing** questions like this before		
I recall seeing questions like this but **never learned/understood** how to do them		
I learned and understood how to do this, but on the assessment, I **forgot how to do** the question		
I learned and understood how to do this, but on the assessment, I **misinterpreted** the question		
I knew how to do this but **did not fully answer** the question		
I choose the **least-best option** (even though my answer could be correct)		
	Total Marks Lost:	

THREE IMPORTANT LESSONS ABOUT MULTIPLE CHOICE

1. _____
2. _____
3. _____

FORMATIVE TASK TWO

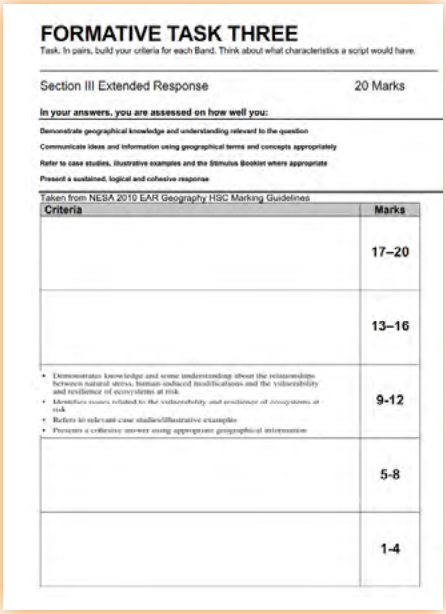
JUSTIFY YOUR CHOICE

Task: In groups, discuss your options and come to a collective decision as to the most correct answer.

Self-evaluate, did you change your original response?

	Your Answer	Collective Answer	Justification Statement	Did you change your original answer? Yes or No
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

Student self-evaluation – **TWO** pressing content areas to revise



FORMATIVE TASK THREE

Task: In pairs, build your criteria for each Band. Think about what characteristics a script would have.

Section III Extended Response 20 Marks

In your answers, you are assessed on how well you:

Demonstrate geographical knowledge and understanding relevant to the question

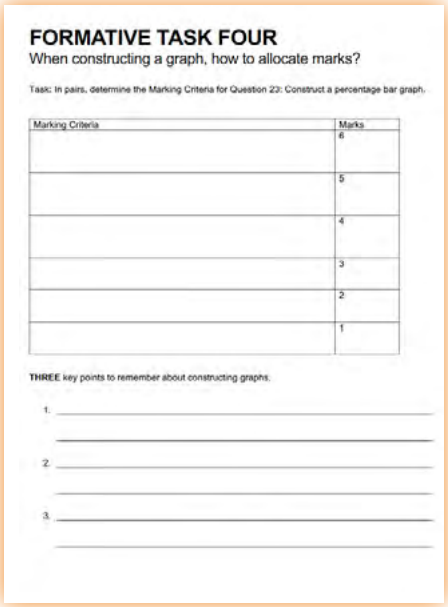
Communicate ideas and information using geographical terms and concepts appropriately

Refer to case studies, illustrative examples and the Stimulus Booklet where appropriate

Present a sustained, logical and cohesive response

Taken from NESA 2010 EAR Geography HSC Marking Guidelines

Criteria	Marks
	17–20
	13–16
• Demonstrates knowledge and some understanding about the relationships between natural stress, human-induced modifications and the vulnerability and resilience of ecosystems at risk • Identifies issues related to the vulnerability and resilience of ecosystems at risk • Refers to relevant case studies/illustrative examples • Presents a cohesive answer using appropriate geographical information	9-12
	5-8
	1-4



FORMATIVE TASK FOUR

When constructing a graph, how to allocate marks?

Task: In pairs, determine the Marking Criteria for Question 22: Construct a percentage bar graph.

Marking Criteria	Marks
	6
	5
	4
	3
	2
	1

THREE key points to remember about constructing graphs.

1. _____
2. _____
3. _____

FORMATIVE TASK FIVE

Task: Swap extended responses, annotate, colour code, and offer suggestions for improvement.

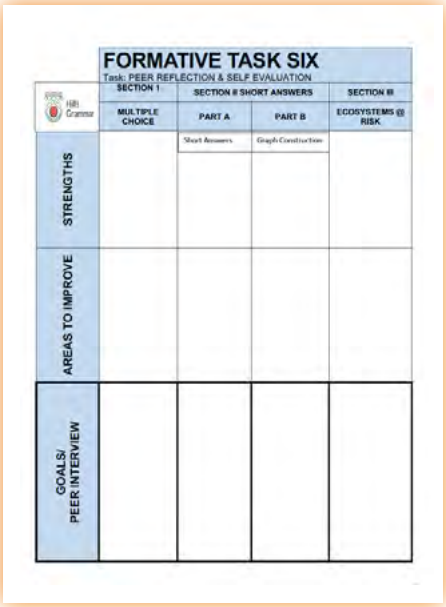
Hills Grammar **GEOGRAPHY EXTENDED RESPONSE PEER EVALUATION**

What YOU did well	Where YOU can improve
KNOWLEDGE OF THE QUESTION/ SYLLABUS AREA • Demonstrate geographical knowledge and understanding relevant to the questions • Refer to case studies, illustrative examples and the Stimulus Booklet where appropriate	**Add specific facts and statistics**
EXPRESSION OF IDEAS • Communicate ideas and information using geographical terms and concepts appropriately **BOSSY WORD**	
EXTENDED RESPONSE STRUCTURE • Present a sustained, logical and cohesive response **ANSWERING THE QUESTION** **INTRODUCTION** **CONTEXT PARAGRAPH** **BODY** **CONCLUSION**	Structure needs to improve E.g. Context paragraph after your introduction
My goals for the next assessment task [Trial HSC]	How will I reach my goals?

NOTE: Refer to individual student script for more detailed peer and self-evaluation

Teacher Interview Date _____ I intend to do further research and submit my rewritten response for teacher review on _____

Signed Teacher_____Student_____



FORMATIVE TASK SIX

Task: PEER REFLECTION & SELF EVALUATION

	SECTION I	SECTION II SHORT ANSWERS		SECTION III
Hills Grammar	MULTIPLE CHOICE	PART A	PART B	ECOSYSTEMS @ RISK
STRENGTHS		Short Answers	Graph Construction	
AREAS TO IMPROVE				
GOALS/ PEER INTERVIEW				

A flexible, any where, any time online learning opportunity through Open Learning

Geographical tools and skills are an important part of teaching Geography.

This professional development course, created by Dr. Paul Batten on behalf of the GTA NSW & ACT, introduces the maps and map skills that teachers should share with students within the NESA Geography Syllabus K–10.

Skills developed in this course include:

- applying knowledge of the content and teaching strategies of Geography to develop engaging teaching activities (NESA Standard 2.1.2),
- applying knowledge and understanding of effective teaching strategies to support students' literacy and numeracy achievement (NESA Standard 2.5.2) and,
- contributing to collegial discussions... to improve professional knowledge and practice (NESA Standard 6.3.2).

The course is designed for flexible delivery. Participants can start, progress and finish at times convenient to them. Participants collaborate in a 'pay it forward' style with other teachers, engaging with previous contributions and creating their own posts, adding to the galleries of exemplars for future participants to review.

Cost: $90 – Register at www.openlearning.com/ptc-nsw/courses/geography110/
For further information about this course contact – gta.elearning@gmail.com

PARTICIPANT FEEDBACK:

"This is an accessible and easy way to learn and improve classroom practice."

"I really enjoyed doing this course. Strong explanations of each skill were given with relevant activities provided to consolidate understanding, plus some really good resources."

"A valuable professional learning activity for those wanting to validate their mapping skills, e.g. primary teachers or those new to teaching Geography."

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

Completing the **Geography 110: Intro to Maps** on **28 November 2019 – 29 October 2020** will contribute **3 Hours** of NSW Education Standards Authority (NESA) Registered PD addressing **2.1.2; 2.5.2; 6.3.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

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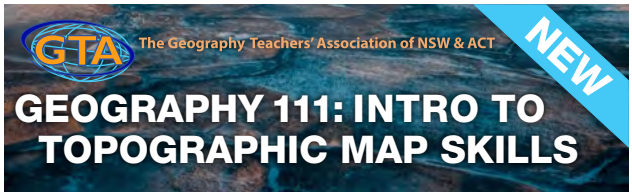

A flexible, any where, any time online learning opportunity through Open Learning

Topographic mapping is an important aspect of teaching Geography in NSW.

This professional development course, created by Dr Paul Batten and Katerina Stojanovski behalf of GTA NSW & ACT, examines the use of these tools for teaching in the NESA Geography Syllabus K–10.

The course explores skills, for example those related to elevation, aspect and gradient, using spatial technologies as appropriate.

Skills developed in this course include:

- applying knowledge of the content and teaching strategies of Geography to develop engaging teaching activities (NESA Standard 2.1.2),
- creating questions to assess student learning (NESA Standard 5.1.2) and,
- contributing to collegial discussions to improve professional knowledge and practice (NESA Standard 6.3.2).

The course is designed for flexible delivery, where participants can start, progress and finish at times convenient to them. The collaboration is in a 'pay it forward' style, where participants engage with previous contributions and contribute themselves – learning in the process, but also adding to the galleries of exemplars and case studies for future participants to review.

COST: $90 for each GTA online course, with discounts available on multiple registrations.

COURSE REGISTRATION: Available soon at
www.openlearning.com/ptc-nsw/courses/geography111

For further information about the GTA online courses contact gta.elearning@gmail.com

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

Completing the **Geography 111: Intro to Topographical Mapping** on **1 August – 31 October 2020** will contribute **3 Hours** of NSW Education Standards Authority (NESA) Registered PD addressing **2.1.2; 5.1.2; 6.3.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

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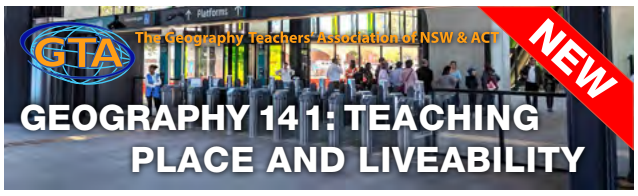

A flexible, any where, any time online learning opportunity through Open Learning

Understanding the focus of the *Place and Liveability* unit is key for effectively teaching Stage 4 Geography in NSW.

This professional development course, created by Katerina Stojanovski and Dr Paul Batten on behalf of GTA NSW & ACT, examines strong approaches to teaching about *Place and Liveability*. The course explores influences and perceptions, access to services and facilities, environmental quality, community and enhancing liveability.

The purpose of the course is to build teachers' understanding of these key ideas. By completing the learning activities participants will demonstrate their capacity to create engaging Geography lessons.

Skills developed in this course include:

- applying knowledge of the content and teaching strategies of Geography to develop engaging teaching activities (NESA Standard 2.1.2),
- selecting and/or creating and using a range of resources, including ICT, to engage students in their learning. (NESA Standard 3.4.2) and,
- contributing to collegial discussions to improve professional knowledge and practice (NESA Standard 6.3.2).

The course is designed for flexible delivery, where participants can start, progress and finish at times convenient to them. The collaboration is in a 'pay it forward' style, where participants engage with previous contributions and contribute themselves – learning in the process, but also adding to the galleries of exemplars and case studies for future participants to review.

COST: $90 for each GTA online course, with discounts available on multiple registrations.

COURSE REGISTRATION: Available soon at
www.openlearning.com/ptc-nsw/courses/geo141

For further information about the GTA online courses contact gta.elearning@gmail.com

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

Completing the **Geography 141: Teaching Place and Liveability** on **1 August – 31 October 2020** will contribute **3 Hours** of NSW Education Standards Authority (NESA) Registered PD addressing **2.1.2; 3.4.2; 6.3.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

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A flexible, any where, any time online learning opportunity through Open Learning

Understanding the focus of the *Landscapes and Landforms* unit is key for effectively teaching Stage 4 Geography in NSW.

This professional development course, created by Dr Paul Batten and Katerina Stojanovski on behalf of GTA NSW & ACT, examines strong approaches to teaching about *Landscapes and Landforms*. The course explores landscapes and landforms, value of landscapes and landforms, changing landscapes, landscape management and protection and geomorphic hazard.

The purpose of the course is to build teachers' understanding of these key ideas. By completing the learning activities participants will demonstrate their capacity to create engaging Geography lessons.

Skills developed in this course include:

- applying knowledge of the content and teaching strategies of Geography to develop engaging teaching activities (NESA Standard 2.1.2),
- using effective teaching strategies to integrate ICT into learning and teaching programs to make selected content relevant and meaningful (NESA Standard 2.6.2 and,
- contributing to collegial discussions to improve professional knowledge and practice (NESA Standard 6.3.2).

The course is designed for flexible delivery, where participants can start, progress and finish at times convenient to them. The collaboration is in a 'pay it forward' style, where participants engage with previous contributions and contribute themselves – learning in the process, but also adding to the galleries of exemplars and case studies for future participants to review.

COST: $90 for each GTA online course, with discounts available on multiple registrations.

COURSE REGISTRATION: Available from October 2020 at
www.openlearning.com/ptc-nsw/courses/geo142

For further information about the GTA online courses contact gta.elearning@gmail.com

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

Completing the **Geography 142: Teaching Landscape and Landforms** on **1 August – 31 October 2020** will contribute **3 Hours** of NSW Education Standards Authority (NESA) Registered PD addressing **2.1.2; 2.6.2; 6.3.2** from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher Accreditation in NSW.

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Exam preparation using selected HSC exam questions

Lorraine Chaffer
Vice President GTA NSW & ACT

Instructions: Here is a list of potential examination questions.

Colour code the difficulty (Diff) column to show how difficult you think each question is.

Place a X in the 'Help' column if you need advice to answer this question.

Plan responses to a variety of question types and difficulty levels. Use an extended response planning template.

Write full answers to a selection of these.

TOPIC: ECOSYSTEMS AT RISK

Easy	Medium	Difficult	Very Difficult

QUESTION	Diff	Help
Extended responses – 20 marks		
Explain the importance of ecosystem management and protection in ecosystems at risk.		
Analyse the biophysical interactions that occur in ONE ecosystem at risk.		
Explain how ONE ecosystem at risk has demonstrated both vulnerability and resilience in response to natural stress and human induced modifications		
Assess the impact of humans on the functioning of TWO ecosystems at risk.		
Discuss how management strategies could be used to address human impacts that are placing TWO ecosystems at risk.		
Evaluate traditional and contemporary management strategies of TWO ecosystems at risk in terms of ecological sustainability		
Assess the effectiveness of the strategies that have been used to manage the threats to at least ONE ecosystem at risk.		
Short answers		
Compare the effect of latitude on the nature of TWO different ecosystems at risk. (3)		
Outline how changes in weather or climate can affect an ecosystem. (2)		
Explain how biophysical factors influence where an ecosystem at risk is located (4)		
Outline why utility value is a reason to protect ecosystems. (2)		
Why is it important to manage and protect ecosystems? (6)		
How is an ecosystem you have studied both vulnerable and resilient? (4)		
How has ONE ecosystem at risk responded to natural stress? (6)		
Describe how the nature of and rate of change in ONE ecosystem at risk affect its functioning. (6)		
Outline how ONE example of human-induced stress has affected the functioning of an ecosystem. (2)		

Full page templates can be found in the Edition 3 Supplement.

TOPIC: URBAN PLACES

Easy	Medium	Difficult	Very Difficult

QUESTION	Diff	Help
Extended responses – 20 marks		
Explain how the nature and distribution of world cities affect their role in the operation global networks.		
Discuss the effects of urban dynamics on a large city in the developed world.		
Account for changes in both social structure and patterns of advantage and disadvantage in a large city from the developed world.		
Analyse responses to the challenges of living in mega cities		
Contrast the nature and character of mega cities in the developing world with world cities.		
Account for the changing nature, character and spatial distribution of mega cities		
Analyse the impact of urban dynamics on the ecological sustainability of a large city in the developed world.		
Short answers		
Using an example, outline what exurbanisation means. (2)		
Outline how ONE urban dynamic of change is operating in a country town or suburb that you have studied. (2)		
How does the changing role of regional centres affect small towns? (3)		
How has ONE urban dynamic, other than urban village, changed the character of a country town or suburb? (4)		
Outline the spatial distribution of megacities in the developing world. Include examples in your answer (3)		
How have megacities in the developing world responded to TWO of the challenges of living in megacities? (3)		
Explain the role of world cities. (6)		
Explain why world cities are important centres of economic and cultural authority. (6)		
Using examples, explain the relationship between world cities and other centres in terms of dominance and dependence. (6)		
Contrast mega cities in the developing world with world cities in terms of their nature and spatial distribution. Include examples in your answer. (6)		

TOPIC: PEOPLE AND ECONOMIC ACTIVITY

Easy	Medium	Difficult	Very Difficult

QUESTION	Diff	Help
Extended responses – 20 marks		
Explain the factors that have influenced the nature and spatial pattern of ONE economic activity.		
Explain how biophysical and technological factors affect the nature of ONE economic activity in a global context.		
Analyse the environmental and social impacts of ONE economic activity.		
Explain how an economic activity you have studied has responded to the challenges of ecological sustainability.		
Explain how locational factors have influenced the character of an economic enterprise operating at a local scale.		
Evaluate factors that have influenced the location of an economic enterprise operating at a local scale.		
Analyse how an economic enterprise operating at a local scale can be affected by global changes		
Short answers		
Explain the social impact and economic impact of an economic activity you studied (6)		
Outline how ONE biophysical factor affects the spatial pattern of an economic activity you studied (3)		
Discuss how the use of technology has affected the nature of an economic activity you studied (4)		
Account for the future direction of ONE economic activity. (3)		
Describe the nature of ONE economic enterprise. (2)		
Outline ONE internal linkage associated with ONE economic enterprise. (2)		
Outline ONE external linkage associated with ONE economic enterprise. (2)		
Describe TWO ecological dimensions associated with ONE economic enterprise. (4)		
Explain how TWO global changes in ONE economic activity affect the future direction of AN economic enterprise (6)		
Explain how an individual economic enterprise improves its ecological sustainability. (6)		

Questions referring to the stimulus booklet, fieldwork and vocational links

ECOSYSTEMS AT RISK

QUESTION	Diff	Help
2016 Refer to Sources D and F on page 2 of the Stimulus Booklet. (d) Explain how human activities may affect ONE ecosystem in South Western Namibia.		
2013 Using Source B on page 1 of the Stimulus Booklet, explain TWO reasons for the management and protection of ecosystems		
2013 With specific reference to both diagrams, explain the biophysical interactions responsible for the functioning of ecosystems.		
2001 Refer to Sources I and K. a. Identify TWO human activities that may place the Avon–Heathcote Estuary at risk. b. Identify a management strategy currently used in the Avon–Heathcote Estuary and evaluate its likely success in terms of the ecological sustainability of this ecosystem.		
2004 Refer to the illustration a. Identify ONE natural stress that could have occurred at B. b. Describe changes in the functioning of the ecosystem that are likely to occur over the 500 years following the natural stress event at B.		
2008 Refer to Source D to answer parts (a)–(b). a. How is the English estuary ecosystem both vulnerable and resilient to natural stress? b. Explain how human-induced modifications to energy flows would affect this ecosystem.		

URBAN PLACES

QUESTION	Diff	Help
2014 Contrast the TWO examples of urban dynamics of change in Source F on page 4 of the Stimulus Booklet.		
2013 With reference to Source G on page 4 of the Stimulus Booklet, account for the rapid growth of megacities in the developing world.		
2013 Using Source H on page 4 of the Stimulus Booklet, explain ONE challenge associated with the provision of services in megacities in the developing world.		
2006 Refer to Source I on page 4 of the Stimulus Booklet. c. Give TWO reasons that explain why the number of mega cities has increased between 1950 and 2000.		
2001 Refer to Sources C, D, F, H and I. From these sources, name TWO locations within Christchurch that demonstrate different urban dynamics, and account for these differences.		

PEOPLE AND ECONOMIC ACTIVITY

QUESTION	Diff	Help
2002 Using Source I on page 4 of the Stimulus Booklet. a. Describe the spatial pattern of the global production of oil in 2000.		
2005 Refer to Source D on page 2 of the Stimulus Booklet. Identify TWO economic activities evident on the map, and account for the location of ONE of these activities. 3 marks		
2007 Refer to Source E on page 3 of the Stimulus Booklet (a)–(d). 8 marks a. Identify an economic enterprise operating in Vancouver. b. State the location of this economic enterprise. c. State TWO locational factors for this economic enterprise. d. Outline possible human impacts on the biophysical environment of the economic enterprise identified in part (a).		

VOCATIONAL AND FIELDWORK QUESTIONS

QUESTION	Diff	Help
2003 Choose ONE vocation, requiring geographical understanding, that is applicable to a workplace likely to be found in the south-west quadrant of the map. Describe TWO DIFFERENT methods that could be employed in the collection of primary geographical data in such a workplace.		
2007 Refer to Source D on page 2 of the Stimulus Booklet. Name and locate an ecosystem that could be investigated using fieldwork. Formulate a geographical question to investigate the ecosystem identified.		
2014 Refer to Source E on page 4 of the Stimulus Booklet. National Park rangers plan to conduct a fieldwork investigation to study the impact of tourism on Little Rotamah Island (AR 1227). What are the possible impacts of tourism on this environment? b. What fieldwork activities could the rangers use to analyse the impact of tourism on this environment? Outline how ONE primary and ONE secondary source could be used by the rangers to provide data and information for their investigation. Recommend a traditional management strategy that may be used to protect this environment.		

Copies of HSC Stimulus booklets can be found in the Google Drive linked to the GTANSW & ACT Senior Geography Teachers Facebook Group at https://www.facebook.com/

Building literacy capabilities for Geography

David Proctor
Head Teacher HSIE, Willyama High School

Making ALARM (thanks Max Woods) friendly for Geography: MEET, IDEAL and Bubbles.

MEET and IDEAL paragraphs

Acronyms like PEEL have long been used to guide student writing, however without direct explicit instruction students may still feel overwhelmed with putting information together.

MEET ***is*** PEEL, with a stronger emphasis on making the acronym stand for directive statements that tell students what to do explicitly. By revising the use of acronyms to incorporate a clearer direction it supports students to organise their ideas prior to writing.

IDEAL is more explicitly linked to the ALARM Matrix, however, builds on the explicit nature of directing students through writing.

Don't know ALARM? Alarm, an introduction – https://www.youtube.com/watch?v=gnZ2TiBh-QY

Bubbles

When focusing on issue-based writing in Geography, students with lower literacy levels benefit from following an ALARM style guided approach moving from low to higher order writing. Using acronyms can work to guide students through this process, building responses in tables too, however, can be overwhelming.

This scaffold aims to further target the steps of the collecting information, then deal with the linking of ideas. Plus, it's fun?

HSC Minimum Standards: Writing

Students seeking to achieve their HSC must attain a tier 3 in the HSC Minimum Standards tests. Numeracy and reading provide students with feedback, however writing which is marked in a similar way to NAPLAN writing tests, does not provide students with any feedback in order to seek improvement. The scaffold here is an adaptation of the criteria students will be tested upon in the Writing section for the Minimum Standards and can potentially be used as a peer marking activity amongst students.

It should be noted that students are asked to write creatively, however, stimulus material such as a photograph of an ecosystem, urban landscape or development issue as a part of a summative task nearing the end of the topic where students can be asked to write creatively but not limited to using content knowledge as well. Often students who do not feel confident to write academically can express their understanding of content through more informal discussions or writing styles.

Examples might be:

- **Stage 5 – Human Wellbeing**
  - Compose a piece of writing about the importance of human wellbeing.
  - Suggested stimulus: photograph of a homeless person (face hidden)
- **Stage 6 – Ecosystems at Risk**
  - How would you convince someone they should save this environment?
  - Suggested stimulus: photograph of a landscape
- **Stage 6 – Urban Places**
  - Pick a location you can see in the photograph of the city where you would want to live
  - Why would you want to live there?
  - Suggested stimulus: cityscape / photo of slums vs formal housing

Writing with structure within a paragraph (MEET)

Make your main idea clear upfront

What idea do you want to you want the reader to know?

Try to use key words from the question.
If needed, use a descriptive or evaluative term.

Expand on your main idea with examples and evidence

Give a word description and some *evidence (data or examples)*

E.g. The Amazon rainforest has tall trees *reaching up to 100m*.

Sentence starters:

For example
This is shown by
Evidence for this is

Explain what effects there are likely to be

Explain by showing the effect/s your evidence has. Use *linking phrases*

E.g. Cutting down tall trees *leads to* habitat loss and species extinction.

Sentence starters:

This means
Because of this
As a result

Tie back your main idea

Summarise the main point again using key words and a *firm tone*.

E.g. *It is clear* that the loss of tall trees in the Amazon has negative consequences for the environment.

Sentence starters:

It is clear that
It can be concluded
We can therefore see

Writing with structure within a paragraph (IDEAL)

Each paragraph has a standard format which surrounds the main idea you are presenting:

- **I**dentify and define your idea/argument upfront
  - ✓ Each paragraph should have one core idea related to the question.
  - ✓ This first topic sentence may also include an evaluation or show your direction of an argument.
- **D**escribe your point in general detail – characteristics and features
  - ✓ Provide a description which shows you understand the theory behind the idea
- **E**xplain your point with examples – names and numbers if appropriate
  - ✓ Use examples to show you can apply the idea to real world case studies
- **A**pply the key verb and key terms
  - ✓ Ensure that you have connected your idea to the key words in the question (e.g. sustainability) and write in a structure that meets the verb (see table below)

EXPLAIN	ANALYSE	EVALUATE	JUSTIFY
Show the initial effects of your idea	What are the ongoing effects of what will or could occur next (at least 2 in a chain) OR The relationships with other ideas	Make a judgement about your point/ example or its effects	Give reasons AND evidence to prove your point
THINK: What happens as a direct result? Have you used a linking phrase/term?	**THINK:** What will happen in the future based on my idea? Are these effects positive or negative?	**THINK:** Were they positive or negative/successful not successful? Did they improve, work towards or uphold your key idea?	**THINK:** What evidence supports your idea? Is my argument responding to the question asked?

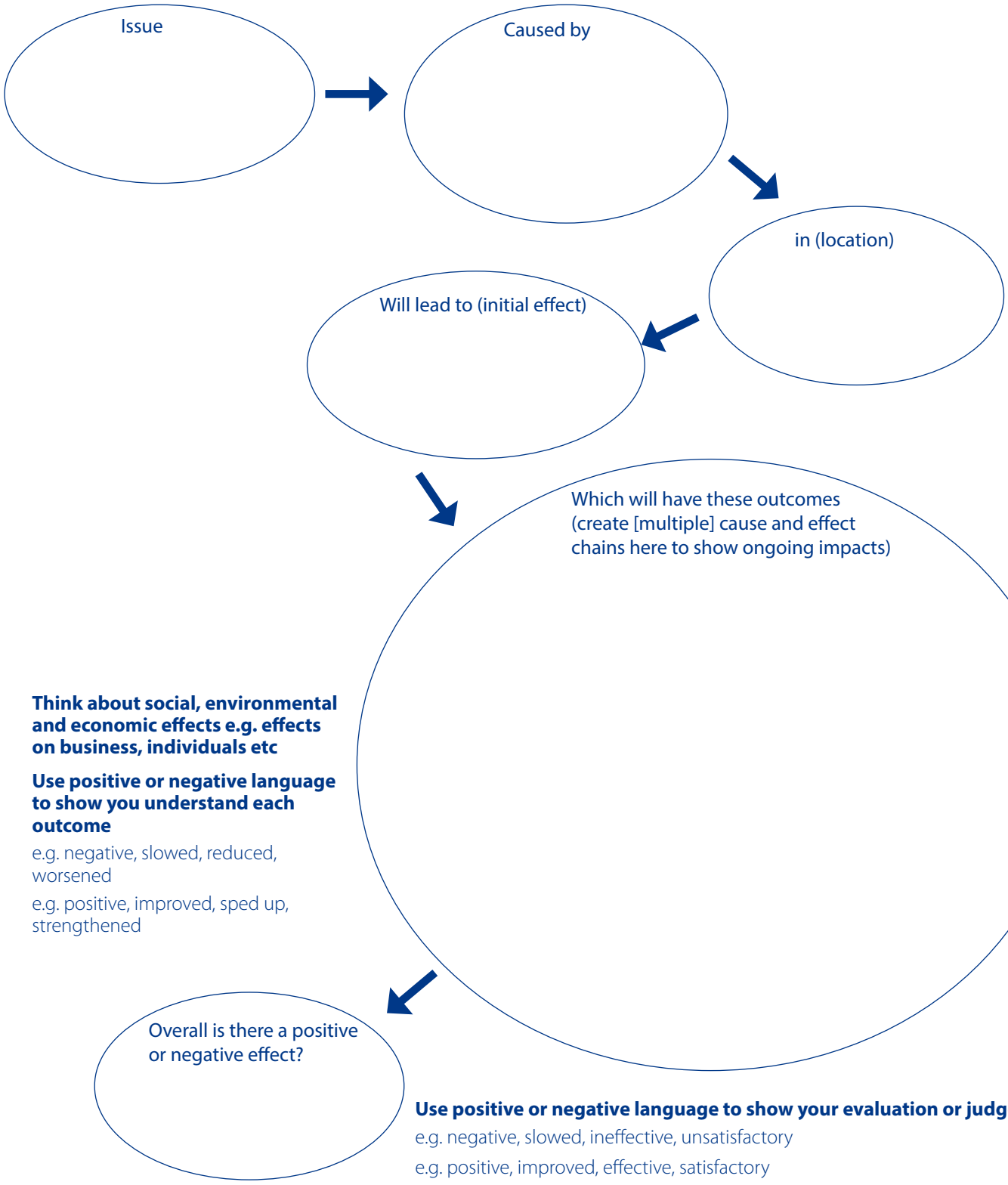
- **L**ink back to the question and conclude this idea/argument
  - ✓ Use words from the question to show how you have answered it directly from by referring to this idea in this paragraph.
  - ✓ You may wish to start your concluding sentence with a high modality starter e.g. "As has been demonstrated…" or "It can therefore be concluded…"

Bubble Response Building

Fill in the bubble to help build a response to the question below. When you have mapped out some individual ideas you will stitch them together in proper sentences.

For each of the arrows you could use a linking phrase to join ideas together and show how they are related. Examples are: caused, has the consequence, led to, resulted in, had the impact of, as a result etc.

QUESTION:



Think about social, environmental and economic effects e.g. effects on business, individuals etc

Use positive or negative language to show you understand each outcome

e.g. negative, slowed, reduced, worsened

e.g. positive, improved, sped up, strengthened

Use positive or negative language to show your evaluation or judgement

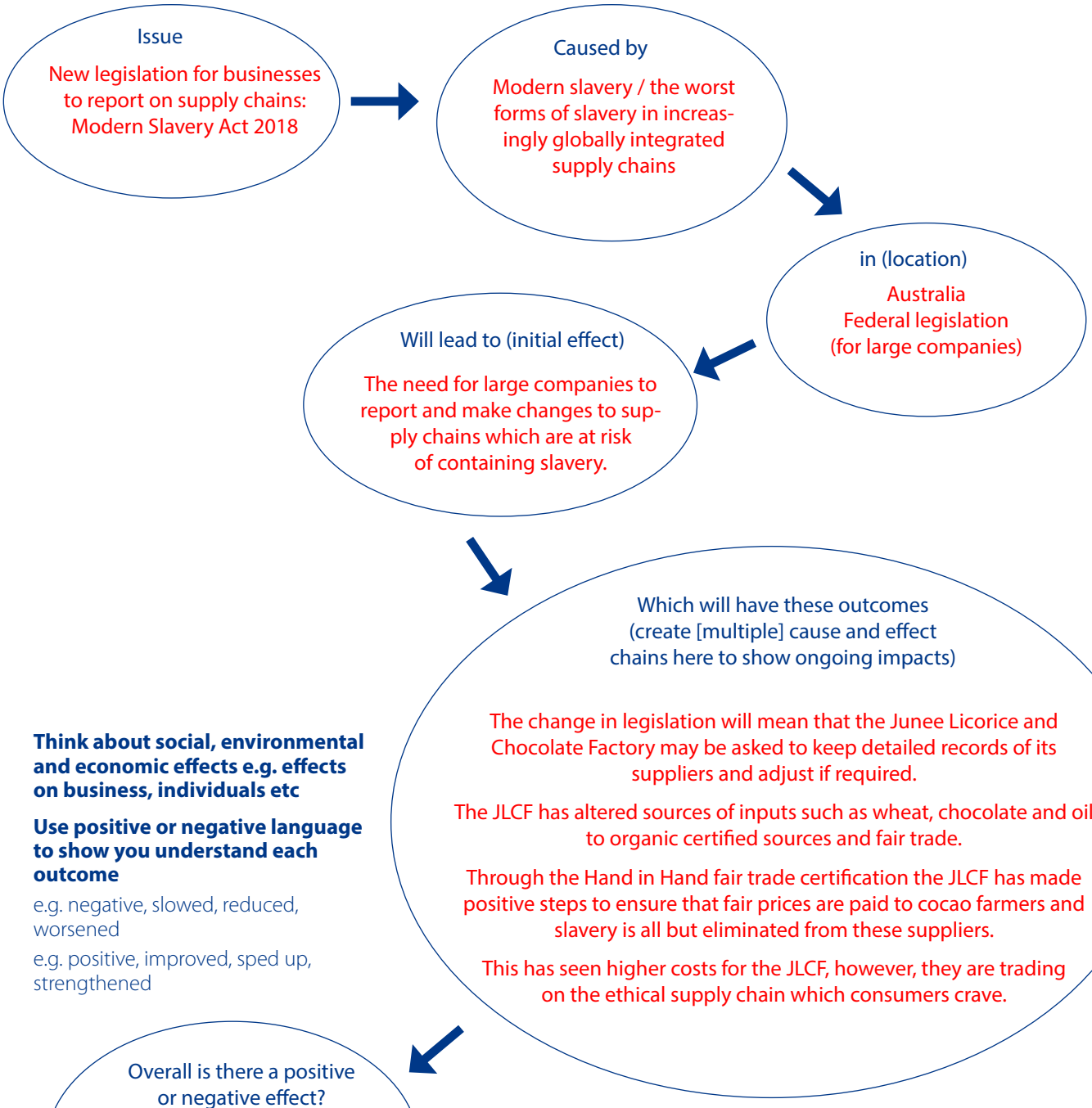
e.g. negative, slowed, ineffective, unsatisfactory

e.g. positive, improved, effective, satisfactory

Bubble Response Building

WORKED EXAMPLE

QUESTION: Evaluate ONE external linkage on an economic enterprise you have studied.



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e.g. negative, slowed, ineffective, unsatisfactory

e.g. positive, improved, effective, satisfactory

HSC Minimum Standards Writing Assessment criteria

What are you looking for?	Examples of what to look for	How well would you score this response? 1 = not so good 5 = very well done				
A clear message and theme in the response	• Does the response match up with the topic?	1	2	3	4	5
	• Is the message in the response clear?	1	2	3	4	5
	• Does the response have a few different ideas (more than one or two)?	1	2	3	4	5
A logical structure and good use of paragraphs	• Are paragraphs are used for new ideas?	1	2	3	4	5
	• Do the ideas appear to be written in the right order?	1	2	3	4	5
	• Has there been editing of the writing to fix issues?	1	2	3	4	5
A range of terms are used to show a wide vocabulary	• Are words used that connect to the topic/theme?	1	2	3	4	5
	• Are a wide range of terms used? / Is repetition avoided?	1	2	3	4	5
	• Are language devices used to help the reader engage in the response? Examples of language devices: *Alliteration, rhyme, allegory, metaphor/simile, onomatopoeia.*	1	2	3	4	5
A sound understanding of grammar	• Are there many grammatical errors? / Do most sentences read well or sound like they make sense?	1	2	3	4	5
	• Is the same tense used throughout the response?	1	2	3	4	5
	• Are pronouns used instead of names when appropriate?	1	2	3	4	5
Varying sentence types are used to engage the reader	• Are simple (short to the point) and more complex sentences used throughout? Example of a simple sentence: *Burning coal pollutes the atmosphere.* Example of a more complex sentence: *Burning coal, which releases toxic gasses such as CO_2, pollutes the atmosphere.*	1	2	3	4	5
Correct punctuation	• Are basic rules of punctuation followed? Examples of punctuation: *Commas, full stops, brackets, exclamation points, semicolon, question mark.*	1	2	3	4	5
Correct spelling	• Are common words spelled correctly?	1	2	3	4	5
	• Are more complex or less common words spelled correctly?	1	2	3	4	5
	• Do spelling errors look like they are easy ones to make?	1	2	3	4	5

HSC essay scaffolds: Topic sentences

Jaye Dunn
Epping Boys High School

The following essay scaffolds were developed to assist students struggling to compose topic sentences to begin their writing.

URBAN PLACES

Possible Extended Response Questions

- Discuss the effects of urban dynamics on a large city in the developed world.
- Contrast mega cities in the developing world with world cities in terms of their nature and spatial distribution. Include examples in your answer.
- Account for changes in both social structure and patterns of advantage and disadvantage in a large city from the developed world.
- Contrast the nature and character of mega cities in the developing world with world cities.
- Account for the changing nature, character and spatial distribution of mega cities
- Analyse the impact of urban dynamics on the ecological sustainability of a large city in the developed world.

Urban Dynamics

Syllabus content

- the urban dynamics of change: suburbanisation, exurbanisation, counterurbanisation, decentralisation, consolidation, urban decay, urban renewal, urban village, spatial exclusion
- a case study of the results of the urban dynamics in a large city selected from the developed world including its:
  - social structure and spatial patterns of advantage and disadvantage, wealth and poverty, ethnicity
  - changing economic character, nature and location of residential land, commercial and industrial development
  - culture of place as expressed in the architecture, streetscape, heritage architecture, noise, colour, street life, energy, vitality and lifestyles
  - growth, development, future trends and ecological sustainability
- a case study showing one of the urban dynamics listed above, operating in a country town or suburb.

Introduction

Urban dynamics are changing the structure and morphology of urban places, particularly large cities around the world. These processes include surburbanisation, exurbanisation, counterurbanisation and decentralisation, urban decay and renewal, consolidation, the creation of urban villages and spatial exclusion. Each of these processes in isolation and combined change the character and structure of cities.

HSC WRITING SCAFFOLDS

Topic Sentence examples:

- **Suburbanisation** is….
  - The impact of this process includes…
  - Specific examples of suburbanisation include…
- **Exurbanisation** is….
  - The impact of this process includes…
  - Specific examples of exurbanisation include…
- **Counter-urbanisation** is….
  This is linked to decentralisation…
  - The impact of this process includes…
  - Specific examples of counter-urbanisation include…
- **Urban decay and renewal** are….
  - The impact of these processes includes…
  - Specific examples of urban decay and renewal include…
- **Urban consolidation** is….
  - The impact of this process includes…
  - Specific examples of urban consolidation include…
- **Spatial exclusion and the creation of urban villages occur when**…
  - The impact of these processes are…
  - Examples include…

Sydney Case Study

- Sydney is a large city in the developed world. Its main **characteristics** and features include….
- Change has occurred in Sydney in the last century due to the following **urban dynamics**…
- The **changing economic character** of Sydney is demonstrated in…
- **Industrial and residential land use** is shown by…. Change in this area includes… and it is due to…
- The **social structure** of Sydney has also changed over time and there is now less of an equal society and more of an economic divide. This is because… and the impact of this is **spatial patterns of advantage and disadvantage** as seen in…
- The varying **cultural geography** of Sydney can be seen through patterns of ethnicity, religion and identity, leading to the creation of a **culture of place** in different locations. Examples include… and the impact of this is…
- The **future growth of Sydney** is guaranteed due to increasing population. A focus on **sustainable development** is essential moving forward.
- The main **issues facing Sydney are a linked to growth in population**. Issues stemming from this include…. And specific examples are…
- The incorporation of **sustainable resource use** is also important. Ways to do this include… specific examples are…
- Conclusion.

