Geography 11–12

Human-environment interactions sample program

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# Rationale

The NSW Department of Education publishes a range of curriculum support materials, including samples of lesson sequences, scope and sequences, assessment tasks, examinations, student and teacher resource booklets, and curriculum planning and curriculum evaluation templates. The samples are not exhaustive and do not represent the only way to complete or engage in each of these processes. Curriculum design and implementation is a dynamic and contextually-specific process. While the mandatory components of syllabus implementation must be met by all schools, it is important that the approach taken by teachers is reflective of their needs and faculty/school processes.

NESA defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as the process of ‘selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject specific skills and knowledge’ (NESA 2022c). A program is developed collaboratively within a faculty. It differs from a unit in important ways, as outlined by NESA on their [advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units) page. A unit is a contextually-specific plan for the intended teaching and learning for a particular class for a particular period. The organisation of the content in a unit is flexible and it might vary according to the school, the teacher, the class and the learning space. They should be working documents that reflect the thoughtful planning and reflection that takes place during the teaching and learning cycle. There are mandatory components of programming and unit development, and this template provides one option for the delivery of these requirements. The NESA and department guidelines that have influenced this template are elaborated upon at the end of the document.

This resource has been developed to assist teachers in NSW Department of Education schools to create learning that is contextualised to their classroom. It can be used as a basis for the teacher’s own program, assessment, or scope and sequence, or be used as an example of how the new curriculum could be implemented. The resource has suggested timeframes that might need to be adjusted by the teacher to meet the needs of their students.

# Overview

**Description**: this program of learning addresses the syllabuses focus area – Human-environment interactions. The lessons and sequences in this program of learning are designed to allow students to develop the knowledge and skills to investigate the global nature of land cover change from a temporal and spatial perspective.

Weeks 1 and 2 of the program provides an overview of change to Earth’s natural systems over time acting as an introduction to the topic Human-environment interactions.

Week 3 of the program focuses on the extent and rate of change in ONE form of land cover and examples of land cover that could be used in this focus area include: forests, deserts, glaciers, ice sheets.

Weeks 4 to 6 of the program, Human–environment interactions study of climate change, develops an understanding of natural and human elements, how they interact and the implications of the interactions for people and the environment.

**Duration**: this program of learning is designed to be completed over a period of approximately 6 weeks in 60-minute lessons but can be adapted to suit the school context.

**Explicit teaching**: suggested learning intentions and success criteria are available for some lessons provided. Learning intentions and success criteria are most effective when they are contextualised to meet the needs of students in the class. The examples provided in this document are generalised to demonstrate how learning intentions and success criteria could be created.

Students investigate the global nature of land cover change, from temporal and spatial perspectives, as they examine the long-term development of natural systems compared to the short time frame of human activity. They investigate evidence for, and causes of, climate change, as well as the role of humans in contributing to land cover change.

Students investigate the interaction between the Earth’s natural systems and people through the study of ONE of the following:

* a geographic region
* a contemporary hazard
* climate change.

This focus area includes an overview of change to the Earth’s natural systems over time. The overview is intended to provide a big-picture perspective as a context for study. Allocate a maximum of 3 hours to this part of the focus area.

# Outcomes

* **GE-11-01** examines places, environments and natural and human phenomena, for their characteristics, spatial patterns, interactions and changes over time
* **GE-11-02** explains geographical processes and influences, at a range of scales, that form and transform places and environments
* **GE-11-03** explains geographical opportunities and challenges, and varying perspectives and responses
* **GE-11-04** assesses responses and management strategies, at a range of scales, for sustainability
* **GE-11-05** analyses and synthesises relevant geographical information from a variety of sources
* **GE-11-06** identifies geographical methods used in geographical inquiry and their relevance in the contemporary world
* **GE-11-07** applies geographical inquiry skills and tools, including spatial technologies, fieldwork, and ethical practices, to investigate places and environments
* **GE-11-08** applies mathematical ideas and techniques to analyse geographical data
* **GE-11-09** communicates and applies geographical understanding, using geographical knowledge, concepts, terms and tools, in appropriate forms

[Geography 11–12 Syllabus](https://curriculum.nsw.edu.au/learning-areas/hsie/geography-11-12-2022/overview) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

# Teacher advice

## Fieldwork

The Year 11 geography course includes 12 hours of mandatory fieldwork. This hands-on learning experience allows students to explore and analyse various aspects of Human-environment interactions, enabling them to gain a better understanding of the world around them. Fieldwork enables students to connect theoretical knowledge with real-world applications. It enhances their critical thinking, problem-solving and observational skills while also promoting a sense of stewardship for the environment.

When conducting fieldwork involving people, ethical practices must be adhered to, including respecting intellectual property (IP) rights. For example, if students are gathering data from community members, informed consent should be obtained, and participants should be made aware of how their information will be used. Additionally, any copyrighted material or resources must be appropriately cited and used with permission.

Fieldwork involving Aboriginal sites or focused on Aboriginal and/or Torres Strait Islander peoples and cultural heritage, requires special consideration of Indigenous cultural and intellectual property (ICIP) rights. To ensure ethical practices, students and teachers should familiarise themselves with cultural protocols for working with Aboriginal communities. Appropriate consultation with local communities and education consultants is necessary to establish respectful and mutually beneficial relationships. For more information, refer to [Aboriginal and Torres Strait Islander principles and protocols](https://curriculum.nsw.edu.au/teaching-and-learning/aboriginal-education).

In accordance with the NSW Department of Education’s [Excursion policy](https://education.nsw.gov.au/policy-library/policies/pd-2004-0010), risk assessments must be conducted prior to any fieldwork activities. This includes identifying potential hazards, assessing risks and implementing control measures to mitigate those risks. Teachers must ensure that adequate supervision is provided, and that all necessary permissions and approvals are obtained before commencing fieldwork.

When planning fieldwork activities for this focus area, please consider how [Environmental and zoo education centres](https://education.nsw.gov.au/teaching-and-learning/curriculum/sustainability/environmental-zoo-centres) might be able to support learning outcomes for students.

## Geographical tools

Geographical tools are to be embedded into classroom activities as appropriate. Students should have more than one opportunity to demonstrate their skills. The following geographical tools have been integrated into this program:

* maps – topographic maps, choropleth maps, flowline maps, cadastral maps, thematic maps, latitude and longitude
* graphs and statistics – compound and composite column and bar graphs, line graphs, scatter graphs, climate graphs
* spatial technologies – virtual maps, satellite images, Global Positioning System (GPS) and Geographical information systems (GIS)
* visual representations – photographs, vertical and oblique aerial photographs, satellite images, flow charts, annotated diagrams and mind maps.

## Geographical inquiry skills

The geographical inquiry skills content is to be integrated throughout the course. ‘Applying geographical understanding’ is an addition to the geographical inquiry skills. It includes:

* evaluating options in response to a geographical challenge by
* developing evaluation criteria based on environmental, social and economic considerations
* making an on-balance judgement about the most appropriate option(s)
* proposing actions and predicting outcomes
* developing a plan to implement a proposal
* assessing how causes, impacts, opportunities, challenges and/or responses relevant to one geographic context might be applicable to another.

## Managing controversial issues

Controversial issues are not static and are impacted by changing attitudes, world events and social values. It is important for all staff to develop practices in accordance with the department’s policies and procedures. Details of how to manage controversial issues and content can be found in the department’s [Controversial Issues in Schools](https://education.nsw.gov.au/policy-library/policies/pd-2002-0045) policy.

School staff should familiarise themselves with the requirements and responsibilities of this policy prior to the delivery of this focus area.

**Prior to planning for teaching and learning, please consider the following:**

**Engagement**

* How will I provide authentic, relevant learning opportunities for students to personally connect with lesson content?
* How will I support every student to grow in independence, confidence and self-regulation?
* How will I facilitate every student to have high expectations for themselves?
* How will I identify and provide the support each student needs to sustain their learning efforts?