World Cities

- the nature, character and spatial distribution of world cities
- the role of world cities as powerful centres of economic and cultural authority
- the operation of global networks
- the relationships of dominance and dependence between world cities and other urban centres and the changing role of regional centres and the demise of the small town.

- A **world city** is defined as… there is an increase in world cities due to…
- World cities are **characterised** by…
- World cities are **dominant** urban areas, with smaller regional centres and rural areas **dependent** on them. The impact of this is… Examples include…
- The **spatial distribution** (where they are on Earth) of world cities is…
- World cities sit atop the **world hierarchy** of urban places and their main **roles** are…
- World cities are **global centres in the operation of global networks**. National metropolis and regional centres are…
- Additionally, world cities are areas of **cultural and sporting significance**. This includes… examples are…
- **Regional centres and small towns** are not only reliant on world cities, but also **declining** in importance because of them. This is caused by… the impact is... and a specific example is…
- Conclusion.

Mega Cities

- the nature, character and spatial distribution of mega cities in the developing world
- the challenges of living in mega cities such as housing, traffic infrastructure, water and power supplies, sanitation services, employment, and other social and health issues
- the responses to these challenges such as self-help projects, community self-government, cooperation from NGOs, urban protest and the operations of informal economies.

- A **megacity is defined** as… the characteristics shared by mega-cities include overurbanisation, labour intensive employment, centres of government in nations and areas of great inequality.…
  The **spatial distribution** of mega cities is…
- Living in mega cities presents a number of **challenges**. These include access to employment, housing, poor infrastructure and low health and wellbeing standards.
- **Employment** in mega cities are characterised into the formal and **informal economies**. The impact of this is… specific examples include…
- There is **inadequate access to housing** in mega cities. The reasons for this include… specific examples are…
- **Infrastructure** often does not meet the needs of the large population in mega cities. This leads to issues with water and sewage, energy, waste disposal, traffic congestion and lack of transport. The specific impacts of this are… examples include…
- **Growing overpopulation issues** has led to increased **poverty and low standards of health** and wellbeing. The impact of this is… and examples include…
- Appropriate and **effective responses to these problems** are crucial for the increasing number of people living in mega cities. The focus must be strengthening local government to be more effective, implement ways to decrease poverty and support communities and ways to make mega cities more sustainable.
- **More specifically, strategies for improvement include**… self-help projects, community self-government, cooperation from NGOs, urban protest and the operations of informal economies.
- **Self-help projects** are… examples include…
- Communities also have the option to **self-govern**. This means… examples include…
- **Non-government organisations** are… examples…
- **Urban protests** are also seen to be important because… examples include…
- **The operation of the informal economy** is essential to reducing issues in mega cities because… examples include…
- Conclusion

Source: https://upload.wikimedia.org/wikipedia/commons/4/49/Mumbai_Night_City_%28182197843 90%29.jpg

ECOSYSTEMS AT RISK

Possible Extended Response Questions

- Explain the importance of ecosystem management and protection in ecosystems at risk.
- Assess the effectiveness of the strategies that have been used to manage the threats to at least ONE ecosystem at risk.
- Explain how ONE ecosystem at risk has demonstrated both vulnerability and resilience in response to natural stress and human induced modifications
- Analyse the biophysical interactions that occur in ONE ecosystem at risk.
- Discuss how management strategies could be used to address human impacts that are placing TWO ecosystems at risk.
- Evaluate traditional and contemporary management strategies of TWO ecosystems at risk in terms of ecological sustainability
- Assess the impact of humans on the functioning of TWO ecosystems at risk.

Syllabus content

Ecosystems and their management

- biophysical interactions which lead to diverse ecosystems and their functioning
- vulnerability and resilience of ecosystems
  - impacts due to natural stress
  - impacts due to human induced modifications to energy flows, nutrient cycling, and relationships between biophysical components
- the importance of ecosystem management and protection
  - maintenance of genetic diversity
  - utility values
  - intrinsic values
  - heritage values
  - need to allow natural change to proceed
- evaluation of traditional and contemporary management strategies.

Introduction

An **ecosystem** is defined as… the **functioning** of ecosystems are essential to the operation of the ecosphere. These key functions include…

Topic Sentence examples:

- **Operations that occur within ecosystems are essential to their functioning.** Some of these key processes include nutrient recycling and energy flows and the carbon cycle. Further details about these include…
- **Factors that affect the functioning of ecosystems** are linked to the four spheres of the biophysical environment. Each of these sphere operations and the interactions are detailed below…
  - Atmosphere…
  - Hydrosphere…
  - Lithosphere…
  - Biosphere…

HSC WRITING SCAFFOLDS

- All ecosystems aim to function in a state of **dynamic equilibrium.** This means that… however all ecosystems are both **vulnerable and resilient** to stress at a variety of levels.
- Ecosystems can suffer impacts due to **natural stress or human induced impacts**. Natural stresses include… On the other hand, human induced stresses are…
- The reasons for certain levels of **vulnerability and resilience are due to the following factors** – biodiversity, extent, linkages and location. Each of these are detailed below in relation to one/two ecosystems at risk.
- BELL – GBR
- BELL – Wetlands
- **Biodiversity** is characterised by the… ecosystem biodiversity leads to…
- The **extent** of an ecosystem affects the vulnerability and resilience due to…
- Ecosystem **linkages** impact…
- The **location** of an ecosystem affects…
- The **management of ecosystems** is important, and they must be managed and protected for several key reasons. **These include the maintenance of genetic diversity for utility, intrinsic and heritage values and the need to allow natural change to proceed.**
- The **maintenance of genetic diversity** includes… examples include…
- All ecosystems have a utility **value.** This refers to… and examples include…
- Similarly, ecosystems have **intrinsic values**. These include… and examples are…
- Also important is the **heritage value** of ecosystems. This means… and examples include…
- Finally, the **need to allow natural change to proceed** refers to… this is essential because… examples are…
- To assist with ecosystem survival, a variety of **contemporary and traditional management** strategies can be implemented.
- A **contemporary management strategy** refers to… examples include… they are effective/ineffective due to (proof)...
- Conversely, **traditional management strategies** refer to… examples include… they are effective/ ineffective due to (proof)...
- Conclusion

Case Studies should be implemented into the above scaffolds.

Sand Dune ecosystem

Syllabus content

- TWO case studies of different ecosystems at risk to illustrate their unique characteristics including:
  - spatial patterns and dimensions: location, altitude, latitude, size, shape and continuity
  - biophysical interactions including:
    - the dynamics of weather and climate
    - geomorphic and hydrologic processes such as earth movements, weathering, erosion, transport and deposition, soil formation
    - biogeographical processes: invasion, succession, modification, resilience
    - adjustments in response to natural stress
  - the nature and rate of change which affects ecosystem functioning
  - human impacts (both positive and negative)
  - traditional and contemporary management practices.

PEOPLE AND ECONOMIC ACTIVITY

Possible Extended Response Questions

- Explain how biophysical and technological factors affect the nature of ONE economic activity in a global context.
- Explain how locational factors have influenced the character of an economic enterprise operating at a local scale.
- Explain how an economic activity you have studied has responded to the challenges of ecological sustainability.
- Explain the factors that have influenced the nature and spatial pattern of ONE economic activity.
- Analyse the environmental and social impacts of ONE economic activity.
- Analyse how an economic enterprise operating at a local scale can be affected by global changes
- Evaluate factors that have influenced the location of an economic enterprise operating at a local scale.

Global Economic Activity

Syllabus content

- a description of the nature, spatial patterns and future directions of ONE economic activity in a global context.
- factors explaining the nature, spatial patterns and future directions of the selected economic activity such as
  - biophysical: climate, soils, topography, site
  - ecological: sustainability and resource use
  - economic: competitive advantage, consumer demand, mobility of labour and capital
  - sociocultural: tradition, changing lifestyles, labour participation rates
  - organisational: ownership, decision making and control
  - technological: transportation, information transmission and flows, biotechnology
  - political: quotas, tariffs, compacts, agreements
- the environmental, social and economic impacts of the economic activity such as pollution, resource depletion, labour exploitation, cultural integration, provision of infrastructure, job creation, transfer pricing.

Introduction

An **economic activity** is defined as… **Characteristics** of the global economic activity of coffee include… The **spatial distribution** of coffee growing is detailed… On a global scale, the production and consumption of coffee… There are several **key factors that determine nature, spatial patterns and future directions.** They include **biophysical, ecological, economic, sociocultural, political, organisational and technological**. These will be examined in depth in this extended response.

Topic Sentence Examples:

- **Biophysical** factors that affect an economic activity on a global scale are… specific illustrative examples include…
- The nature and spatial distribution of coffee is also affected by **ecological** factors such as…
- **Economic** factors also impact coffee as a global economic activity, for example…
- **Social and cultural** factors that impact coffee include… more specifically they…
- **Political** factors also determine the nature and spatial patterns of coffee due to…
- Additionally, **organisational** factors such as …. contribute to coffee as a global economic activity. Examples include…
- Lastly, **technology** has had a profound impact on the production and consumption of coffee. Examples include…
- Conclusion.

Local Case Study – Economic Enterprise

Syllabus content

- a geographical study of an economic enterprise operating at a local scale. The case study should explore:
  - the nature of the economic enterprise
  - locational factors
  - ecological dimensions including environmental constraints, climate, and human impacts on the environment such as pollution and ecological sustainability
  - internal and external linkages and flows of people, goods, services and ideas
  - effects of global changes in the economic activity on the enterprise.

Introduction

Coffee is one of the world's most popular beverages on a global scale. As such, its popularity on a local scale is also increasing. An economic enterprise selling coffee that operates at a local scale is…

Topic Sentence examples:

- The **nature** of … is (description, history operation times, company offers, specialty products, customer appeal, reasons for opening/operating)
- The **location** of …. Is determined by… this can be shown on the following map.
- **Environmental constraints** associated with this economic enterprise include… specific illustrative examples are…
- Similarly, there are also **impacts on the environment caused by humans**. These include… The impact of these actions are…
- This economic enterprise recognises the i**mportance of environmental sustainability** and thus implement the following procedures…
- To ensure the smooth operation of the economic enterprise, both **internal and external linkages** are essential. These include the following internal examples…. and similarly, the external examples are listed…
- The flow of **people (human capital) and goods, services and ideas** is demonstrated through…
- Finally, the changing nature of the **global economy is having impacts on the enterprise** operating at a local scale. This includes… and specific examples are…
- Conclusion.

HALF A CROSSWORD

Katerina Stojanovski, Stella Maris College

'This is a fun activity to get students speaking. They have to complete a crossword by working with a partner. They take it in turn to explain their words which their partner must guess. Obviously, they are not allowed to say the actual word.'

Half A Crossword

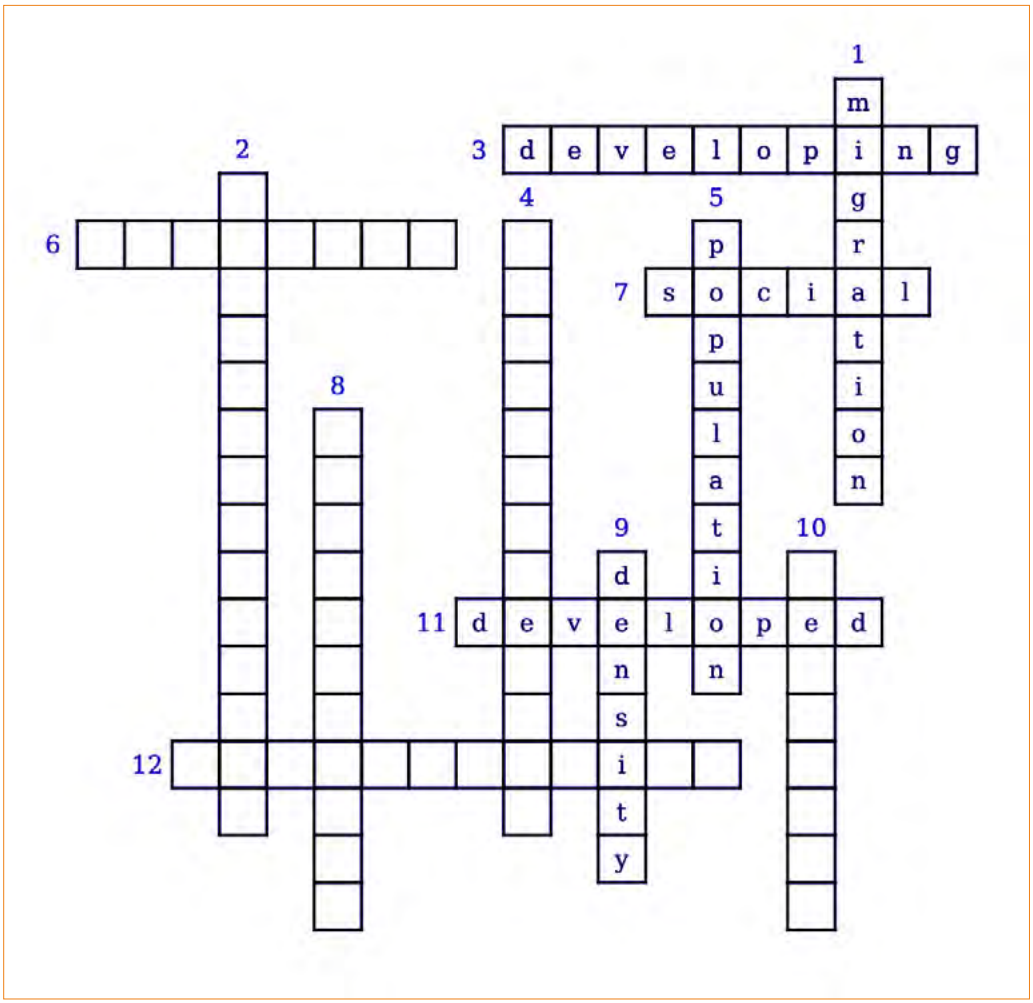
Editor: The example provided by Katerina is for Stage 5, however the tool would be very useful for Stage 6 – revising a topic, as a pre-test of conceptual knowledge or to revisit a previous lesson before moving forward.

Create your own 'Half a crossword' using key syllabus concepts from a topic and the reference link below. The full version of Katerina's Changing Places 'Half a crossword' will appear in Bulletin Edition 4.

Urbanisation – Key terms (Partner 1)

Instructions

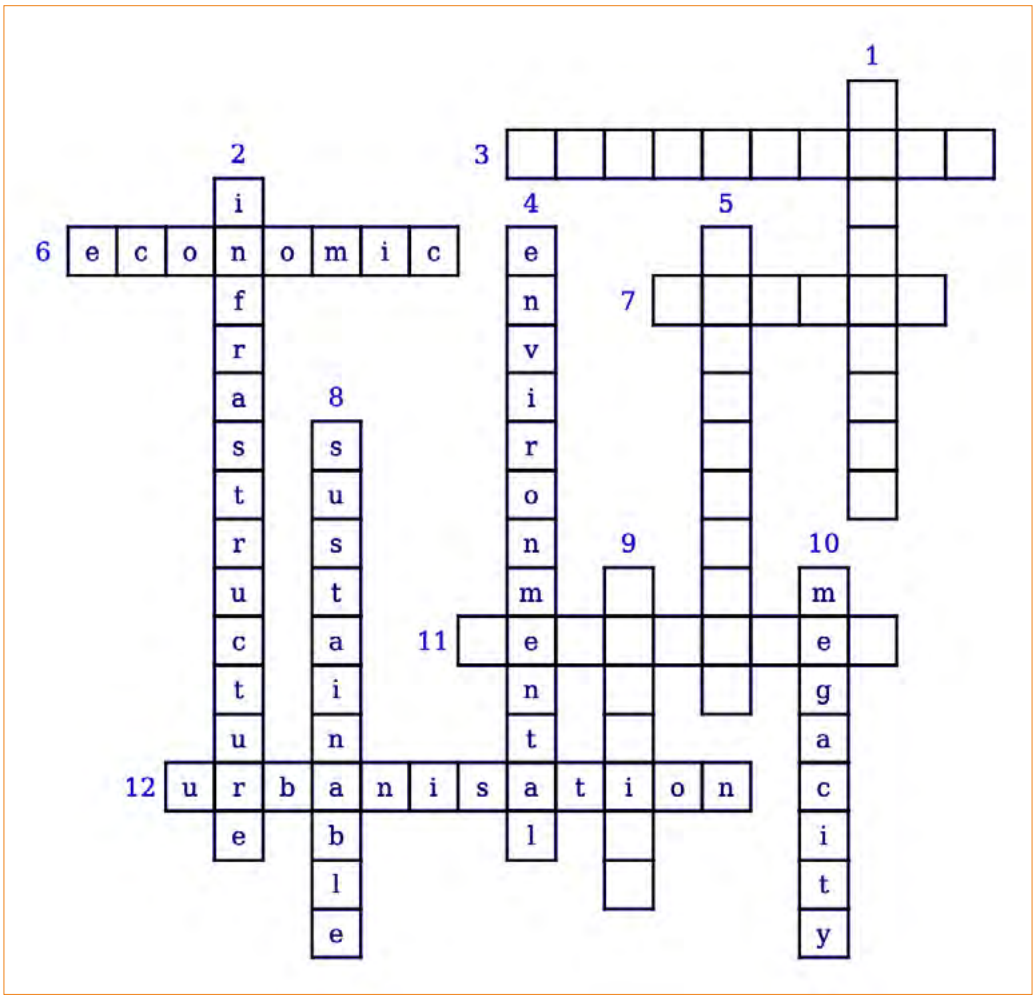
- Work with partner to complete the crossword.
- Explain the meaning of your keyword without telling your partner what the word is.



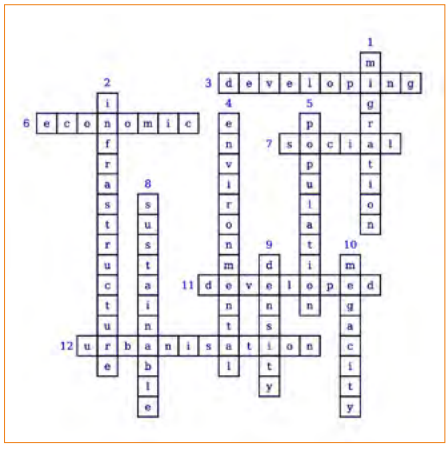
Urbanisation – Key terms (Partner 2)

Instructions

- Work with partner to complete the crossword.
- Explain the meaning of your keyword without telling your partner what the word is.



Answers



Reference

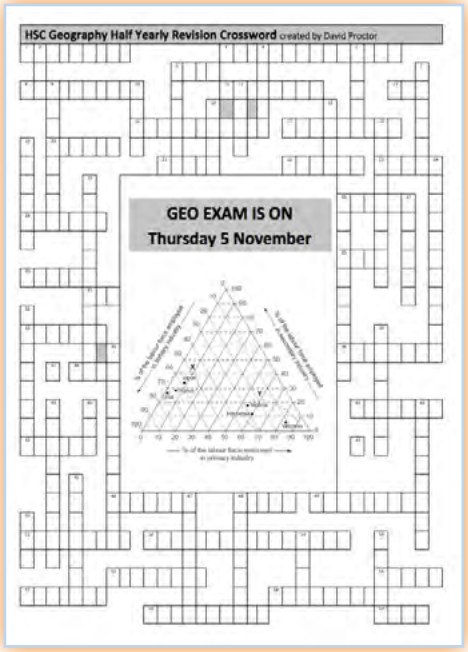
Halfacrossword.com. 2020. ***Home – Half A Crossword***. [online] Available at: https://halfacrossword.com/ [Accessed 30 July 2020].

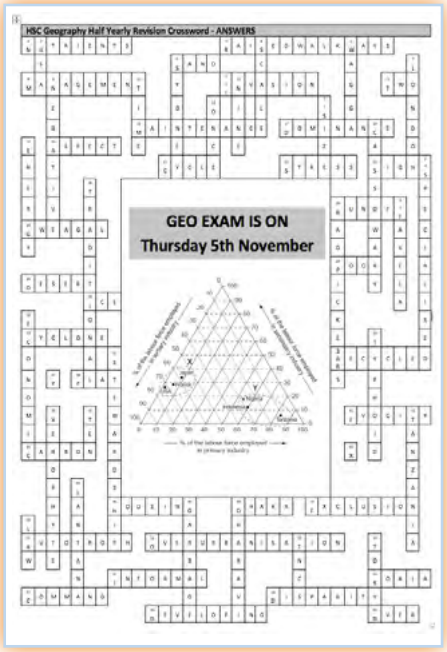
HSC REVISION CROSSWORDS

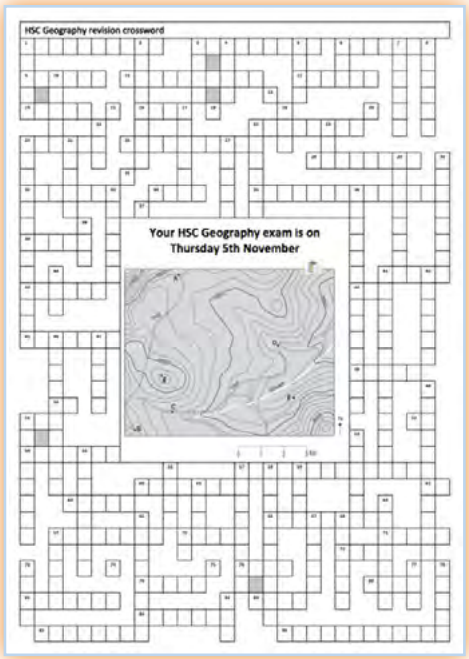
David Proctor
Head Teacher HSIE, Willyama High School

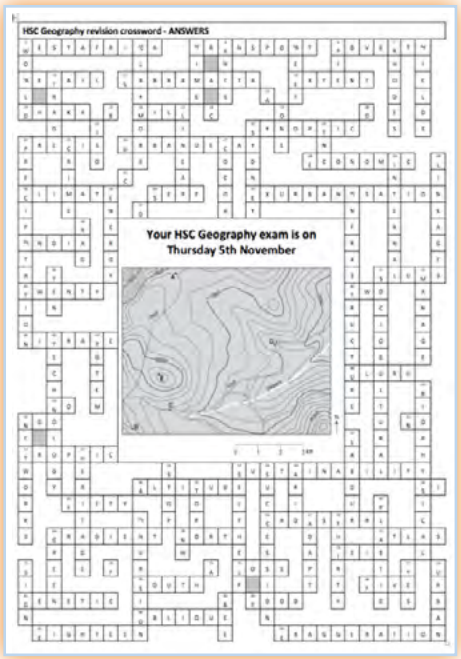
Crosswords are a valuable classroom tool during Stage 6. They can be used as a pre-test of prior learning before commencing a topic as well as revising content and skills at the completion of a topic or before important examinations. David has shared TWO crosswords and answers he uses at different times of the year. Editor

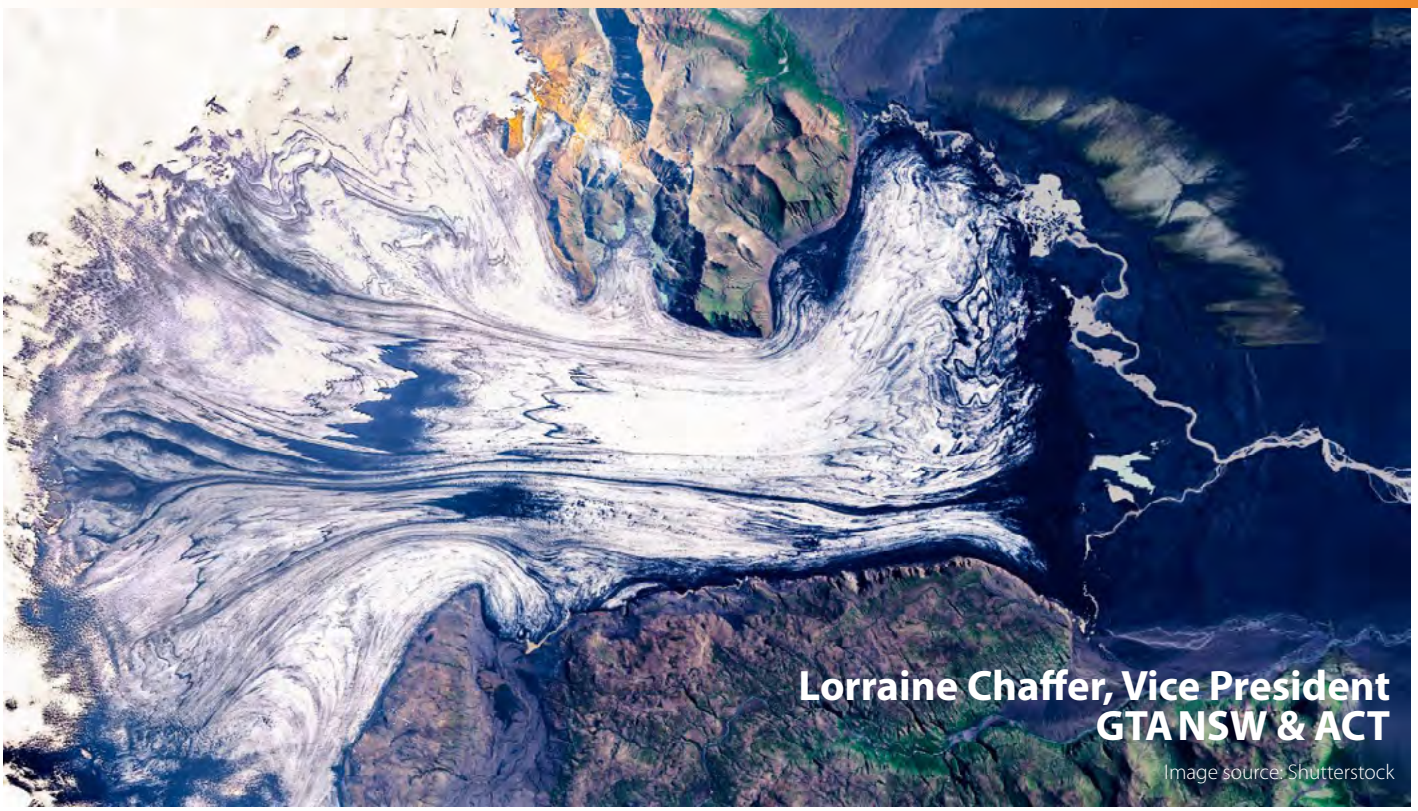
SEE BULLETIN 3 SUPPLEMENT for full versions of the crosswords and answers. Although your case studies may differ, your students should be able to complete most of the answers.











Lorraine Chaffer, Vice President
GTA NSW & ACT

Image source: Shutterstock

EXPLORING THE CRYOSPHERE

INTRODUCTION: 'When I don't know what my students know'

The topic *"Biophysical Interactions"* in Year 11, is about investigating the biophysical processes and interactions that underpin environmental functioning, and the importance of understanding these processes for sustainable management. The topic is foundational learning for Year 12, explicitly for Ecosystems at Risk but also for evaluating the ecological sustainability of economic activities and urban places.

With the implementation of the new K–10 Geography Syllabus, there is significant overlap in content, conceptual understanding, the investigation of biophysical processes and issues currently studied in Stage 6. See Figure 1. Students also study components of the biophysical environment in Science, and potentially in electives subjects such as Elective Geography 7–10, Agricultural Technology 7–10 and Marine and Aquaculture Technology 7–10.

The expectation is that students would undertake a deeper examination of biophysical processes in year 11. Due to variations in how extensively and deeply biophysical processes are investigated in Stage 5, particularly the Environmental Change and Management topic, the problem becomes determining the level prior knowledge and understanding.

A more long-time issue is teaching students you did not teach in Stages 4 and 5 and having confidence in the knowledge, understanding and skills they bring with them into Stage 6. It is important to minimise the reuse of resources and stimulus and reteaching what is known.

Often Biophysical Interactions is taught with a study of each component of the biophysical environment, followed by an investigation of the biophysical interactions in one environment and an issue within that environment. I call this the textbook approach. It is very linear and promotes reteaching or repeating prior learning and inquiry.

STAGE 4 & 5 BIOPHYSICAL TOPICS	STAGE 6 BIOPHYSICAL INTERACTIONS
Water in the World – processes in the hydrosphere and atmosphere – atmospheric /hydrologic hazard **Landforms and landscapes** – processes shaping the lithosphere – geomorphic hazard **Sustainable Biomes** – factors and processes affecting the biosphere (biomes) – biomes used to produce food, fibres and industrial products **Environmental change and management** (biophysical / human interactions in ONE environment)	**The biophysical environment** The nature and functioning of the four components: the atmosphere, hydrosphere, lithosphere and biosphere **in a specific biophysical environment**. The interactions between, and the human impacts on, the functioning of the atmosphere, hydrosphere, lithosphere and biosphere. **Biophysical processes and issue**s A case study investigating **ONE issue in ONE of the biophysical components**, to illustrate how an understanding of biophysical processes contributes to sustainable management in the environment.

Figure 1: Overlap between Stages 4, 5 and 6 topics

The challenges include:

- assessing prior knowledge and understanding to avoid reteaching content
- using resources and case studies not used in Stages 4 and 5.
- starting the year with interesting and challenging investigations to excite and engage

This requires careful programming and lesson development for Geography years 7–12.

Exploring the cryosphere

- It's interesting and topical
- There are plentiful resources, including visual stimulus
- The cryosphere can be used to assess student prior learning about the hydrosphere.
- Links between the cryosphere and the atmosphere, lithosphere and biosphere provide opportunities to assess student understanding of these components of the biophysical environment and interactions between them.
- The cryosphere is undergoing immense change and lends itself to a case study of ONE ISSUE in a component of the biophysical environment e.g. climate change, melting ice caps and retreating glaciers and future water supplies.

A topic plan

A. Create a list of essential knowledge and understanding for each component of the biophysical environment. This will be used in *Step 2* below. See figure 2

B. Design a sequence of learning using the cryosphere as an introductory case study and stimulus. See figure 3.

C. Examine links between the cryosphere, atmosphere, lithosphere, hydrosphere and biosphere.

D. Complete the sequence of learning in Figure 3 for each subsequent sphere. This could be based on other microstudies or stories e.g. *'Miracle in the storm'* for atmosphere; *'Madagascar: a biodiversity hotspot'* for Biosphere; *'Diving between earth's plates'* for Lithosphere.

E. Apply knowledge and understanding of biophysical processes and interactions to:
   - A study of ONE ENVIRONMENT
   - A study of ONE ISSUE in one biophysical component.* This issue may be one that arose in Step 3 and selected for deeper class investigation e.g. climate change, deforestation, dam building, coastal erosion

**Note:* The environment study and / or issue could also be integrated into the sequence of learning where relevant.

Essential knowledge and understanding: Hydrosphere

- Hydrological cycle – processes, volumes, storages, flows
- Global distribution of water
- Open (local) and closed (global) water cycles including the concept of a water budget.
- Factors influencing the hydrologic cycle at different scales.
- Interactions with other components of the biophysical environment
- Human interactions and impacts
- Contemporary issues

Figure 2: Sample list of knowledge and understanding considered essential at Stage 6 level.
Note: This list will be influenced by the environment selected for study in Year 11 Biophysical Interactions and Case Studies selected for Year 12 topics

Sample sequence of learning: Cryosphere / hydrosphere

Step 1: Teacher creates a focus inquiry question and student activities to determine knowledge and understanding about the cryosphere and subsequently, the hydrosphere. This could be stimulus based and differentiated. Students work in small groups to complete activities.

Step 2: As a class create a KWNR chart

- Class populates the **Know** column with known facts and concepts revealed through investigating the cryosphere.
- Students populate the **Want to know** column with their own questions linked to the case study or story.
- Teacher populates the **Need to Know** column. (tick known content)

Step 3: Students complete investigations to answer selected *'Want to know'* questions. Share findings with the class.

Step 4: Explicit teaching and inquiry learning activities to cover remaining 'Need to know' syllabus content about the cryosphere / hydrosphere.

Step 5: Revisit the KWNR Chart to complete the **Reflect** column.

Step 6: Answer the key inquiry question

Step 7: Discuss potential SGP topics that investigate the hydrosphere in the local area.

Figure 3: Sample sequence of learning

KNOW Knowledge and understanding about the cryosphere and hydrosphere	**WANT** My questions about the cryosphere	**NEED** Syllabus requirements (Teacher input) Hydrosphere	**REFLECT** What did I learn?

Figure 4: KWNL chart. What I KNOW, WANT to know, NEED to know, REFLECT. See full page template in Edition 3 Supplement

INVESTIGATING THE CRYOSPHERE

Aim

The following activities illustrate the use of steps 1 – 5 in a sequence of learning about the cryosphere and hydrosphere.

The aim is to stimulate student interest in Earths natural systems through an investigation of the cryosphere while using the activities to unlock the knowledge and understandings students already have from their studies in Stages 4 and 5.

Key inquiry question: How vital is the cryosphere to Earth's natural systems?

Contributing questions:

- *What is the cryosphere? (Features and characteristics)*
- *Where is the cryosphere? (On a world map).*
- *How does the cryosphere change over time? (Temporal change - seasonal, yearly, decadal, over millennia; Spatial change)*
- *Does the cryosphere have critically important interactions with Earth's other biophysical components?*
- *What biophysical processes are unique to the cryosphere?*
- *How have humans altered the cryosphere? What is the impact of change?*
- *Explain how the cryosphere interacts with the hydrosphere, atmosphere, lithosphere and biosphere?*

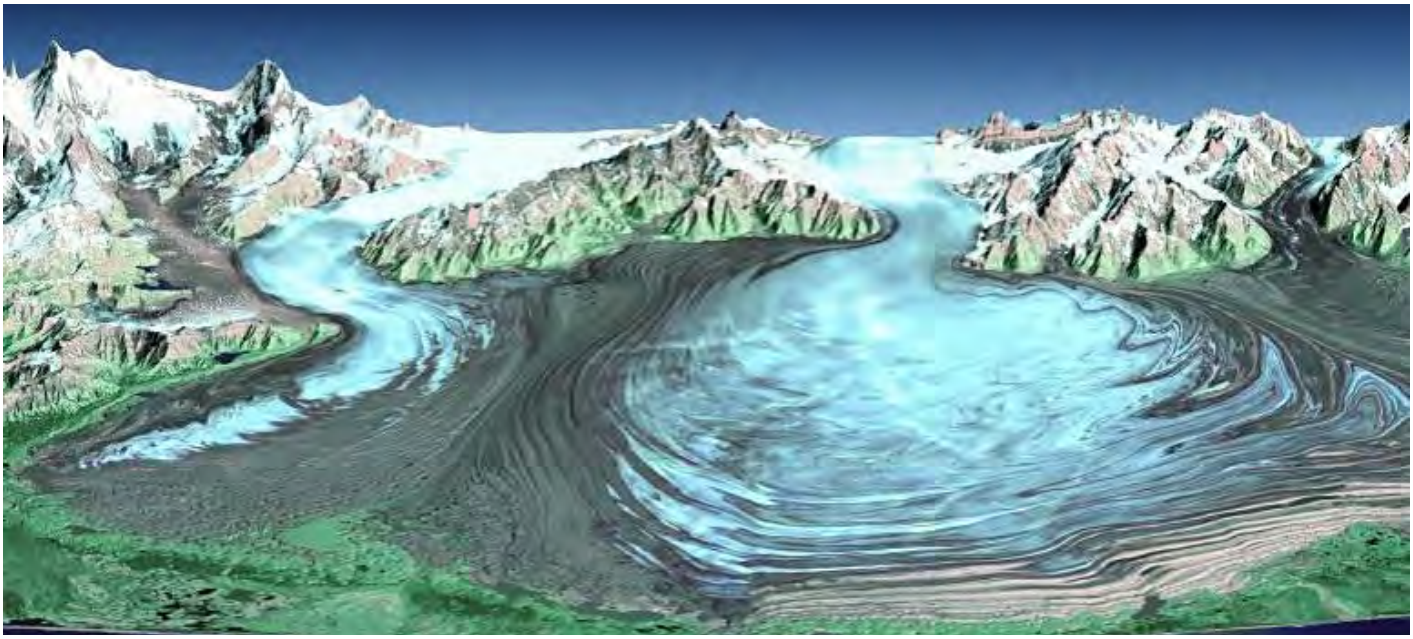
ACTIVITY 1: Features of the cryosphere (Group and class activity)

Use one or more stimulus items such as **Source A** and other visuals on the PPT.

Use a variety of geographical tools such as photographs, simulations, maps and diagrams.

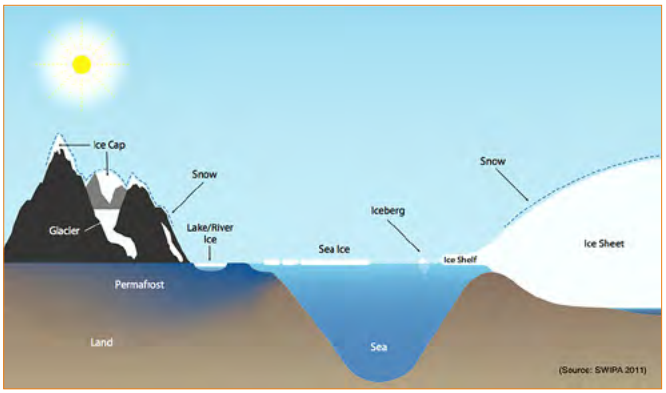
- Group brainstorming / mind mapping - What is the cryosphere? What are its features and characteristics?
- Class discussion and KWNR Chart (See Supplement):
  - Record all responses into the KNOW column.
  - Encourage students to challenge the correctness of responses
  - Use **Source B** to confirm features of the cryosphere
  - Discuss a range of biophysical processes in the cryosphere such as formation of snow, glaciation, glacier advance and retreat, permafrost, iceberg calving, sea ice formation.
- Students suggest content for the REFLECT column. They may also make notes.
- Students start a glossary of key terms and concepts.

Source A: Cryosphere time lapse



Source: Scitechdaily – https://scitechdaily.com/ice-in-motion-incredible-time-lapse-satellite-footage-captures-decades-of-change/

Source B: Features of the cryosphere



Source: https://globalcryospherewatch.org/about/cryosphere.html

ACTIVITY 2: Mapping spatial patterns / peer assessment (Group Activity)

- Students map where they believe features of the cryosphere would be located on a world map. (Where is the cryosphere found?)

  On Map 1: Create a colour key and shade where you would expect to find each feature:
  - Ice cap
  - Ice shelf
  - Sea ice
  - Glacier
  - Permafrost

  On Map 2: Select a colour to represent snow. Shade the areas on the map that would generally receive snow during a year.

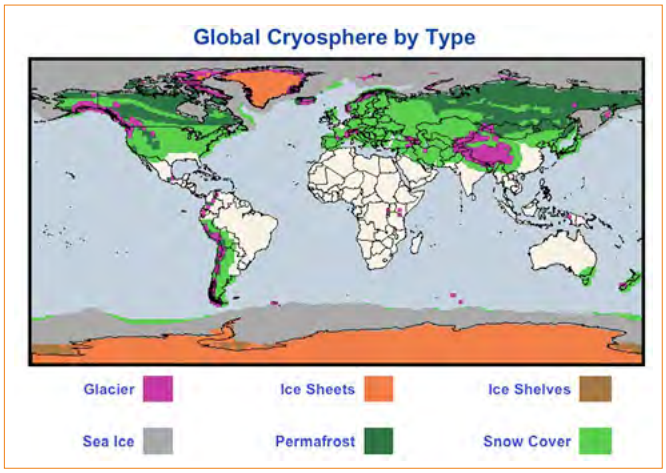
  See Supplement for world maps

- Peer assessment:
  - ONE student from each group shares maps with a nearby group for feedback.
  - The student reports back to their group who may choose to adjust the maps.
  - Each group swap maps with a different group for peer assessment.
  - Use **Source C** as the criteria for assessment. Display using the PPT

Allocate 1 mark for each correctly located feature to a maximum of 20 marks.