**Representation**

* What are some different ways I can present content to enable every student to access and understand it?
* How will I identify and address language and/or cultural considerations that might limit access to content for students?
* How will I make lesson content and learning materials more accessible?
* How will I plan learning experiences that are relevant and challenging for the full range of students in the classroom?

**Expression**

* How will I provide multiple ways for students to respond and express what they know?
* What tools and resources can students use to demonstrate their understanding?
* How will I know every student has understood the concepts and language presented in each lesson?
* How will I monitor if every student has achieved the learning outcomes and learning growth?

# Overview of change to Earth’s natural systems over time

## Weeks 1 and 2 – change to Earth’s natural systems over time

**Teacher note:** examples included in the syllabus are provided to support delivery of course content. These examples are not mandatory and teachers might choose to use the examples provided or select appropriate alternatives.

Overview of change to Earth’s natural systems over time acts as an introduction to the topic Human-environment interactions and should take no longer than 3 hours of course time to complete.

### Learning intentions

These learning intentions and success criteria are general and should be contextualised to suit your school and students’ needs.

Students will:

* understand the different causes of environmental changes, distinguishing between natural changes (such as erosion and natural disasters) and human-induced changes (such as urbanisation and pollution)
* explore the natural processes and human activities contributing to climate change, understand the greenhouse effect and its significance in climate change
* investigate climate change trends over time by using various types of graphs and statistics to compare temperature data, ice cap sizes and sea levels
* understand the historical and contemporary factors influencing climate change through various sources and data analysis
* apply the acquired knowledge and analytical skills to engage in meaningful discussions, debates and present their findings through multimedia presentations and written responses
* understand the environmental and global impacts of deforestation, desertification and changes in ice cover, through research, discussion and analysis of provided resources.

### Success criteria

Students can:

* successfully complete a brainstorming session, listing the various causes of natural and human-induced changes to environments and visually represent the relationship between natural changes and human-induced changes
* prepare a well-thought-out response summarising their findings from the GIS software analysis, reflecting on the implications of environmental changes in their chosen region
* accurately summarise the information from the specified webpage and create a coherent fishbone diagram showing evidence of climate change
* accurately analyse and interpret climate data using various types of graphs, make informed inferences about climate change and its impact on different regions
* effectively compare data from different regions, and collaboratively reflect on the evidence to understand the implications of climate change for humans
* accurately summarise the key points regarding how climate has changed over time and the human activities contributing to climate change using evidence
* critically analyse historical and contemporary data to identify trends and impacts, and effectively communicate their findings through debates, multimedia presentations and written responses, reflecting a sound understanding of the topic
* create annotated maps illustrating land cover changes on a global scale and engage in a meaningful discussion on the global implications of these changes, showcasing their ability to synthesise information and propose viable solutions.

Table 1 – change to Earth’s natural systems over time

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation or adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-11****Natural change compared to human-induced change****Geographical tools/skills*** Maps
* Visual representations
* Spatial technologies
 | Complete a [brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=d6fc8c85-bc4d-ddf2-5df9-c787fd599e15) about the causes of natural change and human-induced change to environments. Create an interactive multi circle Venn or Euler diagram of natural change compared to human-induced change. [Visme](https://www.visme.co/venn-diagram-maker/), [Meta-Chart and](https://www.meta-chart.com/venn) [Creately](https://creately.com/lp/venn-diagram-maker/) might be useful resources.**Teacher note:** this activity is designed to be completed in 2 groups. One group will research natural changes (for example, erosion, natural disasters) and the other human-induced changes (for example, urbanisation, pollution). The following webpages provide a starting point for research – [Australian Bureau of Meteorology](http://www.bom.gov.au), [Australian Government Department of Agriculture, Fisheries](http://www.awe.gov.au) and Forestry, [US Geological Survey](http://USGS.gov).Conduct research to complete Table 1 in ‘Activity 1 – Is it natural or human induced change?’ in the resource booklet.Access GIS software such as [ArcGIS](http://www.arcgis.com/) or [Google Earth](https://earth.google.com/). Select a region that has undergone significant natural and human-induced changes (for example, the Amazon Rainforest). Access historical satellite imagery and other relevant spatial data for the chosen region.Analyse the imagery and data to identify signs of natural and human-induced changes, noting the timeframe and scale of these changes.Prepare a short response summarising the findings and reflecting on the implications of these changes.Reflect on the use of GIS tools in this activity. How do they enhance understanding of geographical changes in the region?Complete a class discussion using the following prompts:* What challenges are faced in distinguishing between natural and human-induced changes? What made this task difficult or uncertain?
* How might natural and human-induced changes affect this region in the future? What could be done to mitigate negative impacts?
* Can you think of other regions in the world where a similar analysis might be beneficial? Why?
 | Students effectively brainstormed causes of natural and human-induced changes.Used interactive diagram tools like Visme to illustrate distinctions and overlap between natural and human-induced changes.Demonstrated understanding of key concepts by accurately categorising examples of changes.Compiled comprehensive lists of natural changes like erosion, and human-induced changes like urbanisation.Presented findings to the class, showcasing their understanding and the depth of their research.Successfully filled out the table in Activity 1 of the resource booklet.Demonstrated comprehension by providing accurate information and relevant examples.Used GIS software like ArcGIS to analyse historical satellite imagery of the Amazon Rainforest.Identified significant natural and human-induced changes, noting the timeframe and scale.Displayed proficiency in using GIS tools to enhance understanding of geographical changes.Prepared concise responses summarising their findings and reflecting on the implications. | Pre-teach key vocabulary such as erosion, urbanisation, GIS, satellite imagery and so on, before teaching the activities.Provide a glossary or encourage the use of bilingual dictionaries for terms like urbanisation, GIS and so on.Ensure all students understand technical terms related to GIS and geographical concepts.Offer guided practice on using GIS software and understanding geographical terms.Encourage students to use the technical vocabulary while discussing and working on the activities.During practical learning activities like GIS analysis, emphasise the usage of target language and encourage students to communicate their findings using the correct terminology.Use visual/multimedia examples to explain the process of researching and analysing geographical changes.Encourage student reflection through various modes such as written, oral or digital responses.Divide students into groups to research natural and human-induced changes, while considering the needs of students who might find group work challenging.Offer practise opportunities before group work, or alternative options like working independently or in pairs. |  |
| Evidence of climate change in the contemporary world**Geographical tools/skills*** Maps
* Spatial technology
* Tables and graphs
* Climate graphs
* Spatial technologies
 | Access [What is climate change?,](https://www.science.org.au/learning/general-audience/science-climate-change/1-what-is-climate-change) and use the 4 main headings to briefly summarise the information from the webpage.Using the summary, and the article [How do we know climate change is real?](https://climate.nasa.gov/evidence/#:~:text=Global%20Temperature%20Is%20Rising,atmosphere%20and%20other%20human%20activities.) create a [fishbone diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599?clearCache=83682bdd-81f4-a59f-47be-3fc44434669) that shows evidence for climate change in the contemporary world.Use [NOAA Climate.gov](http://www.climate.gov/), [USGS Earth Explorer](https://earthexplorer.usgs.gov/), [Google Earth](https://earth.google.com/) and [Climate Data Snapshots](https://www.climate.gov/maps-data/data-snapshots) to investigate climate change trends. Examine the various types of graphs and statistics to compare temperature data, ice cap sizes and sea levels using line graphs, bar charts or scatter plots.Explore global weather patterns by examining real-time data on the [NOAA View Global Data Explorer](https://www.nnvl.noaa.gov/view/globaldata.html). Analyse data related to temperature, precipitation and storm patterns over a specified time period. Use the data to:* make inferences about climate change and its impact on different regions
* study geographical features and phenomena such as ocean currents, land use and vegetation
* compare data from different regions to understand the geographical variations and its implications.