- Class discussion of the spatial patterns shown in Source C. Identify locations such as poles, equator, continents, mountain ranges, oceans, hemispheres
- Students write a paragraph describing the global distribution of the cryosphere.
- Students add information to the REFLECT column. They may also make notes.

Source C: Spatial distribution of the cryosphere

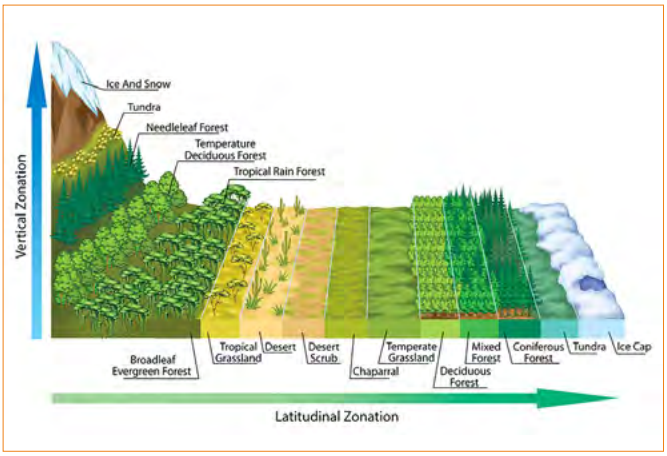


Source: https://globalcryospherewatch.org/about/cryosphere.html

ACTIVITY 3: Factors explaining cryosphere distribution

- Discussion: What factors explain the distribution of the cryosphere.
  - Use **Source D** to assist students struggling to get started.
  - Add correct responses to the Know column of the KWNR Chart
  - Some explicit teaching or directed questioning may be needed here to link prior learning
- Remind students that they studied the hydrosphere in Stage 4 Water in the World and biosphere in Stage 5 Sustainable Biomes. Make use of Geography Bulletin 52, Edition 2 Snapshot to revisit processes linked to biomes and water.
- Students write a paragraph explaining the distribution of the cryosphere using geographical concepts e.g. climate, latitude, altitude, insolation, atmosphere

Source D: Factors explaining the location of the cryosphere



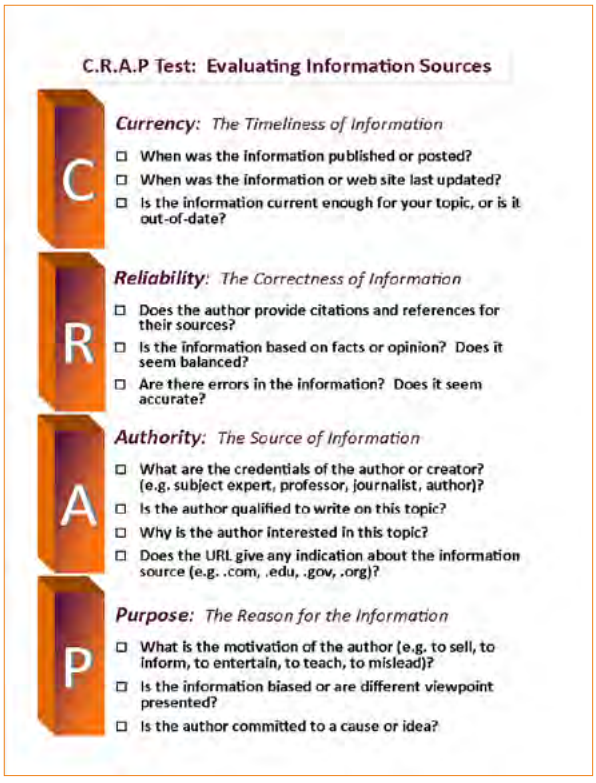
Source: Shutterstock

ACTIVITY 4: Investigation

Students contribute questions for the WANT to know column in the KWNR Chart.

- Individually or in pairs students select ONE question to research for ONE lesson.
  - Use websites to answer the selected question.
  - Evaluate two websites using **Source E**, the Information Evaluation Rubric or CRAP Test. (See Supplement for evaluation template).
  - Give an 'Explain in 1 minute' presentation to the class including a CRAP or NOT CRAP assessment of the two selected websites.
- Class identifies components of the CRAP TEST that match the concepts of validity, reliability and usefulness used in the Stage 6 Geography Syllabus
- In the absence of student questions, have a range of questions prepared that you can suggest. These should create deeper knowledge about the cryosphere. For example:
  - How do icecaps form?
  - What is glacial melt and why is it important?
  - Is the cryosphere fresh or saltwater?
  - How thick are icecaps, glaciers and sea ice?
  - How does soil freeze?
  - Is the cryosphere a source of freshwater for human use?

Source E: Evaluating Information Sources



Source: https://library.maryvillecollege.edu/crap-test

ACTIVITY 5: Change over time

> *"Large, continental ice sheets in the Northern Hemisphere have grown and retreated many times in the past. We call times with large ice sheets "glacial periods" (or ice ages) and times without large ice sheets "interglacial periods."The most recent glacial period occurred between about 120,000 and 11,500 years ago. Since then, Earth has been in an interglacial period called the Holocene. Glacial periods are colder, dustier, and generally drier than interglacial periods. These glacial–interglacial cycles are apparent in many marine and terrestrial paleoclimate records from around the world."*
>
> Source: https://www.ncdc.noaa.gov/abrupt-climate-change/Glacial-Interglacial%20Cycles

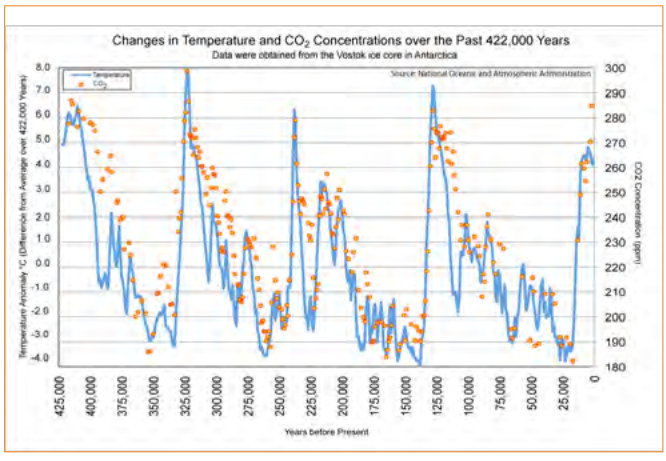
Time-lapse videos of Earth's glaciers and ice sheets as seen from space, static pictorial records and simulations provide insights into how the planet's frozen regions have changed over time.

Graphs and tables provide statistical data from scientific and research organisations that are used to identify changes and trends and to project / extrapolate possible futures.

- Use stimulus such as the visualisations shown in **Source F** and **Source G** and others on the PPT to examine changes to the cryosphere over time. Include reference to glacial and interglacial cycles, human induced change and evidence of change.

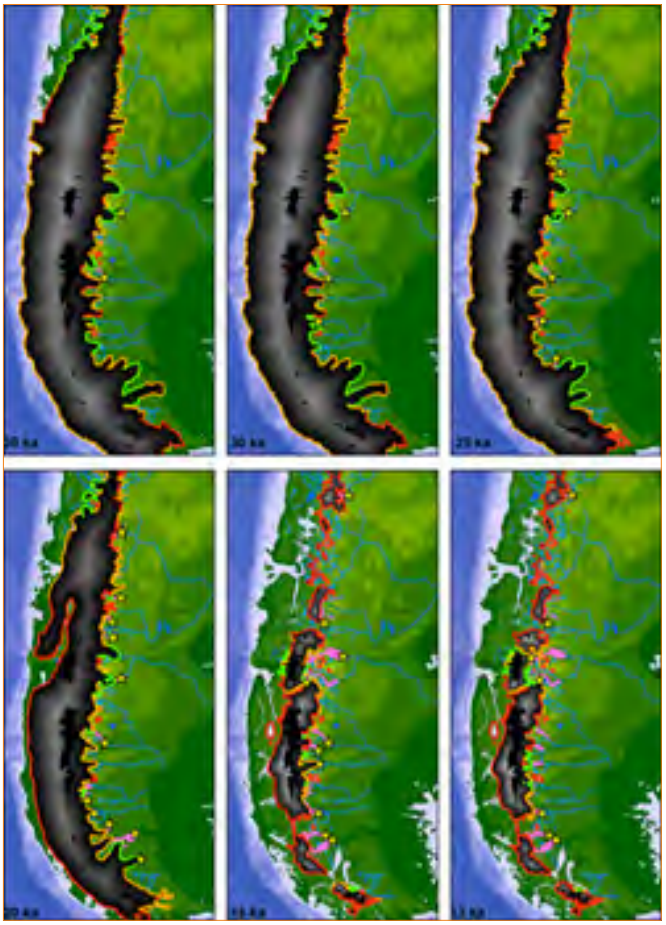
NOTE: Retreating glaciers and ice sheets could be the selected ISSUE for study and completed at this point.

Source F: Glacial and Interglacial cycles



Source: Georgia State University School of Geosciences – http://sites.gsu.edu/geog1112/lab-6-part-5/

Source G: GIF – Recession of Patagonian glaciers and ice-dammed lakes



Source: http://www.antarcticglaciers.org/glacial-geology/patagonian-ice-sheet/patice/patice_2020_02_28__1000-2/

Use the Graphic News stimulus items if selecting this issue. See *Stage 6 Skills*

- Antarctica's Doomsday Glacier Explained
- Mont Blanc Glacier on the verge of collapse
- Impact of global crisis on global ice

ACTIVITY 6: Biophysical Interactions

Activity 5 leads nicely into a broader review of biophysical interactions through the lens of the cryosphere. Start with the opening question 'How is a changing cryosphere impacting on other components of the biophysical environment'. Impacts could include fresh water supply (hydrosphere) natural hazards and sea levels (Hydrosphere, Atmosphere, lithosphere), biodiversity and ecosystems (Biosphere).

When examining interactions between the cryosphere and other spheres you will be testing student knowledge and understanding from Stages 4 and 5. Use resources that challenge thinking and avoid comprehension activities. Develop questions that require students to draw on what they remember or can predict based on their understanding.

Fill gaps in knowledge, understanding and skills as you go.

a. Interactions within the hydrosphere - precipitation, runoff, storages and flows of water
b. Interactions with the atmosphere – water cycle, weather, albedo effect
c. Interactions with the biosphere – biomes, ecosystems and biodiversity.
d. Interactions with the lithosphere – geomorphic processes, glaciation, isostacy, permafrost

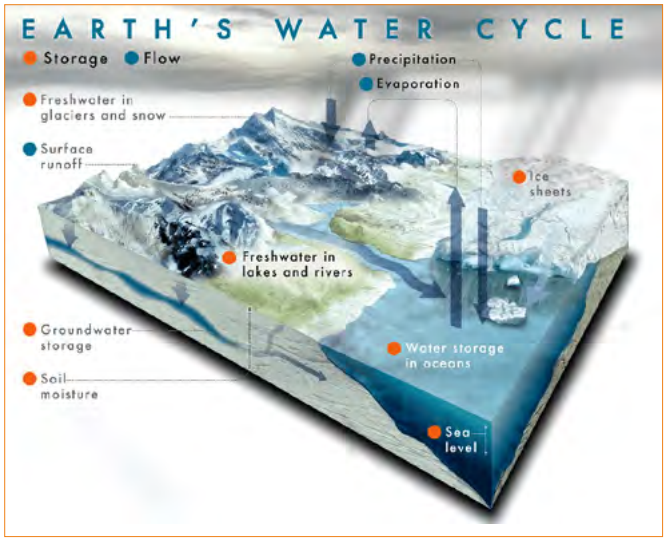
Suggested activities:

- **Cryosphere / Hydrosphere / Atmosphere interactions**

Refer to **Source H** to complete a range of activities such as:

- Match volumes of water with letters on an image
- Identify and explain interactions between the atmosphere and cryosphere
- Predict the impact of cryosphere loss on global water security.
- Complete a Futures Wheel / Consequence Chart with the statement 'If all Earth's ice melted?' in the centre *See Supplement.*
- Discuss responses then watch 'If all Earth's ice melted' – https://www.youtube.com/watch?v=VbiRNT_gWUQ and using media reports.

Source H: Global water cycle



Source: NASA Climate Kids – https://climatekids.nasa.gov/water-cycle/

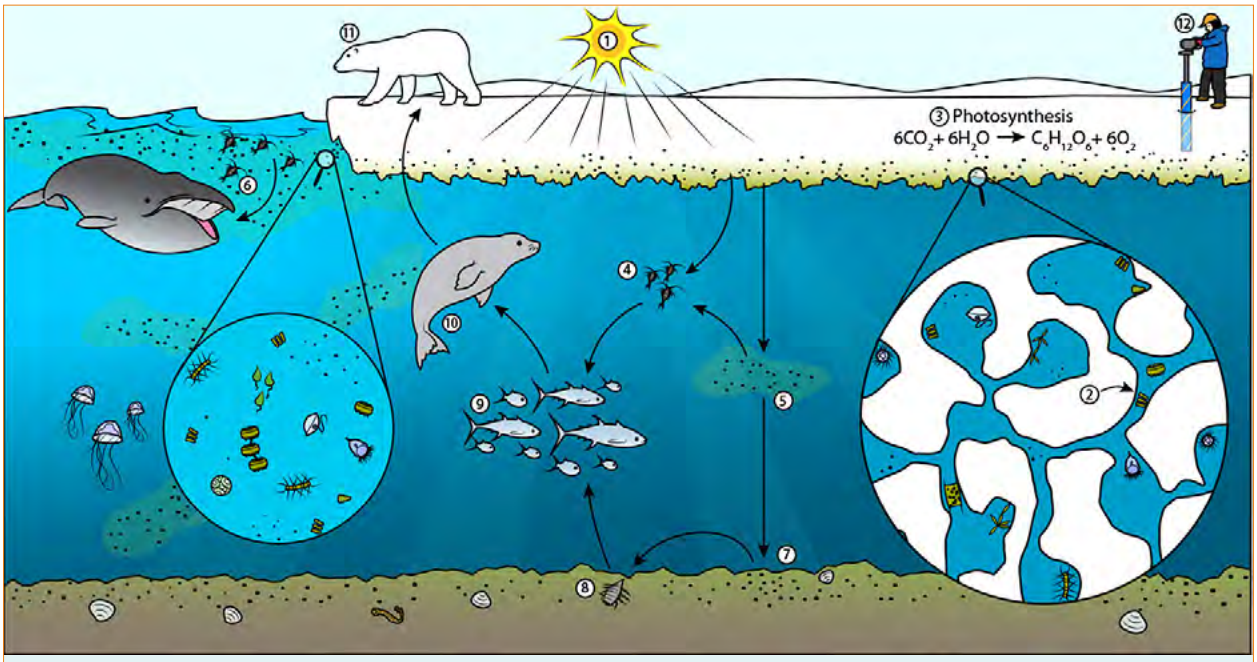
See Edition 3 Supplement for suggested activities.

- **Cryosphere and Biosphere**
  Remind students that they studied the biosphere in Stage 5 Sustainable Biomes.
  - Use *Geography Bulletin 52, Edition 2* Snapshot 1 Biomes and their productivity to revisit processes in the biosphere.
  - Students continue to build their glossary of key terms and concepts.
  - Refer to **Sources D**, Snapshot 1 and **Source I** to discuss cryosphere / biosphere interactions. Use the following questions to guide discussions:
    'Which biomes are strongly connected with the cryosphere'?
    'Does the cryosphere affect biome productivity?'
    'Does the cryosphere limit biodiversity in an environment or ecosystem?'
  - List arguments to support or reject the following statement:
    'Ice as important to the arctic ecosystem as soil is to a forest'

- **Cryosphere and Lithosphere**
  Refer to **Sources B, C and H** to discuss cryosphere / lithosphere connections
  Use focus questions such as:
  - How much of Earth's land is covered by the cryosphere?
  - How does the lithosphere influence the cryosphere?
  - How does the cryosphere affect the lithosphere?

ACTIVITY 7: Drawing conclusions and making judgements

- Complete the *Test your recall. Stop the bus activity* based on contributing questions. *See Supplement*
- Revisit the Key inquiry question 'How vital is the cryosphere to Earth's natural systems?'
- In **Source J** the cryosphere is identified separately to the hydrosphere. Is this justified?



Sunlight (1) shines on the microscopic algae (2) in the sea ice. The sea ice algae convert carbon dioxide (CO2) to sugars through a process called photosynthesis (3).

The algae in the ice are eaten by small animals like copepods (4). Some of the algae in the ice are not eaten and melt out of the ice and sink into the water (5) where they can be eaten by the small animals (4) or whales (6). Some of the algae are heavy and sink to the sea floor (7) where they can be eaten by bottom-feeding animals such as isopods (8; which are crustaceans, like the copepods).

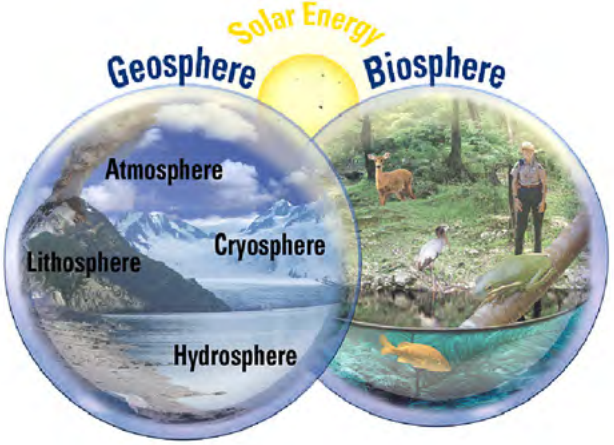
The small animals in the water (4) and on the seafloor (8) might in turn be eaten by fish (9). The fish are the food choice of seals (10). Seals are a preferred food of polar bears (11), which inhabit the area and roam on top of the ice in search of food.

Sea ice algae are the main basis of the marine food web in the late winter and spring in the Arctic. The scientist is drilling a hole through the ice (12) to collect an ice core.

Source https://askabiologist.asu.edu/explore/frozen-life

- Teacher populates the NEED to know column of the KWNR Chart in relation to the Hydrosphere.
  - Tick content covered during the cryosphere activities.
  - Use explicit teaching and inquiry learning activities to cover remaining 'Need to know' syllabus content about the cryosphere / hydrosphere.

Source J: The Earth System



The Earth System has two primary components: the geosphere and the biosphere. The geosphere has four subcomponents: lithosphere (solid Earth), atmosphere (gaseous envelope), hydrosphere (liquid water), and cryosphere (frozen water)

Source: https://www.geographyrealm.com/what-are-the-earths-systems/

In Source J the cryosphere is identified separately to the hydrosphere. Is this justified?

ACTIVITY 8: Biophysical Interaction

- Complete KWNR Charts for the Atmosphere, Lithosphere and Biosphere
  - Students complete the KNOW, WANT and REFLECT columns based on the retrieval of knowledge and understanding during the study of the Cryosphere
  - Teacher populates the NEED to know column with predetermined content
- Use explicit teaching and inquiry learning activities to cover remaining 'Need to know' syllabus content.

OR

- Undertake an investigation using a case study or story as stimulus. Use stimulus such as:
  - 'Miracle in the storm' – Atmosphere *See Supplement*
  - 'Madagascar: a biodiversity hotspot' – Biosphere
  - 'Where in the world can you dive between earth's plates?' Lithosphere.

  Resources for these studies can be found in the *PPT*, *Supplement* and *Resource list. Source K*

OR

- Investigate the biophysical interactions in ONE environment drawing on knowledge and understanding gained from Activities 1 – 8.

  Resource List See Supplement.

Source K: Biophysical Interactions – Investigation options

1. 'Where in the world can you dive between earth's plates?

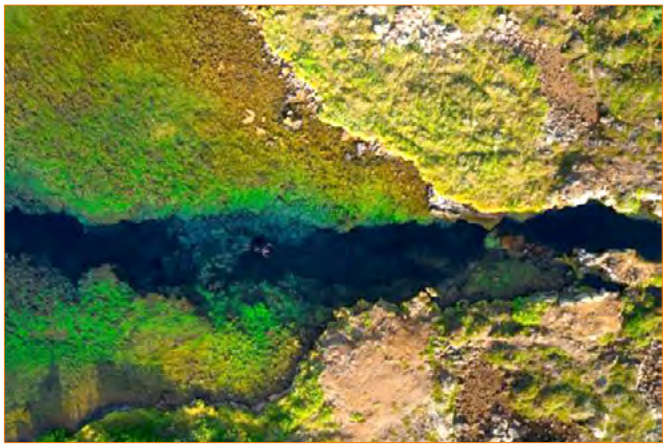


Image source: Shutterstock,

1. 'Where in the world can you dive between earth's plates? (continued)

Images: L Chaffer

2. Biosphere: Madagascar a biodiversity hotspot

Photo source: Shutterstock. Map: Retrieved from https://sites.google.com/a/lincoln.edu.gh/biodiversity-hotspots-lcs-ess/madagascar-indian-ocean-islands

3.Atmosphere: Miracle in a storm

"I wanted to fly around the clouds, but I got sucked 20 metres per second up into it and started to spiral," she told smh.com.au. "After 40 minutes or an hour, I woke up and I was 6900 metres. "I was still flying but I realised I didn't have the brakes in my hand. "I saw my hands and the gloves were frozen, and I didn't have the brakes, and the glider was still flying on its own. "I was thinking I can't do anything, so I only have to wait and hope that the clouds were bringing me out somewhere"

https://www.smh.com.au/national/ewa-sucked-into-storm-and-lives-to-tell-20070217-gdphms.html

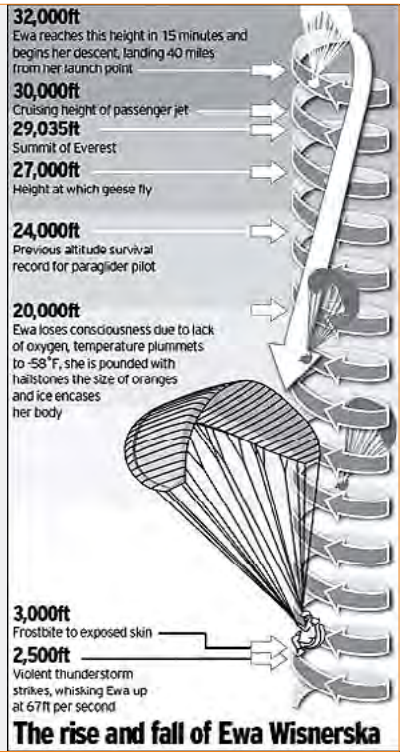


Image retrieved from Telegraph UK
Illustration retrieved from https://www.telegraph.co.uk/news/worldnews/1542962/Paraglider-survived-in-storm-at-32000-ft.html

Understanding Sea Levels

Reference is frequently made to sea level and rising sea levels in the teaching of Geography. However, sea level is a complex phenomenon that varies in the open ocean as well as along coastlines. It is important that students can distinguish between ocean sea level and relative sea level along coastlines and the causes and consequences of changes in each.

Understanding the complexities of sea level will assist students to understand variations in the environmental challenges they study throughout years 11 and 12 in topics such as Biophysical Interactions e.g. coastal erosion, saltwater seepage into coastal aquifers and sinking coastal cities. Many Megacities and Ecosystems at risk are impacted by relative sea level change that can be contributed to many causes, including climate change. Editor

WHAT DETERMINES THE LEVEL OF THE SEA?

Retrieved and adapted on 13 August 2020 from *Sea Level 101. What determines the level of the sea?* https://climate.nasa.gov/blog/2990/sea-level-101-what-determines-the-level-of-the-sea/

Did you know?

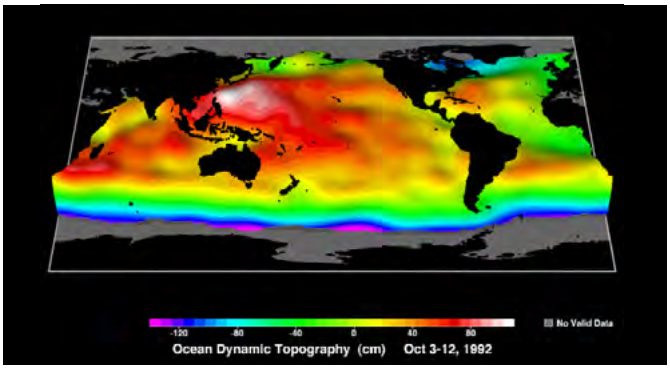
- Even in the absence of waves the ocean is not flat.
- Ocean topography is used to determine the speed and direction of ocean currents in the same way air pressure is used to calculate the speed and direction of winds
- Ocean currents flow around ocean hills and valleys, much like wind blows around areas of high and low pressure.
- Ocean topography can only be seen from space
- The ocean stores energy from the sun and moves it around the planet via currents

Waves in the bathtub

Most of the time, Earth's ocean looks pretty darn flat to those of us here on the ground, like the water in a bathtub. If you're on a boat at sea, the only topography you're going to notice on the ocean is waves. Generated by the friction between wind and water, wind waves range from tiny ripples on a calm sea to storm-generated monsters that can tower more than 30 meters high. Some wind waves are generated locally. Others, called swells, which result from winds that blew somewhere else in the past, travel across the ocean surface.

But even in the absence of waves, it turns out the ocean isn't really flat at all. It has hills and valleys just like land surfaces do, though they're relatively small — up to about 2 meters high.

The ocean's "dynamic" topography tells oceanographers the speed and direction of ocean currents in the same way that maps of atmospheric pressure are used by meteorologists to calculate the speed and direction of winds. It reveals the height of the ocean relative to the geoid, a surface where gravity is always uniformly pointed downward.



The dynamic ocean topography shown in this map varies by about 2 meters between its highest and lowest places. The colour scale corresponds to relief in centimetres. The vertical scale is exaggerated to illustrate the three-dimensional perspective of the topography. Credit NASA/JPL-Caltech

Factors influencing ocean topography

These small variations in ocean surface topography are influenced by many factors, including the temperature of the water, how much salt it contains (its salinity), the pressure of the atmosphere above the ocean surface, and ocean currents.

Ocean currents

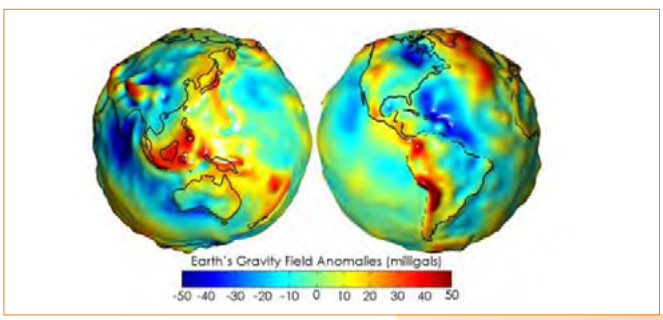
Currents move ocean waters around our planet over long distances, primarily in a horizontal direction, reshaping the ocean's surface and causing it to tilt. They're generated by various forces, including winds, breaking waves, ocean temperature, salinity, and a phenomenon known as the Coriolis effect (which causes water and wind to deflect to the right in the Northern Hemisphere and to the left in the Southern Hemisphere). Currents flow around the ocean's hills and valleys, much like wind blows around areas of high and low pressure in our atmosphere.

Ocean currents happen in the open ocean and generally don't have a big impact on coastlines, with a few major exceptions, such as the Gulf Stream in the Atlantic Ocean along the U.S. East Coast and a similar Pacific Ocean current off the coast of Japan called the Kuroshio, which transports water northward up Japan's east coast and then due east. As our planet warms, it affects wind patterns that drive most of these currents, changing them.

Visualization of the Gulf Stream stretching from the Gulf of Mexico to Western Europe. Credit: NASA's Scientific Visualization Studio

Earth's geoid

While all of these factors are important drivers of ocean surface topography, there's an even larger force working to shape the ocean: changes in Earth's geoid. The geoid is the shape that Earth's ocean surface would take if the only influences acting upon it were gravity and Earth's rotation. Changes in the solid Earth affect Earth's gravitational field, causing the height of Earth's geoid to vary by up to 100 meters around the globe. For example, in places where Earth's crust is thick and dense, the gravitational pull causes extra water to pile up. In addition, the shape of the geoid is partly determined by geologic features on the floor of the ocean, including seamounts (underwater mountains) and valleys, which pull the water due to the force of gravity.

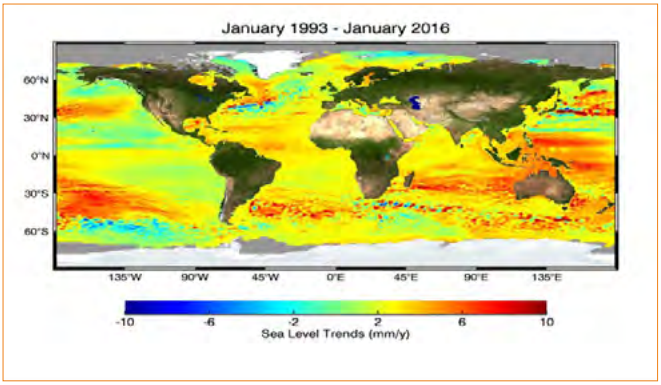


Measuring ocean topography: How and Why

Topographic features on the open ocean can only be seen from space, by specialised instruments called altimeters that precisely measure the height of the ocean surface. Since 1992, NASA has partnered with other U.S. and European institutions on multiple satellite missions to map ocean surface topography.

Measuring ocean surface topography allows us to understand ocean circulation (how our ocean stores energy from the Sun and moves it around our planet), accurately track changes in global sea level, and understand how the ocean joins forces with Earth's atmosphere to create our weather and climate, including phenomena such as El Niño and La Niña and weather patterns such as hurricanes and other storms.

Trends



For nearly 30 years, satellite altimeters have measured the sea surface height of our ever-changing ocean. This image shows the 23-year trend of rising seas across the globe from 1993 to 2016. Credit: NASA/JPL-Caltech

A look at a current map of trends in the nearly 30-year satellite record of global ocean surface topography reveals clear regional differences across the globe, with variations of up to 20 centimetres of sea level rise and fall from one place to another.

"Most of these 20–30 cm changes in sea level on the open ocean are cyclic, from natural things like El Niño and La Niña, or ocean currents speeding up or slowing down," he said. "They've always been part of the story and always will be. But what really matters to people at the coast are long-term changes in their relative sea level – that is, the height of the ocean relative to the land. Those are caused by the overall rise due to global warming, and the movement of the land. And both of those are here to stay."

LEFT: If our ocean had no tides or currents, the sea surface would assume the shape of the geoid. These "gravity anomaly" maps show where Earth's gravity field differs from a simplified Earth model that is perfectly smooth and featureless. Areas coloured yellow, orange or red are areas where the actual gravity field is large, such as the Himalayan Mountains in Central Asia (top left of the left-hand globe).

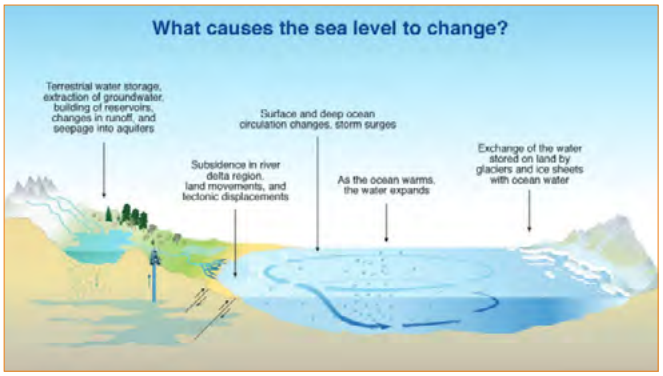
ALL SEA LEVEL IS 'LOCAL'

Retrieved and adapted on 13 August 2020 from *Sea level 101: All sea level is local* – https://climate.nasa.gov/blog/3002/sea-level-101-part-two-all-sea-level-is-local/

Did you know?

- Global sea level rise has multiple causes
- Sea level rise is local and relative
- Relative sea level rise affects coasts
- There are natural and human causes of relative sea level rise

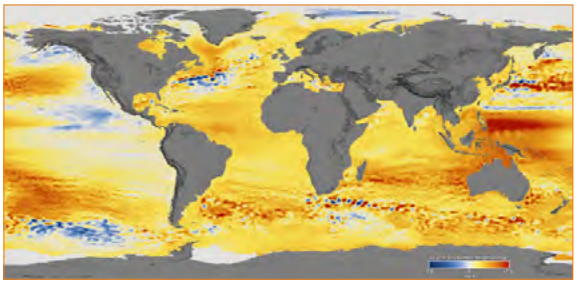
Global sea level rise is complex. To begin with, it has multiple causes, including the thermal expansion of the ocean as it warms, runoff of meltwater from land-based ice sheets and mountain glaciers, and changes in water that's stored on land. These factors combine to raise the height of our global ocean about 3.3 mm every year. That rate is accelerating by another 1 mm per year every decade or so.



Factors that contribute to sea level change. Credit: Intergovernmental Panel on Climate Change 2001

Uneven sea level rise and impacts

Another factor that makes sea level rise complex is that it's not uniform around the globe. If you look at a global map of sea level rise, you'll find it's happening rapidly in some places and more slowly in others. This means that although sea level rise affects coastal areas all over our ocean planet, some regions feel its effects sooner and more severely than others. This is reflected in future projections of sea level rise, with many cities in Asia expected to be among the hardest hit localities. Here in the United States, cities expected to see the worst impacts include New York, Miami and New Orleans, to name but a few.



Total sea level change between 1992 and 2014, based on data collected from satellites. Credit: NASA's Scientific Visualization Studio

Indeed, at any given place and time around our planet, sea level rise varies. But why is that? It turns out that when it comes to sea level rise, it's all local. And it's all relative

Factors causing relative sea level changes

"*Relative sea level*" refers to the height of the ocean relative to land along a coastline.

Common causes of relative sea level change include:

- Changes due to heating of the ocean, and changes in ocean circulation
- Changes in the volume of water in the ocean due to the melting of land ice in glaciers, ice caps, and ice sheets, as well as changes in the global water cycle
- Vertical land motion (up or down movements of the land itself at a coastline, such as sinking caused by the compaction of sediments, or the rise and fall of land masses driven by the movement of continental or oceanic tectonic plates)
- Normal, short-term, frequent variations in sea level that have always existed, such as those associated with tides, storm surges, and ocean waves (swell and wind waves). These variations can be on the order of meters or more.

Thermal expansion

When you heat up water, it expands and takes up more space. How much it expands depends on how deep the warming occurs as well as the temperature of the water to begin with. For example, in Earth's tropics, a 1-degree Celsius warming in the temperature of the top 100 metres of the ocean raises sea level there by about 3 centimetres. This thermal expansion of the ocean is responsible for between one-third and one-half of the overall global sea level rise observed over the last two decades. Because Earth's ocean isn't warming at the same rate everywhere, it results in regional differences in relative sea level rise, with areas that are warming faster seeing faster sea level rise.

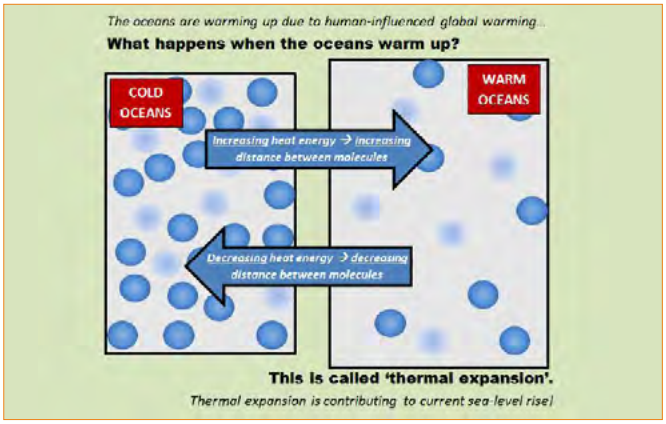
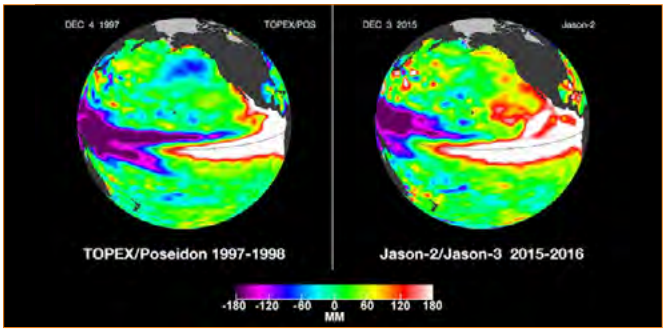


Diagram explaining the concept of thermal expansion of the ocean. Credit: Roseanne Smith

Circulations

Changes in ocean circulation also contribute to regional sea level differences. For example, in the United States, El Niño, a cyclical, naturally occurring ocean circulation pattern of warming and cooling can temporarily raise relative sea level along the West Coast by more than 30 cm for up to a couple of years. Similarly, along the U.S. East Coast, the speedup or slowdown of the major ocean current known as the Gulf Stream can temporarily add or subtract as much as 5 centimetres (of sea level height to local coastlines.



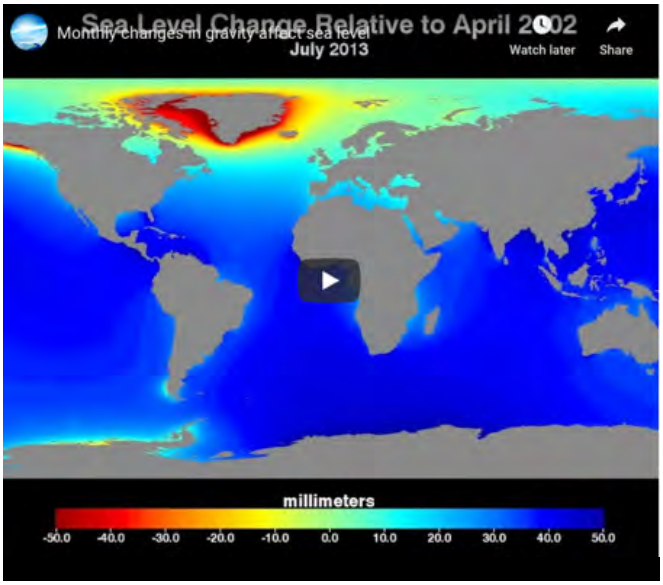
The El Niño of 2015-2016 was the biggest, so far, of the 21st century. This image shows a side-by-side comparison of Pacific Ocean sea surface height anomalies during the 2015-16 event with the famous 1997-1998 El Niño. Credit: NASA-JPL/Caltech

Melting land ice

Next, there's melting land ice in the Greenland and Antarctic ice sheets and Earth's glaciers and ice caps. The largest contribution is from Greenland, which loses hundreds of billions of tons of ice a year and is a major contributor to sea level rise across the globe. As Greenland loses ice, the land beneath its ice sheet rises as the weight of the ice sheet is removed. As a result, Greenland itself doesn't see any local sea level rise.

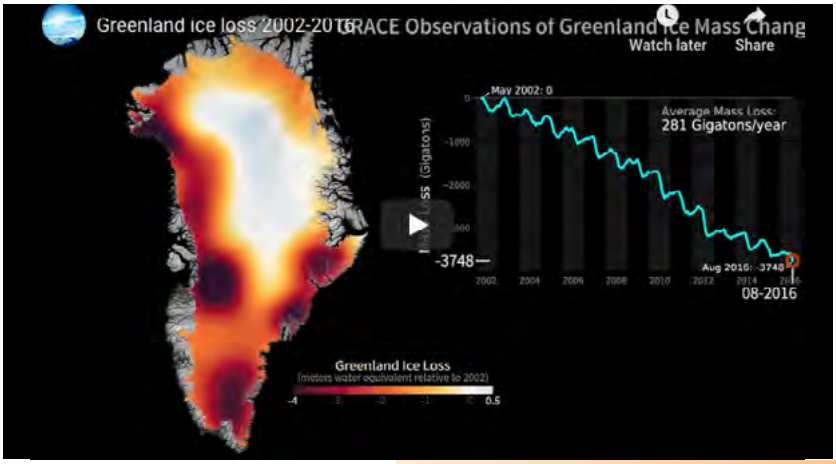
But all of its melted ice — currently averaging 281 gigatons a year has to go somewhere. Gravity causes it to flow into the ocean, causing sea level to rise thousands of miles away. Data from GRACE-FO tell us that melting land ice in glaciers, ice caps, and ice sheets contributed about two-thirds of global sea level rise during the last decade.