Use GIS and remote sensing data to analyse spatial impacts of climate change on different regions. In pairs, highlight how different areas are affected by climate change. Use the following driving questions to conduct a [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645?clearCache=8e151f5-64d0-663e-6167-df381cd23b4c):* Explain how geographical features of an area impact the weather and climate.
* What are some natural processes that contribute to climate change?
* How do human activities impact the natural processes identified?
* Explain the concept of the greenhouse effect and its significance on climate change.

Examine and reflect on the evidence to create a [Y chart](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599?clearCache=83682bdd-81f4-a59f-47be-3fc44434669) showing what the evidence means for humans. Share the findings with the class. | Students successfully identified the 4 main headings to summarise the information and understand the concept of climate change and its indicators.Students created a fishbone diagram that demonstrated various evidence of climate change in the contemporary world, aiding in visual representation and better understanding of the topic.Students used various graphs and statistical data to explore and compare climate change trends over time. This included analysing temperature data, ice cap sizes and sea levels using line graphs, bar charts or scatter plots, which enhanced their data interpretation skills and understanding of climate change impacts.Students effectively made inferences about climate change impacts on different regions, studied geographical features and phenomena, and compared data from different regions to understand geographical variations and its implications.Students engaged in a Think-Pair-Share activity with driving questions that helped clarify the distinction between climate and weather, natural processes contributing to climate change, human activities enhancing the greenhouse effect and the concept of the greenhouse effect. | Pre-teach vocabulary such as ‘climate change’, ‘greenhouse effect’, ‘temperature trends’, ‘ice cap sizes’, ‘sea levels’, ‘real-time data’, ‘GIS (Geographic Information System)’, and ‘remote sensing data’ before delving into the activities.Provide a glossary of terms and allow the use of bilingual dictionaries for any unfamiliar terms.Introduce technical tools like NOAA Climate.gov, USGS Earth Explorer and Google Earth, and ensure students understand their functionalities.Encourage students to use the key vocabulary while discussing and sharing their findings during activities.During practical activities, emphasise the usage of the target language regarding climate change and geographical tools and encourage students to use this language in context.Offer visual aids, multimedia resources and real examples to explain concepts like climate change trends, greenhouse effect and geographical data analysis.Model the process of summarising information from a webpage, creating fishbone diagrams and analysing data using geographical tools.Provide templates for fishbone diagrams and Y-charts to assist students in organising their thoughts and findings.Check understanding through verbal or non-verbal responses, such as discussions, gesture, response cards or digital platforms.Offer support for students who find group work challenging, by providing opportunities for independent or paired work. |  |
| Evidence for the causes of climate change over time**Geographical tools/skills*** Visual representations
* Graphs and statistics
* Spatial technologies
* Photography
 | Review [How has climate changed?](https://www.science.org.au/learning/general-audience/science-climate-change/2-how-has-climate-changed) and [Are human activities causing climate change?](https://www.science.org.au/learning/general-audience/science-climate-change/3-are-human-activities-causing-climate-change). Complete a [dictogloss](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/661?clearCache=138bc494-aaeb-3757-a1c9-826ae8bcc35) for each source.Use evidence and information collected in the fishbone to respond to the statement ‘Climate change is a contemporary geographical issue’.Explore the evidence for the causes of climate change over time using the [NOAA View Global Data Explorer](https://www.nnvl.noaa.gov/view/globaldata.html).Using [Nearmap,](https://www.nearmap.com/au/en?utm_source=google&utm_medium=organic) conduct a comparative analysis of aerial photographs. View the vertical aerial photographs from different periods to identify climate change impacts on landforms and land use.In groups, create an Interactive climate change timeline showcasing significant climate change events and impacts using multimedia tools, for example, [Tiki-Toki](https://www.tiki-toki.com/) or [TimeGraphics](https://time.graphics/).Complete Table 2 in ‘Activity 2 – evidence of climate change in the contemporary world and over time’, in the resource booklet.Undertake a historical climate change analysis by analysing historical photographs, maps and data to understand past climate change events and their impacts. Analysis should include resources from local, state or national archives, for example, [NOAA Paleoclimatology](https://www.ncei.noaa.gov/products/paleoclimatology).* Complete a short response explaining the historical data and analysis of trends over time. The response should include how temperature or sea level has changed over the years.
 | Students successfully identified and documented the key points from the sources regarding climate change’s history and human-induced factors.Students actively participated in the debate, employing data and evidence collected from previous activities.Demonstrated an understanding of different perspectives on climate change, including its causes and effects on geographical and human systems.Compiled a structured report on their findings, explaining the changes in atmospheric constituents and temperature variations observed in the data.Students successfully collaborated to create a timeline showcasing significant climate change events and impacts.Students accurately filled in the table, demonstrating comprehension of various climate phenomena and their characteristics | Pre-teach climate-related terms and concepts such as greenhouse gases, carbon footprint and global warming.Provide glossaries and bilingual dictionaries for terms like anthropogenic, carbon sequestration and climate.Provide a structured debate format, with clear guidelines and sentence starters to assist in language use.Offer visual aids or multimedia presentations to explain the debate topic and supporting evidence.Guide students through the use of NOAA View Global Data Explorer with step-by-step instructions and demonstrations.Differentiate by providing alternative, simpler online tools or resources for students who find the data explorer challenging.Provide clear instructions and examples for analysing aerial photographs.Scaffold the analysis process, providing graphic organisers or templates to support students’ understanding and language use. |  |
| Land cover change at a global scale, including deforestation, desertification, melting glaciers and retreating ice sheets**Geographical tools/skills*** Maps
* Spatial technologies
* Visual representations
 | Complete [The One-Minute Paper](https://www.rochester.edu/college/teaching/teaching-guidance/one-minute-paper.html#:~:text=A%20one%2Dminute%20paper%20is,of%20that%20day's%20class%20session.) for each of the following:* deforestation
* desertification
* melting glaciers
* retreating ice sheets.

Write a response to each of the questions in ‘Activity 3 – land cover change at a global scale’, in the resource booklet.Use [Deforestation and Forest Loss](https://ourworldindata.org/deforestation) to compare and contrast deforestation rates across different countries using the interactive map provided. Complete the questions:* What is the net change in forest cover, and how is it calculated?
* Which countries are experiencing positive changes in forest cover, and which ones are facing negative changes?
* How has the global forest cover changed over the past 10 000 years?
* What factors have contributed to deforestation historically?

Use the [Mapping the shocking extent of desertification](https://earth.org/data_visualization/how-desertification-has-affected-these-9-countries-since-1984/) article to discuss the global implications of desertification and [brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=d6fc8c85-bc4d-ddf2-5df9-c787fd599e15) potential solutions to address this issue.In pairs, complete the following questions:* How is desertification defined and what are its primary causes?
* What are some of the consequences of desertification in China, Yemen, Kenya and Mali?
* What strategies have been employed to combat desertification, and have they been successful?

Use the [Global Ice Viewer](https://climate.nasa.gov/interactives/global-ice-viewer/#/) to investigate the rate of ice melt in the Arctic and Antarctic over the past decade including melting glaciers and retreating ice sheets. [Discuss](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/547?clearCache=62eebc47-e1d0-284d-46b6-358935ecb46b) the global implications of ice melt and [brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=d6fc8c85-bc4d-ddf2-5df9-c787fd599e15) solutions to mitigate its effects. Using the following questions to drive the discussion:* What are the main factors contributing to global ice melt?
* How does the changing polar ice caps affect global sea levels?
* What are some observable effects of changes to ice cover on local ecosystems?
* What measures are being taken globally to mitigate the ice loss?
* How does data from satellites contribute to our understanding of global ice trends?

Complete an annotated [map or maps of the world](https://drive.google.com/file/d/1O5yELA3-VgZuR0m6EwdrE_iv0OEX5tq-/view?clearCache=c0cd53fa-55c0-9c03-e5ed-d05c62b2b188&pli=1) illustrating land cover change at a global scale for deforestation, desertification and melting glaciers and retreating ice sheets.Use [Not passive victims: Indigenous Australians respond to climate change](https://www.foreground.com.au/culture/not-passive-victims-indigenous-australians-respond-to-climate-change/), complete a [SWOT](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/660?clearCache=a02ecfda-3273-4c85-a7ab-eae8db2b373) analysis of First Nations peoples’ responses to climate change. Conduct further research and discuss the effects of climate change on a specific community of Indigenous Australians. Complete the following questions:* How is climate change affecting the socio-economic and environmental systems of Indigenous populations in Australia?
* What are some examples of the impacts of climate change on traditional sites and practices of Indigenous Australians?
* How are Indigenous Australians adapting to the challenges posed by climate change?
* What are some new initiatives and alliances mentioned in the article that aim to strengthen cultural practices amid climate change?
 | Students succinctly summarised the key points and implications of each land cover change, showcasing their understanding and ability to communicate environmental issues effectively.Students analysed and compared deforestation rates across countries, using the interactive map to gather data.Students illustrated global land cover changes, demonstrating their ability to use geographical data and create visual representations of complex environmental issues.Students explored the socio-economic and environmental systems impacts, traditional sites and practices impacts, and adaptation strategies of Indigenous Australians facing climate change, demonstrating their comprehensive understanding and ability to connect broader environmental issues with local impacts.Conducted further research on the impacts of climate change on a specific community of Indigenous Australians, showcasing their ability to synthesise and apply knowledge. | Pre-teach key vocabulary terms related to deforestation, desertification, glaciers, ice sheets and climate change before engaging with the activities.Provide sentence stems or prompts to support students in beginning their responses.Allow students to respond in various modes – writing, drawing or discussing with a peer.Scaffold the research process by providing guiding questions or recommended resources.Provide structured templates for students to record their findings.Pair stronger students with those needing more support for the paired discussion.Provide visual aids or multimedia resources to enhance understanding of desertification.Offer various levels of support in interpreting data and creating the maps.Scaffold the SWOT analysis with guiding questions or a structured template. |  |

# Land use and land cover change

## Week 3 – the extent and rate of change in ONE form of land cover

**Teacher note**: examples included in the syllabus are provided to support delivery of course content. These examples are not mandatory and teachers might choose to use the examples provided or select appropriate alternatives. Examples of land cover that could be used in this focus area include:

* forests
* deserts
* glaciers
* ice sheets.

### Learning intentions

These learning intentions and success criteria are general and should be contextualised to suit your school and students’ needs.

Students will:

* know about changes to land cover and understand how land use can impact natural systems and land cover
* describe the key physical and ecological characteristics of the tundra biome and analyse the impact of human activities on this biome
* develop skills in creating informative visual representations (concept maps and cause-and-effect diagrams) that effectively communicate the complex relationships and changes within the tundra biome
* develop skills to analyse and interpret changes in land cover across various regions in Australia over the past decade
* investigate the characteristics of alpine and tundra environments, focusing on climate, vegetation, wildlife and the impact of climate change.

### **Success criteria**

Students can:

* clearly identify and describe specific aspects of the tundra biome present in the video, including climate, vegetation, animal life and geographical features
* accurately identify and explain the main threats to the tundra biome originating from human activities, showing a clear understanding of the cause-and-effect relationship
* create a detailed concept map and a cause-and-effect diagram that visually represent the relationships within the tundra biome, including threats and their impacts
* write a comprehensive extended response that includes a clear introduction to the tundra biome, a focused thesis on a specific type of land cover, detailed information about the chosen land cover, its role in the ecosystem, and relevant data or statistics showing changes over time
* demonstrate a thorough analysis of assigned Australian regions, comparing and contrasting land cover, and effectively considering factors like climate, human activity and topography
* make reasoned predictions about the impacts of global warming on tundra land cover and subsequently evaluate these predictions based on recent data, expert opinions and findings from authoritative sources.

Table 2 – the extent and rate of change in ONE form of land cover: tundra

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation or adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-05**The extent and rate of change in ONE form of land cover, including:* how changes in land use can interrupt natural systems and contribute to the land cover change

**Geographical tools/skills*** Graphs and statistics
* Spatial technologies
* Visual representations
 | **Teacher note**: the format and strategies can be adapted for other forms of land cover to meet individual school contexts. [360 video Journey to Elbrus Mountain, Russia 8K aerial video](https://youtu.be/iU9AaGzXblM) can be viewed on desktop or for an immersive experience viewed through 360 goggles.Access the [360 video Journey to Elbrus Mountain, Russia 8K aerial video](https://youtu.be/iU9AaGzXblM) (2:46), [Tundra](https://earthobservatory.nasa.gov/biome/biotundra.php#:~:text=Description,Europe%2C%20and%20Siberia%20in%20Asia) and [Alpine Tundra](https://thewildclassroom.com/biomes/alpine-tundra/) to research the land cover and the tundra biome.Describe the key physical features that are observed and are characteristic of the tundra biome. Complete the following questions:* What specific aspects of the tundra biome are visible in the video? How do these aspects differ from other biomes?
* What are the main threats and/or interruptions for the tundra biome? How do these threats and/or interruptions originate from human activities?
* What measures could be taken to mitigate the threats to the tundra biome?

Create a [concept map](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577?clearCache=d1cca449-4e0e-6053-358e-3dbeff7d93d) highlighting the key features of tundra biomes. Consider the following questions:* What are the primary characteristics of the tundra biome to be included in a concept map? Consider factors like climate, vegetation, animal life and geographical features.
* How can the relationships between different elements of the tundra biome be visually represented on a concept map?
* How will the structure of the concept map clearly show the cause-and-effect relationship between these threats and their impacts on the tundra biome?

Create a cause and effect diagram using [Tundra threats explained](https://education.nationalgeographic.org/resource/tundra-threats-explained/) and [Effects of human activities and climate change](https://www.britannica.com/science/tundra/Effects-of-human-activities-and-climate-change). The effect side of the diagram should identify which part of the tundra’s natural system or biophysical environment will be affected. Write an extended response that explains the size and changes over time of one type of land cover in a tundra biome. The response must:* Briefly introduce the tundra biome.
* State the specific type of land cover being discussed (for example, permafrost, mosses, lichens).
* Present a thesis statement that outlines the main points regarding the extent and rate of change of this land cover.
* Provide detailed information about the chosen land cover in the tundra.
* Show the importance and role in the tundra ecosystem.
* Use the current extent of the land cover in the tundra including any relevant data or statistics. Historical data on the land cover, should show how it has changed over time.
 | Students successfully identified and described features like sparse vegetation, permafrost and low biodiversity. They compared these aspects with other biomes, demonstrating an understanding of the unique characteristics of the tundra biome.Students articulated the main threats to the tundra biome, such as climate change and human activities. Proposed feasible mitigation strategies, showing an awareness of environmental conservation.Students created a comprehensive concept map that effectively displayed relationships between climate, vegetation, animal life and geographical features of the tundra. The map clearly illustrated the interconnectedness of these elements.Students constructed a detailed diagram showing the cause-and-effect relationships between human activities, climate change and their impact on the tundra’s natural system. This demonstrated their analytical skills in understanding environmental impacts.Students wrote a well-structured response that included an introduction to the tundra biome, a thesis statement on a specific land cover and detailed information about its current extent and historical changes. They used data and statistics effectively to support their arguments, showing their ability to synthesise and analyse geographical information. | Pre-teach key geographical terms related to tundra biomes. Provide a glossary of terms and encourage the use of bilingual dictionaries.Use visual aids such as diagrams of tundra features alongside the video. Offer a transcript of the video with closed captions.For students with visual or auditory processing needs, provide a descriptive narration of the video content.Provide sentence starters or a structured worksheet to guide students in describing the tundra biome.Allow students to present their observations in various formats such as oral, written or digital presentations.Offer alternative assignments such as creating a collage or a digital presentation for students who might find traditional writing challenging.Provide a guided research template with specific questions and subheadings.Encourage group discussions using digital platforms or in-person, with options for students to use speech-to-text tools if needed.For students who find group work challenging, allow individual research projects or pairing with a peer.Use visual examples of concept maps related to biomes. Provide clear instructions on how to link different elements.Offer the use of digital tools for concept map creation, especially for students who might struggle with fine motor skills.Offer structured templates for the extended response, including sections for introduction, thesis statement and main points.Allow students to draft their responses using speech-to-text software or present their findings in a video format. |  |
| The extent and rate of change in ONE form of land cover, including:* the impacts of the land cover change at a range of scales, including climate change