As land ice in Greenland, Antarctica and elsewhere melts, it changes Earth's gravity field and slightly shifts the direction of Earth's rotation. This causes uneven changes in sea level across the globe. Each melting ice mass around the world creates its own unique pattern of sea level change in the global ocean. For example, when ice melts in Antarctica, the amount of sea level rise it generates in California and Florida is up to 52 percent greater in those locations than if the global ocean just filled up uniformly, like water in a bathtub. Scientists use gravity data from the GRACE-FO mission to calculate patterns of sea level change associated with the loss of ice from glaciers, ice caps and ice sheets, as well as from changes in land water storage.



An animation showing "sea level fingerprints," or patterns of rising and falling sea levels across the globe in response to changes in Earth's gravitational and rotational fields. The movement of water across our planet can cause localised bumps and dips in gravity, sometimes with counterintuitive effects. Melting glaciers, for example, actually cause nearby sea level to drop; as they lose mass, their gravitational pull slackens, and sea water migrates away.

This animation shows that since 2002, sea level is dropping around rapidly melting Greenland (orange, yellow). But near coastlines at a sufficient distance, the added water causes sea levels to rise (blue). Credit: NASA-JPL/Caltech



The mass of the Greenland ice sheet has rapidly declined in the last several years due to surface melting and iceberg calving. Research indicates that between 2002 and 2016, Greenland shed approximately 280 gigatons of ice per year, causing global sea level to rise by 0.8 mm per year.

These images show changes in Greenland ice mass since 2002. Orange and red shades indicate areas that lost ice mass, while light blue shades indicate areas that gained ice mass. White indicates areas where there was very little or no change in ice mass since 2002. The largest mass decreases of up to 30 centimetres per year occurred along the West Greenland coast. Credit: NASA

Land subsidence and uplift

Then there's vertical land motion along coastlines. When land sinks (a process known as subsidence), it causes a relative increase in sea levels. When land rises (known as uplift), it results in a relative decrease in sea levels.

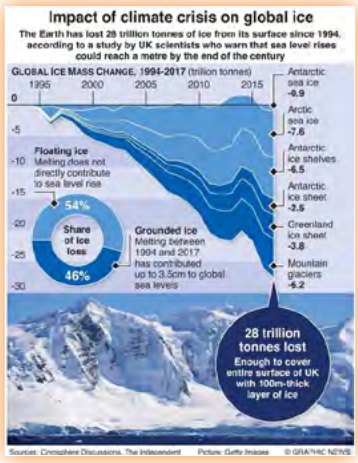
A number of factors, both natural and human-produced, cause land to rise or sink, including:

- Adjustments related to the rebound of land during and following the retreat of past ice sheets in North America and Eurasia at the end of the last Ice Age (known as isostatic, or post-glacial, rebound). The retreat of the ice sheets lightened the load of mass on the underlying mantle deep below Earth's surface, causing Earth's surface there to slowly rise. Land areas that were once near the edge of these ancient ice sheets, such as along the U.S. eastern seaboard, are today falling, exacerbating sea level rise there.
- Plate tectonics. Earth is divided into multiple slowly moving tectonic plates that interact with each other along plate boundaries. At some plate boundaries, the motion of one plate under, over, or past another, results in vertical uplift or subsidence of the land surface above.
- Natural or human-produced compaction of sediments, such as those caused by pumping groundwater, or oil and gas. Subsidence related to groundwater withdrawal can be especially pronounced in areas with large populations and extensive agriculture. Sediments can also be compacted by construction activities by humans or by the natural settling of new soils. In the United States, subsidence is a major factor in relative sea level rise along parts of the Gulf and East Coasts.

Oceanographer and climate scientist Josh Willis of NASA's Jet Propulsion Laboratory in Southern California says that when it comes to relative sea level rise at any particular coastal location, subsidence is the most immediate consideration.

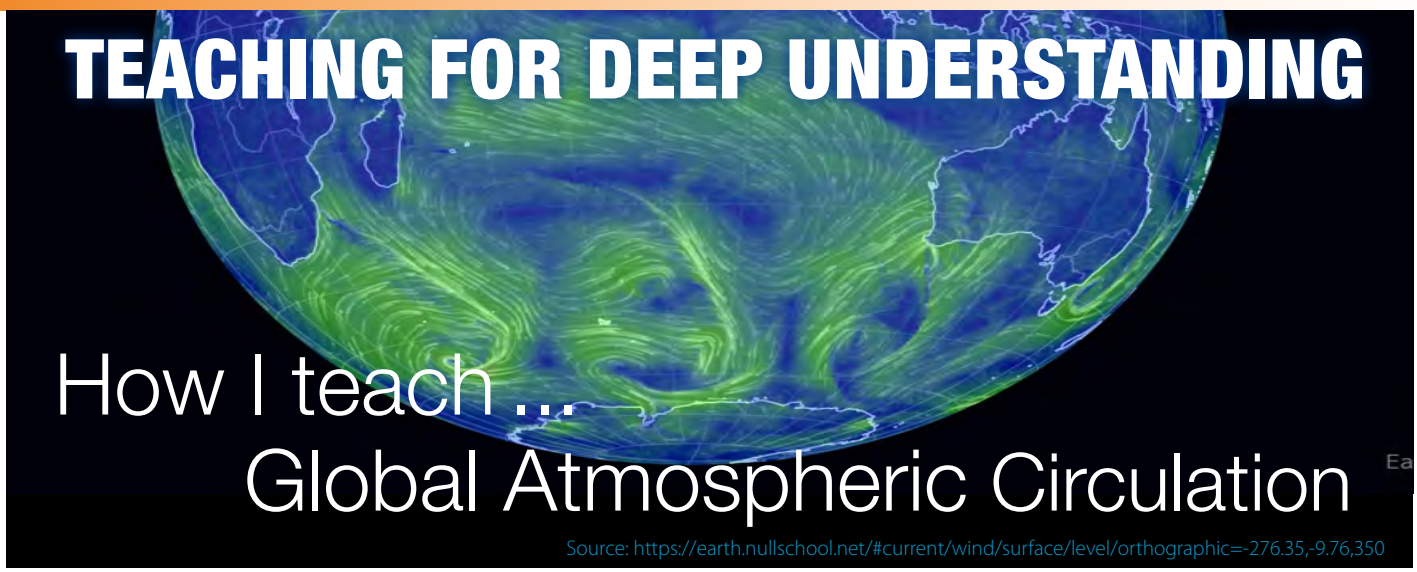
> *"People in coastal areas need to know what the land is doing right now where they live," he said. "Is it sinking? If so, how fast? When you combine a sinking coastline with sea level rise caused by other contributing factors, you're in trouble. Remember, scientists are projecting feet of global-mean sea level rise in this century. But in some places, land can sink by one foot in a decade. We have to understand all of these pieces before we can project future sea level rise at a beach near you."*
>
> Source: https://climate.nasa.gov/blog/2990/sea-level-101-what-determines-the-level-of-the-sea/

Children play in the flooded streets of Kampung Melayu, Penang.
Source: Wikimedia Commons



Skills activities linked sea levels, melting glaciers and climate change are included in the Stage 6 Skills section

TEACHING FOR DEEP UNDERSTANDING



How I teach ... Global Atmospheric Circulation

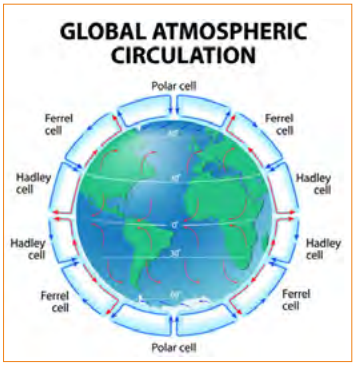
Source: https://earth.nullschool.net/#current/wind/surface/level/orthographic=-276.35,-9.76,350

"How I teach…" introducing a mini-series

Team Geography (A blog for #geographyteachers to engage and discuss all things geographical) https://teamgeography.wordpress.com/2019/11/10/how-i-teach-introducing-a-mini-series/

This is the introduction to, what I hope, will form a series of blogs into how I (and hopefully other geography teachers!) teach different elements/topics of geography. I have absolutely loved the recent shift in educational discourse towards big ideas of curriculum, so much of this narrative has helped me elevate my practice. But, I think we need to do more to demystify the lesson-level processes we utilise everyday.

As a trainee, I remember being told to go and watch teacher X because she was brilliant at teaching Y. The problem was, without the opportunity to deconstruct what I'd seen and little/no guidance on the processes behind the lesson, I got very little out of these observations… Whilst no blog will emulate planning with a colleague, watching them teach and then discussing post lesson, I hope that maybe these blogs will help us consider how we teach key geography and share some best practice. Teachers helping teachers!



Source 1: Image accessed via– https://www.internetgeography.net/topics/what-is-global-atmospheric-circulation/ (Sunday 10th November, 2019)

Tom Highnet

How I teach… Global Atmospheric Circulation Model

SOURCE: Team Geography (A blog for #geographyteachers to engage and discuss all things geographical) https://teamgeography.wordpress.com/2019/11/10/how-i-teach-global-atmospheric-circulation-model/

NOTE: This does not reflect an hour, or any other convenient package of learning, but is instead an overview of how I would go about unfolding this concept.

A recurring theme within the #geographyteacher community on Twitter is about how to teach the global atmospheric circulation model. The model seems to strike fear into the hearts of teacher, and students, alike. I confess, I felt exactly the same the first time I taught it. Now, it is right up there as one of my absolute favourite topics to teach.

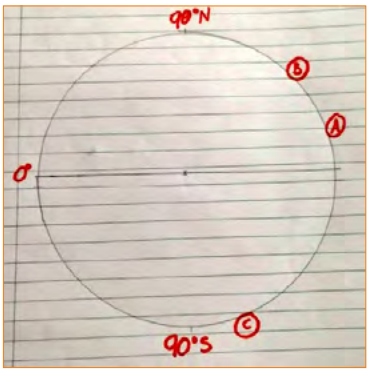
At first glance, it looks intense. I certainly don't begin with the image you see above. There is just too much going on and students quickly become overwhelmed by it all.

In teaching about this, I want my students to be able to:

- Confidently define latitude and identify how it changes, this will help them too…
- Understand the process of differential heating, which will inform their understanding of…
- The difference between high and low air pressure, when they know this they can…
- Explain the weather conditions associated with different types of air pressure, which will mean they can determine
- How the circulation of air changes around the world – taking the form of cells

Key idea – Understanding latitude

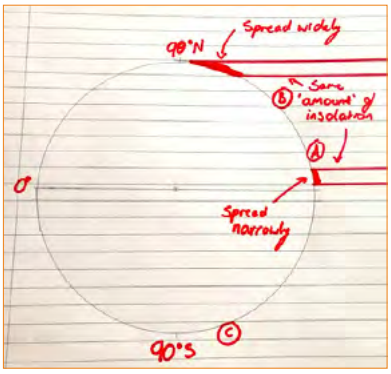
To begin with, we recap what is meant by latitude. This takes the form of me working at the whiteboard (don't have a visualiser :() and sketching an outline of the Earth. I discuss with students that the Equator is at 0 degrees – dividing the world into two equal hemispheres, Southern and Northern. As we go away (North or South) from the equator, the latitude increases. This concept can prove tricky for some and I will do some quick questions to check we're all clear.



Source 2: Gradually introduce questions to check: Which letter is at the highest latitude? A or B? Explain why. Which letter is at the highest latitude? B or C? Explain why. How do you know A is at a low latitude?

Key idea – Differential heating

Assuming I am happy with students understanding of latitude at this point, we would now move onto consider the impacts of uneven insolation across the surface of the Earth. Addressing my class, I would explain that the sun's rays do not heat the surface of the Earth evenly, resulting in **differential heating**. This is due to the **curvature** of the Earth. I would model this to students on the diagram:



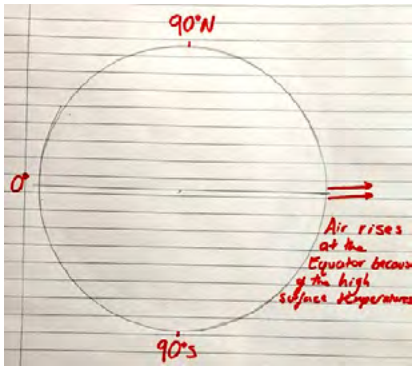
Source 3: Advantages of a lined pad – makes sure my sun's rays are equal. Students can see the impact of the Earth's curve on the spread of insolation.

Now that we have an understanding of latitude and differential heating, I pose a question to my class; 'At the equator, where the insolation is most concentrated, what happens to the air?'. The key here is ensuring I make my answer and explanation clear and concise: At the equator, where the sun's rays are most concentrated air is warmed because of the higher surface temperatures and begins to rise, as it is less dense than the surrounding air. In reviewing this statement, I may ask a series of probing follow up Q's – e.g. just remind me why is the insolation most concentrated at the equator? OR Why would the surface temperature be higher at the equator than at higher latitudes? – Ensuring we plan these follow up questions is a really important in consolidating our students understanding, don't neglect them.

Now that we are happy, we have a) an understanding of latitude, b) an understanding of differential heating across the Earth and c) an emerging familiarity with the notion of rising air at the equator, we can continue.

Key idea – Air pressure

I may now re-purpose my diagram to allow me to add the rising air at the equator. I explain that the rising air is made up of large amounts of water vapour, because evaporation over the oceans is high at the equator – remember differential heating.



Source 4: Have modified/ added a new diagram to reduce distraction and allow students to focus on air pressure and movement.

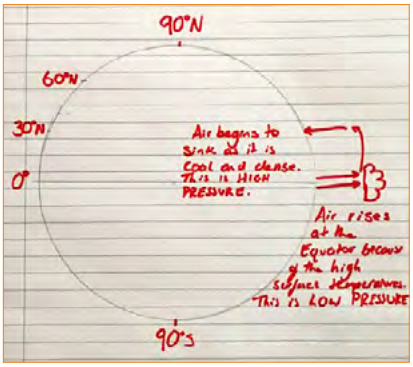
As the air rises, I explain that it begins to cool because it is no longer heated by its contact with the warm Earth's surface. As it cools, the water vapour in the air begins to condense (some students have a comfortable understanding of what is meant by condensation and others do not). Condensation results in the formation of large clouds over the equator which, in turn, results in high levels of rainfall at the equator (link to rainforests, depending on your curriculum sequence!).

I teach students that this rising air is known as low pressure. I explain that we measure the 'amount' of air at the surface (in millibars) as it is a useful indicator of wider weather conditions. When teaching air pressure, it is well worth investing the time in getting students clear on the differences – low pressure = rising air, there is less air at the surface and high pressure = sinking air, there is more air at the surface. This can often be a stumbling block for many students. Use what's out the window here too – if it's raining, ask students about air pressure – help them see it.

Key idea – Hadley Cell

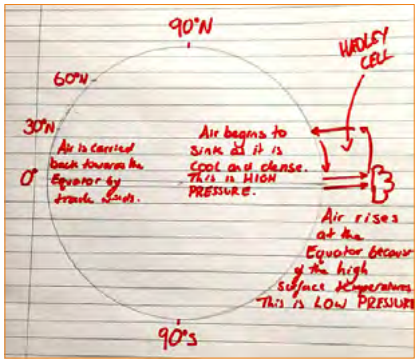
As the air rises, it eventually reaches the atmosphere, forcing air to spread North and South of the equator, unable to return to the equator because of rising air. This is our first introduction to the idea of 'circulation' – with the air moving away from the equator and circulating round to higher latitudes.

As the air moves both North and South, high above the surface, I explain that it is cooling and begins to sink. This sinking takes place because the process of cooling has made the air more dense. Back to the diagram, I add on arrows to show the air sinking at ~30 degrees N+S.



Source 5: Building up the diagram – note the additions of cloud and extra annotations.

Depending on curriculum, the visualisation of high pressure at 30~ degrees N+S is an opportunity to recap on deserts. I would finalise this first cell with the knowledge that trade winds carry the sinking air back towards the equator, allowing me to draw an arrow from 30 degrees N/S back towards the equator. This gives students their first completed cell; the Hadley cell.

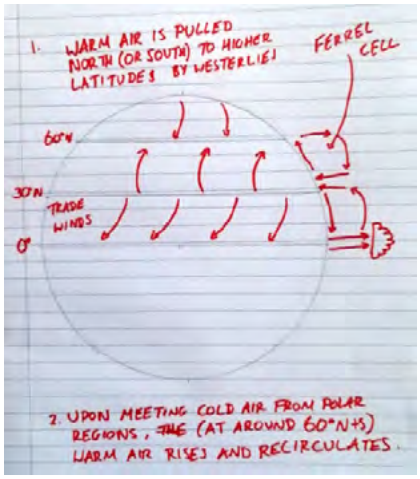


Source 6: I have my first fully completed cell – if I had more space, I would label rising air as low pressure and sinking air as high pressure.

I would start to get students to move away from attending my notes/teaching and would start to get them applying their own understanding. At this point, this primarily takes the form of a blank diagram of the Earth (with lines of latitude at 30, 60 and 90 added in). I would walk students through what we have learnt thus far – the uneven concentration of insolation across the Earth and the implications of this for air pressure. Whilst I am doing this recap, I would expect students to be adding to their own diagrams – providing a list of key term/prompts on the whiteboard to support. We would now proceed to add in the remaining cells.

Key idea – Ferrell Cell

Bringing the class back together, I revisit my diagram, with the Hadley cell on it, and explain that, at 30 degrees N+S, air is pulled in two directions – some back to the equator, and some northwards by winds known as **Westerlies.** These Westerlies carry the warm air from 30 degrees up to ~60 degrees North or South. It is at this point, this warm air meets cold polar air, moving to lower latitudes under the influence of **polar easterlies.** Where these two bodies of air meet – the warm air from 30 degrees N+S and the cold air from the poles – there is a mix, forcing the air to rise (as it is warm and thus less dense). This creates an area of low pressure known as the **subpolar low.** When we have identified this, as shown below, I ask students to add the **Polar cell** (the final cell of the tri-cellular model) using all we have covered.



Source 7– Note: I have only completed cells for the Northern hemisphere, deliberately leaving out the polar cell for students to finish/ add air pressure.

Conclusion

Like all complicated concepts and ideas, nailing down your explanations and the way you will sequence knowledge, is crucial. Also, plan your questions and how you'll check for understanding – these elements are essential if students are to overcome misconceptions.

A word of advice, as tempting as it is to use a completed diagram/videos, I would strongly urge you to avoid these until students have pieced together the full idea – diagrams and videos make perfect sense to us, as the teacher, as we have a fully developed understanding of the topic. For students, this is much less the case. Finally, (here comes the controversy) I'd cut the gimmicks – 3D models, balloons, paper plates – they all may have a place but first time in, I'd be planning high quality diagrams and precise, concise explanations – don't overload your students.

This has been a bit of whistle stop tour of 'How I teach…' as the GACM is **BIG**. But I hope you've had a bit of a peek behind the resources/PowerPoints we often see bandied around and seen into the bigger idea of lesson planning.

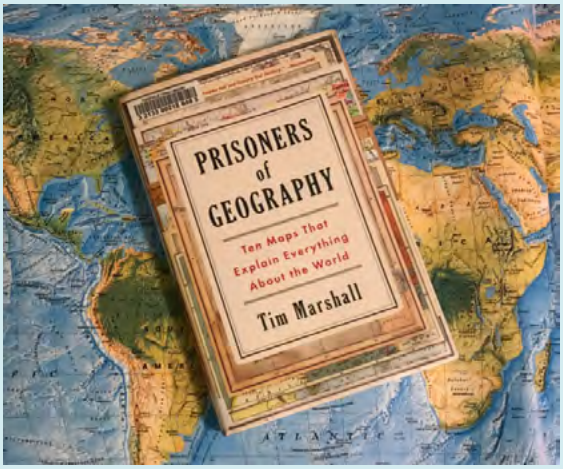
EDITORIAL COMMENT

Team Geography is a blog for #geographyteachers to engage and discuss all things geographical.

The blog has some very useful posts for developing teaching skills and thinking about how geography can be taught.

Where's the Geography?

https://teamgeography.wordpress.com/2018/02/20/wheres-the-geography/



The following are 'GUEST POSTS' for Year 11 Global Challenges:

Political geography

How I teach… Russia, using Prisoners of Geography @ missbytheway
https://teamgeography.wordpress.com/2020/06/15/guest-post-how-i-teach-russia-using-prisoners-of-geography-missbytheway/

Note: link to some good resources.

Development geography

How I teach… The development gap @RobboGeog
https://teamgeography.wordpress.com/2020/06/07/guest-post-how-i-teach-the-development-gap-robbogeog/

Skills activities linked to Biophysical Interactions and Ecosystems at Risk are included in the Stage 6 Skills section

GREAT BARRIER REEF: Resilience and change

Editor Lorraine Chaffer

"As an ecosystem the GBR has been more resilient to past sea-level and temperature fluctuations than previously thought, but it has been highly sensitive to increased sediment input over centennial–millennial timescales."

INTRODUCTION

Webinar

In a recent University of Sydney, Lunchbox Science webinar, Associate Professor Jody Webster explained the use of fossil reef cores to learn about past sea level, climate and environmental change and responses of the Great Barrier Reef. The webinar is based on a study led by Jody and published in **Nature Geoscience:** *'Rise and fall of the Great Barrier Reef over 30,000 years'*

This webinar would make great teacher professional learning and provide an opportunity to differentiate content and challenge more capable HSC students.

Link to webinar
https://www.sydney.edu.au/science/news-and-events/events/lunchbox-science/lunchbox-science-with-jody-webster.html

Link to Nature Geoscience

Rise and fall of the Great Barrier Reef over 30,000 years'
https://rdcu.be/Prgb

Blog entry

Associate Professor Webster summarised key highlights from the paper *Rise and fall of the Great Barrier Reef over 30,000 years'* in a blog entry on his research group's website Coastal Research Group. Selected highlights relevant to Ecosystems at Risk include:

- The GBR had a complex and dynamic history of reef growth and demise over the past 30,000 years, characterised by five distinct reef sequences.
- Each reef sequence consists of shallow and deep reef habitats that can be traced in space and time.
- The GBR shows a remarkable capacity to laterally migrate as it tracked falling and rising sea levels.
- We identified two different types of reef death/demise events, one caused by subaerial exposure during falling sea level and the another caused by drowning as sea level rose beyond the capacity of the reef to keep up.
- As an ecosystem the GBR has been more resilient to past sea-level and temperature fluctuations than previously thought, but it has been highly sensitive to increased sediment input over centennial–millennial timescales.

Link to blog entry
https://grgusyd.org/2018/05/29/hot-off-the-press-the-rise-and-fall-of-the-great-barrier-reef-over-the-past-30000-years/

Note: The Coastal Research Group website Coastal research Group at https://grgusyd.org maintains a lot of interesting articles, multimedia, resources and blogs and links to original research papers that might be of interest to teachers and students with an interest in Geoscience topics.

News item

The item below from Sydney University News summarises the study led by Associate Professor Webster. The study reveals how the reef migrated laterally, landward or seaward, in response to sea level changes over a period of 30,000 years.

Link to USYD news item
https://www.sydney.edu.au/news-opinion/news/2018/05/29/rise-and-fall-of-the-great-barrier-reef-over-30-000-years.html

Rise and fall of the Great Barrier Reef over 30,000 years

University of Sydney News

World's largest reef system has suffered five death events

An international study led by Associate Professor Jody Webster has shown the reef is resilient to major environmental changes but is highly sensitive to increased sediment input and poor water quality.

A landmark international study of the Great Barrier Reef has shown that in the past 30,000 years the world's largest reef system has suffered five death events, largely driven by changes in sea level and associated environmental change.

Over millennia, the reef has adapted to sudden changes in environment by migrating across the sea floor as the oceans rose and fell.

The study published today in Nature Geoscience, led by University of Sydney's Associate Professor Jody Webster, is the first of its kind to reconstruct the evolution of the reef over the past 30 millennia in response to major, abrupt environmental change.

The 10-year, multinational effort has shown the reef is more resilient to major environmental changes such as sea-level rise and sea-temperature change than previously thought but also showed a high sensitivity to increased sediment input and poor water quality.

Associate Professor Webster from the University's School of Geosciences and Geocoastal Research Group said it remains an open question as to whether its resilience will be enough for it to survive the current worldwide decline of coral reefs.

"Our study shows the reef has been able to bounce back from past death events during the last glaciation and deglaciation," he said. "However, we found it is also highly sensitive to increased sediment input, which is of concern given current land-use practices."

The study used data from geomorphic, sedimentological, biological and dating information from fossil reef cores at 16 sites at Cairns and Mackay.

The study covers the period from before the "Last Glacial Maximum" about 20,000 years ago when sea levels were 118 metres below current levels.

History of death events

As sea levels dropped in the millennia before that time, there were two widespread death events (at about 30,000 years and 22,000 years ago) caused by exposure of the reef to air, known as subaerial exposure. During this period, the reef moved seaward to try to keep pace with the falling sea levels.

During the deglaciation period after the Last Glacial Maximum, there were a further two reef-death events at about 17,000 and 13,000 years ago caused by rapid sea level rise. These were accompanied by the reef moving landward, trying to keep pace with rising seas.

Analysis of the core samples and data on sediment flux show these reef-death events from sea-level rise were likely associated with high increases in sediment.

The final reef-death event about 10,000 years ago, from before the emergence of the modern reef about 9000 years ago, was not associated with any known abrupt sea-level rise or "meltwater pulse" during the deglaciation. Rather it appears to be associated with a massive sediment increase and reduced water quality alongside a general rise in sea level.

The authors propose that the reef has been able to re-establish itself over time due to continuity of reef habitats with corals and coralline-algae and the reef's ability to migrate laterally at between 0.2 and 1.5 metres a year.

Future survival

However, Associate Professor Webster said it was unlikely that this rate would be enough to survive current rates of sea surface temperature rises, sharp declines in coral coverage, year-on-year coral bleaching or decreases in water quality and increased sediment flux since European settlement.

"I have grave concerns about the ability of the reef in its current form to survive the pace of change caused by the many current stresses and those projected into the near future," he said.

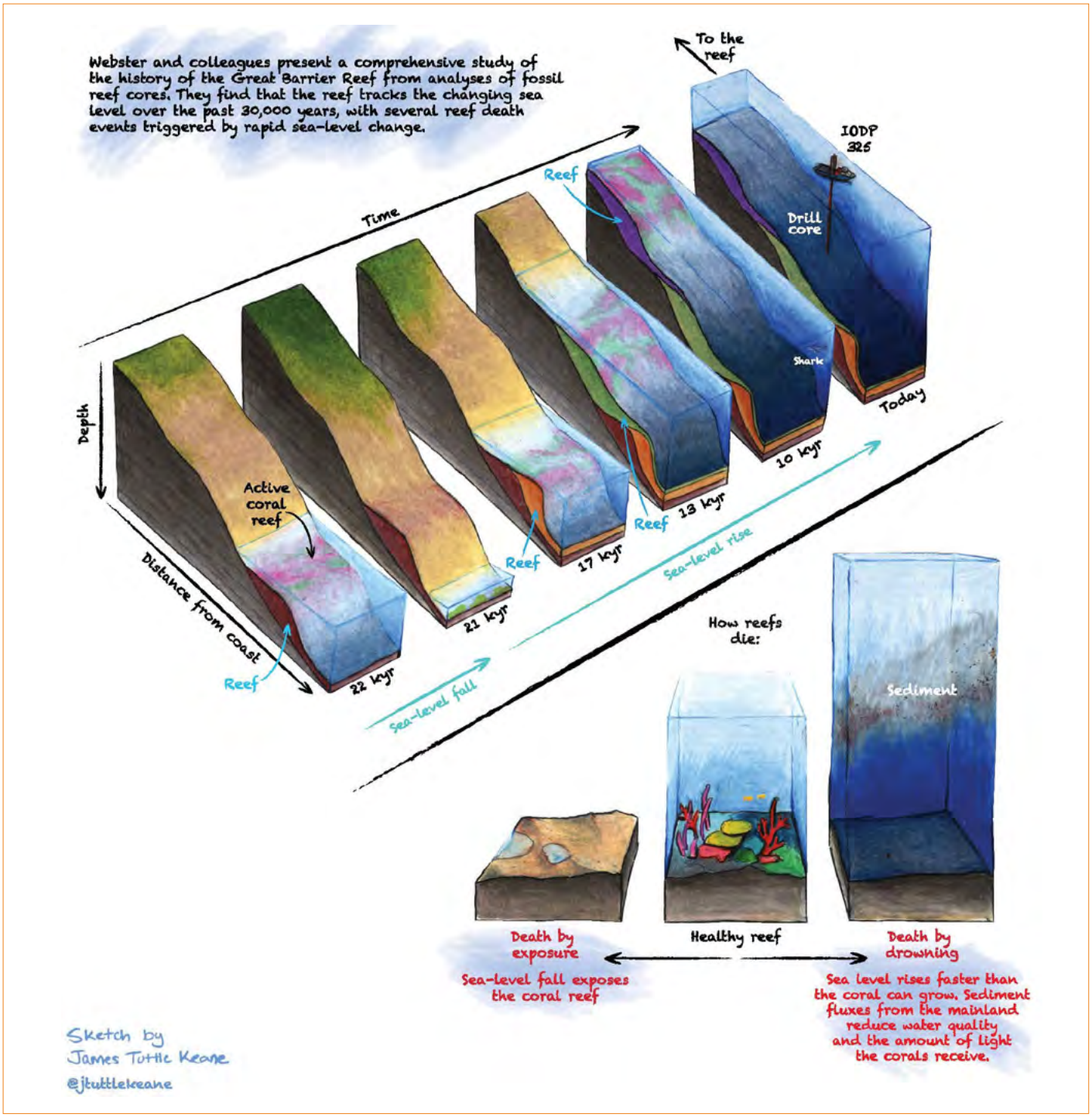
Associate Professor Webster said previous studies have established a past sea surface temperature rise of a couple of degrees over a timescale of 10,000 years.

Rise and fall of the Great Barrier Reef over 30,000 years

However, current forecasts of sea surface temperature change are around 0.7 degrees in a century.

"Our study shows that as well as responding to sea-level changes, the reef has been particularly sensitive to sediment fluxes in the past and that means, in the current period, we need to understand how practices from primary industry are affecting sediment input and water quality on the reef," he said.

Great Barrier Reef: Spatial and temporal change



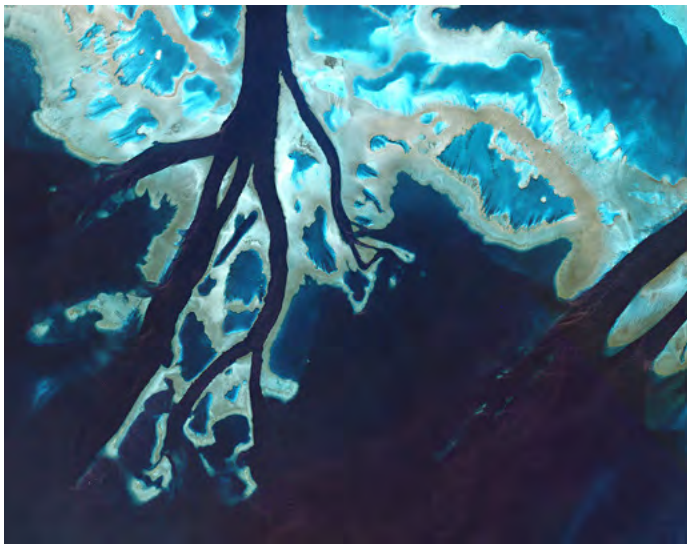
The reef has died five times in the past 30 millennia, largely in response to sea-level change caused by glaciation and deglaciation. A death event about 10,000 years ago looks more associated with high levels of sediment. Graphic by James Tuttle Keane and courtesy of Nature Geoscience

References

Webster, J.M., Braga, J.C., Humblet, M. et al. Response of the Great Barrier Reef to sea-level and environmental changes over the past 30,000 years. *Nature Geosci 11*, 426–432 (2018). https://doi.org/10.1038/s41561-018-0127-3

Rise and fall of the Great Barrier Reef over 30,000 years. Retrieved from University of Sydney News August 4, 2020. https://www.sydney.edu.au/news-opinion/news/2018/05/29/rise-and-fall-of-the-great-barrier-reef-over-30-000-years.html

Hot off the press! The rise and fall of the great barrier reef over the past 30,000 years. Retrieved from Coastal Research Group Blog, August 4, 2020. https://grgusyd.org/2018/05/29/hot-off-the-press-the-rise-and-fall-of-the-great-barrier-reef-over-the-past-30000-years/ .



Further reading

Mapping the fate of our reefs University of Sydney News, 29 March 2017 . Global warming and coral bleaching in the Great Barrier Reef. https://www.sydney.edu.au/news-opinion/news/2017/03/29/mapping-the-fate-of-our-reefs.html

How the great barrier reef sculpts underwater landscapes, July 20, 2020 by Geocoastal Research Group. https://grgusyd.org/2020/07/20/how-the-great-barrier-reef-sculpts-underwater-landscapes/

ABOVE: Envisat satellite image of a section of the Queensland coast and reef near Cape Melville NP. Source: https://commons.wikimedia.org/wiki/File:The_Great_Barrier_Reef,_Australia_-_Envisat.jpg

LEFT: Tidal channels cut through unnamed reefs off the coast of Queensland. Source: https://commons.wikimedia.org/wiki/File:Great_Barrier_Reef,_Australia_by_Planet_Labs.jpg

Recommended resources for teaching about coral reef resilience

Reef Resilience Network

Includes

- Ecological resilience
- Coral reef resilience including natural mechanisms such as recruitment and herbivory
- Resilient based management
- Reef resilience in practice – including GBR case study.

https://reefresilience.org/resilience/what-is-resilience/

Reef Blueprint: GBRMPA

http://www.gbrmpa.gov.au/our-work/reef-strategies/managing-for-a-resilient-reef

Great Barrier Reef – ABC Catalyst activity

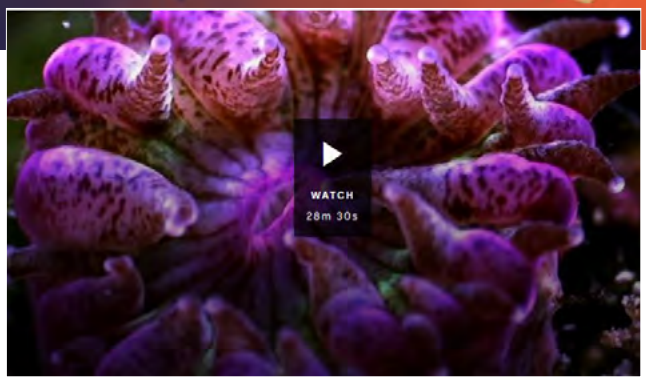
Bleached coral, Acoropora sp. Source: https://upload.wikimedia.org/wikipedia/commons/4/47/Bleached_coral%2C_Acoropora_sp.jpg

Justin Mahoney, Geography Teacher,
All Saints' College Maitland, St Mary's Campus

Introduction

"This summer, large parts of the Great Barrier Reef saw the hottest sea temperatures and the most severe coral bleaching ever recorded – so before the next impact hits, scientists are racing against time to understand the demise of reefs and the prospects for their recovery. Catalyst explores the lethal threat of bleaching to the Great Barrier Reef, and the challenges we all face to protect this global treasure."
Catalyst: Coral Bleaching 2016

Catalyst



View the Catalyst program "Coral Bleaching" using the following weblink.
https://www.abc.net.au/catalyst/coral-bleaching/11016946#:~:text=Early%20in%202016%2C%20high%20sea,effort%20to%20map%20what%20happened.&text=We%20flew%20over%20nearly%201%2C200,of%20the%20Great%20Barrier%20Reef.

Complete the activities on the following pages

Key technical geography terms used in the program

- **Symbiotically** or **symbiosis** – refers to two organisms living together and providing nutrients to each other in a positive way. In the GBR, a key symbiotic process is the co-dependent relationship between coral polyps and algae zooxanthellae.
- **Symbiodinium** or **symbionts** – algae that sustains coral life. Sometimes called zooxanthellae.
- **Photosynthesis** – process by which plants and some bacteria use the energy from sunlight to produce glucose from carbon dioxide and water.
- **Pulsed inflation** – occurs when coral expels their algae symbionts through repeated convulsions.

Find a version of the following activity in the Edition 3 Supplement

1. The process of coral bleaching

- A_____, p_____ or m_____? Coral is a mix of all three – an upside down jellyfish called a p_____ that embeds plant cells in its flesh and builds solar power cities from limestone.
- To survive, coral needs a key partner, a_____. Microscopic single-cell algae of the genus **Symbiodinium**. Coral takes the algae from the water to live symbiotically inside its own cells. That's how the polyp gets its colour. It's a positive relationship – the algae, or symbionts, receive s_____ and carbon dioxide from their host. In return, the coral obtains most of its nutrition from s_____that the algae make through photosynthesis. But there's a catch – this solar-powered partnership depends on temperature to work. So what happens when water warms up? Over a week, QUT researcher Brett Lewis increased the water temperature by 4 degrees, to peak at 32 degrees Celsius.
- Mushroom corals – a large solitary type that don't build reefs, expelled their algal symbionts with repeated convulsions, known as pulsed i_____. Some of the largest expansions seen were 3_____% the size of the actual original tissue.
- As clouds of algae are pumped into the water, the coral loses its c_____ and becomes pale. Corals are known for doing this to get rid of s_____, but to get rid of algae in this way has not been seen before.
- That's the reaction of just one coral in a lab. This is what happens on the scale of a reef. Early in 2016, high sea temperatures over many weeks caused mass bleaching in parts of the Great Barrier Reef.
- _____%-plus of GBR's corals bleached, because when that level of bleaching occurs, you're looking at _____% or more mortality.
- Bleaching doesn't usually kill them outright but if the algae aren't replaced, the coral slowly s_____. When healthy, each square centimetre of coral tissue is packed with around _____ million algal cells.
- In previous bleaching events, they've seen algal symbionts reduce to about _____ – a tenfold decrease. This time in samples from the northern reefs, they found barely any left at all.

2. When bleaching happens, what's going on inside the coral?

- The algae actually go into hyperdrive, to some extent. So with all that heat, all that _____, they become over-reactive and therefore the coral doesn't like that so they essentially just _____ them out of their tissues.
- Above _____ degrees, the algae start to lose their ability to convert solar energy. That energy has to go somewhere and ends up creating reactive forms of o_____n, like peroxide and bleach, inside the coral cells. The very light a coral needs for growth becomes poisonous.
- 6 months, 12 months down the track, higher levels of d_____e can occur. Once the health of the coral is compromised, bacteria and other microbes cause _____.
- This lesion will move up to ____mm to _____mm a day. In some areas, it can be seen to move centimetres a day. And so some corals that have been infected with these lesions will be dead within weeks.
- For corals to recover, they don't just have to take up their symbionts again, they have to repair their t_____, they have to fight off these i_____ and then they have to select that one microbe that they need to survive.
- Some corals didn't die slowly of starvation because they'd lost the symbiont, they actually cooked over a period of just a week or two because the temperatures in the northern Barrier Reef were so extreme.
- The average sea surface temperatures in summer 2015-2016 were the highest ever recorded.
- This year, we saw some locations well over _____ degrees Celsius warmer than they would usually experience in the hottest time of year.
- It takes 10 to _____ years for the fastest-growing corals to bounce back after a severe disturbance, like a bleaching event or a cyclone.
- Severe Tropical Cyclone _____ was the strongest to hit the South Pacific in recorded history. When it struck Fiji in February 2016, it came eventually to the coast of Queensland as a _____ depression and it sat around the bottom half of the Great Barrier Reef for a period of several weeks. It brought the temperature down by about _____ degrees centigrade. So the Barrier Reef was saved, the southern half, by the vagaries of that cyclone coming along.

- We now know that Symbiodinium has a broad range of g_____ diversity, in fact as many as 400–500 species. In fact, the deeper we go into the genetic variation, the more variability we find.
- The question is, will this genetic diversity be able to match the challenges of environmental change?
- To what extent can corals save themselves by selecting new symbionts, new solar panels if the old ones aren't up to scratch?
- There's emerging evidence that if they survive a bleaching event, some adult corals can then switch their algal s_____ to a tougher species.

3. Bringing all of the information together to write an essay paragraph on coral bleaching.

Sample essay question: Analyse ONE human impact on an ecosystem at risk

- **Analyse** = explore relationships and explain the implications (effects). Key phrases include "implications", "meaning", "resulting in", "event **x** has a relationship with event **y**", "leading to", "as a consequence". For this question, the relationships will be between the spheres.
- **Impact** = short and long term consequences of an event.
- **Human impact** = changes induced by people, such as global warming and associated coral bleaching.

In the space below, write a paragraph about the impacts of coral bleaching that addresses the above question.

Your paragraph must follow the TEEL structure and include at least five of these technical geography terms: ***Bleaching, Symbiodinium, symbionts, zooxanthellae, photosynthesis, pulsed inflation, natural stress, tropical cyclone, rain depression, genetic diversity, geomorphological/lithosphere, limestone exoskeleton, atmosphere, hydrological/hydrosphere, biogeographical/biosphere, Drupella, mushroom coral, instant mortality, turfing algae, resilience, vulnerability, elasticity.***

A B&W version of this activity with larger writing spaces can be found in the Edition 3 Supplement

THE NSW RIVERINA IS

... rice, fish farms, malted grains, water markets, bioenergy production, jujubes, **water management**, automated farming, tree nuts, **cotton ginning**, food processing, soil microbiome enhancement, farm financing, biochar, flavour and aroma extraction, **RAMSAR listed wetlands**, liquorice, farm management techniques for growing climatic variability, **regenerative farming techniques**, art deco period and vernacular architecture, organic farming systems, different types of business structures, automated farm management systems, vehicle guidance by satellite, **intermodal freight nodes**, vegetable/animal/aromatic oils, bankless irrigation channels, on-farm value adding, **transport logistics**, wine/whisky/cider/beer, pollination services, stud breeding of horses/working dogs/cattle/earthworms/sheep, **landforming**, cheesemaking, maize, sentinel animals, **The Murray Darling Basin Plan**, river biome restoration, factors in farm business decision making, livestock exchanges, **rural and environmental research**, emu farm, cherries, on-farm biosecurity, apricots, abattoirs, Wiradjuri language restoration, **Murrumbidgee River floodplain**, chocolate, designing product marketing campaigns, flower farming, **biocontrols of insect pests**, regional tourism, canola, **industry supply chains**, farm business succession, government regulation and compliance measures, prunes, solar farms, cold country berries, agricultural aircraft, apples, **on-farm irrigation design and engineering**, jojoba, export controls, farmer cooperatives, sunflowers, juicing and table citrus, ethnic diversity, **floodplains**, pomegranates, olives for table and oil, oats, phytosanitary measures, animal welfare, barley, **red gum forests**, rural health and welfare, Aboriginal histories and culture, industry associations and politics, **soil types and soil archives**, spelt, hay exports, **European carp controls**, market-oriented plant breeding, dairying, beeswax for nutraceuticals, poultry, **dryland broadacre farming**, woolbroking, farm waste disposal and utilization, animal nutrition and feeds production, rural engineering, **purpose-built and organic-growth towns**, grains quality management, sawmilling, rural skills training, historical phases from pre-invasion to market-based, fat lambs, farm machinery dealers, **regional population trends**, rural workforces, citrus export arrangements, farm forestry, **alpine to semi-arid vegetation communities** ...

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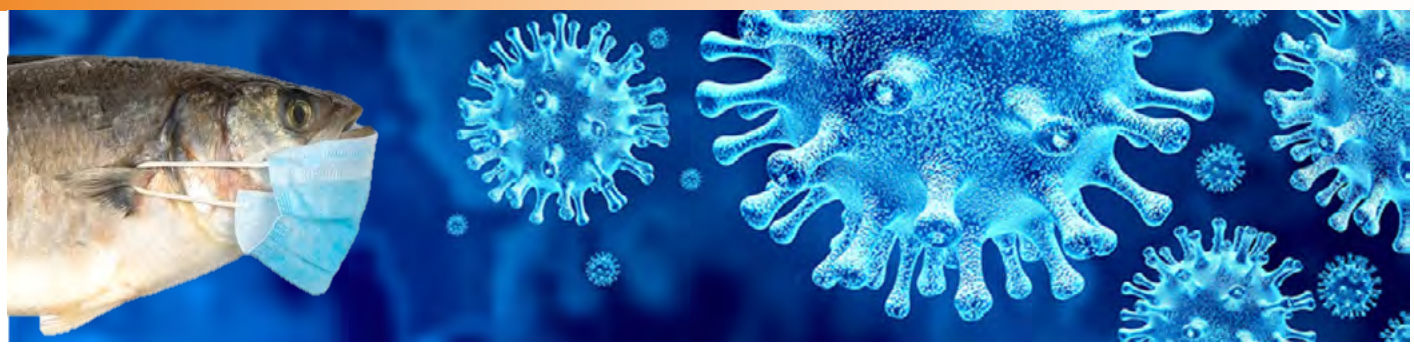


Source: http://www.fao.org/in-action/globefish/news-events/details-news/ru/c/1268337/

ECONOMIC ACTIVITIES AND COVID-19

Lorraine Chaffer
Vice President GTA NSW & ACT

SYLLABUS LINKS

- Factors explaining the nature, spatial patterns and future directions of an economic activity (BEESTOP)
- Internal and external linkages of an economic enterprise
- Effects of global changes in the activity on an economic enterprise.

ACTIVITY 1: Is your economic activity a winner or loser?

Study Source A: 'DECODING THE ECONOMICS OF COVID-19'

a. Identify the area of production in which your economic activity falls.
b. Do you agree that your activity is correctly categorised as a short-term winner OR loser in the COVID-19 pandemic? Justify your answer.
c. Choose ONE potential winner and ONE potential loser (not your own activity) and suggest how COVID-19 would have positively or negatively impacted that activity.

Extension: Research evidence or provide anecdotal evidence to support your suggestion.

SOURCE A: Winners and losers

Source: Alamy stock photos

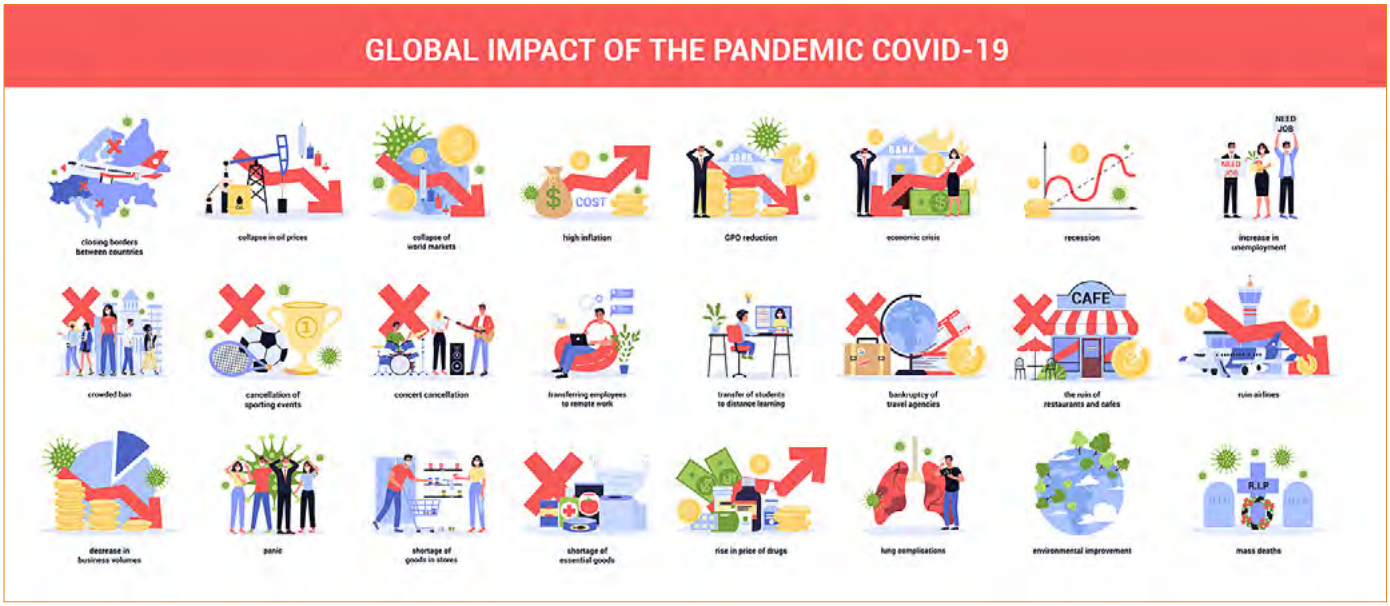
ACTIVITY 2: How has Covid-19 impacted activities globally?

Study Source B: 'GLOBAL IMPACT OF THE PANDEMIC COVID -19'.

Use the relevant worksheet in the Edition 3 Supplement

a. Beside each image on the activity worksheet add the letters EC (Economic), EN (Environmental) or S (social) to identify the impacts of COVID -19.
b. Select four of impacts on the infographic that are relevant to the global economic activity you studied and that you can elaborate on in the text bubbles on the worksheet.
c. Create a consequence diagram to illustrate how one impact has a flow on effect for an economic activity.

SOURCE B: Global impact of Pandemic Covid-19



Source: Shutterstock

ACTIVITY 3: How has COVID -19 impacted on your economic activity and enterprise?

'The Great Lockdown: the global economic impact of COVID-19' states that businesses will suffer adversely due to Covid-19 through changes to demand, supply chains, financial impacts and impacts external to business activities.
See Source D

According to *Deloitte Insights* (Source E) COVID-19 will impact on economic activities in three ways:

- Directly impacting on production
- Disrupting supply chains and markets
- Financial impacts

Sources A, B and C and associated activities are included in the PPT that supports this Edition.

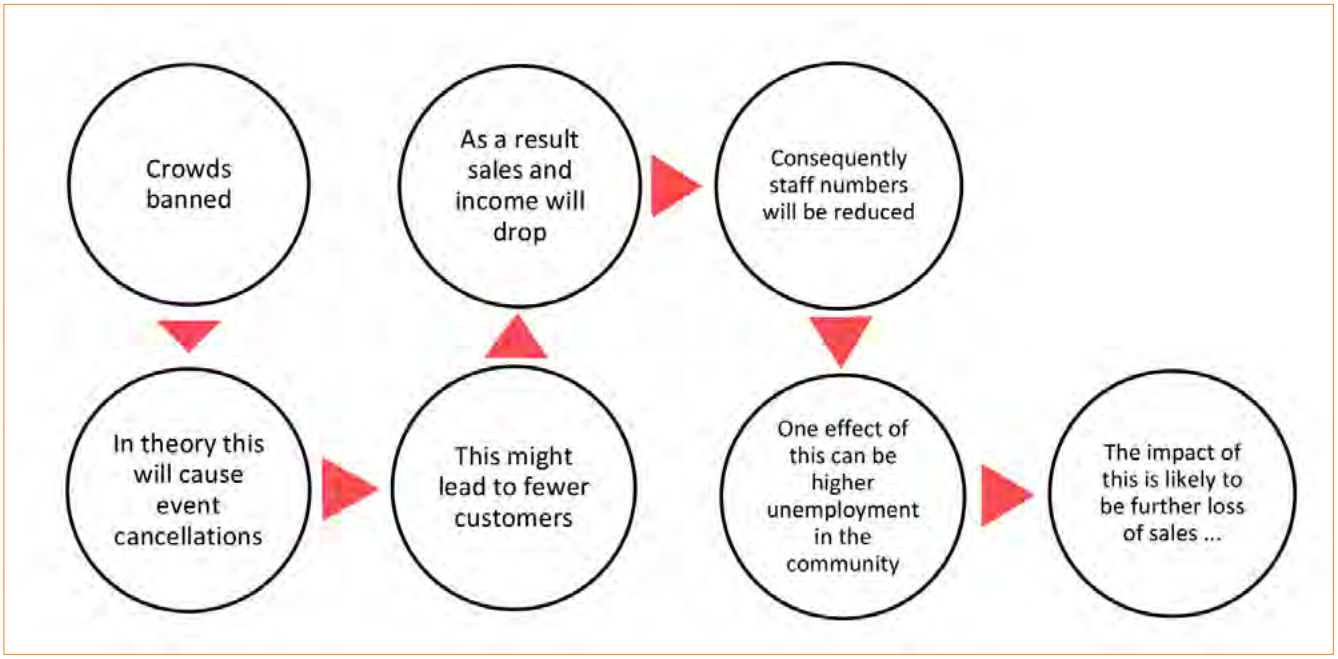
Refer to Sources D, E and F to complete the relevant worksheet in the Edition 3 Supplement

a. In Column 1 list potential impacts of Covid-19 on economic activities
b. In Column 2 outline if and how each impact has affected the economic activity you studied
c. In Column 3 outline if and how each impact has affected the economic enterprise you studied

ACTIVITY 4: Develop your reasoning skills to explain or predict COVID -19 impacts

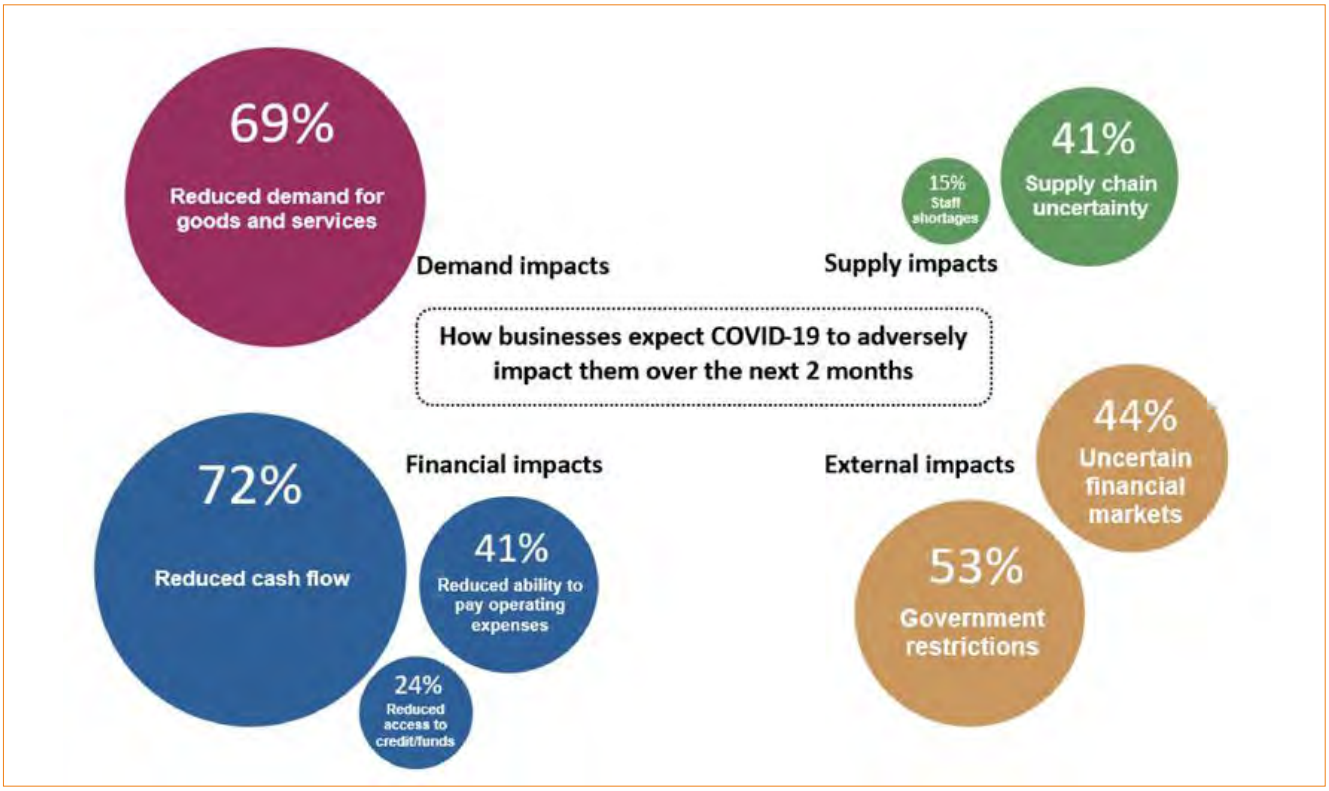
Create 'chains of reasoning' to illustrate the consequences of TWO impacts of COVID 19 on your **economic enterprise**. **Use Worksheet 3 in the Edition 3 Supplement.**

SOURCE C: Sample 'Chain of reasoning' for a microbrewery offering functions and weekend entertainment.



Created by L Chaffer.

Source D: Impacts of COVID-19



Source: Wine Australia https://www.wineaustralia.com/news/market-bulletin/issue-203?utm_source=DWN&utm_campaign=fae08b21c9-DWN_CAMPAIGN_MAY_2020_COPY_01&utm_medium=email&utm_term=0_1787000e4c-fae08b21c9-223178105

SOURCE E: Economic Impacts of COVID-19

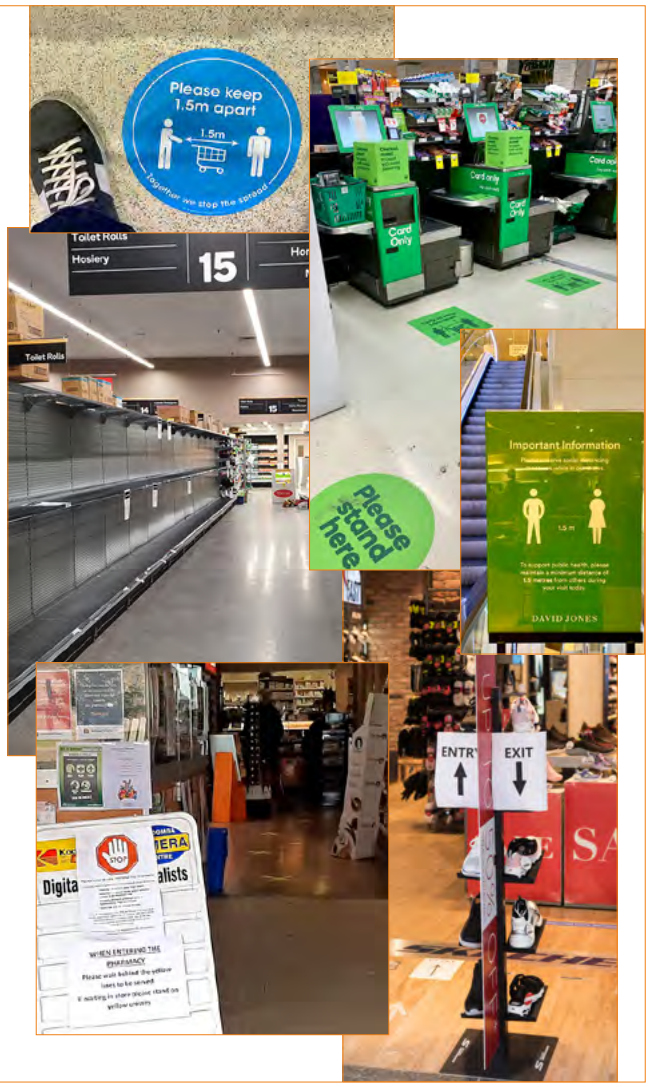
EXTRACT from 'The economic impact of COVID-19 (novel coronavirus)'

COVID-19 could affect the global economy through:

Direct impact on production. *Chinese production has already been substantially affected by the shutdown in Hubei province and other areas. Some other countries are also beginning to feel a direct impact as their authorities put in place similar measures.*

The slowdown in China has effects on exporters to China. China's largest sources of imports are Korea, Japan, and other Asian countries, according to the World Bank. Thus, even without new outbreaks of the disease, these areas will likely experience slow growth in the first half of 2020.

Supply chain and market disruption. *Many manufacturing firms rely on imported intermediate inputs from China and other countries affected by the disease. Many companies also rely on sales in China to meet financial goals. The slowdown in economic activity—and transportation restrictions—in affected countries will likely have an impact on the production and profitability of specific global companies, particularly in manufacturing and in raw materials used in manufacturing. For companies that rely on intermediate goods from affected regions, and that are not able to easily switch sourcing, the size of the impact may depend on how quickly the outbreak fades. Small and medium-sized firms may have greater difficulty surviving the disruption. Businesses tied to travel and tourism are facing losses that are likely not recoverable.*



Deloitte Insights. Source: https://www2.deloitte.com/us/en/insights/economy/covid-19/economic-impact-covid-19.html#. Montage images: Wikimedia Commons

Image source: https://commons.wikimedia.org/wiki/File:Canberra_Coronavirus_Field_Hospital_June_2020.jpg

SOURCE F: Examples of COVID-19 impacts on economic activity

Viticulture

'The International Wine and Spirit Record (IWSR) is predicting that the current recession will have a much longer lasting impact on the global drinks industry than the GFC. There are similarities in consumer behaviour between the two time periods, such as increased at-home consumption and consumption at the lower end of the price spectrum. However, the differences include on-trade consumption practically ceasing altogether and the lack of international travel. They also forecast that the effects of the economic downturn will be worse for beer, the consumption of which is heavily dependent on the on-trade, sports fixtures, festivals, and events.

IWSR's most recent data release predicts a decline of 13 per cent in wine consumption globally in 2020, falling by 3.2 billion litres to 20.9 billion litres. The forecast recovery is slow; an average growth rate of just 3 per cent per annum to reach 23.3 billion litres by 2024. For context, global wine consumption in 2019 was estimated to be 24.1 billion litres.'

https://www.wineaustralia.com

'With cellar doors and on-premise outlets closed, and consumers making fewer trips out to 'bricks and mortar' retailers, both consumers and wine producers have little choice but to focus on e-commerce. This trend had already started in Australia following the bushfires.'

https://www.wineaustralia.com/news/market-bulletin/issue-196

Image source: https://commons.wikimedia.org/wiki/File:Bottle_shop_in_Brisbane,_Queensland.jpg

Aquaculture

'Fish and fish products that are highly dependent on international trade suffered quite early in the development of the pandemic from the restrictions and closures of global markets, whereas fresh fish and shellfish supply chains were severely impacted by the closure of the food service sectors (e.g. hotels, restaurants and catering facilities, including school and work canteens). The processing sector also faced closures due to reduced/lost consumer demand. This has had a significant impact, especially on women, who form the majority of the workforce in the post-harvest sector.

The lockdowns implemented by some countries have resulted in logistical difficulties in seafood trade, particularly in relation to transportation and border restrictions. The salmon industry, in particular, suffered from increased air freight costs and cancellation of flights.

Some shortages of seeds, feeds and related aquaculture items (e.g. vaccines) have also been reported, due to restrictions on transportation and travel of personnel, with particular impacts on the aquaculture industry.'

http://www.fao.org/2019-ncov/q-and-a/impact-on-fisheries-and-aquaculture/en/

Image source: https://commons.wikimedia.org/wiki/File:CSIRO_ScienceImage_199_Measuring_Western_Rock_Lobster_Catch.jpg

Coffee

'About 80% of the coffee in the world is produced by 25 million small farmers, and 125 million people depend on the collection activity for their livelihood. Even before this crisis, the lack of investment in modernization and the impact of climate change represented serious risks for the sustainability of the sector.

Medium and small farmers were already having difficulty covering operating costs. The decrease in prices in recent years has made their livelihood increasingly difficult. For example, Brazil, the main coffee-producing country, has about 264,000 plantations of which 72% have an area of less than 20 hectares, 16% are between 20 and 50 hectares and 12% have over 50 hectares. The level of mechanization is low and about 70% of the coffee is handpicked by two million people employed seasonally.

The main risk is therefore the possible shortage of manpower due to the spread of the virus and the measures of lockdown'. The consequent delay or postponement of orders by consumer countries could cause the definitive closure of many farms with the consequent destruction of entire local coffee-based economies.'

https://coffeebi.com/2020/05/11/covid-19-impact-of-the-pandemic-on-the-coffee-production-chain-part-1-production-international-trade/

https://upload.wikimedia.org/wikipedia/commons/9/9c/DirkvdM_harvested_coffee.jpg

	FARMERS	EXPORTERS	COFFEE ROASTERS	BAR AND RESTAURANTS	CONSUMERS
Short Term	Shortage of manpower, postponement of order requests.	Shortage of staff / crew, fewer shipments and less container space.	Temporary closure of production, delays and blocking of deliveries, accumulation of stocks.	Business closures and limitations, takeaway and home deliveries, lack of liquidity.	Collapse of consumption outside the home, slight increase in consumption at home, increase in online orders.
Medium/Long Term	Monetary devaluations, investment reduction, closure of small operators, possible destruction of local economies.	Investment for personal safety and disinfection.	Closure risk for medium / small operators linked to away-from-home, postponement of investments.	Adjustment measures required, prolonged risk of reduction of space and customers.	Possible reduction of disposable income, reduction of consumption, particularly outside the home.

Source: COFFEEBI.COM

Source: https://coffeebi.com/2020/05/13/covid-19-impact-of-the-pandemic-on-coffee-consumption-part-2/

Chocolate

Two-thirds of the world's chocolate supply comes from West Africa, but the number of confirmed COVID-19 cases on the continent is now rising fast. The pandemic is exacerbating cocoa farmers' poverty, meaning they can't invest in proper protection from the virus.

This uncertainty and disruption in the supply chain could jeopardise the future of cocoa production, which is already suffering from the effects of climate change and deforestation.

https://www.euronews.com/living/2020/06/19/could-chocolate-be-the-next-victim-of-the-pandemic

Unsplash image by Etty Fidele @fideletty

Global Tourism Update 2020

Dr Grant Kleeman

The COVID-19 outbreak brought the world to a standstill. The global tourism industry was amongst the most severely affected of its economic activities. Around the world, airlines grounded thousands of aircraft, hundreds of cruise ships lay idle at anchor, hotels closed, and millions of tourism employees were stood down as governments implemented travel bans, closed borders and instituted quarantine measures. More broadly, the pandemic had an unparalleled and unforeseen impact on our lives, our economies, our societies and our livelihoods. There is a very real risk that the world is on the verge of a deep and prolonged recession – a decline so pronounced that it could eclipse the Great Depression of the 1930s. It may take years for the global tourism industry to recover.

Figure 1: April 2020. A worker sanitizes Venice's St. Mark square during the national lockdown for Covid-19 pandemic. Typically packed with tourists the square is eerily empty.

Why does it matter?

Global tourism is big business. According to the World Tourism Organisation (WTO), the industry accounts for some 10 per cent of global GDP (US$8.9 trillion) and one in 10 jobs (330 million workers). More than 100million of these employees, and some $2.7 trillion in GDP, are at immediate risk because of the current crisis.

Global tourism before the onset of the pandemic

In 2019, before the COVID–19 pandemic lay waste to the industry, global tourism reached a level of activity never before experienced. More than 1,460 million people travelled internationally in the calendar year (see figure 3) an increase of a healthy 3.8 per cent increase over 2018 but just below the decade long average of 4.2 per cent annual growth (see Figure 4). Europe continues to be the most popular destination (51%) followed by Asia–Pacific (25%). (See figure 5).

The rapid rate of growth in international tourist arrivals evident since World War II illustrates just how important the industry is to the global economy. In the years following the war, just 25 million people travelled internationally each year and most of these journeys involved cross-border movements within Europe and North America. By 1980, the number of international tourists had increased to 202 million driven by declines in the real cost of air travel and rising standards of living. By 2000, 699 million people travelled internationally.

Tourism receipts exceeded US$1,507 billion in 2019. Again, Europe dominates with 39 per cent of the revenue generated by the industry, followed by Asia and the Pacific (30%) (See Figure 6). Tourism economic

importance by highlighted by the observation that it is the world's third most valuable export after fuels and chemicals. (See Figure 8). Africa is the most tourism-dependent region. The Asia–Pacific region is the least dependent (See Figure 9).

Figure 2: Grounded Qantas aircraft

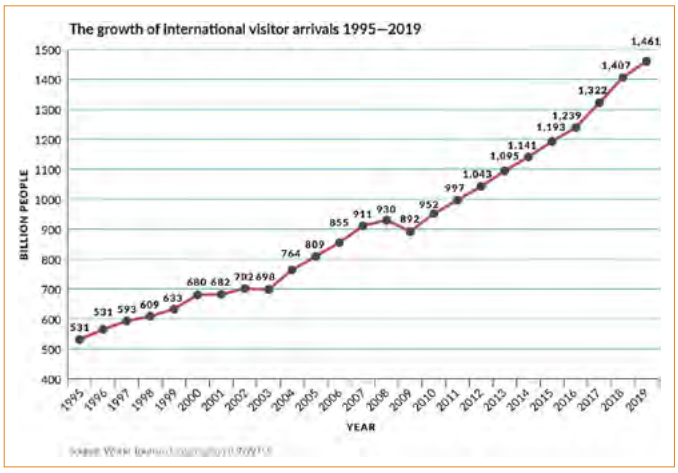


Figure 3: This line graph illustrates the growth of international visitor arrivals 1995–2019.

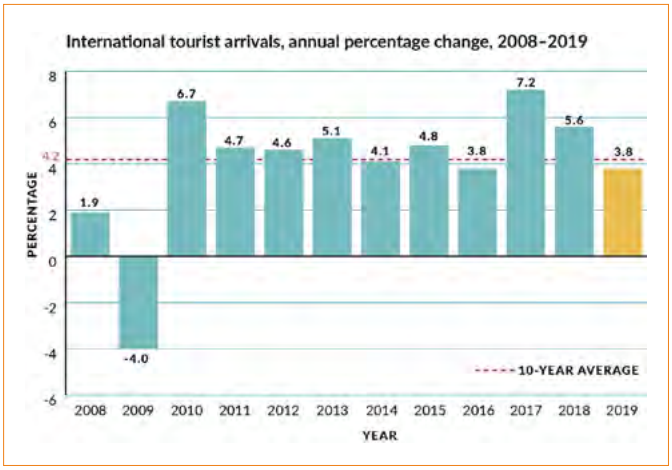


Figure 4: International tourist arrivals, annual percentage change, 2008–2019

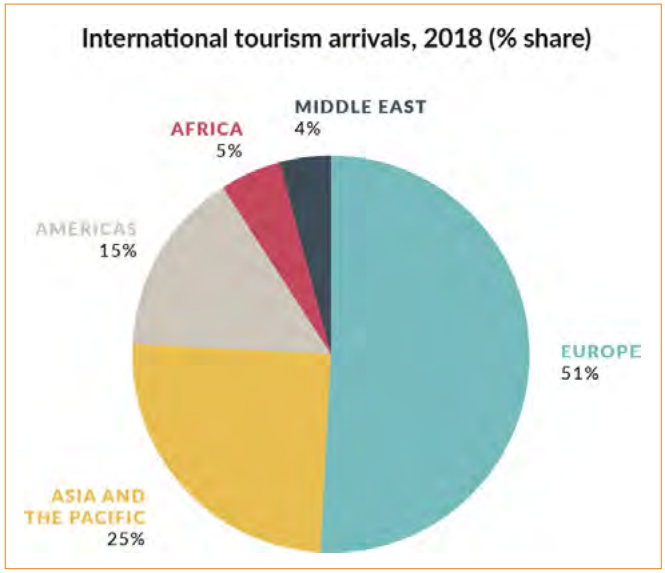


Figure 5: International tourism arrivals, 2018 (% share)

Figure 6: International tourism receipts, 1995–2018

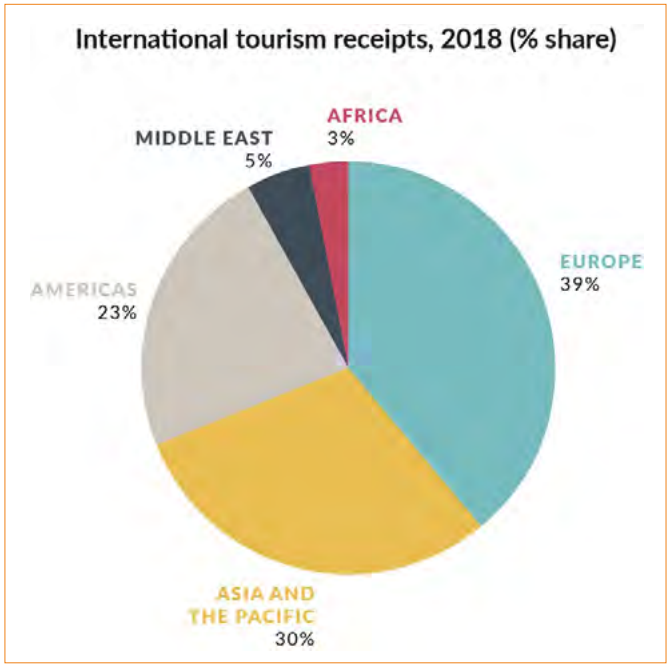


Figure 7: International tourism receipts, 2018 (% share)

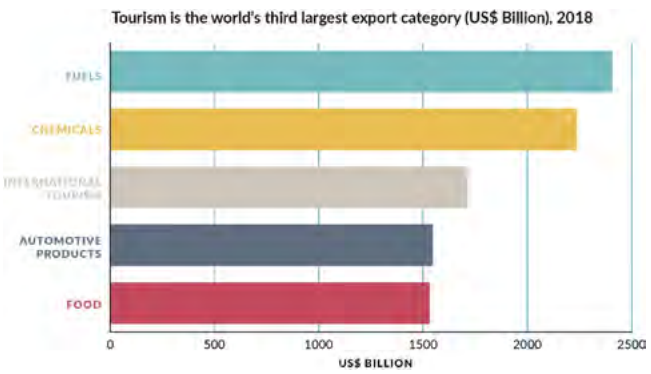


Figure 8: Tourism is the world's third-largest export category (US$ Billion), 2018

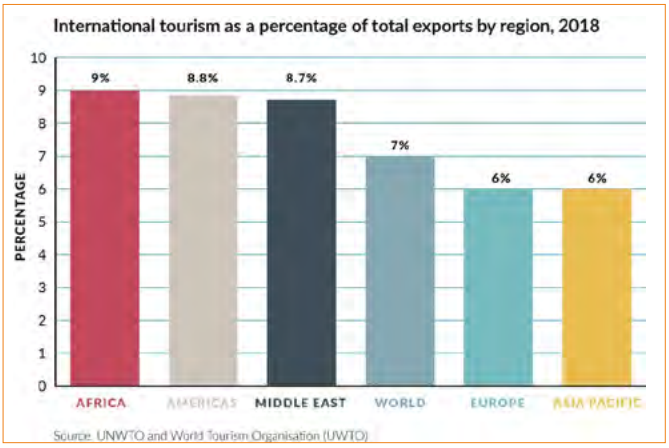


Figure 9: International tourism as a percentage of total exports by region, 2018

Figures 10 and 11 highlight the key features of global tourism in 2018. Figure 10 shows the purpose of travel. Travel for leisure, recreation and holidays dominate followed by visiting friends and relatives and religion (27%). The principal mode of travel is air (58%) followed by road (37%). (See Figure 11).

Figure 10: Purpose of visit, 2018 (% share)

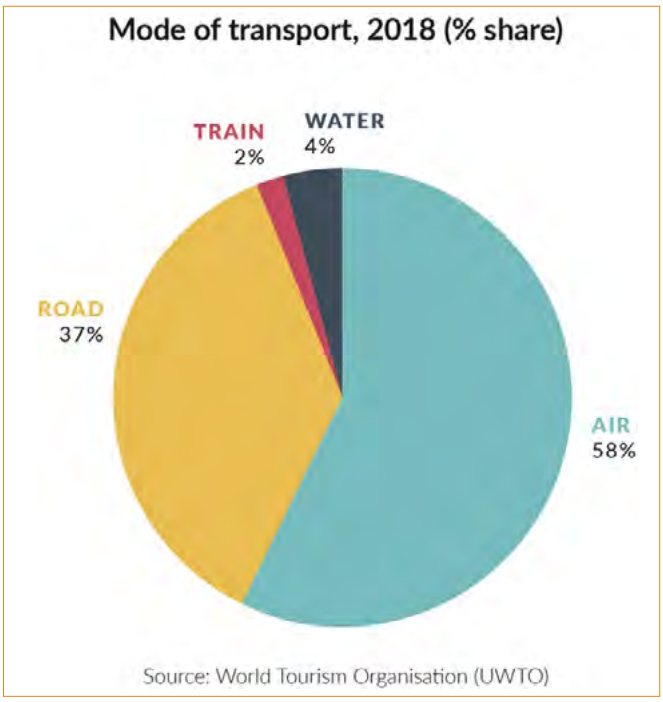


Figure 11: Mode of transport, 2018 (% share)

A key feature of global tourism is its increasing product diversity and specialisation. The degree of specialisation, expressed in terms of revenue, is shown in Figure 12. Cultural tourism continues to be the largest sector, followed by culinary tourism, ecotourism and wellness tourism.

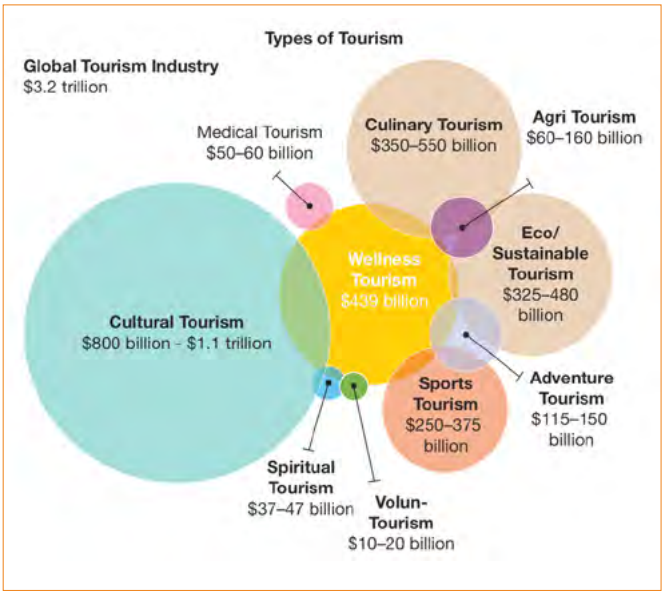


Figure 12: Types of tourism

Figures are included in the PPT that supports this Edition.

Figure 13: Young Chinese tourists in London. The rapidly growing Chinese middle class is a major driver in the growth of global tourism

Accounting for the growth in global tourism

Much of the growth in global tourism can be accounted for by the decline in the real cost of travel (driven largely developments in aviation technologies, especially the introduction of high capacity aircraft beginning with the Boeing 747 in 1969) and the rise of a global middle class with enough discretionary income to engage in travel.

In terms of the latter, the world's middle class continues to grow rapidly. By 2020, half the world's population were part of the middle class or lived in wealthy households. Specifically, out of a total of 7.6 billion people in the world, 3.6 billion now belong to the middle class. This is a significant figure, especially when you consider that only 10 years ago the number of people making up the middle class was just half that (around 1.8 billion).

After reaching the first 1.0 billion at the end of the 1980s, the middle class took more than 20 years to add another 1.0 billion. It took just eight years to add the last 1.6 billion.

Looking ahead, the growth of the middle class shows no signs of slowing. Indeed, the latest estimates place the total population of the middle class at around 5.2 billion by 2030 (around 1.6 billion more than today), which will represent some two-thirds of the world's population.

Since 2009, China has been responsible for the entry of around 700 million people into the ranks of the global middle class: 40 per cent of all new entrants. Furthermore, taking China and India together, the two countries account for around 60 per cent of the new middle class (some 1.0 billion people).