**Geographical tools/skills*** Fieldwork
* Maps
* Visual representation
 | Access the [DEA Land cover](https://www.dea.ga.gov.au/products/dea-land-cover) webpage and [Digital Earth Australia map](https://maps.dea.ga.gov.au/story/DEALandCover). In groups, analyse changes in land cover over a set period of time. This can include changes in vegetation, urbanisation or water bodies.Complete a class discussion on the different types of land cover identified including the natural and human factors influencing these changes.**Teacher note:** complete a jigsaw activity with students working individually or in pairs. Identify regions in Australia where significant land cover change has occurred over the past decade. Each student or pair is assigned a different region to research. Students compare and contrast the land cover in these regions, considering factors like climate, human activity and topography.Complete a jigsaw activity to compare and contrast different regions of Australia. Use the following guiding questions to conduct research on the assigned region:* What types of changes have taken place?
* What are the potential environmental impacts of these changes in land cover? Consider aspects such as biodiversity, soil health and water resources.
* Compare the land cover of a coastal region and an inland region in Australia. What are the key differences and why do they exist?
* How does the variation in land cover between these regions affect their respective ecosystems and human activities and climate change?
* What are the main differences and similarities between alpine and tundra environments in terms of climate, vegetation and wildlife? What role do elevation and latitude play in defining the characteristics of these 2 environments?
* What are the typical climatic conditions found in alpine and tundra environments?
* How have plants and animals adapted to survive the harsh conditions of these environments? Provide specific examples.

Access [climate change impacts on our alpine areas](https://www.climatechange.environment.nsw.gov.au/alpine). Create a poster or infographic using [Canva for Education](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/canva-for-education.html?clearCache=684df347-3951-68d3-1eba-b4a19702c07bto%20) to show the impacts of climate change on the land cover of alpine tundra in the New South Wales and Australian Capital Territory alpine region.Observe the images showing [Projected changes of the alpine tundra domain (ATD) in the Alps under warming levels with respect to the reference period (1981-2010)](https://www.researchgate.net/figure/Projected-changes-of-the-alpine-tundra-domain-ATD-in-the-Alps-under-scenario-RCP45-and_fig3_342589788) and [Climate change may make the Arctic tundra a drier landscape](https://phys.org/news/2019-05-climate-arctic-tundra-drier-landscape.html).Complete a [Predict, Observe, Explain thinking routine](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/662?clearCache=cabe5afa-f317-305-fa4b-f05e072db0) of the impacts of continued global warming. Predictions should consider aspects like permafrost thawing, vegetation changes, animal migration patterns and increased human activities like mining and drilling.Research and compile recent data based on a specific case study including expert opinions on the current state of tundra ecosystems. Focus on observed changes in land cover including biodiversity, and environmental conditions linked to climate change and human activities.Access the [Intergovernmental Panel on Climate Change](https://www.ipcc.ch/reports/) (IPCC Reports) and the [World Wildlife Fund Climate Change Effects](https://www.worldwildlife.org/threats/effects-of-climate-change). Make predictions on the specific impacts of global warming on tundra land cover. Predictions should consider aspects like permafrost thawing, vegetation changes, animal migration patterns and increased human activities like mining and drilling.Using the [National Snow and Ice Data Center](https://nsidc.org/home) (NSIDC), explain the reasons behind the changes in tundra land cover in short response format. Correlate the findings with the initial predictions, discussing the accuracy or inaccuracy of their hypotheses and the reasons behind this. | Students successfully accessed the DEA resources, demonstrating the ability to use digital geographical tools. They conducted a detailed analysis of land cover changes over a specific period, identifying variations in vegetation, urbanisation and water bodies.Completed a well-researched comparison of land cover in their assigned Australian region, indicating a strong grasp of regional differences influenced by climate, human activity and topography.Identified a region with significant land cover change and analysed the environmental impacts. They provided well-constructed arguments on biodiversity, soil health and water resources, showing an in-depth understanding of the ecological consequences of land cover changes.Students successfully differentiated between these diverse environments, demonstrating their understanding of climatic conditions, vegetation, wildlife and the role of elevation and latitude.Students used Canva for Education to create informative posters or infographics.Predicted the impacts of global warming on tundra ecosystems. Their observations and explanations displayed a strong understanding of permafrost thawing, vegetation changes and the influence of human activities.By accessing these authoritative sources, students showed proficiency in locating and interpreting high-level scientific data.Students effectively connected their initial hypotheses with real-world data from the NSIDC. The accuracy of their predictions showcased their analytical skills and their ability to critically assess and learn from their research findings. | Pre-teach key geographical and environmental vocabulary with visual aids and examples.Provide a glossary and bilingual dictionaries for complex terms.Use closed captions and provide a simplified summary or transcript of any instructional videos.Offer a step-by-step guide or video demonstration on how to navigate the website and maps.For students struggling with group work, allow an option to work independently or in smaller pairs.Provide structured templates or scaffolds for recording observations and analysis.Offer a variety of response methods: verbal descriptions, written reports, visual presentations.Use visual aids like charts or diagrams to explain natural and human factors influencing land cover changes.For students with language barriers, encourage the use of images or symbols to communicate their findings.Provide a tutorial on using Canva for Education, including step-by-step instructions or a video guide.Offer a choice of creating either a poster or an infographic, based on student preference and skill level.Start with a group brainstorming session to generate ideas and predictions.Provide sentence starters or guiding questions for the prediction phase.Use visual stimuli and real-world examples to help students understand complex concepts like permafrost thawing.Provide summaries or key points of the IPCC and WWF reports for easier understanding.Use group discussions to help students articulate their predictions and thoughts.Provide checklists or criteria to help students evaluate the reliability of their sources.Provide a guided worksheet or set of questions to help students interpret NSIDC Data analysis.Allow students to work in pairs or small groups for support. |  |

# Human-environment interactions study

## Weeks 4–6 – study 3 – climate change

**Teacher note**: teachers should consider building on the concepts and selecting different examples to those that might be studied in Stages 4–5. Scale is an important concept in this study option – for example, investigating impacts, challenges and responses at a range of scales.

**Human–environment interactions study**

Students undertake ONE of the following studies to develop an understanding of natural and human elements, how they interact, and the implications of the interactions for people and the environment.

**Study 1:** A geographic region (this might fall within a state or country or encompass a small group of neighbouring countries)

**Study 2:** A contemporary hazard (ONE natural hazard OR ecological hazard)

**Study 3:** Climate change.

### Learning intentions

Students will:

* know the spatial and temporal characteristics of global climate change
* understand the impacts of climate change on humans and natural systems
* identify challenges, opportunities and responses to climate change from varying perspectives and scales
* understand the main environmental challenges opportunities and responses Pacific Island nations like Kiribati face due to climate change
* explore and analyse various strategies for mitigating climate change effects in the Pacific Islands, utilising geographical tools and concepts
* understand how climate change affects coral reefs, with a particular focus on the Great Barrier Reef. This includes exploring the causes and impacts of phenomena like coral bleaching and ocean acidification
* discuss the effectiveness of managing the climate change challenge of global warming at the Great Barrier Reef.