So why does this matter? The purchasing power of the middle class is projected to increase from $35 trillion in 2018 to $64 trillion in 2030. Households entering the middle-class increase the demand for both consumer durables and services including tourism, entertainment, health, education and transport. The lifestyle aspirations of the middle class are central to the tourism industry's future.

One consequence of the growth of the global middle class has been a surge in the number of Chinese tourists. In 2019, almost 220 million Chinese travelled internationally and accounted for one-fifth of international tourism spending, or $277 billion. By way of contrast, tourists from the United States spent $144 billion.

Before the onset of the pandemic, the WTO projected that the number of Chinese tourists would reach 400 million by 2030 (that's nearly a quarter of all international travellers). Of the increase in total international movements between 2019 and 2030 (from 1.3 billion to 1.8 billion) almost half are projected to originate in China.

Even at 400 million, there is still potential for further growth. Significantly, China's outbound tourists represent less than 28 per cent of the country's total population. This suggests there exists a huge potential to grow the number of Chinese engaged in international tourism.

Figure 14: Venice crowds pre-pandemic. The iconic Italian city is in danger of depopulation due to the crowing and high cost of living

The impacts of growth

The growth in global tourism is not without its consequences. Before the onset of COVID–19, overcrowding was the most pressing issue facing the industry as the surge in visitor numbers alienated residents of popular destinations, overwhelmed local infrastructure and degraded the environment.

Take Venice for example, one of the most visited places on earth. Before the onset of COVID–19, the greatest tourism-related challenge facing the iconic Italian city was how to cope with the rapidly growing number of

tourists crowding into its squares, canals and narrow laneways. Today, the city is largely deserted. Travel bans and lockdowns have resulted in the collapse of both international and domestic travel.

Prior to the pandemic, as many as 30 million tourists from all over the world descend on Venice, pumping up to $5 billion into the local economy. But relatively few of those visiting the city is Italian. Italians who have never been as enamoured with the city and its canals as the rest of the world.

Many local are not keen for the city to resume 'business as usual' once the pandemic is controlled. The non-profit group, ***We Are Here Venice***, for example, has been fighting to get authorities to recognise the advantages of sustainable tourism. Of particular note is the campaign to keep massive cruise ships out of Venice.

Figure 15: Cruise ships disembark thousands of tourists into an already crowded Venice every day

Venice has become a victim of its popularity. Over tourism, driven by the low-cost air travel and the growth of the cruise ship industry has initiated the flight of residents unsettled by the tourist invasion. Many have simply relocated to the mainland, driven out by the crowds, high prices and rising rents as owners have found the short-term, Airbnb market more lucrative.

Activists hope to see a new Venice emerging in the post-pandemic world. They claim that the lack of permanent residents is a greater threat than the number of tourists. The population of Venice has declined from 175,000 after World War II to just over 52,000 today. Many of those who are left are elderly and alone. With more residents, activists claim the city will better reflect the Venetian culture and the wonderful lifestyle that this amazing city offers.

Threats to ban visiting cruise ships that decant thousands of tourists into the city each day have met some resistance, especially from the thousands employed at the city's massive cruise terminal.

Activists argue that the pandemic gives Venice the opportunity to rethink mass tourism and try to create a new type of sustainable visitor experience for the fragile city. They want to transition away from a focus on designer shops and luxury goods to goods made in Venice. They want to promote local artisans. They also want to promote Venice as a place of education with tourist apartments housing students and bringing new energy to the city.

The Australian tourism industry

Tourism is one of Australia's major exports. In 2019, Australia attracted 8.6 million international visitors (i.e. 980 arrivals per hour). Together, they spent $43.9 billion on goods and services. The following observations highlight the economic importance of the industry:

- Tourism is Australia's largest services export industry. Education comes in second. Iron Ore is number one!
- Since 2009, Australia has seen a steady increase in international arrivals, with dramatic growth observed every year from 2012 onwards.
- In 2018, the top six source countries were China (1.43 million), New Zealand (1.38 million), the United States (789,000), the United Kingdom (733,000), Japan (469,000), and Singapore (448,000).
- NSW is the most visited state (4.3 million) followed by Victoria (3.0 million) and Queensland (2.7 million).
- The summer months of December, January, and February attract the most visitors to the country. The warmer weather, combined with popular seasonal sporting events (such as the Australian Open and the cricket), is major factors in high international arrivals during the summer. It is also the peak of the cruising season when an increasing number of ships base themselves in Sydney. Autumn was the quietest season for international visitors to Australia.
- The average length of trips to Australia has decreased over the past decade. In 2009, the average international trip to Australia lasted 35 nights. In 2018, the average international trip to Australia lasted 32 nights.
- Australia's isolation from other continents makes it a difficult destination for travellers living in the northern hemisphere. Australia does not make the WTO's list of top ten countries visited in 2018. The long distances and cost of flights act as a deterrent to people wishing to visit Australia from the northern hemisphere. The abundance of cheaper travel destinations around Australia such as Indonesia and Thailand also affect the number of tourists visiting Australia.

- In 2018, Australian residents undertook 9.5 million outbound international trips – 5.39 million of those trips were for holiday purposes, while 4.4 million were for other purposes such as visiting friends and relatives and business trips.
- Outbound international trips have nearly doubled in the past decade, increasing from 5.1 million in 2008. Indonesia (principally Bali) has seen the greatest increase in outbound trips in the last decade, from 287,000 trips in 2008 to over 1.4 million trips in 2018.
- New Zealand remains the most popular destination with 1.26 million Australian visitors in 2018.

A global tourism catastrophe: The pandemic and its impacts

The COVID–19 pandemic was a disaster for global tourism. The pandemic brought both international and domestic travel and tourism to an abrupt standstill. The shutdown affected everything from the smallest tourism operator to the massive global hotel chains, such ACOR, the Intercontinental Hotel Group (IHG), Hilton and Marriott International. The world's airlines grounded thousands of aircraft and the fleets of the cruise industry giants, Carnival Corporation and Royal Caribbean, lay idle.

Data from the first three months of 2020 highlights the speed and depth of the downturn in global tourism. In the January–March period international tourist arrivals dropped by 22 per cent, with arrivals in March down by 57 per cent following the lockdowns, travel bans, and border closures implemented by many countries including Australia. This represented a loss of 67 million international arrivals in the first quarter of 2020 compared to the same period in 2019. The economic impact of this downturn resulted in an US$80 billion hit in terms of lost export earnings.

The impacts of the slowdown varied by region. Asia and the Pacific, the first region to suffer the impact of COVID-19, saw a 35 per cent decrease in arrivals. The second-hardest hit was Europe with a 19 per cent decline, followed by the Americas (-15%), Africa (-12%) and the Middle East (-11%).

The WTO estimates that the full-year impact of the pandemic could be a decline of 60–80 per cent in terms of international arrivals compared with 2019. This would result in a decline of between 850 million and 1.1 billion tourist arrivals costing US$910 billion to US$1.2 trillion in lost export revenue. That compares with a 0.4 per cent decline during the SARS epidemic in 2003 and a 4.0 per cent drop in 2009 following the global financial crisis.

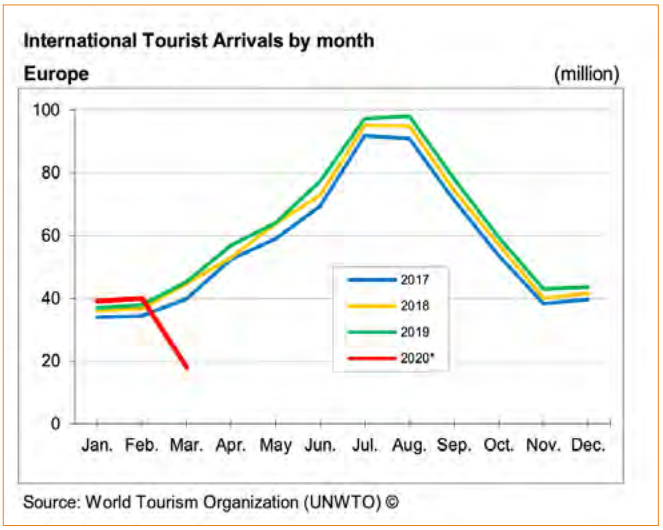


Figure 16: This graph of international tourism arrivals by month shows the dramatic decline experienced in March 2020.

Jobs losses of 100–120 million are predicted in one of the most labour-intensive sectors of the global economy. The losses will, however, vary from country to country depending on how dependent the country is on tourism. Of the world's twenty largest economies, Australia ranks sixth in terms of the industry's contribution to GDP (10.8%). Mexico is first (14.5%), followed by Spain (14.3%) and Italy (13.0%). Others include Germany (9.1%), the UK (9.0%) and the USA (8.6%).

Worldwide, 44 countries rely on the travel and tourism industry for more than 15 per cent of their total share of employment. Unsurprisingly, many of the countries suffering the most economic damage are island nations, especially those in the Caribbean. The island nation of Antigua & Barbuda, for example, has 95 per cent of its workforce engaged in the tourism industry.

New Zealand has 479,000 people employed in the tourism industry. Cambodia, which attracted 8.3 million tourists in 2019, has 2.4 million jobs in the sector. Croatia, one the world's tourism 'hot spots', generated US$13 billion from tourism in 2019. Twenty-five per cent of the country's workforce is engaged in tourism.

The downturn could have been worse had it coincided with the peak summer tourism season in the Northern Hemisphere. (See Figure 16). If the current crisis extends through the northern summer the economic impact of the downturn will be massive, especially in tourism-dependent regions.

The duration of the downturn in global tourism will depend on the following factors:

- How long the pandemic lasts and how long it takes to develop an effective treatment or vaccine.

- The time it takes to lift travel restrictions and lockdown measures, and social distancing rules.
- The time it will take consumers and businesses it will resume travel. And. How travel behaviours change as a result of the pandemic.
- How deep and how long will the global recession be.
- The impact of the pandemic on consumers' discretionary spending decisions.
- The extent to which governments enact measures that support tourism.

The COVID–19 is by far the worst crisis international tourism has faced since World War II. The impact will be felt to varying degrees in the different global regions, with the Pacific expected to be the first to rebound once the travel bans are relaxed between Australia, New Zealand and perhaps the Pacific Islands.

Impacts on aviation

Those of us living in Sydney will have noticed how empty the skies are of aircraft. We are conscious of the absence of the deep roar of domestic and international flights descending on the approaches of Sydney's (Kingsford Smith) International Airport at the end of the overnight curfew at 6.00 am. In the evening, we no longer see the lights of descending aircraft stretching into the distance, especially to Sydney's southwest. No one knows when these flights will resume. Qantas has grounded more than 150 aircraft, suspended its international flights and reduced its domestic and regional services to a minimum. Even these had to be heavily subsidised by the Federal Government. Qantas stood down 20,000 employees as a result of the COVID–19 outbreak. Australia's second airline, Virgin Australia, collapsed into receivership as a result of the travel restrictions imposed by the government. Eight thousand Virgin Australia employees were stood down.

The following observations highlight the extent of the Australian aviation industry's plight:

- International scheduled passenger traffic in March 2020 was 1.725 million compared to 3.285 million in March 2019 – a decrease of 47.5 per cent.
- In April 2019, there were up to 722 international flights arriving and departing Australian airports each day – with New Zealand (174), Singapore (88) and China (64) topping the list. In early April 2020, just 147 arrived and departed Australia, a decline of more than 80 per cent.
- The air corridor between Sydney and Melbourne, usually the second busiest in the world, typically has as many as 210 flights a day. At the height of the pandemic, there were fewer than 15 flights a day between Australia's capital cities.
- Over Easter, 2020, one of the busiest weekends for domestic air travel, there were 77 per cent fewer aircraft in the air. On those few flights operating, only an average of 30 per cent of seats is occupied, compared to a regular average of up to 85 per cent.

Foreign-owned airlines fared little better than their Australian counterparts. Singapore Airlines, for example, grounded all but 10 of its 200 aircraft. Seventeen of these were mothballed at the Asia Pacific Aircraft Storage facility near Alice Springs. The Alice Springs facility is ideal for housing grounded aircraft due to its very dry climate. This reduces the risk of corrosion of planes as compared to humid climates such as that of Singapore's.

Plane storage facilities, such as the one near Alice Springs, have been getting more crowded in recent months as airlines grapple with the impact of a decline in passenger traffic. The International Air Transport Association (IATA) described the plunge in global passenger traffic as the "largest decline in recent history" last month. Traffic nosedived 52.9 per cent in March, compared with the same period in 2019. Asia-Pacific airlines led the fall, losing 65.5 per cent of passenger traffic. In the USA, airline passenger traffic fell by about 94 per cent and half of the industry's 6,215 planes are parked at major airports and desert airstrips.

The impacts of the pandemic on the global aviation industry are likely to be far-reaching. In 2019, before the onset of the pandemic, the global airline industry carried 4.54 billion passengers – a 4.2 per cent increase on the previous year. Industry figures expect only a slow recovery, made worse by the inevitable economic slowdown.

The government imposed travel restrictions have had the greatest impact on the industry. According to the UN's WTO COVID–19, 100 per cent of all worldwide destinations had introduced travel restrictions of one type or another in response to the pandemic. Ninety-seven destinations (45%) totally or partially closed their borders for tourists. Sixty-five destinations (30%) suspended totally or partially international flights. Thirty-nine destinations (18%) closed their borders in a more differentiated manner by banning the entry for passengers from specific countries of origin.

Airlines are responding to the crisis by reducing their cost base to ensure the ongoing viability of their business. They are reducing their workforce, reducing their fleet size, cutting out less profitable, or loss-making, routes and bringing forward the retirement of older, less fuel-efficient aircraft. Airlines cancelled orders for new aircraft resulting in aircraft manufacturers laying off thousands of workers.

Airports have also been seriously affected. Many have reported up to a 97 per cent decline in passenger numbers since the pandemic took hold. These important transport hubs, which are typically very large employers, have also been adversely affected, with greatly reduced passenger traffic. And it's not only those involved in making sure that aircraft are refuelled, serviced and cleaned, and passengers checked in and their luggage handled, it's also those employed in airport cafes and shops.

The pandemic's impact on the Australian tourism industry

Australia's tourism industry has been especially hard hit by the COVID-19 pandemic. Travel restrictions imposed by the Federal Government resulted in the country suffering the biggest drop in overseas arrivals ever recorded. The Australian Bureau of Statistics (ABS), noted that overseas arrivals to Australia slumped 60 per cent in March – the largest-ever drop in overseas travel the country has seen.

During March there were 331,900 short-term visitors to Australia, down from 836,300 in March 2019. Visitor numbers from China fell 78 per cent to 27,900, Japan fell 75 per cent to 13,300 and the United States fell 61.5 per cent to 34,300. Visitors from New Zealand, which is Australia's largest source of overseas arrivals, fell 56 per cent to 48,200. (See Figure 17). There was also a record fall in the number of Australian residents returning from short-term trips overseas, down 29 per cent to 538,400.

Visitor arrivals, March 2020 – Top 10 source countries, Number of Arrivals and Annual % Change

Country of Residence	'000	% Change
New Zealand	48.2	-56.2
UK (a)	39.4	-46.8
USA	34.3	-61.5
China(b)	27.9	-77.5
India	20.1	-40.8
Japan	13.3	-75.1
Singapore	13.0	-66.3
Germany	11.8	-46.4
Canada	10.1	-55.4
Malaysia	9.5	-68.5
Total	**331.9**	**-60.3**

(a) Includes the United Kingdom, Channel Island and the Isle of Man.(b) Excludes SARs & Taiwan.

Figure 17: Visitor arrivals, March 2020 – Top 10 source countries

The March numbers capture the impact of Australia's ban on visitors from mainland China on February 1, and the gradual expansion of these bans on all non-Australian citizens and non-residents from 20 March.

The full impact of these measures became evident in the ABS data for April. In April, overseas arrivals to Australia fell 99 per cent due to the COVID–19 travel restrictions. The strict border controls resulted in just 22,000 arrivals through April, more than two-thirds of which were Australian citizens returning home from overseas. Just under 7000 arrivals were non-Australian citizens. (See Figures 18 and 19).

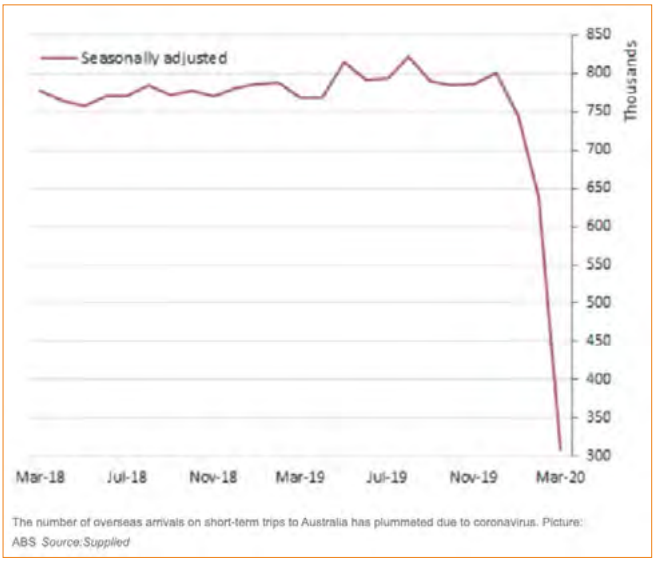


Figure 18: Tourist arrivals (seasonally adjusted), 2018–2020 (ABS)

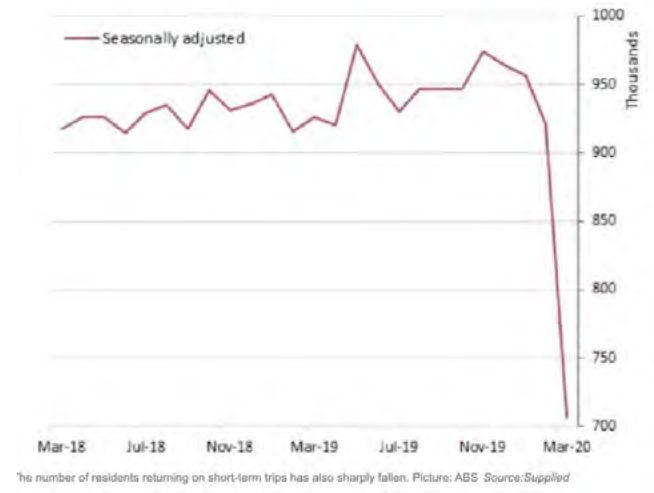


Figure 19: Returning Australian residents on short-term trips (ABS)

In March, the Northern Territory suffered the biggest drop in inbound tourist arrivals (66%) followed by NSW (64%), Queensland (63%) and Victoria (58%). (See Figure 20).

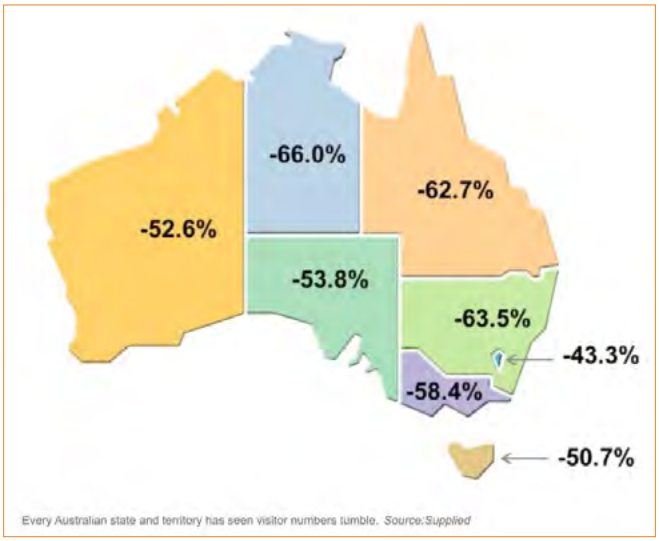


Figure 20: Change in visitor numbers by state and territory, March 2020

Coronavirus is expected to deal a heavy blow to Australia's tourism industry, which had already suffered due to the devastating summer bushfires.

Industry megatrends

While the global tourism industry may take years to recover from the impacts of the COVID–19 pandemic two megatrends are likely to endure. These are the polarisation evident within the industry and diversification of the tourism market.

The polarisation taking place within the industry is especially evident in the tensions between globalisation and localisation (See Figure 22). At one end of the continuum are the transnational corporations – the global travel companies, airlines, cruise lines, and multi-brand hotel corporations. At the other end of the continuum are local entrepreneurs – the entertainers, tour guides, stallholders, restaurant and bar owners, operators of local attractions and the owners of small hotels, B&Bs and Airbnb accommodation. Local entrepreneurs typically take advantage of the economic opportunities stemming from the flow of tourists generated by tourism-focused TNCs.

Figure 21: China is a major source of tourists.

Budget tourist accommodation. Source: https://upload.wikimedia.org/wikipedia/commons/4/46/Motel_%22Formule_1%22_-_panoramio.jpg

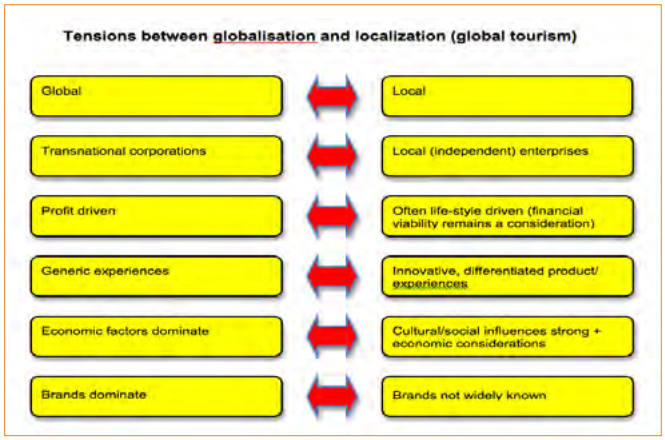


Figure 22: The polarisation evident in the global tourism industry is exemplified in the tensions between the forces of globalisation and localisation

The hotel industry provides an example of this polarisation. Over time, the hotel industry has become more diverse. In addition to the smaller, family-operated hotels, lodges, B&Bs and, more recently, the proliferation of Airbnb rentals there are the large, multi-brand global hotel chains (TNCs). The product differentiation evident within the sector reflects the increasingly diverse needs of the business and leisure traveller.

The world's largest hotel corporations have grown through a process of mergers and acquisitions, and by introducing new hotels brands targeting specific travel markets. They have also been very active in expanding into the rapidly developing Chinese tourism market.

Of the top four hotel TNCs featured in Figure 23, all target the business and leisure traveller seeking luxury and up-market accommodation. They also target the mid-market accommodation sector. Of the big four, only Accor targets the budget traveller.

Figure 23: Global hotel corporations and the brands they control

GROUP (CORPORATE HQ)	NUMBER OF PROPERTIES	NUMBER OF ROOMS	LUXURY BRANDS	UP-MARKET BRANDS	MID-MARKET BRANDS	BUDGET BRANDS
Marriott International (Bethesda, Maryland, USA)	30 brands with 7,003 properties in 131 countries	1,332,826	• Ritz-Carlton • Bulgari Hotels • JW Marriott • St Regis • Luxury Collection	• Renaissance • Marriott • Delta • Gaylord Hotels • W Hotels • Design Hotels • Westin Hotels & Resorts • Le Méridien • Sheraton • Courtyard by Marriott • Residence Inn by Marriott • Four Points by Sheraton • Aloft Hotels	• Fairfield Inn by Marriott • Protea Hotels • TownePlace Suites	
Hilton Worldwide (McLean, Virginia, USA)	16 brands with 6,110 properties across 120 countries	893,494	• Waldorf Astoria • LXR Hotels & Resorts • Conrad Hotels & Resorts	• Hilton Hotels & Resorts • Canopy by Hilton • Curio Collection by Hilton • Signia by Hilton • Embassy Suites by Hilton • DoubleTree	• DoubleTree by Hilton • Tapestry by Hilton • Tempo by Hilton • Hilton Garden Inn • Homewood Suites by Hilton • Hampton By Hilton • Motto by Hilton	
InterContinental Hotels Group (Denham, Buckinghamshire, UK)	17 brands with 5,656 properties across 100 countries	842,749	• InterContinental Hotels • Regent Hotels & Resorts • Six Senses	• Crowne Plaza • Kimpton Hotels • Hotel Indigo • EVEN Hotels • Indigo hotels • Hualuxe Hotels & Resorts • Voco	• Avid Hotels • Candlewood Suites • Holiday Inn • Holiday Inn • Holiday Inn Resort Express • Staybridge Suites • Atwell Suites	
Accor (Paris, France)	33 + brands with 4,800 properties in 100 countries	704,000	• Sofitel Legend • Banyan Tree • Delano • Sofitel • Fairmont Hotels & Resorts • Raffles • Rixos	• Pullman • Swissôtel • MGallery • The Sebel • Adagio Premium • Grand Mercure • Mantis • Art Series • Mandarin • Orient Express • Angsana • Hyde • Movenpick • Peppers • The Sebel	• Novotel • Adagio • Mercure • Mantra • Tribe	• Break Free • Ibis • Ibis Style • Ibis Budget • Jo&Joe • Hotel F1

Figure 24: Royal Caribbean's Spectrum of the Seas. Royal Caribbean targets the mass tourism market. Its cruises are popular with families and the younger demographic.

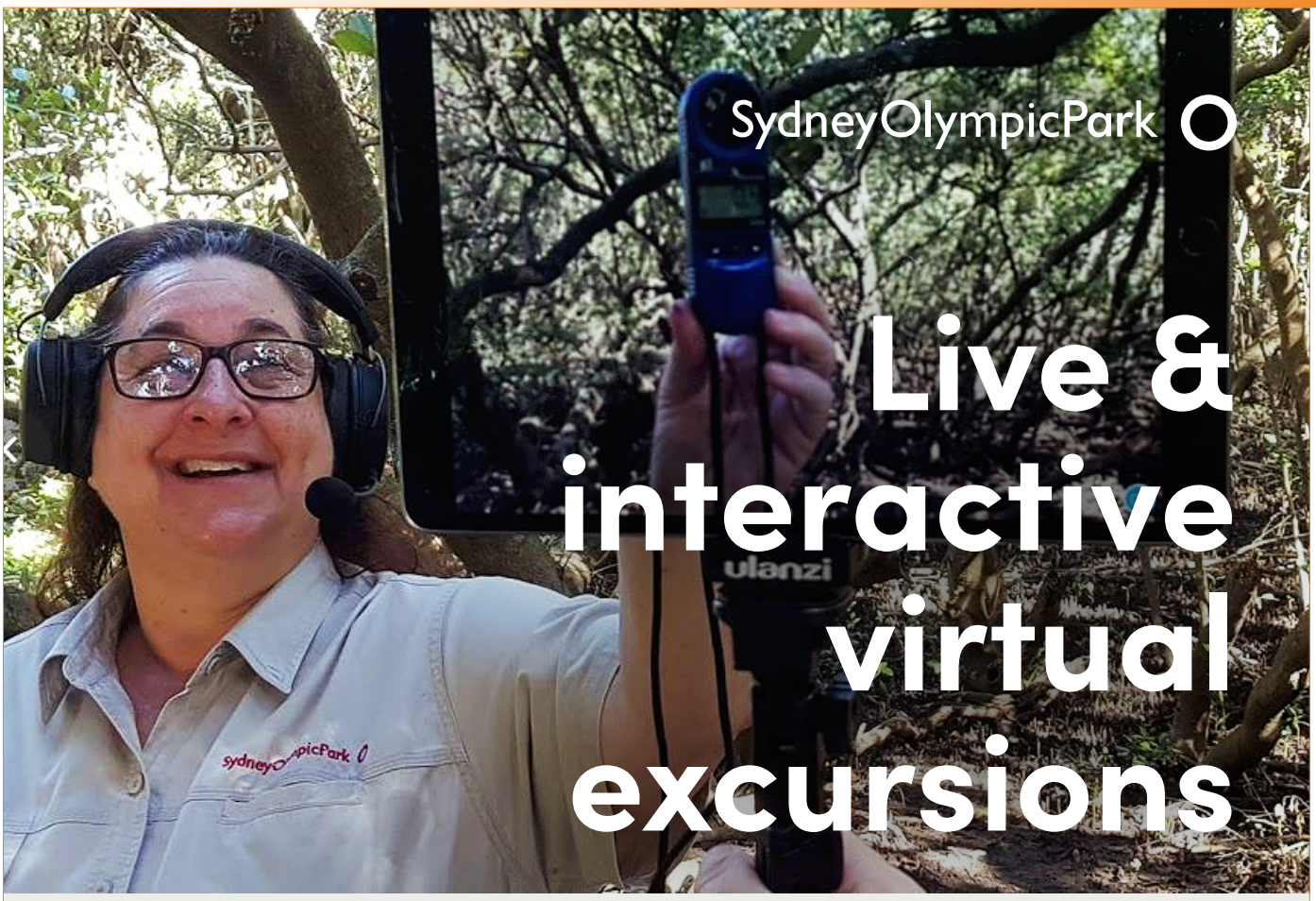
In the case of the global cruise industry, two TNCs dominate, Carnival and Royal Caribbean. Carnival Corporation & PLC's (a British–American company) brands include Princess Cruises, Costa Cruises, AIDA Cruises, Holland American Line, P&O Cruises, P&O Cruises Australia, Cunard and Seabourn. Royal Caribbean Cruises Ltd. brands include Royal Caribbean International, Celebrity, Azamara and Silversea. Other large players include Norwegian Cruise Line Holdings (Norwegian Cruise Lines, Oceania Cruises and Regent Seven Seas). MSC Cruises and Genting. Carnival and Royal Caribbean together account for 70.5 per cent of all cruise passengers (Carnival 47.5% and Royal Caribbean 23%) – 18.3 million out of a total of 26 million passengers. The revenue of the two companies exceeds 27.6 billion (Carnival accounts for 39.4% of the industry's revenue while Royal Caribbean garners 20.2% of all revenue).

Unlike other sectors of the global tourism industry, there are few small players in the cruise industry. The large capital costs involved in building and operating cruise ships is a major barrier to new entrants. Small, local and highly specialised operators have had some success in specific locations. Typically, however, the vessels operated are very small.

Like the hotel industry, there is an increasing degree of specialisation or diversification within the cruise industry. There are those cruise companies that target the (budget) family market (Disney Cruise Line, P&O Australia, Carnival, Royal Caribbean, Norwegian, MSC and Costa), those that target the more mature traveller (Princess Cruises, Holland America, Cunard and Celebrity), those that target the ultra-luxury (well-healed) tourists with a preference for smaller, all-inclusive, cruise experiences (Seabourn, Viking, Silversea, Crystal and Regent Seven Seas) and, those targeting the expedition cruise ship market (Silversea Expeditions, Ponant, Scenic and Hurtigruten).

Figure 25: Silversea's Silver Muse. All-inclusive cruises on smaller vessels are popular with older, more affluent travellers.

Skills activities linked to tourism are included in the Stage 6 Skills section



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– Intertidal Wetlands

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Busting the bands: Mega cities

An update on teaching Urban Places – Mega cities

Matt Carroll, Head of Geography
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Deepening students understanding of the complexity, despair and hope of living in a mega city in the developing world (MCDW).

According to the United Nations a mega city (MC) is a large urban agglomeration of 10 million people or more. MC's are dynamic areas with vulnerable urban peripheries, a clear 'youth bulge' (Muggah 2017) and with subsequent social polarisation. As the world continues to rapidly urbanise and surpass 7.7 billion (LSE), a geographical exploration into the feasible solutions from a range of governments, NGO's and community self-help initiatives to the challenges of living in MC's is imperative in achieving the United Nations SDG's.

The topic of MC's is always of high interest for both our Geography students and for teachers. It's what many of us use to generate interest in our senior course when subject selection rolls around. Furthermore, it is often a very polarising topic for our students, as many come from environments where the thought of living in a city with more than 10 million people is incomprehensible. As we know, there are a plethora of amazing resources and go to case studies that never fail, however, many students struggle to get past the basic description of the nature, character, spatial distribution, challenges and responses in their written work. Students need to build their capacity in 'connecting the dots' across the 3 core syllabus dot points in order to demonstrate deep knowledge and analysis, in preparation for questions which require an 'explanation', 'account for', 'analysis' or 'evaluation'.

Makoko floating slum – Lagos, Nigeria. Source: Shutterstock

So, what does our syllabus say?

Mega cities

- the nature, character and spatial distribution of mega cities in the developing world (DP1)
- the challenges of living in mega cities such as housing, traffic infrastructure, water and power supplies, sanitation services, employment, and other social and health issues (DP2)
- the responses to these challenges such as self-help projects, community self-government, cooperation from NGOs, urban protest and the operations of informal economies (DP3)

Some important points within our current syllabus are the use of the phrases 'in the developing world' (DP1) and 'such as' (DP2). This is important to consider when students and teachers are honing in on their use of appropriate case studies/illustrative examples, despite the rapid emergence of MC's in more unfamiliar places. Students must ensure that chosen examples are solidified (by the UN, or another reliable source) in their criteria of meeting 'developing world' status, using case studies such as, but not limited to:

- Lagos, Nigeria
- New Delhi, India
- Mumbai, India
- Jakarta, Indonesia
- Mexico City, Mexico
- Rio de Janeiro, Brazil
- Sao Paulo, Brazil
- Dhaka, Bangladesh

Acronyms are used extensively throughout the HSC Geography course, ranging from BEESPOT all the way to BELL and from USUCCEED to HUMIN. Some tried and tested options for MC's that assist students in finding those 'go to talking points' when tackling exam style questions, include:

DP1: TRIP & SIP for nature and character

TRIP (nature of MC's and the reasons for their existence/formation – Transformation of rural economies, Rapid/turbo urbanisation, Industrialisation leading to Population growth), SIP (character of MC's based on their Social polarisation/equity (evidence of a vast divide in wealth, gated communities and subsequent crime, violence and corruption), Informal economies (centres of manufacturing) and Population compositions.

Explanation of TRIP:

- The transformation of rural areas has occurred due to the mechanisation and technological innovation of modern farming methods that increase productivity and decrease the availability of work opportunities in rural areas, forcing farmers to leave rural areas and look for employment in cities.
- Rapid/ turbo urbanisation to cities (caused by push/pull factors).

  PUSH FACTORS – famine, drought, natural disasters, poor living conditions (health, education, housing), agricultural reform, unemployment, civil war. e.g. flooding in Bangladesh has resulted in rapid rural urban migration to Dhaka at the rate of 1000 people a day.

  PULL FACTORS – employment, high incomes, better healthcare and education, urban facilities, protection from conflict.
- Industrialisation – TNC's locate in a large city for cheaper labour and manufacturing costs and this attracts more workers, a result of globalisation, is redefining the employment structure in mega-cities. The people employed in manufacturing have increased, especially in the cities host to labour intensive manufacturing processes of TNC's, such as in Dhaka, Bangladesh where 60% of people are employed in garment, 'fast fashion' sweat shops. Most of the growth in employment has occurred in the new industrial estates built on the outskirts of MC's.
- Population growth – As a result of these factors and naturally high birth/fertility rates, MC's populations grow exponentially (in many cases), resulting in SIP.

Explanation of SIP

There are a multitude of characteristics associated with MC's which can be overwhelming for our students to learn. The core characteristics associated with MCDW and which best account for the challenges associated within these cities, include:

- Social polarisation: Mega-cities have large social divisions, with the middle-class enjoying a 'developed world' lifestyle, resulting in SOCIAL POLARISATION. A quarter of the population of developing countries are living in situations of absolute poverty on less than $1 a day (World Bank). The rich are retreating to well resourced, gated communities, using privatisation to develop their own basic services, while the poor are restricted to makeshift housing on the outskirts of cities, where governments cannot provide basic services. This is evident in the UN's most recent listing of Lima, Peru, suffering a housing crisis and urban divide in its population, evident in the 'wall of shame'. MC's which suffer from social polarisation tend to have high rates of crime (in Rio de Janeiro, the leading cause of death for males aged 15–44 is homicide and in Mexico City there are over 400 kidnappings per day). This stems from colonialism, slavery (favelas in Rio de Janeiro), lack of government revenue and complex urban morphologies which result in slums/favelas becoming havens for organised crime (e.g. the 'Red Command' in Rio).
- Informal economies: All mega-cities have large informal economies (black market), such as vending and hawking of services. Informal sectors serve the needs of the urban poor and operate outside the control of authorities. In Lagos, the informal sector accounts for 69% of total employment. The informal sector is caused by a lack of jobs in the formal sector, forcing people in slums to create their own employment in locally owned workshops as barbers, beggars, street vendors etc. Mega-cities have attracted labour intensive 'footloose industries' from TNC's.
- Population composition: MC's have unique population compositions, evident in growth rates, structure and densities. Lagos has a population density of 18,000 people/km2 and Manila now exceeds some 43,500km2 leading to a serve strain on the provision of social and health services.

Rocinha favela, Rio do Janeiro. Source:https://upload.wikimedia.org/wikipedia/commons/6/6e/Rocinha_rio_de_janeiro_panorama_2010.jpg

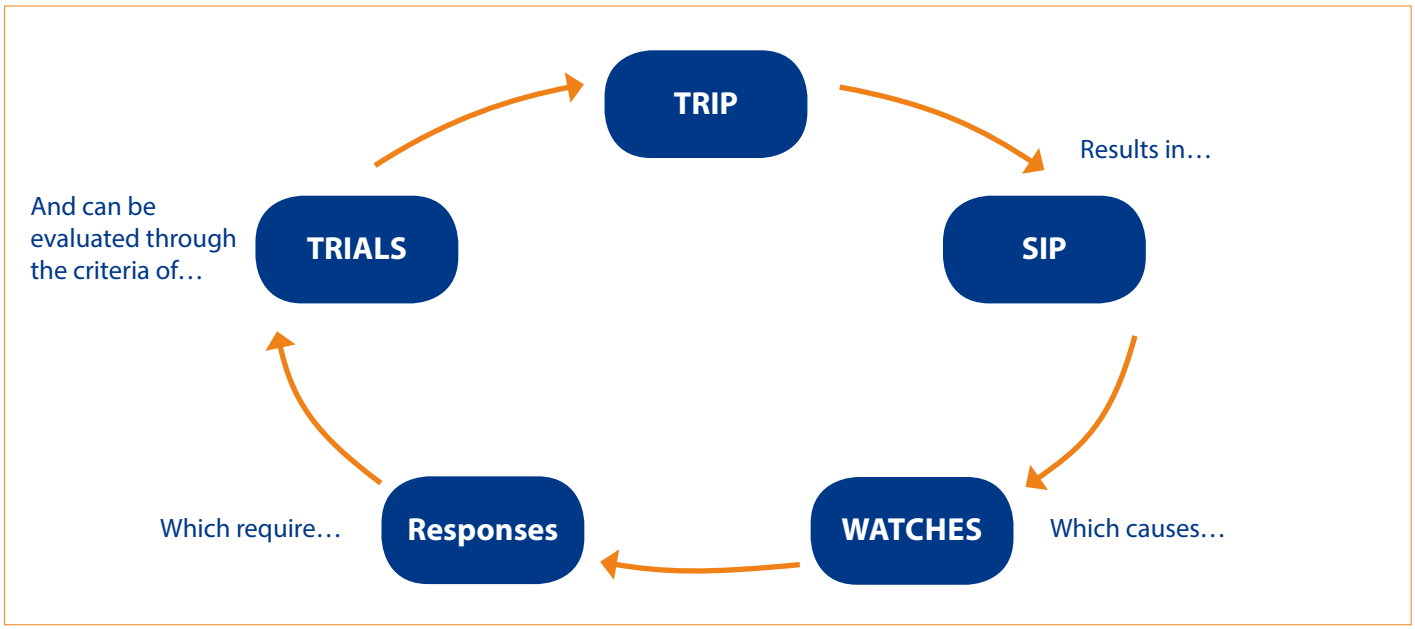
DP2: WATCHES for challenges

WATCHES (water and power supplies, air pollution, traffic congestion/infrastructure, crime violence and corruption, housing, employment and sanitation and other social and health issues) for the 'challenges' associated with living in a MC in the developing world.