### Success criteria

Students can:

* correctly define and identify spatial and temporal characters of global climate change
* use visual representations to show causes and impacts of climate change on natural processes, systems and/or environments and people and communities over a range of scales
* engage with a range of resources to examine challenges, opportunities and responses to climate change
* identify and analyse the main environmental and socio-economic challenges faced by Kiribati and other Pacific Island nations
* articulate well-reasoned insights into the long-term geographical changes, potential solutions, and strategies for resilience of climate change, both locally and globally
* demonstrate the basic principles of coral reef ecosystems, the process of coral bleaching, and how climate change causes issues in the context of the Great Barrier Reef
* analyse and interpret data related to coral reef health and climate change indicators, such as Carbon Dioxide (CO2) levels, temperature changes and biodiversity
* develop and present a plan incorporating local, national and global scales examining past, present and future management of global warming on the Great Barrier Reef.

Table 3 – climate change

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation or adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-03, GE-11-04, GE-11-05, GE-11-09**Spatial and temporal characteristics of climate change at a global scale**Geographical tools/skills*** Maps
* Visual representation
* Spatial technologies
* Statistics
* Spatial patterns
 | Access [What is Climate Change?](https://www.un.org/en/climatechange/what-is-climate-change), and [Climate projections for Australia](https://www.csiro.au/en/research/environmental-impacts/climate-change/climate-change-information) to refresh knowledge. In small groups, engage in a game of [Hot seat](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/569?clearCache=fa74856c-f671-e27e-6fa1-6588da3d671) where the person in the middle is asked one of the questions from the [Climate change questions and answers](https://www.csiro.au/en/research/environmental-impacts/climate-change/Climate-change-QA) article. Provided are further guiding questions for further discussion based on the previous articles:* What defines climate change and how is it different from global warming?
* What are the long-term trends or shifts that define climate change?
* How and why is the world warming, and what is the ‘enhanced’ greenhouse effect?
* What are the projected future changes in climate, and what factors will influence these changes?

Complete Table 3 and 4 of Activity 4 in the resource booklet. Using the table and further research, complete a [quick write](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/548?clearCache=c0d12264-bfaf-d062-f284-d477dc42a058) activity that describes the spatial and temporal characteristics of climate change.Access the [World Bank climate knowledge,](https://climateknowledgeportal.worldbank.org/country/somalia/climate-data-historical) [Somalia summary](https://climateknowledgeportal.worldbank.org/country/somalia). Select a second country and explore the historical climate data from 1991 to 2020. Focus on comparing the spatial variation, seasonal cycles and time series analysis.Use the provided tools on the portal to visualise national and sub-national climate data for the 2 countries. Research various factors influencing the countries climate, such as the Inter-Tropical Convergence Zone (ITCZ), monsoonal winds and ocean currents.Examine different aspects of the countries climate, including temperature trends, rainfall patterns and the impact of the El Niño Southern Oscillation (ENSO). Conduct a detailed study on the rainy seasons in the countries examining their impact on local agriculture and livelihoods. Use the following questions to guide the research:* What are the primary climatic characteristics of Somalia and the other country for the period 1991–2020?
* How do geographical factors like monsoonal winds and ocean currents influence Somalia's and the other country’s climate?
* Discuss the seasonal temperature and precipitation patterns in Somalia and the other country. How do they vary between the northern and southern regions?
* What is the role of the El Niño Southern Oscillation or other climate patterns in influencing Somalia’s and the other country’s climate variability?
* How does the average annual rainfall vary across different parts of Somalia? Is this similar to the other country? What implications does this have for agriculture and water resources?

**Temperature variation and change**Access the article and observe the map in [Rising temperatures: A month versus a decade](https://climate.nasa.gov/news/2180/rising-temperatures-a-month-versus-a-decade/). How is temperature across the globe recorded and analysed?Label and annotate locations on the map that experienced reduced, +2°C and +4°C temperature change from the norm April to September 2014.The article states: ‘But in the context of climate change, it does not make sense to try to derive much meaning from a single month—or, for that matter, even a single year’ (Voiland 2014). Research average temperature change over at least a 20-year period in 3 of the locations identified in the annotated map.Complete a [See, Think, Wonder thinking routine](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/662?clearCache=cabe5afa-f317-305-fa4b-f05e072db0). ‘Think’ why the observed temperature change has occurred in these locations. ‘Wonder’ what impacts people and natural systems experience in each location and what they could be in the future.Read and explore the chart in [How Understanding the History of the Earth's Climate Can Offer Hope Amid Crisis](https://time.com/5680432/climate-change-history-carbon).In pairs or small groups, complete the following steps:1. Create 5 questions.
2. On a separate sheet of paper, record the answers to the questions.
3. Swap with another pair or small group.
4. Complete the questions and review the responses.
5. Swap with another pair or small group and do the same.

Create a [group brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=d6fc8c85-bc4d-ddf2-5df9-c787fd599e15) summarising causes of global temperature change over time. Provided are some guiding questions for the brainstorm:* What historical events or discoveries led to our understanding of carbon’s role in climate change?
* How has the scientific understanding of carbon emissions evolved over time?
* What are the key scientific studies or experiments that have demonstrated the impact of carbon on the climate?
* How did early industrialisation contribute to the increase in carbon emissions?
* What are some of the most significant sources of carbon emissions historically and in the present day?
* How do current carbon emission levels compare with those in the past?

**Precipitation patterns**Use [How climate change is disrupting rainfall patterns and putting our health at risk](https://climate.ec.europa.eu/news-your-voice/news/how-climate-change-disrupting-rainfall-patterns-and-putting-our-health-risk-2023-08-03_en) and background knowledge to explain how climate change affects precipitation patterns. Use diagrams, flowcharts and other visual representations in the support response.Read the article and examine the diagram in [Rainfall becomes increasingly variable as climate warms](https://phys.org/news/2021-07-rainfall-increasingly-variable-climate.html). Write a short response based on the article and further research about the spatial impacts of climate change on rainfall. Provided are some guiding questions for the research and the response:* What do climate models predict about rainfall variability in wet regions globally due to global warming?
* How does increased rainfall variability impact the incidence of floods and droughts?
* How does increased water vapor in the air due to warming climates affect rainfall variability?

**Sea-level change**Explore the computer model in [A NASA first: Computer model links glaciers, global sea level](https://sealevel.nasa.gov/news/43/a-nasa-first-computer-model-links-glaciers-global-sea-level/). Use the information and data provided to support the statement – ‘Sea-level change differs across the globe’. Read [Sea Level Rise](https://education.nationalgeographic.org/resource/sea-level-rise/), (the response to the statement above).Complete a [words and images brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=d6fc8c85-bc4d-ddf2-5df9-c787fd599e15) representing the spatial impacts of rising global sea level.Access [Sea Level](https://climate.nasa.gov/vital-signs/sea-level/). Construct a response using explicit data as evidence to explain how the graph supports the ‘key takeaway’ statement indicated at the top of the webpage.Review the completed tables in Activity 4 in the resource booklet. Add additional examples and evidence to the tables based on the previous webpages and activities from:* temperature variation and change
* precipitation patterns
* sea-level change.

Recap and reflect on the original short response that described the spatial and temporal characteristics of climate change. Write a reflection on the response based on the main ideas, opinions or conclusions. Engage in a comparison between the original responses and the new information. For example, what has changed? Are there any contradictions or reinforcements between the old and new information? After the discussion, write a revised response, incorporating students’ new understanding and/or insights. Share these revised responses within the group and discuss the evolution of thoughts and understanding. | Students demonstrated an understanding of the key concepts and differences between climate change and global warming. Engagement in critical thinking and verbal articulation of their knowledge through responding to questions.Students identified and described spatial and temporal characteristics of climate change. Demonstrated ability to synthesise and summarise data from various sources.In-depth analysis of climate data for Somalia and another chosen country, showing understanding of geographical factors influencing climate.Ability to connect theoretical knowledge with real-world data, demonstrating understanding of monsoonal winds, ocean currents and their impact on climate.Demonstrated understanding of the role of carbon emissions in climate change. Collaborative skills in creating and answering questions related to the history of Earth’s climate.Successfully connected theoretical knowledge with current research, showing understanding of global warming’s impact on rainfall variability.Students demonstrated ability to summarise and reflect on information regarding global sea-level rise.Student successfully reflected on initial responses and comparison with new insights showing depth of understanding and evolution of thought. | Pre-teach key vocabulary and concepts.Provide glossaries and bilingual dictionaries.Use closed captions for any video materials.Provide visual and multimedia examples.Check understanding through quizzes or interactive discussions.Pair EAL/D students with peers for support during group discussions.Provide clear definitions of spatial and temporal characteristics.Offer word banks for writing.Use graphic organisers for planning responses.Allow use of speech-to-text software for writing.Break down complex terms into simpler language.Use visual dictionaries or infographics.Model the research process step by step.Writing scaffolds.Offer structured outlines for research notes.Explain technical terms like ‘norm’ and ‘temperature change’.Use interactive temperature maps for visual learners.Structure the ‘See, Think, Wonder’ routine with clear examples.Offer group or pair work for the analysis task.Pre-teach terms like ‘precipitation patterns’ and ‘climate models’.Use diagrams and flowcharts to explain concepts.Provide structured templates for writing responses.Allow for oral presentations or digital submissions.Use visual aids like maps to show sea-level changes.Writing scaffolds offer clear, step-by-step guides for constructing responses.Provide a structure for reflection and comparison.Use peer feedback to enhance understanding. |  |
| Environmental and human impacts of climate change at a range of scales, including:* impacts on natural processes, systems and/or environments

**Geographical tools/skills*** Maps
* Graphs and statistics
 | Access [NASA Climate change and global warming](https://climate.nasa.gov/) and [World Bank Climate Change Knowledge Portal,](https://climateknowledgeportal.worldbank.org/) students create thematic maps showing different aspects of climate change impacts (for example, temperature rise, sea-level change). Using GIS software to map areas most affected by climate change (for example, melting ice caps, areas of deforestation). Analyse the maps to discuss the regional differences in climate change impacts.Access satellite images, vegetation identification charts and remote sensing data to investigate changes in vegetation over time. Compare current satellite images with historical data, using the following links [Google Earth Engine,](https://earthengine.google.com/) and [Atlas of Living Australia](https://ala.org.au/). In groups, discuss how climate change is affecting plant species distribution and biodiversity.Access [Climate change and sea-level rise in the Australian region](https://coastadapt.com.au/climate-change-and-sea-level-rise-australian-region) and [CoastAdapt](https://coastadapt.com.au/). In small groups, complete a [Frayer diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/553?clearCache=4385ac88-f51-1243-d27a-4c53674b6602) showing impacts of climate change on the allocated impacted natural system in Australia. The 4 areas to complete the Frayer diagram are:* projections
* impacts
* variations across Australia
* data and points of interest.

Use virtual instruments like GIS to measure beach profiles and observe signs of erosion or sea-level rise. Access photographs or Google maps of the area to document current conditions.In small groups, access [Climate change is the single biggest threat facing the Reef?](https://www.barrierreef.org/the-reef/threats/climate-change#:~:text=Already%20marine%20heatwaves%20have%20triggered,and%20conditions%20return%20to%20normal) and further research to answer the following questions:* What is the primary cause of the rising temperatures in our oceans and on land? Explore the role of carbon dioxide and greenhouse gases in climate change.
* How does coral bleaching occur, and what are its consequences? Discuss the process of coral bleaching and its impact on the Great Barrier Reef.
* Explain the phenomenon of ocean acidification and its effect on coral reefs.
* What are the impacts of severe weather events on the Great Barrier Reef?
* Examine how climate change increases the frequency and intensity of storms, cyclones and flooding.
* How do habitat changes, due to rising water temperatures, affect marine life in the Great Barrier Reef?

Create an [infographic](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/canva-for-education.html?clearCache=aff041a2-8a6a-a760-6361-9d7ec913f582) showing the Great Barrier Reef’s natural processes and the impacts of climate change. This could include coral polyp growth, symbiotic relationships with algae, nutrient cycles and reef ecosystem interactions. In planning the infographic, outline the key points and develop a rough sketch to plan the layout. Consider dividing the infographic into sections, like ‘Natural Processes of the Reef’ and ‘Impacts of Climate Change’. Use design software or online tools like [Canva](https://www.canva.com/en_au/) or [Adobe Spark](https://express.adobe.com/page/9bPqZ/?tp=1). Include diagrams of coral polyps and their symbiotic relationship with algae. Use before-and-after images or icons to represent the impact of climate change, such as healthy coral versus bleached coral. Create graphs or charts to show data on temperature changes, coral bleaching events or species decline. Cite all sources used for data and images to maintain credibility. Include a small section at the bottom of the infographic for references.Use [Climate change impacts on our coasts](https://www.climatechange.environment.nsw.gov.au/coasts#:~:text=Effects%20include%20sea%20level%20rise,%2C%20estuaries%2C%20lagoons%20and%20rivers) and further research to explain:* the value of the coastal environment and it’s natural processes
* how the coastal environment is affected by climate
* impacts of specific climate changes on coastal natural systems, environment, plants and animals.
 | Students accessed NASA Climate Change and World Bank Climate Change Knowledge Portal to create thematic maps.Demonstrated skill in using GIS software to map areas affected by climate change.Analysed maps to discuss regional differences in climate change impacts, showing understanding of temperature rise and sea-level change.Used satellite images, vegetation charts and remote sensing data to study changes in vegetation over time.Compared current satellite images with historical data from Google Earth and Atlas of Living Australia.Group discussions reflected an understanding of how climate change affects plant species distribution and biodiversity.Students used Climate change and sea-level rise in the Australian region and CoastAdapt for research.Created Frayer diagrams focusing on impacts of climate change on natural systems in Australia.Effectively covered projections, impacts, variations across Australia and relevant data and points of interest.Documented current conditions using photographs or Google maps, showing an understanding of coastal changes.Researched the causes of rising temperatures in oceans and on land, identifying the role of carbon dioxide and greenhouse gases.Discussed coral bleaching, its process and consequences on the Great Barrier Reef.Explained ocean acidification and its effect on coral reefs.Investigated the impacts of severe weather events on the Reef.Created an infographic on the Great Barrier Reef’s natural processes and the impacts of climate change, demonstrating skills in data representation and design.Researched and explained the value of the coastal environment and its natural processes.Analysed how the coastal environment is affected by climate change. | Pre-teach GIS software features and provide step-by-step guides.Use visual aids and closed captions in instructional videos.Provide a glossary for technical terms related to climate change and map-making.Offer alternative options for students with difficulties in using GIS software, like simplified mapping tools or printed maps for manual annotation.Provide transcripts and closed captions for any instructional videos.Use visual aids to explain how to compare satellite images.Offer bilingual dictionaries for non-English speaking students.Explain the concept of a Frayer diagram with examples and provide a template.Use group discussions to cater to students who learn better through verbal communication.Provide digital and paper options for creating the diagram.Pre-teach key vocabulary related to the reef and climate change.Use augmentative communication devices for students with speech difficulties.Provide templates for infographics and give examples.Coastal environment and climate change impacts tasks can be broken down into smaller steps and provide clear instructions.Use visual aids to explain the value of coastal environments.Offer different research options, like videos, articles or interactive websites, to cater to various learning preferences.Provide scaffolding for writing responses, like sentence starters or paragraph structures. |  |
| Environmental and human impacts of climate change at a range of scales, including:* impacts on people and communities

**Geographical tools/skills*** Climate graphs
* Statistics
* Visual representations
* Photographs
* Soil testing
 | Conduct a brief discussion on climate change, its causes and general impacts on the people, communities and human health. Pose the following questions:* What do you already know about climate change and its impact on people and communities?
* How do you think climate change affects our health and the environment?