Students should be prepared to answer questions from DP2 which require a 'description, explanation, account or analysis'. Students should also be prepared to answer questions which are worded through 'social and health issues'. It is therefore important that a deep knowledge of DP1 is crucial in addressing the 'cause and effect' or 'how and why' in both Section II and Section III in the HSC exam.

Traffic congestion and pollution, New Delh. Source: https://upload.wikimedia.org/wikipedia/commons/a/a8/Ratan_Lal_Market%2C_Kaseru_Walan%2C_Paharganj%2C_New_Delhi%2C_Delhi%2C_India_-_panoramio_%281%29.jpg i

Figure 1: Connecting the syllabus for students.



DP3: TRIALSS – for making a judgement based on criteria on the effectiveness of a response to a challenge of living in a MCDW

The criteria which can be used to evaluate the effectiveness of responses to the challenges of living in MC's:

- T Time frame and cost appropriate?
- R Has it resolved the issue?
- I Intragenerational & Intergenerational equity
- A Another city responded this way effectively?
- L Living standards improved?
- S Ecological sustainability in an urban context
- S Self sufficiency

The following pages include a snapshot of our recent two-part assessment task at Cranbrook School.

Students complete a hand in written report (five pages on five different challenges from **WATCHES**) in preparation for a stimulus based, short answer exam (/30 marks), consisting of 7 x 1-mark skills questions, 15 x marks from 2–6-mark short answer responses and an 8-mark response. This targets student's capacity to respond to Question 21's in the HSC exam, as well as stimulus based 'application style' questions. Some elements of the notification are included here, along with the marking criteria and a student work sample. Notice the use of colour coding in order to clearly demonstrate the core aspects of 'explain' and 'evaluate'. The student clearly shows deep knowledge from TRIP, SIP, WATCHES and TRIALS.

Task Description

Part 1: Hand -in Written Task: 20% Weighting

- You will be required to use the template provided to complete the hand-in typed report
- Your completed report will address 5 challenges that a range of mega cities in the developing world face, such as:
  - **W**ater and power supplies
  - **A**ir quality
  - **T**raffic infrastructure
  - **C**rime, violence and corruption
  - **H**ousing
  - **E**mployment
  - **S**anitation and other social and health issues
- Your completed template will also evaluate the range of responses to reduce these challenges according to appropriate criteria such as:
  - **T** Time frame and cost appropriate?
  - **R** Has it resolved the issue?
  - **I** Intragenerational & Intergenerational equity
  - **A** Another city responded this way effectively?
  - **L** Living standards improved?
  - **S** Ecological sustainability in an urban context
  - **S** Self sufficiency
- Your template will be marked /50

Template Requirements

The template provided requires you to:

- Provide a one-page overview (650 words per challenge) that responds to the issue in the following way:
  - Detailed **explanation** of the challenge in Mega Cities of the developing world
  - Locational example and **description** where the challenge is prevalent
  - Response to the challenge and by whom- name of response, date, aim/goals of the response
  - **Evaluation** of the response based on appropriate criteria

Student Template

Challenge 1:

1. **Explanation of the challenge in megacities of the developing world:**
   a. Causes of the challenge
   b. Effect of the challenge
2. **Locational example:**
   a. Geographic location
   b. Population data of the city
   c. Causes of the challenge in the locational example
   d. Effect of the challenge in the locational example
3. **Response to the challenge:**
   a. Description of the responses:
      i. Who made the response? When was it introduced? What are the core aims/goals of the response?
      ii. Evaluation of the responses based on appropriate criteria, such as:
      - **T** Time frame and cost appropriate?
      - **R** Has it resolved the issue?
      - **I** Intragenerational & Intergenerational equity
      - **A** Another city responded this way effectively?
      - **L** Living standards improved?
      - **S** Ecological sustainability in an urban context
      - **S** Self sufficiency

Part A: Marking Criteria	Mark
– Demonstrates a comprehensive understanding of mega cities in the developing world and the responses to the challenges of living in them – Makes detailed judgements on the effectiveness of the responses to the challenges of living in mega cities in the developing world with reference to appropriate criteria – Integrates and refers to relevant case studies, illustrative examples and evidence where appropriate with direct reference and analysis of sourced material – Presents a sustained, logical and cohesive written response in the template using appropriate geographical information, ideas and issues	9 – 10
– Demonstrates a well-developed understanding of mega cities in the developing world and the responses to the challenges of living in them – Attempts to make judgements on the effectiveness of the responses to the challenges of living in a mega city and may refer to appropriate criteria direct reference of sourced material – Refers to relevant case studies, illustrative examples and evidence where appropriate – Presents an answer using appropriate geographical information, ideas and issues	6 – 8
– Demonstrates some understanding of mega cities in the developing world and some of the responses to the challenges of living in them – May refers to relevant case studies, illustrative examples where appropriate – May refer to geographical information, ideas and issues	3 – 5
– Demonstrates a basic understanding of Mega Cities of the developed world	1 - 2

Student sample:

The Housing Challenge (cause/effect/evidence)

The growth of urban populations in the developing world, home to now some 33 mega cities (MC's), is widening the housing gap, exacerbating inequality and if current trends continue, 1.6 billion people around the world will lack access to affordable, adequate and secure housing by 2025[1]. Moving towards a world populated by more than 9 billion people, finding affordable and reasonably spacious houses is becoming increasingly problematic, primarily in urban places, which now accommodate 56% of the global population.

Housing in Lagos – Geographic Location – Population Data.

The saying "may the city not spoil", has become ever so significant in 21st century Lagos, Nigeria – a MC facing the impacts of a dynamic population composition, especially towards its housing system. Lagos, located in the South-West quadrant of Nigeria on the coast of the Gulf of Guinea (6.5244° N, 3.3792° E), has rightfully attained the name Africa's Boom Town[2], with populations growing from 1.4 million in 1970, to approximately 14 million in 2020[3]. In consequence, slum households have been increasingly displaced by the government, which, although intending for a "slum upgrading", has only exacerbated the birth rates of urban dwellers into intergenerational poverty and segregation on the cities periphery. The government has also failed to address Lagos' major infrastructure crisis', having accumulated only $3 billion of the estimated $32 billion needed to restructure the MC's urban morphology. Poor housing conditions have resulted in overcrowded slums, income inadequacies and residential evictions, as well as a provision of services due to demand exceeding supply. As such, one-fifth of the city's 21 million residents still live in poverty[4], particularly in "the world's biggest floating city[5]" Makoko, facing the Atlantic Ocean 6 metres AMSL. Here, reporter Tolu Ogunlesi found "house[s] built from wooden planks, and ris[ing]...on stilts", reinforcing that approximately half of slum citizens live on less than $2 daily,[6] with 80% living in one room with an average of seven people[7]. Furthermore, 3,000 households were displaced by the Lagos government in the Badia East community between 2013 and 2017 due to the outsourcing of cheap labour and the subsequent influxes of rural migrants, thus straining the provision of houses and resulting in severe cases of homelessness and poverty.

The response, and by whom (criteria/evaluation/evidence)

Numerous projects are attempting to address the poor housing conditions in Lagos, Nigeria. Most notably, the billionaire Chagoury Brothers' are developing their NGO Eko Atlantic project, reclaiming land from the Atlantic Ocean and transforming it into 10 square kilometres of urban area, attempting to accommodate and improve the living standards of displaced and poorly housed Lagosians. As such, the Eko Atlantic's plan to provide houses for more than 500,000 people illuminates its highly beneficial effects, whilst its provision of a power-water supply and an independent road network highlights the wide-ranging advantages of the construction, reviving Lagos' urban space and liberating the MC from its 6,871 residents per square kilometre. By extension, living standards are envisioned to improve dramatically, with goals to bring 250,000 new jobs into the Lagos economy, helping resolve housing shortages brought by surging populations, stemming from the nature and character of Lagos. Moreover, by producing a "clean and eco-friendly" construction framework, the Chagoury Brothers have embedded intergenerational equity within their project's philosophy, fortifying the Eko Atlantic against pressures of climate change and overurbanisation. However, urban critics suggest that, although the project may solve the MC's intergenerational poverty cycle, it's sea wall "could worsen the situation for neighbouring areas"[8], as storm surges move around the wall towards surrounding suburbs. It is therefore evident that despite the project's integration of urban dwellers, and its offering of intergenerational access to quality housing, its construction will negatively benefit neighbouring populations, ultimately spurring greater migration and overpopulation within the city.

Endnotes

1. R. King (2017) The Crisis in Affordable Housing Is a Problem for Cities Everywhere
2. R. Draper (2015) How Lagos has become Africa's boom town
3. World Population Review (2020) World City Populations
4. T. Mcdonnell (2017) Slum Dwellers In Africa's Biggest Megacity Are Now Living In Canoes
5. T. Ogunlesi (2016) Inside Makoko: danger and ingenuity in the world's biggest floating slum
6. A. Adeoye (2019) In Lagos, finding a home to rent is an impossible mission
7. M. Ketchell (2020) Lagos makes it hard for people living in slums to cope with shocks like COVID-19
8. M. Onuoha (2017) A 5-mile island built to save Lagos's economy has a worrying design flaw

Go to resources

Unequal scenes – https://www.weforum.org/agenda/2019/02/10-cities-are-predicted-to-gain-megacity-status-by-2030

Visual Capitalist – https://www.visualcapitalist.com/pearl-river-delta-megacity-2020/

ArcGIS Story Maps – https://storymaps.arcgis.com/stories/a900831b442e43c79cf9eeb399d5440f

ABC Radio Podcast – https://radio.abc.net.au/programitem/peE3nRN0e3

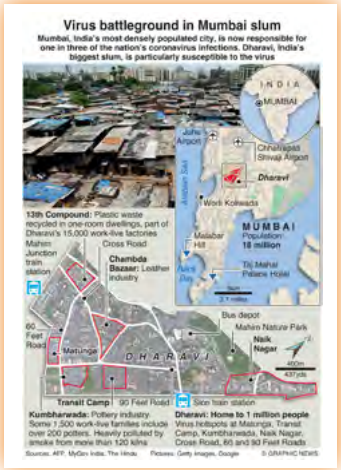
World population density – http://luminocity3d.org/WorldPopDen/#3/12.21/10.02

How big will mega cities be in 30 years? – https://www.youtube.com/watch?v=_jnMivEZ8gc&feature=emb_logo

How to protect fast growing cities from failing? TED Talk – https://www.youtube.com/watch?v=rokPqHc9iD0&feature=emb_logo

20 Short answer practice questions to master MCDW

1. Outline the nature of mega cities in the developing world (2-3)
2. Account for the emergence of and growth of mega cities in the developing world (2–3)
3. Describe the changing nature of mega cities (3–4)
4. Explain the nature of the urban morphology in mega cities in the developing world (3–4)
5. Outline a characteristic associated with mega cities of the developing world (2–3)
6. Justify the prevalence of informal housing settlements within mega cities of the developing world (3–4)
7. Account for the prevalence of informal economies within mega cities of the developing world (3– 4)
8. Explain the implications associated with the character of mega cities of the developing world (4)
9. Explain the nature and character of mega cities (4)
10. How does the nature and character strain the provision of services in mega cities in the developing world? (4–6)
11. How does the spatial distribution influence TWO challenges of living in mega cities of the developing world? (4–6)
12. Describe ONE contemporary challenge of living in mega cities of the developing world (3–4)
13. Account for ONE social and ONE health issue associated with living in mega cities (4–6)
14. Analyse TWO challenges of living in mega cities and describe why these are prevalent in all mega cities of the developing world (6)
15. Explain TWO challenges associated with living in mega cities of the developing world (4)
16. Discuss TWO responses to the challenges of living in mega cities (6–8)
17. Asses the effectiveness of a response to a challenge of living in mega cities of the developing world (6)
18. Evaluate the effectiveness of urban protest in responding to a challenge of living in a mega city of the developing world (6)
19. Evaluate a government, NGO or community self-help response to a challenge of living in a mega city (6–8)
20. How can the spatial distribution of mega cities inhibit the success of responses to combat challenges of living in a mega cities of the developing world (6–8).



Skills activities linked to Dharavi slum in the megacity of Mumbai are included in the Stage 6 Skills section.

The following article explains how Dharavi slum dealt with the COVID-19 pandemic to reduce the health impact on communities https://www.bbc.com/news/world-asia-india-53133843

WHY HAS CORONAVIRUS AFFECTED CITIES MORE THAN RURAL AREAS?

Published 13 July 2020

This article was originally published on Economics Observatory under a Creative Commons license. Read the original article at https://www.coronavirusandtheeconomy.com/question/why-has-coronavirus-affected-cities-more-rural-areas?utm_source=Twitter&utm_medium=social&utm_campaign=SocialSignIn

Why have big cities around the world become coronavirus hotspots, while many smaller towns and rural regions have suffered fewer cases and deaths? And what are the roles of urban density and social interaction when global pandemics become more common?

Urban areas, especially megacities, have been hit hardest by Covid-19, although that pattern is shifting as outbreaks spread across countries. There are four main explanations linking urban areas and coronavirus, emphasising density; connectivity; crowded living conditions; and exposed occupations. There is evidence for each, but disentangling their effects is challenging.

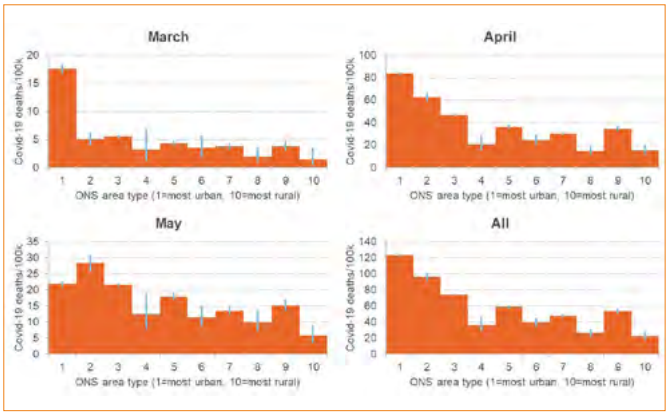
A better understanding of the links between Covid-19, urban form and urban conditions will help us to develop more resilient 'post-virus' cities. The coming years may see shifts in economic activity away from urban cores towards rural areas. The wider effects of such shifts on economic and social wellbeing are still unclear.

What does the evidence from economic research tell us?

Cities around the world, especially the biggest urban areas, have become coronavirus hotspots, while smaller and rural places have – until recently – been less affected. In the United States, deaths per 100,000 people were highest in large urban counties, followed by suburbs, smaller towns and rural areas (although that pattern is now shifting towards suburban areas.

In England and Wales, data from the Office for National Statistics (ONS) show a similar pattern (see Figure 1). In March, adjusted standardised mortality ratios were concentrated in the biggest cities. By the end of May, they were higher in smaller cities (like Preston and Brighton) than the biggest cities (like London, Manchester and Birmingham), and they had risen substantially in rural towns and small hamlets.

Figure 1: Covid-19 deaths per 100,000 people by area type, England and Wales, March–May 2020

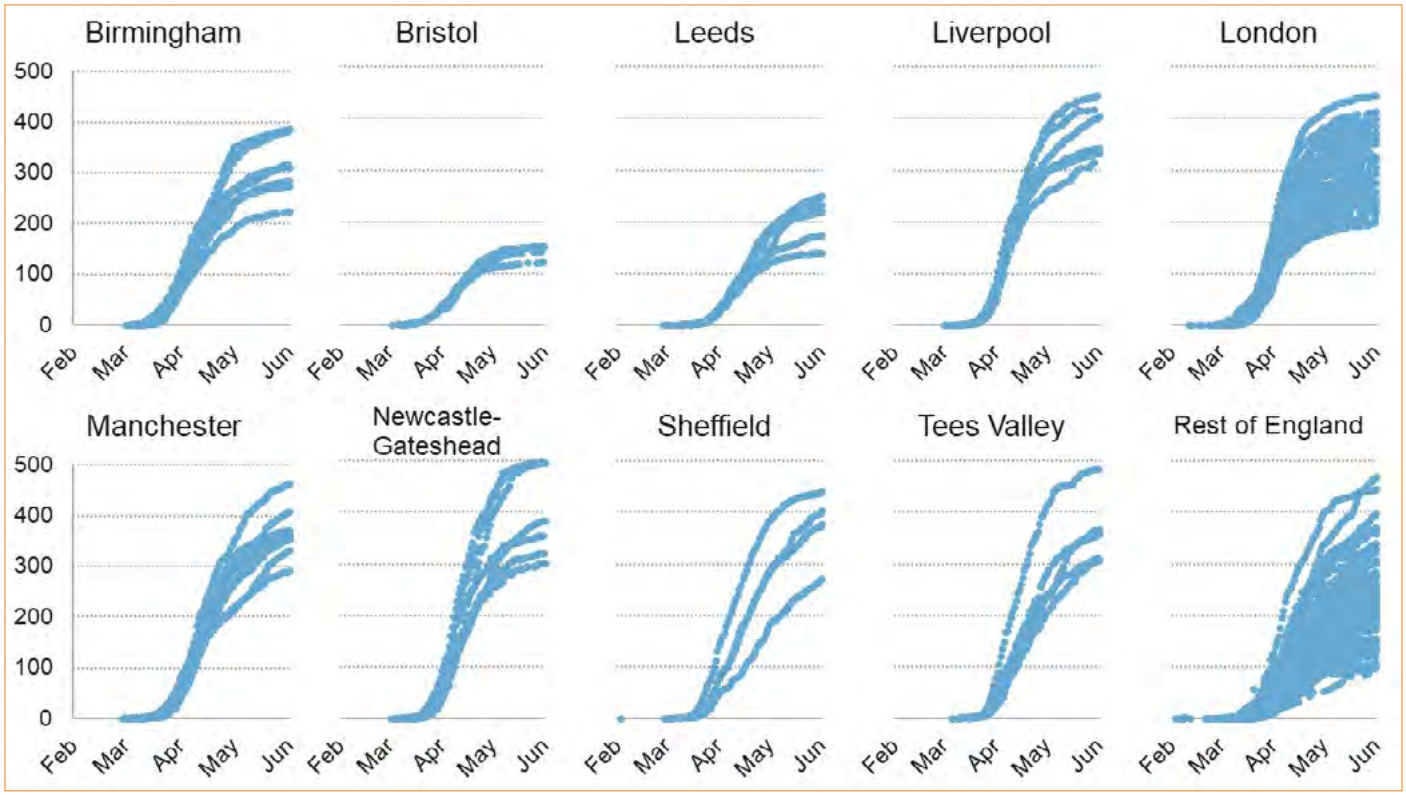


Source: ONS data for England and Wales.
Notes: Age-standardised mortality rates with 95% confidence intervals. Area types: 1: Major conurbation; 2: Minor conurbation; 3: Urban city/town; 4: Rural town/city; 5: Rural town/fringe; 6: Sparse rural town/fringe; 7: Village; 8: Sparse village; 9: Hamlets; 10: Sparse hamlets

Does this mean that people in bigger cities are inherently more at risk? Not necessarily. It's generally a mistake to read off individuals' outcomes from area characteristics: statisticians call this an 'ecological fallacy'.

Figure 2 shows that within England, as Covid-19 spread, city-regions like Bristol and Leeds had lower case rates than the rest of the country – and there is a lot of variation ***within*** city-regions.

Figure 2: Covid-19 confirmed hospital cases per 100,000 people, English city-regions, 1 February – 1 June 2020



Source: Public Health England data for England, 1 February - 1 June.
Notes: Confirmed hospital cases per 100,000 people for local authorities within city-regions. City-regions defined using combined authority boundaries and GLA boundary for London.

What might explain these patterns? There are four overlapping theories.

Density

Density and social interaction are key features for the success of cities. But these features are also conduits for the spread of disease. Pandemics through history have tended to hit big cities hardest (The Economist, 2020). Just as agglomeration economies scale with city size, so bigger, more connected cities may be more vulnerable to disease than smaller towns and rural areas.

As we saw above, evidence suggests a more severe impact of the Covid-19 pandemic in the most densely populated areas such as London and New York – the biggest and densest locations.

Transport networks

Big cities are hubs for international transport networks; they have extensive public transport networks; and they act as commuting hubs for their surrounding city-regions. These channels may help the virus move between city cores and suburbs, and through countries as a whole. There is suggestive evidence that well-networked areas have higher infection rates, controlling for income and density (The Economist, 2020).

A Spanish study using mobile phone data links the high prevalence of Covid-19 in sparsely populated areas with the frequency of weekend trips to and from Madrid before the introduction of lockdown measures. Other evidence suggests that supply chain networks helped to spread Covid-19 between relatively low-density industrial clusters.

Crowded housing

Crowding brings people into sustained close contact. In England, there is a clear association between crowding and Covid-19 cases, especially in multi-generational households. This implies that cases – and deaths – will be higher in poorer versus richer cities, in more crowded neighbourhoods within cities, and among groups most affected by urban housing crises. In turn, Covid-19 outbreaks should be worse in the biggest and most expensive cities, such as London.

Industry and occupational structure

Work differs significantly between urban and rural areas. Jobs in cities, especially big cities, are more likely to be in services sectors, highly dependent on physical proximity and face-to-face interactions, while rural jobs are largely geared towards manufacturing industries and less reliant on social interaction.

Urban labour markets have increasingly polarised into high-wage knowledge-intensive work and low-wage, low-skilled service roles. Both sets of jobs depend on face-to-face interaction, but while the first group of workers have the possibility of working from home, the second group often cannot. In the UK, younger, poorer (and some minority ethnic) people outside the Greater South East are least likely to be working from home. Again, this suggests that Covid-19 will have unequal effects both across and within cities.

Taken together, these four theories also imply that the impact of coronavirus ***within cities*** will be very unequal. Specifically, Covid-19 will do more damage in more unequal cities and among neighbourhoods and groups most affected by economic deprivation.

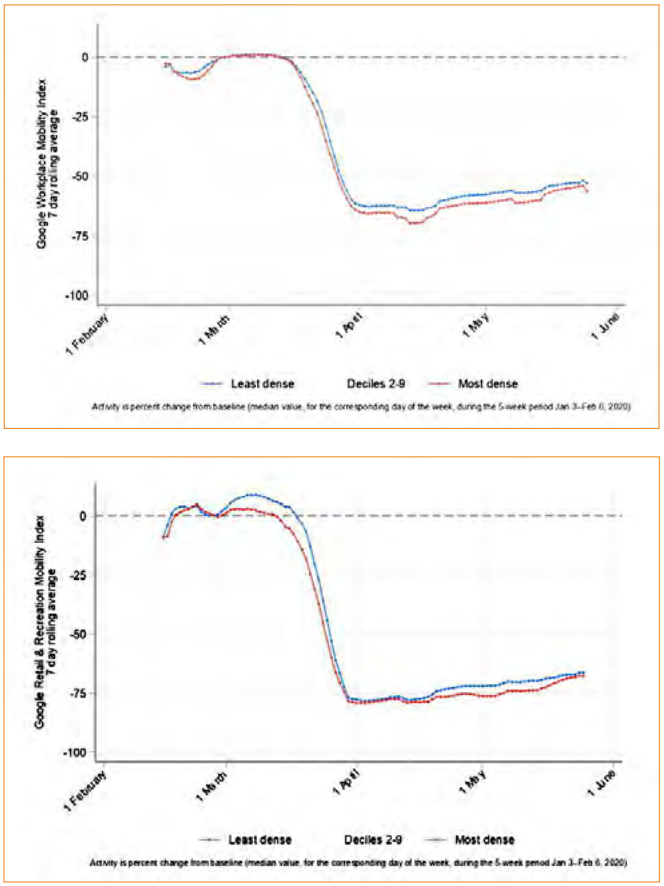
In this respect, there is growing evidence on the link between Covid-19 outcomes, area deprivation and demography. Covid-19 related deaths are linked to minority ethnic status and to higher deprivation, partly reflecting socio-economic disadvantage, and largely urban location, type of work and household structures.

A striking ONS analysis also identifies the UK jobs most likely to be in frequent contact with people and exposed to disease. This workforce – including health and care sector workers, rank and file police, hairdressers, bar staff, primary and nursery teachers – is more women than men, around one in five minority ethnic (twice the population share) and has a large minority earning below median wages. Many of these workers – as well as security guards and bus/taxi drivers – also have very high Covid-19 death rates.

How reliable is the evidence?

Explaining urban-rural differences in the prevalence of Covid-19 is not clear-cut. First, the majority of evidence to date is based on correlations, and different factors are closely related to each other. Densely populated metropolises are more likely to have large public transport systems, more face-to-face interaction occupations, and greater within-home overcrowding and higher levels of income inequality than rural areas. It is not straightforward to disentangle the relative importance of these factors.

Figure 3: UK change in workplace, retail and leisure travel mobility by density of area



Source: Google Community Mobility initiative.
Notes: Vertical axis shows the percentage change in visits to workplaces (top) and retail & recreational places (bottom), by density of the geographical area.

Second, both the pandemic and responses to it are dynamic. As outbreaks move through space, people change their behaviour if they can, and the size of the response varies across cities and rural areas. Figure 3, using Google mobility data, shows that work and non-work mobility has decreased more in the densest areas of the UK.

Notably, we can see a bigger response in the densest areas ***before*** the UK's lockdown policies took effect. This is consistent with other UK and US evidence, and with US evidence that lockdowns had bigger health benefits in denser places. Citizen response may help to explain why density seems to get less important in explaining coronavirus cases over time.

But how people respond will itself be driven by an area's overall outbreak and its occupational structure. The extent to which people can effectively socially distance is shaped by their economic and household circumstances – those in 'essential' jobs and crowded homes can't do this easily.

What else do we need to know?

Urban density and interaction are key factors in national economic growth over the last century. It is therefore critically important that we also understand the roles of density and interaction in a world in which global pandemics become more common.

For economists, this research agenda is growing rapidly, at least among those with the time to write under lockdown. This work will be vital for the design of urban infrastructure and urban policies in a world in which global pandemics are more common.

On top of understanding how different urban features may contribute to the spread of Covid-19 and other diseases, we need to know more about how these features contribute to differences in health outcomes for different types of people. In particular, we need to know more about the role of occupations, particularly those with a high degree of face-to-face interaction, in the spread of Covid-19. And we need to understand better how the rural and urban workforces will change following the pandemic.

Overall, the need for dense cities will not go away, and cities have proven to be able to adapt quickly, especially to previous pandemics (The Economist, 2020). This implies that even permanent social distancing measures post-lockdown are unlikely to affect the growth of cities as thriving centres of production.

We may, however, see changes in the way we use cities, and which may in turn rebalance activity between urban and rural centres. For example, permanent shifts to remote working may lead many 'knowledge workers' to move out of urban areas. This might improve wellbeing (by reducing commuting times) or hurt it (by reducing workplace interactions and social capital).

These shifts are likely to be partial, as many occupations found in cities cannot work from home. They may also hurt productivity, as most existing evidence suggests that teleworking is an imperfect substitute for face-to-face interactions. While many managers seem positive about remote working, many workers report extensive 'Zoom fatigue'.

The system-wide consequences of these shifts are very hard to predict. One recent study suggests that in some urban centres, high-skilled workers who can work from home will leave urban centres in favour of larger, more rural, homes. This will lead to a decline in urban housing costs, allowing lower-paid workers who cannot work from home to relocate to urban centres. Overall, this modelling predicts that urban-rural inequality will decrease, as will workers' commuting times.

Overall, cities are likely to be resilient to this crisis, despite the higher risk faced. Urban density will still play a key role for economic growth, but much depends on how cities will be able to adapt to the new challenges, in particular in public transport networks, amenities, housing conditions and the protection of exposed workers and communities.

Where can I find out more? Media reports, visual and audio presentations

Covid-19 and the future of cities: Video discussion

What does Covid-19 mean for cities?: Freakonomics audio conversation

The city and the virus: *Medium article*

What does the Covid-19 crisis mean for the economies of British cities and large towns? *Centre for Cities blog*

Density is normally good for us; that will be true after coronavirus, too: *New York Times*

The pandemic is killing the attraction of megacities: *Financial Times*

THE FUTURE OF CITIES: Resources recommended by the Editor

BBC: How do you build a city for a pandemic? – https://www.bbc.com/future/article/20200424-how-do-you-build-a-city-for-a-pandemic
Refers to urban density, creating flexible places and spaces, localisation, self-sufficiency.

QUARTZ: The future of cities: In the future, you'll never have to leave your neighbourhood – https://qz.com/1375277/in-the-future-youll-never-have-to-leave-your-neighborhood/

Archisearch: Pandemic architecture – https://www.archisearch.gr/architecture/open-call-pandemic-architecture-international-ideas-competition/
'What can architecture do for our health?', 'Architecture shapes Disease cities. When the needs of citizens change, so do their cities and their homes.'

National Geographic: Future cities (Pre Covid-19) – https://www.nationalgeographic.com/magazine/2019/04/see-sustainable-future-city-designed-for-people-and-nature/

Observatory Hill EEC

Virtual Fieldwork Webinar Offerings

The impact of COVID-19 made 2020 a year we'll never forget. The stress levels have been unprecedented. To alleviate some of the stress, Observatory Hill EEC created a range of online learning opportunities to assist you and your students. Live, online webinars have been created for the *Urban Places* component of the HSC Geography syllabus, in addition to a collaborative webinar with Taronga Zoo for *People and Economic Activity – Tourism*.

During these approximately one hour long (People and Economic Activity is two hours long) webinars, trained DoE Geography Teachers, through Zoom, Microsoft Teams, etc., join your class and describe in detail, a syllabus aligned case study. Providing facts, figures, and insight, your students are able to develop a deep understanding of the case study despite being unable to travel in person.

To ensure student engagement, worksheets accompany each webinar, and dedicated and maintained Google Sites for each case study support your students after the event. The sites showcase the virtual fieldwork case studies for key geography topics and include general information about the case study sites, key syllabus concepts, related film clips, current news articles and more. In addition, students (and teachers) will receive a link to a previous recording of the webinar so they can review the content, a VR tour to immerse themselves in the location, and a copy of the presentation delivered to aid in their study.

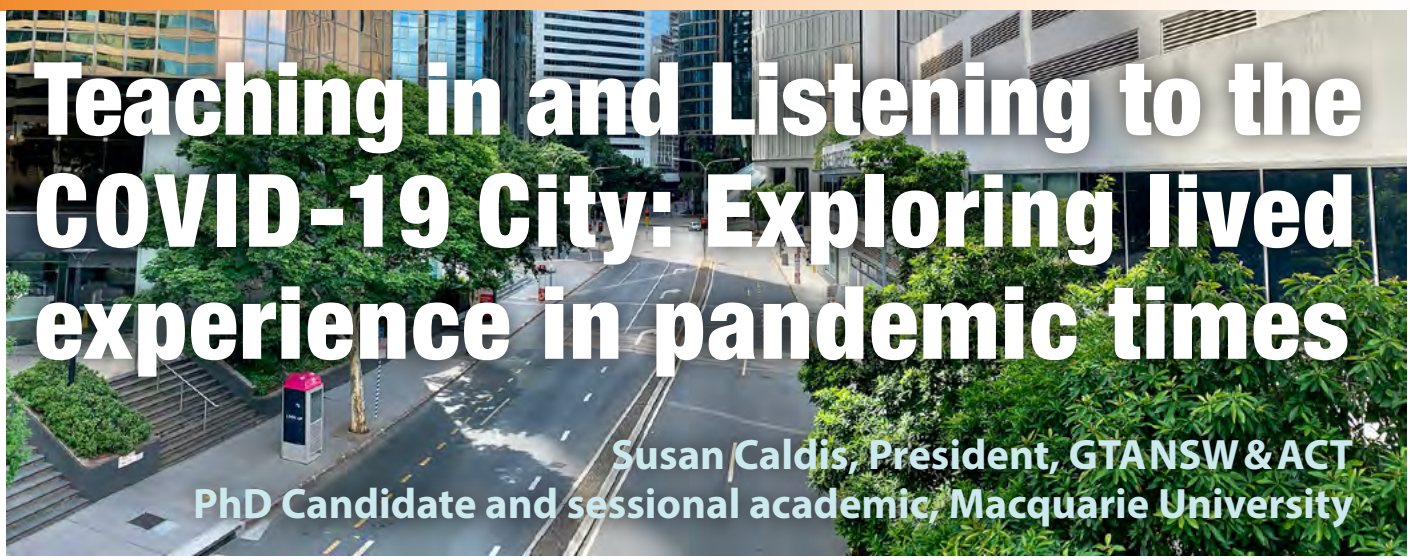
Webinars have been developed for the following options: *Urban Places* – [An urban dynamic operating in a country town or suburb] for *Pyrmont*, *Green Square* or *Barangaroo*, and *People and Economic Activity – Tourism: Taronga Zoo* (an Economic Enterprise). We are currently taking bookings for all options, please note there is a nominal cost per class.

Please contact us on 9247 7321 or visit our website – https://observatoryhilleec.schools.nsw.gov.au/ for more information.

Looking forward to seeing you online,
The Team at Observatory Hill EEC

FIELDWORK AT GREEN SQUARE

FIELDWORK AT TARONGA ZOO



Teaching in and Listening to the COVID-19 City: Exploring lived experience in pandemic times

Susan Caldis, President, GTANSW & ACT
PhD Candidate and sessional academic, Macquarie University

Teaching in and Listening to the COVID-19 City; Exploring lived experience in pandemic times is a two-part article which draws on theory and practice to explore a range of lived experiences during the time of a pandemic.

Overview

Both parts of the article are connected to City Road Podcast (www.cityroadpod.org); a portal of evidence-informed podcasts about cities, urban life, and urban-planning related issues. The founder of City Road Podcast is Dr., Dallas Rogers, Senior Lecturer in the School of Architecture Design and Planning at the University of Sydney. In March 2020, Dr., Rogers reached out via social media seeking contributors, to what would become, a rapidly mobilised international podcast project of collective biographies and digital story-telling. The project is called *Listening to the city in a global pandemic* and it aims to provide an open-access platform of resources to help people better understand life in the COVID-19 City. *Listening to the city in a global pandemic* came to life through the contributions of twenty-five academics who work across the discipline of Geography including geographical education. The academics are located in Australia, Canada, Germany, India, Iran, New Zealand, Singapore, United Kingdom, and the United States of America. The podcasts are a combination of theoretically-grounded stories and 'in-the-moment' reflections about how cities and life in them are impacted by the COVID-19 pandemic (https://cityroadpod.org/2020/03/29/listening-to-the-city-in-a-global-pandemic/).

The article opens with *Teaching in the COVID-19 City* which references one of the podcasts in the *Listening to the city in a global pandemic* project. Although it is urban-focused and urban-produced, it the only podcast to focus specifically on education in schools. This article does not recount the script of the podcast because it is hoped readers will listen to the podcast either before or after reading this article. Rather, *Teaching in the COVID-19 City* focuses on the story of and considerations resulting from the podcast. Ten Geography teachers were asked three questions at the beginning of lockdown and they generously share their experience of quickly pivoting their practice from teaching face-to-face to teaching fully online. Analysis of such lived experience reveals the strength of personal values, beliefs and convictions about teaching when responding to a structural or externally created problem that yields few options and choices. Such analysis also reveals important implications to consider for Initial Teacher Education and the provision of Teacher Professional Learning. The second part of the article, *Listening to the City* focuses on connecting geographical learning in *Urban Places* to several podcasts from the suite available in *Listening to the city in a global pandemic*. In addition to connecting learning between syllabus and podcast, some teaching ideas are also offered. Beyond the *Listening to the city in a global pandemic* project, the resources available on the City Road Podcast portal (www.cityroadpod.org) can be accessed by Geography teachers to either use for their own enrichment and professional development or use with students in their Geography class (Caldis, 2018).


Photo credit: Susan Caldis

PART 1: TEACHING IN THE COVID-19 CITY – EXPLORING LIVED EXPERIENCE IN PANDEMIC TIMES

Abstract

Two days, one podcast, four minutes, three questions, ten Geography teachers. Such numbers equated to one unexpected chance to include the voice of urban school-based geography educators in an urban-geographies academic project.

The urban-geographies academic project, *Listening to the City in a global pandemic* provides an exciting opportunity to capture the lived experience of teachers from the frontline in real-time. The opportunity occurs during the first week of a pandemic-related lockdown for New South Wales (NSW) in March 2020 and focuses on the resultant pivot from in-school learning to home-based learning, However, the opportunity also presents a challenge. The challenge being, that in such a tumultuous and demanding time, it is uncertain whether or not teachers will have the capacity to respond to questions about their practice.

Despite the constraints of a tight timeline (two days), a brief overview (three questions), and a small participant group (ten Geography teachers), a compulsion occurred to overcome such scenarios and be enabled by the prospect of telling an important story (one podcast, four minutes) about the transformation of practice and perhaps delve in to potential implications for education and/or geography education (Solem & Boehm, 2018). To tell such a story also meant the voice of urban school-based geography educators would be included in a larger academic urban-geographies narrative about living in a COVID-19 city, thus joining an authentic avenue of collaboration between school and university geographers (National Committee for Geographical Sciences, 2018).

It is acknowledged the data-generation for *Teaching in the COVID-19 City* is informal and reliant on the goodwill, trust and relationships established between the researcher and the participants (Neale, 2019).

However, the data-generation is indicative of a qualitative reflexive digital methodology (Rogers et al., 2020) and does follow a basic research design procedure: identification of a gap in the literature, formation of research question(s), selection of a participant group, design and conduct of a research methodology, data interpretation and analysis through a theoretical lens, suggestions for further research, and dissemination of findings (Johnson & Christensen, 2017). The purpose of this article is to broadly share the findings from an informal data-generation process and consider future implications for teaching rather than to detail the research design and data analysis procedure. However, it is worth highlighting the following points:

- **Gap in the literature**
  At the time of creating the *Teaching in the COVID-19 City* podcast, a scarce pool of literature was available about teaching in Australian schools during the COVID-19 pandemic. Since the creation and publication of the podcast, locally and internationally generated research and reports have emerged. Such reports include *Thinking about pedagogy in an unfolding pandemic* (Doucet et al, 2020) and *Lessons for education during the coronavirus crisis* (OECD, 2020). As the literature pool builds, increasing opportunities arise to reflect on the key messages arising from the *Teaching in the COVID-19 City* podcast. For example, relevant and thought-provoking material upon which to reflect and learn occurs from reading empirical studies about online learning (Eager, 2020) and scholarly blogs about the impact on COVID-19-related teaching practice from Cunningham (2020) and Norman (2020) on the *Edu Research Matters* blog hosted by the Australian Association for Research in Education.
- **Participant group**
  The ten Geography teachers, whose responses are anonymously featured in the podcast, were

purposefully selected because they teach Geography and work across government, Independent and Catholic schools. The participants also represent the spectrum of career stages, from 'first-year-out' and the early-career years, through to those at a mid-career point and those who have almost two decades of experience. Each teacher responded on the same day the questions were posed. A 100% response rate is unusual for any type of research and although the participant group is too small to be representative of a population, the purposive sampling does provide an opportunity to understand experience across a range of cases and offers a future possibility to drill down further and more formally into particular case case-studies if desired (Johnson & Christensen, 2017; Neale, 2019).

- **Research question(s)**
  The questions were posed towards the end of the first week of lockdown. It was an intense time of disruption to familiar practice and also a time of demand for a quick enactment of a new way of being. The questions posed are:
  - In three words or less, what is it like to try and teach *students* in the COVID-19 city the moment
  - In three words or less, how do *you* teach in a pandemic?
  - In three words or less, how are students reacting at the moment?

The informal data-generation about the lived experience of ten Geography teachers who were rapidly adapting their practice in response to the demands of lockdown – or in the words of one teacher, "...reacting and scrambling to change the way of teaching we have known" – reveals a sense of cautiousness, determination and intrigue. The need to embrace a new way of being in the urgent transition to a home-based classroom or distance learning context is met with mixed reactions including:

(i) hesitation and a sense of fingers-being-crossed whilst enacting lessons in a technology-enabled way: "I'm feeling proud, I just taught my first ever zoom lesson today and it worked." (an experienced Geography teacher); and

(ii) excitement: "intense yet innovative" (a mid-career Geography teacher)

To explain the actions and practice of teachers evident in his research about the enactment of policy on teacher practice, Norman (2020) puts forward the notion of anti-fragility – responding to shock by getting stronger. The 'shock' being the rapid transition to online learning; the 'getting stronger' being the adjustment to, and improvement in confidence with, new teaching practices or 'the craft' of teaching. The idea of anti-fragility is also relevant to the findings from this informal data-generation with Geography teachers.

Becoming a reflexive practitioner relies upon our willingness to identify and consider the extent of influences that enable or constrain our practice, and then take appropriate action. Such influences include:

- our personal values and beliefs;
- the structural procedural or contextual situations we work with; and
- the surrounding culture of people and place

By going through the process of identifying enabling and constraining influences upon practice, followed by contemplating the 'most influential' influence to drive future action, and then deciding 'what' and 'how' to act upon the driving influence, we are able to transform existing practice (Archer, 2013).

So, a connection can be drawn between reflexive practice and anti-fragility.

On paper, the structural influence of teaching in a pandemic looks to be very constraining. Although the pivot from face-to-face teaching to a fully online delivery was a required action and not a choice, it was the strength and conviction of personal values and beliefs about what it means to be an effective teacher overall that enabled and drove the ten Geography teachers to respond in an 'anti-fragile' reflexive way to a very difficult situation.

> "It is challenging and intriguing all at once, but you have to overcome this challenge otherwise the students will not be taught well" (a first-year out Geography teacher)
>
> "You have to adapt, improvise, and overcome" (a first-year out Geography teacher)

Teacher workload did increase dramatically as teaching programs were adapted to support students, parents/care-givers (and teachers) in response to teaching fully-online from home. Whilst teacher-workload was not specifically referenced by the ten Geography teachers in this podcast it is definitely acknowledged as being part of their story and as a feature of teaching in a pandemic (Cunningham, 2020; Norman, 2020). Norman (2020) illuminates several positive experiences for teachers in his research which result from the lockdown-induced home-based learning scenario. Such experiences include:

- students being more willing to contribute during lessons because they are more comfortable in an online learning space;
- teachers working alongside each other and with students to support each other, share learning and develop their technological capability;

- teachers feeling that a 'forced' pivot actually improved and diversified their teaching practice, helping them to become better at their craft in extraordinary yet ongoing circumstances.

Some of the aforementioned themes are identifiable in *Teaching in the COVID-19 City,* particularly about student learning. When asked about student reactions to transitioning to an online-learning scenario, the common words expressed were "engaged and focused; adaptive; motivated yet anxious and looking for answers that we as teachers cannot always provide". An early-career teacher noticed his students becoming more autonomous in their learning and taking initiative to solve problems through independently setting up group-chats to converse with each other about various aspects of the lesson. Such an observation reflects the work of Eager et al., (2020) who reminds us to allow, recognise and purposefully include student voice and student choice in online learning courses so that as teachers we can recognise that students want to know and find useful in their learning or engagement with our classes.

In response to the observation from Norman (2020) about teachers working alongside each other and with students to support each other, share learning and develop their technological capability, the OECD (2020) report suggests this will become the new reality of remote teaching. Furthermore, teachers who engage in collaborative professional learning also report more regular use of effective teaching practices.

Although the work from Rogers et al., (2020) emerges from the academic space of urban geography, it is important to remember geography education is present and visible. When reading the collaboratively written article about the project *Listening to the city in a global pandemic,* a powerful and captivating quote prompts further reflection on what this could mean for education:

> The sound of the city we hear throughout the broader podcast is almost defined by an absence of the familiar; and this opens up the possibility for thinking about different futures (Rogers et al., 2020, p. 444)

Similar sentiments are also echoed in the quote below from *Thinking about pedagogy in an unfolding pandemic: An independent report on approaches to distance learning during COVID-19 school closures* (Doucet at al., 2020).

> This type of school closure has never happened on such a scale before. It will require all stakeholders to rethink how education happens during this emergency scenario and then beyond." (Doucet et al., 2020, p. 1)

Unsplash image: You X Ventures@youxventures

When the above quotes are read in conjunction with responses from *Teaching in the COVID-19 City*, important questions arise for us as educators. Such questions should become key points of reflection upon our own practice in the first instance because the experience of COVID-19 provides a unique opportunity to experience what full-time, online education delivery could be like (Renton & Stobbe, 2020). Based on such an experience to 'rethink education' in the 'absence of the familiar and open up of possibilities', some reflective questions include:

What is it that is not here anymore?; followed by

- Do we need to re-include this absence in a new way? or
- Has what is absent actually become obsolete? and
- Are we ready to embark a new way of being within teaching and teacher education?
- What can be reimagined and introduced to education broadly?
- How and when can we have a critical look at teaching practice and envisage a different future for teaching and teacher education – from initial teacher education through to the formal and informal provision of professional learning opportunities?

In the uncertain and unusual circumstance of teaching in a pandemic, where an urgent transition to a new practice is required, it is important to acknowledge both the heart-wrenching and the inspiring stories of transformation (Cunningham, 2020). It is acknowledged that in this instance, the profiled stories of transformation are inspiring. The stories demonstrate struggling and being in the zone of confusion at a time of immense learning and they also demonstrate the embracement of a challenge.

> It's a great opportunity to teach in this manner, we have literally changed from teaching in the traditional classroom to something vastly different [to what we have known] in just over a day – revolutionary almost (an early-career Geography teacher)

To contribute to *the Listening to the city in a global pandemic* urban-geographies project and therefore include the voice of education from urban geography educators in the assemblage of resources for teaching, research and dissemination is not only unique, it importantly provides an opportunity to:

(i) increase the visibility of geography education in the discipline of Geography, and also provide a pathway for future collaboration between school and university geographers (National Committee for Geographical Sciences, 2018); and

(ii) consider how the absence of the familiar can prompt thinking and action about future ways of being, for example with our teaching practice and its effective transformation in the transition to an online teaching environment (Rogers et al., 2020; Schultz 2020).

The lived experiences expressed in the podcast demonstrate the owners of those stories as being reflexive, anti-fragile and ready-to-learn practitioners. I would like to close Part 1 by publicly thanking the ten Geography teachers who generously shared their lived experience for a very public and reflexive digital story-telling project.

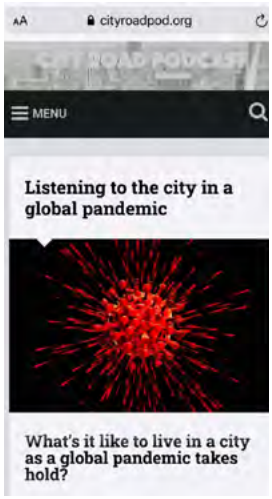


Photo credit: Screenshot from www.cityroadpod.org

PART 2: LISTENING TO THE COVID-19 CITY – EXPLORING LIVED EXPERIENCE IN PANDEMIC TIMES

Abstract

A call-out via social media, 'in-the-field' and 'in-the-moment' recordings from iPhones and similar devices, 25 academics, global representation. Such a scenario equates to a unique suite of personalised, agentic podcasts curated as part of an urban-geographies academic project. One unintended and exciting outcome of this project lies in its suitability for use in school-based Geography classrooms.

https://cityroadpod.org/2020/03/29/listening-to-the-city-in-a-global-pandemic/

In 2017 I discovered City Road Podcast and decided to use selected podcasts with my undergraduate students in teacher education. Sometimes I shared the podcasts with students purely for content and as a knowledge-generating tool to help students develop the skills of critical analysis. For example, the podcasts might be used to promote discussion about how the experiences, evidence or opinions shared in the podcast were similar or different to those expressed in the prescribed readings about the relevant urban place or urban planning issue. Sometimes I shared the podcasts with students to show how the content within it connected to the Geography syllabus; then I would demonstrate teaching strategies to show how the podcast could form an authentic teaching tool in the Geography classroom. The strategic plan for Geography, *Geography: Shaping Australia's Future* (National Committee for Geographical Sciences, 2018) puts forward a series of evidence-based recommendations for the future flourishing of Geography in schools and research, in the community, and as a career pathway that has impact on the economic, environmental, political and socio-cultural priorities of Australia. One of the recommendations is to explore ways to increase collaboration between school and university geographers as part of a strategy to (i) raise the level of geographical knowledge and understanding within the Australian population; and (ii) improve the visibility and integrity of the discipline (National Committee for Geographical Sciences, 2018).

The potential for collaboration occurs when familiarity with people and product exist, therefore, where possible I actively seek opportunities to connect 'academic Geography' to Geography in schools and to communicate such connections. Often this occurs via Twitter, a point of intersection and engagement between geography academics and the #geographyteacher community. At other times I write articles such as this one. In the table and paragraphs below, I provide suggestions about connection between the content of podcasts featured in *Listening to the city in a global pandemic* to the HSC unit *Urban Places*. Some teaching ideas are also offered. Readers might also like to access or revisit *Using podcasts and journal articles as a tool of professional learning and a tool of instruction in the Stage 6 Geography classroom* (Caldis, 2018) for suggestions about how to use other resources available on the City Road Podcast portal (www.cityroadpod.org) to either use for their own

enrichment and professional development or to use with students in their Geography classroom.

When accessing *Listening to the city in a global pandemic*, an introduction to and rationale for the project occurs. As already indicated in the overview and in Part 1, the podcast project is a fairly informal and short report about life in a city during a pandemic-related lockdown. The reports are captured 'in-the-field' and in-the-moment; all reports are based on the lived experience of place and time. The lived experience belongs to either the academic who makes the recording or to a specific group of people featured in the digital story-telling method. As a result, the podcasts are all easy-listening and easy-comprehending which enhances their useability in a school-based Geography classroom. Furthermore, the currency of such considered observations captured in the podcasts provide a unique set of illustrative examples that go beyond and also support information available in the textbook.

The next part of *Listening to the city in a global pandemic* features the sub-heading *COVID-19 Cities* and provides a background to the outbreak of and response to the novel coronavirus. The section then goes on to explore the historical geographies of pandemics in Sydney, such as smallpox and the bubonic plague. The purpose being to use stories, photographs and data from the associated period of time to set the scene for interpreting current reactions and responses to COVID-19.

> At City Road, we wanted to know more about people's experiences as they confront the many social, political, economic and material implications of the next disease to hit their city. (City Road Podcast, 2020)

The first podcasts encountered on the *Listening to the city in a global pandemic* page are contributed by Associate Professor Tanja Dreher and Associate Professor Kurt Iveson, and then the process of participation in the project is identified, followed by the 25 podcasts. For the remainder of this article, the podcasts are not necessarily addressed in order of appearance. Focus on the podcasts is centred around a possible teaching sequence using the podcasts in relation to order of the syllabus for Urban Places.

During August and September – a time when this article is being written and published – it is likely that students are looking for interesting ways to revise their work in the lead-up to the HSC examinations. They will also be seeking strategies and information to help maximise their achievement in various examinations. For Geography, we all know the power of applying geographical knowledge and understanding to known (studied) and unknown (broadsheet) contexts, and also in bringing-in a range of illustrative examples to support or counter learned information from case-studies and broader course content. So, I would like to suggest that by revising Urban Places through conceptualising learning through the lens of COVID-19 will enable students to use the podcasts of *Listening to the city in a global pandemic* and therefore demonstrate to you their application skills whilst incorporating several illustrative examples into their revision notes and practice extended responses.

To start, an overview to some themes about how to interpret a city or known place is required, and Professor Eugene McCann introduces four themes. If the themes themselves are one-step too far to integrate into extended responses, the themes do provide some nomenclature to use when discussing, for example, challenges and responses to living in mega-cities of the developing world, or the social structure and spatial patterns of advantage and disadvantage, wealth, poverty and ethnicity of a case study for urban dynamics. The four themes, contextualised around Vancouver ("Van"), are:

- visibility and invisibility: more aware of the disease as being invisible yet manifested through its visible traits such as masks
- privilege and privation: those who can self-isolate in private space compared to those who are marginalised, homeless or living in communal accommodation
- selfishness and solidarity: social and personal behaviours such as hording vs sharing, caring messages for community from community
- absence and presence: emptiness, who and what is here or not here? 'less buzz' metaphorically and literally in a city

Further detail about the themes can be found in *The City Under COVID-19: Digital Podcasting as Methodology* (Rogers et al., 2020) which is recommended as a professional reading rather than for use with students.

To then really situate us in time and place and to also prompt personal memories and lived experience of the pandemic-related lockdown, it would be good to listen to Associate Professor Kurt Iveson's podcast. Acknowledging it is Sydney-centric – which lends itself to inclusion across multiple parts of the syllabus as suggested in the upcoming table – the podcast clearly provides a picture about the urban pandemic life of people and place; and alludes to the economic and cultural authority of such places. Next it would be good to listen to Associate Professor Tanja Dreher's podcast who challenges us to consider who we are listening to as part of a process of 'paying attention' socially and politically.

Table 1 below clusters the podcasts according to the written order of the syllabus for Urban Places. It is acknowledged teachers may not cover Urban Places sequentially but for the purpose of writing, to connect podcasts to a linear progression through this unit is easier. Therefore, the appearance of podcasts in Table 1 are not in the same order as they appear in ***Listening to the city in a global pandemic***. Teachers should also note this is my interpretation, as you listen to the podcasts, you may make different connections to the syllabus and identify different themes. For the world cities connections, I am using the whole scope of world cities, from the top-tier through to middle and bottom tier of authority and influence. Australian cities have been included within the urban-dynamics case study section but could also be connected to world cities.


Unsplash image: Juja Han@juja_han

Table 1: Clustering the podcasts according to the syllabus for Urban Places

Podcast Author	Location	Connection to Urban Places	Theme
Carolyn Whitzman	Ottawa, Canada	**World Cities** Role of world cities	Privilege and privation Selfishness and solidarity
Beth Watts	Edinburgh, Scotland	**World Cities** Role of world cities	Absence and presence
Em Dale	Oxford, England	**World Cities** Role of world cities	Absence and presence Selfishness and solidarity
Mirjam Budenbender	Berlin, Germany	**World Cities** Role of world cities Networks	Absence and presence Selfishness and solidarity
Amanda Kass	Silicon Valley, USA	**World Cities** Networks	Visibility and invisibility Absence and presence
Creighton Connolly	Lincoln, England	**World Cities** Networks Relationships of dominance and dependence	Selfishness and solidarity
Kelly Dromboski	Christchurch, New Zealand	**World Cities** Relationships of dominance and dependence	Privilege and privation Selfishness and solidarity
Madeleine Pill	Sheffield, England	**World Cities** Relationships of dominance and dependence	Absence and presence Selfishness and solidarity Privilege and privation
Roger Kiel	Toronto, Canada	**World Cities** Relationships of dominance and dependence	Absence and presence Selfishness and solidarity

Ash Alam	Dunedin, New Zealand	**World Cities** Relationships of dominance and dependence	Selfishness and solidarity
Tooran Alizadeh	Iran (possibly Tehran)	**Mega Cities** Challenges and responses to living in a mega city	Privilege and privation Selfishness and solidarity
Deepti Prasad	India (Indian cities overall)	**Mega Cities** Challenges and responses to living in a mega city	Privilege and privation Selfishness and solidarity
Matt Wade and Renae Johnson	Denpasar, Indonesia (and other Indonesian locations); and Singapore	**Mega Cities** Challenges and responses to living in a mega city **World Cities** Role of world cities Networks	Absence and presence Absence and presence Selfishness and solidarity
Nat Osborne	Brisbane, Meanjin Country, QLD, Australia	**Urban Dynamics** Dash points within the case study: culture of place; changing economic character	Absence and presence Selfishness and solidarity
Cameron Murray	Brisbane, Meanjin Country, QLD, Australia	**Urban Dynamics** Dash points within the case study: culture of place	Absence and presence
Matt Novacevski	Melbourne, VIC, Australia (suburb of Carlton)	**Urban Dynamics** Dash points within the case study: culture of place	Absence and presence Selfishness and solidarity
Kate Murray	Melbourne, VIC, Australia	**Urban Dynamics** Dash points within the case study: culture of place	Absence and presence Selfishness and solidarity Privilege and privation
Kurt Iveson	Sydney, NSW, Australia	**Urban Dynamics** Dash points within the case study: changing economic character, culture of place, growth development	Absence and presence Selfishness and solidarity Privilege and privation
Tanja Dreher	Dharawal Country, south of Sydney, NSW Australia	**Urban Dynamics** Dash points within the case study: growth development, future trends	Selfishness and solidarity Privilege and privation
Elle Davidson	East Kimberley region, WA, Australia	Voices from Aboriginal Community and on-Country in the East Kimberley region	Selfishness and solidarity
Jason Byrne	Hobart, TAS, Australia	**Urban Dynamics** Dash points within the case study: culture of place	Absence and presence
Paul Maginn (plus the car-pool video)	Perth, WA, Australia	**Urban Dynamics** Dash points within the case study: culture of place	Absence and presence

Source: https://cityroadpod.org/2020/03/29/listening-to-the-city-in-a-global-pandemic/

To close Part 2, hopefully the suggestions above provides an opportunity to consider new ways of covering Urban Places to reflect the current time; to do so would also encourage students to apply illustrative living and dynamic examples from in-the-field and in-the-moment to fairly static, well-known and rehearsed case-studies. It is worth emphasising the power of observation as a fieldwork tool, as demonstrated through the podcast suite in *Listening to the city in a global pandemic*. It may be the case that audio-recordings of observations in-place about seeing, hearing, smelling and feeling, interpreted through such themes of absence and presence may start to form an integral part of future fieldwork for Urban Places; noting that such fieldwork activities and themes will also be appropriate for Ecosystems at Risk.

Listening to the city in a global pandemic provides a unique and accessible pool of resources suitable for use in the school-based Geography classroom. As Geography educators, we all have a role to play in emphasising the distinctiveness, relevance and visibility of our subject. One way in which we can do this is to make a concerted effort to use and connect current research happening in the field to geographical learning from the syllabus.

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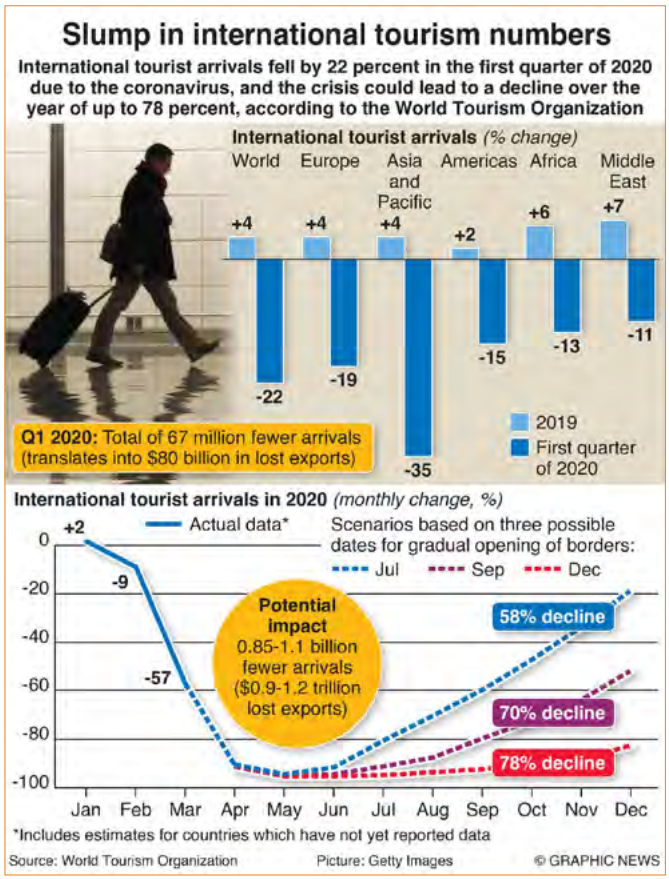
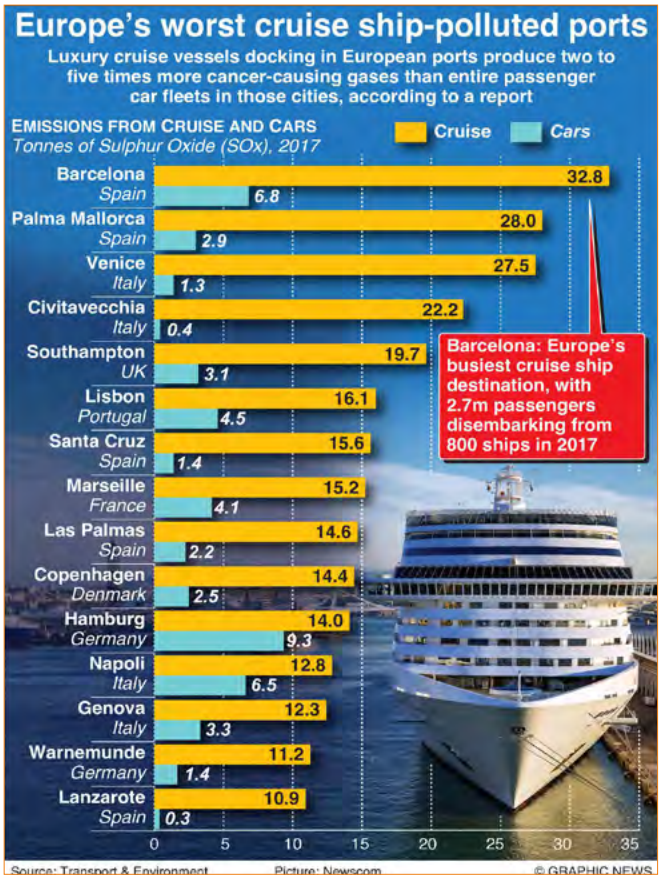
SOURCE A: Tourism



SOURCE B: Cruise Tourism



SOURCE C: Great Barrier Reef Ecosystem

Pacific volcano helps revitalise Great Barrier Reef

August 25, 2020 – A vast raft of volcanic pumice stones that floated across the Pacific is helping to revitalise Australia's embattled Great Barrier Reef.

In what seems like an unlikely chain of events, a mass of floating rocks twice the size of Manhattan spewed up from an underwater Pacific volcano and drifted westwards across the ocean to reach Australia's eastern seaboard.

Volcano F, located just north of the Vava'u islands in Tonga, erupted in August 2019, sending trillions of small pumice stones to the ocean surface where they were carried by currents across the Pacific. Pumice stones are formed from frothy volcanic glass filled with solidified gas bubbles and are light enough to float.

As the rocks bobbed around in the water, they attracted marine organisms like algae, barnacles, corals, and more. These tiny hitchhikers ended up riding thousands of kilometres across the ocean, and are now helping to seed and replenish endangered Australian coral systems with new corals and other reef-building organisms.

It is not the first time this has happened – Volcano F also erupted in 2001, and activity is becoming more frequent, with the volcano expected to breach the surface in coming years and form a new island.

Researchers are hopeful the latest pumice delivery will do some good for the Great Barrier Reef, which is beset by coral bleaching as the world's ocean temperatures rise due to climate change

The 2019 eruption's pumice raft can now be found along Australia's east coast from Townsville in Queensland to northern New South Wales – a spread of more than 1,300 kilometres.

Source: Graphic News:https://www.graphicnews.com/en/pages/40498/environment-giant-pumice-raft-reaches-australia

Challenges of mega cities: Dharavi

Collated by Lorraine Chaffer

SOURCE D: Dharavi and COVID-19

Coronavirus hits India's "Maximum City"

May 18, 2020 – Mumbai, India's most densely populated city, is now responsible for one in three of the nation's coronavirus infections. Dharavi, India's biggest slum, is particularly susceptible to the virus.

Located in the centre of Mumbai, the capital of Maharashtra state, Dharavi has an estimated one million people crammed into 239 hectares of space. They work in the slum's 15,000 work-live factories or as maids and chauffeurs to the financial capital's residents. However, Dharavi is the most educated slum in the country, with a literacy rate of 69 per cent.

Dharavi's narrow alleys, crowded housing and poor sanitation offer the perfect breeding ground for the virus. Dharavi has been under a severe lockdown since the coronavirus appeared in the slum. Virus hotspots include Matunga labour camp, Kumbharwada, Transit Camp and Naik Nagar, as well as along Cross Road, 90 Feet Road and 60 Feet Road. Police are using drones to make sure people obey the strict lockdown.

Graphic News: Published 18/05/2020

SOURCE E: Extract from ABC News report

India's biggest slum has so far nailed coronavirus. Here's how they did it

ABC NEWS. Read the full article here – www.abc.net.au/news/2020-08-08/indias-biggest-slum-declares-victory-over-coronavirus/12518818

With its narrow streets, congested housing, underfunded health care and poor sanitation, many thought India's largest slum would be devastated by COVID-19. In fact, Dharavi – located in India's financial capital Mumbai – was often heralded as a prime example of why the country was ill-prepared to deal with the coronavirus.

The World Health Organisation has lavished praise on local authorities after they embarked on an ambitious and comprehensive program to bring the coronavirus under control in a region where social distancing and contact tracing is impossible. With a million residents crammed within 2.4 square kilometres, local government assistant commissioner Kiran Dighavkar said relying on home quarantine was not an option.

"In one apartment of 10 feet by 15 feet (3 x 5 metres), you'll find at least 10 to 12 people," he said. "It is very difficult to do contact tracing because one person who used the community toilet, or toilet seat, is used by another 500 people.

Anything from sports centres, schools, nursing homes and hotels were converted into coronavirus treatment and isolation centres. Hundreds of community toilets were sanitised multiple times a day. Instead of waiting for symptomatic patients to come forward, authorities would doorknock homes to test temperatures and oxygen levels. Anyone considered at risk or showing depleting oxygen levels was taken into care.

SOURCE F: Reflection from a slum tourist

Look Inside Dharavi: My Experience

Source: https://www.tripsavvy.com/mumbai-dharavi-slum-tours-4072927

"Welcome to Dharavi!" a customer called out to us from the *chai wala*, as we exited the stairs at Mahim West railway station. I had just entered what is often labelled as Asia's largest slum. Yes, THAT slum, which rose to fame in the movie *Slumdog Millionaire* and angered many Indians for its portrayal of poverty. The movie has been referred to as an example of "poverty porn", one that encourages perverse western voyeurism and promotes slum tourism and volunteering.

And, there I was, about to embark on a two hour "slum tour" of Dharavi. But, if you think I was indulging in any kind of poverty voyeurism, think again.

"It's important for everyone to come to Dharavi and see how it functions, see the industry going on here. This is not a place where poor people are depressed. Look around. Do you see any beggars?", he (tour guide Salman) implored me.

Indeed, I could not. What I could see were laughing children running through the lanes and playing cricket, and people diligently working in all types of small-scale industries.

Dharavi's Astonishing Economy

To further dispel any notion of poverty-stricken people miserable in squalor, Salman began quoting astonishing numbers to me. In Dharavi, there are a total of 4,902 production units bringing in an annual income of around $1 billion. They're divided into:

- 1039 textiles
- 932 potters
- 567 leather
- 498 embroidery
- 722 recycling
- 111 restaurants
- Thousands of boutiques.

"Dharavi has so many specialist industries because of the people moving here from different areas of India, and they bring their skills with them," Salman informed me. It's worth nothing that, apparently, there is less than 10% unemployment in Dharavi.

Dharavi's incredible recycling industry

The first part of the Dharavi tour took us through some of the small-scale industry workshops. It was fascinating to see how they operated. Salman explained the process of plastic recycling, as we watched the work going on.

"First, the plastics for recycling are grouped together according to colour and quality. Next, they're crushed and made into small pieces. Then, they're washed and dried on the roof tops. After that, they're taken and rolled into pallets, and sent to the plastic manufacturers. 60,000 recycled products are made from them." All kinds of plastic items, from *chai* cups to pieces of old telephones, were being sorted through and processed by Dharavi residents.

Redevelopment of Dharavi

As we walked, Salman continued to explain the importance of Dharavi in the context of Mumbai. "Now, everyone is taking an interest in Dharavi's infrastructure and facilities. It's well connected by both Mahim West railway station and the Eastern Express Highway. The government wants to redevelop the area and build high-rise apartments, and they'll move the residents into these apartments."

Without understanding Dharavi, you could easily mistake this for a good thing. After all, residents will be getting free apartments as part of the deal. However, as Salman revealed to me, the truth is much more complicated. "The residents have emotional attachment to their *chawls*. Plus, the government is going to give everyone 225–275 square foot apartments, regardless of how much space they already have. Also, only people who have been living in Dharavi from before the year 2000 are eligible to get an apartment."

Then, there is the troublesome issue of what will happen to the small-scale industries, which will have to be moved out of the area. "It will be difficult for residents to have to travel to far-off, relocated workplaces," Salman lamented.

Other Small-Scale Industries in Dharavi

My friend and I got really excited once we reached the block-printing workshop. They were making export quality fabrics – and due to overwhelming demand, it was possible to buy them! Salman called the "boss man" over. "He doesn't look like the boss, but he is," he referred to the informally dressed topless man, who commenced laying out a range of beautiful fabrics before us. Unlike many Indian shopkeepers, he knew not to pull out too many pieces, which would overwhelm and confuse us. He also left us alone to decide what we wanted.

The tour progressed through other small-scale industries. Used tin drums were being renewed and repainted, leather was being processed, vessels were being spun on pottery wheels, small clay *diyas* were being shaped, and *pappads* were being rolled out (next time you dine at a restaurant in Mumbai, it's likely that the *pappad* you eat would've been made in Dharavi).

While photography isn't allowed on the Dharavi tour, occasionally Salman gave us the opportunity to take pictures. "The artists do appreciate the acknowledgement of their work. It makes them proud that foreigners come and take an interest in what they do, and even buy what they make."

Conclusion and lessons learned

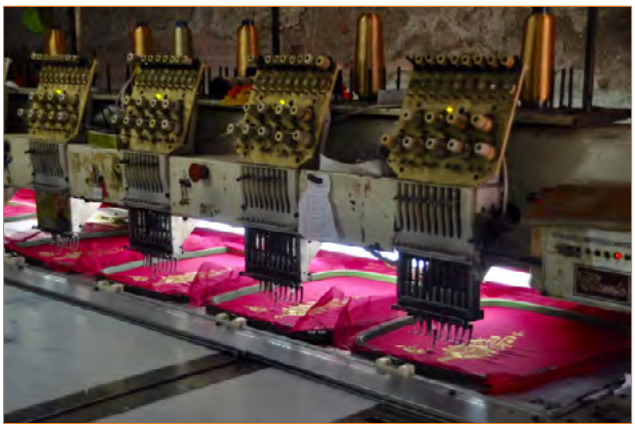
Without a doubt, it was an amazing, eye-opening, and POSITIVE experience. Everyone should go on a Dharavi tour and experience it for themselves. In my view, anyone who is reluctant to do so because they're worried about "poverty tourism" needs to examine their egos and false sense of superiority. The people in Dharavi are not ashamed of how they live, nor are they miserable. They are friendly, welcoming, and dignified.

SOURCE G: A photo tour of Dharavi: A working slum

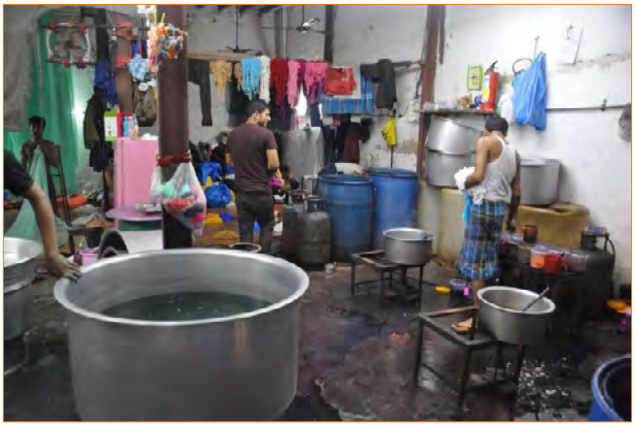
Taken by Lorraine Chaffer during a tour of Dharavi Slum in 2016

Housing

Clothing manufacturing: gold embroidery on silk, white & blue jeans, sports clothing



Fabric and textile dying



Smelting metals

Baking goods for Mumbai and beyond

Recycling a large amount of Mumbai's waste

SOURCE H: Cryosphere – Glacier collapse

Mont Blanc glacier on brink of collapse

September 25, 2019 – Part of a glacier on a mountain in the Mont Blanc range is at risk of collapse, prompting Italian authorities to close roads and evacuate Alpine hamlets.

A section estimated to contain up to 250,000 cubic metres of ice could fall down the mountain, the mayor of the nearby town of Courmayeur, Stefano Miserocchi, has warned.

Roads in the Val Ferret on the Italian side of Mont Blanc have been closed, after experts warned that a section of the glacier was sliding at speeds of 50-60cm per day.

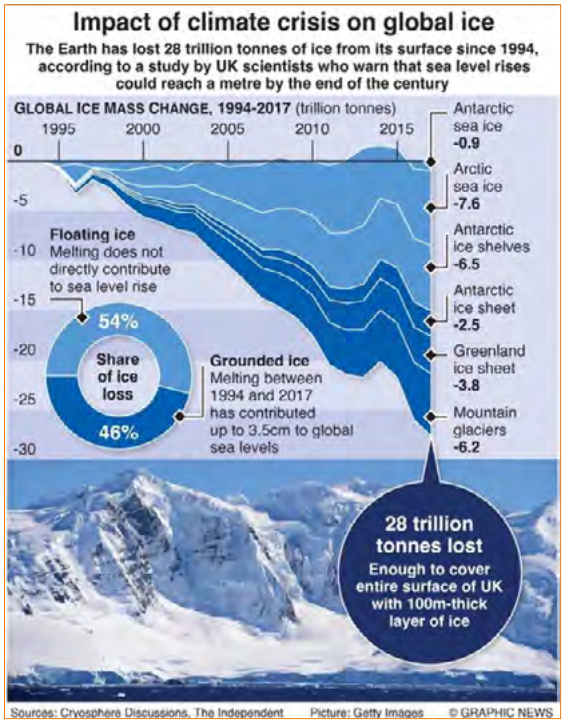
Rising global temperatures are causing the melting of mountain glaciers and the retreat of polar ice sheets.

Read more:

- Mont Blanc: Glacier in danger of collapse, experts warn (BBC)
- A Low-Cost Optical Remote Sensing Application for Glacier Deformation Monitoring in an Alpine Environment

Source: Graphic News – https://www.graphicnews.com/en/pages/39543/climate-change-mont-blanc-glacier-collapse

SOURCE I: Cryosphere – Global ice losses



Source: Graphic News – https://www.graphicnews.com/en/pages/40501/environment-global-ice-loss

Earth has lost 28 trillion tonnes of ice since 1994

August 26, 2020 – The Earth lost 28 trillion tonnes of ice between 1994 and 2017 with 60 percent of melting occurring in the northern hemisphere, according to data published in the online journal Cryosphere Discussions.

Scientists from Leeds and Edinburgh universities and University College London combined satellite observations and numerical models to identify the impact of global warming.

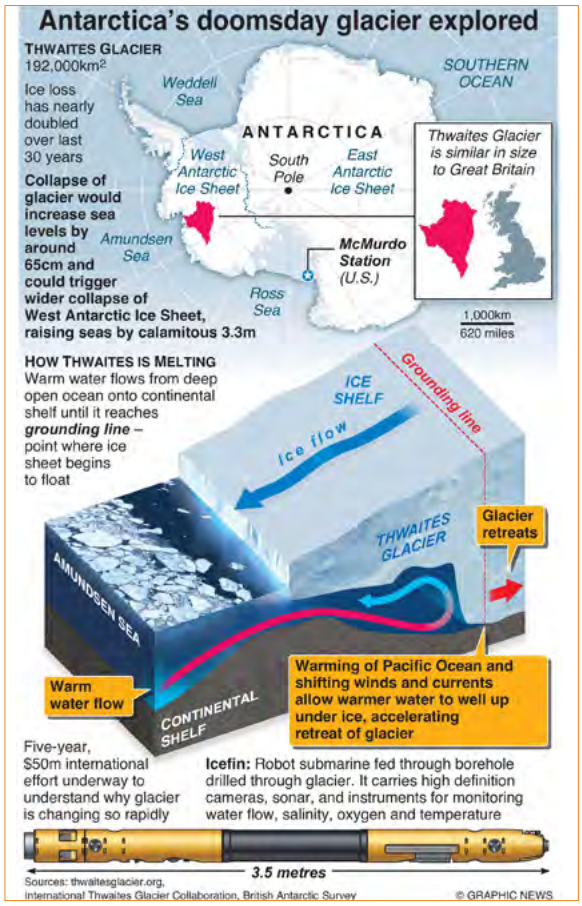
The group of researchers describe the ice loss as "staggering" and warn that melting glaciers and ice sheets could cause sea levels to reach a meter by the end of the century.

The analysis showed that the rate of ice loss has risen by 57 percent since the 1990s – from 0.8 to 1.2 trillion tonnes per year – owing to increased losses from mountain glaciers, Antarctica, Greenland, and from Antarctic ice shelves.

The majority of all ice losses were driven by atmospheric melting, with 68 percent from Arctic sea ice, mountain glaciers, ice shelf calving and ice sheet surface mass balance. The remaining 32 percent of the losses were from ice sheet discharge and ice shelf thinning, driven by oceanic melting.

Read more: Earth's ice imbalance (Cryosphere Discussions)

SOURCE J: Cryosphere – Antarctic glacial melt



Source: Graphic News – https://www.graphicnews.com/en/pages/39917/climate-change-antarcticas-doomsday-glacier-1

Antarctica's doomsday glacier melting fast

January 29, 2020 – A massive research effort is underway to understand why the Thwaites glacier is melting so fast. If it collapses, it could trigger catastrophic sea level rise, putting coastal cities around the world at risk.

Thwaites glacier, covering 192,000 square kilometres – an area the size of Great Britain – is particularly susceptible to climate and ocean changes. Over the past 30 years, the amount of ice flowing out of the region has nearly doubled.

A collapse of the glacier would increase sea levels by around 65cm and could trigger a wider collapse of the West Antarctic Ice Sheet, raising seas by a calamitous 3.3m.

As part of a five-year, $50m international effort underway to understand why the glacier is changing so rapidly, a team of scientists have drilled through the Antarctic glacier.

The 600-metre deep borehole has allowed researchers to lower down a torpedo-shaped robotic submarine to explore the underside of the ice shelf.

Called Icefin, it carries high definition cameras, sonar, and instruments for monitoring water flow, salinity, oxygen and temperature.

As climate change raises global sea levels, parts of the West Antarctica Ice Sheet are particularly vulnerable to collapse. At the end of the last ice age, parts of West Antarctica thinned by an average of 0.5m to 1m per year. Today with GPS, satellite and airborne measurements, scientists are seeing parts of West Antarctica thin by 1m to 6m per year.

SOURCE K: PQE Method for analysing maps, graphs and statistics

PQE is a tool used by geographers to describe the data and to look for patterns in this data.

P – Pattern

Give a general overview of any patterns you may identify. Look for things that stand out or form patterns. A pattern may be a group of similar features on a diagram, a concentration of a particular colour or feature on a map, or a particular shape that is created by data on a graph. For example, a feature is located in a particular area on a map or a general trend shown by a graph.

Q – Quantify

Add specific and accurate information to define and explain the patterns. Use statistics (quantities) such as amounts, sizes and locations to give specific details. For example, replace 'The forest is located in the centre of the country' with 'Approximately 10,000 hectares of forest extend across an area between 3 degrees south and 10 degrees south'.

'The graph shows an increase between 2010 and 2020 from 10,000 to 25,000 people'.

E – Exceptions

Identify everything that does not fit your patterns e.g. There are pockets of forest spread throughout the country' or '2020 was an unusual year that did not fit the general trend shown in the graph'

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

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

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

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

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

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

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

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

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

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

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

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

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

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