Access [Climate change and health](https://www.betterhealth.vic.gov.au/health/healthyliving/climate-change-and-health), [How climate change is affecting community groups](https://www.climatechange.environment.nsw.gov.au/community-groups/effects-community-groups#:~:text=General%20impacts%20of%20climate%20change,other%20members%20of%20the%20community.) and explore how climate change affects various groups, such as those with social or economic disadvantages, non-English-speaking communities and rural areas. Use case studies and real-life examples to illustrate these impacts and guiding questions:* How do extreme weather events like bushfires and floods uniquely impact rural and regional communities?
* What mental health issues can arise in community groups due to climate events, and how can they be addressed?

Access the  [Climate change](https://youtu.be/eZiiIPEqSiM?si=kVI-uhsF0N850kyG) and health (1:37) and the [Climate change and health – Extreme weather events](https://youtu.be/VBoS1FOxoac) (1:07) videos. Answer the post-viewing questions:* What are some key points you learned from these videos?
* How do extreme weather events relate to climate change and health?

Complete a [Venn diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599?clearCache=83682bdd-81f4-a59f-47be-3fc44434669) on ‘Impacts of climate change’. Label one circle ‘natural systems and environments’ and the other ‘people and communities’. In the overlapping area, note impacts that affect both natural systems and human communities.Use a [storyboard](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/559?clearCache=d8c9eea5-c40-8770-98dd-71cac5efcfff) scaffold to develop a presentation titled ‘Impacts of climate change on people and communities’. Assist in planning. The presentation should clearly identify at least 3 effects of climate change on natural systems such as increased temperature, increased flooding or sea-level rise. The impacts of climate change on people and communities should be based on these natural system impacts.Conduct climate change and communities’ statistical analysis by using graphs and statistics (for example, data tables, climate graphs). In groups, analyse statistical data on how climate change affects different communities, focusing on aspects like health, economy and migration patterns. Using resources such as [Australian Bureau of Statistics](https://www.abs.gov.au/) for demographic and economic data related to climate change.Access the [State Library of NSW](https://www.sl.nsw.gov.au/) digital collections to locate and compare historic photographs of a local area with current ones to analyse environmental changes. Focus on aspects like vegetation changes, erosion or urban development.Access [Food and Agriculture Organization of the United Nations: Climate Change](https://www.fao.org/climate-change/en/) and [National Farmers’ Federation Australia](https://nff.org.au/), to explore the impact of climate change on agricultural practices and communities.**Teacher note:** the following fieldwork activity provides an opportunity for a hands-on learning experience. If this is not accessible in your context, a virtual meeting with a farmer might be a suitable alternate activity.Visit a local farm to conduct soil tests and interview farmers about changes observed and adaptations made. Tools could include soil testing kits, climate graphs, interviews with local farmers. Compile and analyse data, presenting findings on how climate change is impacting local agriculture and food security.As a class, discuss how climate change exacerbates existing environmental stresses such as habitat loss, invasive species and water scarcity. Focus on how this impacts groups like [Landcare](https://landcareaustralia.org.au/) and their conservation efforts. Conduct research using the following questions:* How does climate change threaten conservation efforts by environmental groups?
* What new challenges do environmental groups face in terms of species regeneration and habitat preservation?
* Create a proposal for an environmental group to tackle new challenges brought by climate change, such as dealing with new weed species or planning conservation efforts under changing climatic conditions.
 | **Students actively participated in discussions, sharing prior knowledge about climate change and its effects on communities and health. Developed a summary of points made by students, highlighting varied perspectives.****Students demonstrated understanding of basic concepts of climate change, citing examples of how it affects communities and human health.****Students accessed and discussed content from specified videos, demonstrating an understanding of the health effects of climate change.****Articulated the relationship between extreme weather events and health issues, showing an ability to interpret and relate information from different sources.****Completed Venn diagrams that accurately reflected the impacts on both natural systems and human communities.****Presentations demonstrated comprehensive understanding and effective communication skills, with clear identification of at least 3 effects of climate change.****Demonstrated ability to analyse and interpret statistical data from resources like the Australian Bureau of Statistics.****Showed a successful understanding of how climate change affects different communities, focusing on health, economy and migration patterns.****Successfully compared photographs to identify environmental changes over time.****Demonstrated an understanding of local environmental changes, such as vegetation changes, erosion or urban development.****Engaged in research and soil testing to understand the impact of climate change on local agriculture.****Presented findings effectively, showing an understanding of climate change’s impact on food security and agricultural practices.****Responses to research questions indicated a grasp of the challenges faced by conservation groups due to climate change.****Demonstrated creativity and practical understanding in developing proposals to address new challenges posed by climate change.****Proposals reflected a comprehensive understanding of the needs of environmental groups under changing climatic conditions.** | Pre-teach key vocabulary and concepts related to climate change.Provide transcripts and closed captions for any video materials used.Use visual aids to support understanding of the discussion topics.Offer bilingual dictionaries for non-English-speaking students.Provide case studies and real-life examples in multiple formats (text, video, audio).Use closed captions and transcripts for videos.Facilitate small group discussions for deeper engagement.Provide a template for the Venn diagram.Use speech-to-text tools for students who prefer digital means.Offer the option to work independently or in pairs.Climate change and communities statistical analysis provide step-by-step guides on how to interpret and analyse statistical data.Include visual representations of data for better comprehension.Allow group work to enable peer learning and support.Use digital collections accessible to all students.Provide guided questions to direct the analysis.Allow for oral or written responses to accommodate different learning preferences.Virtual or in-person farm visits should be made accessible for all students.Provide tools like soil testing kits and climate graphs with clear instructions.Offer the option of interviewing farmers remotely for students unable to travel.Use multimedia resources to explain the impacts on conservation efforts.Provide guiding questions and templates for research.Provide examples of successful proposals for guidance.Offer templates and scaffolds for structuring the proposal.Allow for different modes of submission (paper, digital). |  |
| Challenges, opportunities and responses, including:* varying perspectives
* mitigation in relation to the rate and magnitude of change
* minimising risk through adaptation, resilience and innovation
* local, national and global action

**Geographical tools/skills*** **Graphs and statistics**
* **Visual representations**
 | **Teacher note**: ‘Challenges, opportunities and responses to climate change and rising sea levels in Pacific Island countries’ has been selected as the focus to address syllabus content. The format and strategies can be adapted to other case studies to meet individual school contexts.Access [24 Hours of Reality 2017: Weight of the World (Kiribati](https://youtu.be/Swv1lOA5zDc)) (7:58) and [Kiribati: Battling for Survival (Rising Sea Levels)](https://youtu.be/hW9EAkqu6aY?si=XEMuLJ1aJXH0OceL) (4:02). Complete the following questions:* What are the main environmental challenges faced by Kiribati as presented in the video?
* How does climate change impact the geography and population of Kiribati?
* Discuss the socio-economic effects of environmental changes on the residents of Kiribati.
* What are the potential long-term geographical changes in Kiribati due to climate change?

Complete a [Perspectives Six Thinking Hats thinking routine](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/545?clearCache=f1873028-33f1-3653-4ab3-aaeeb10dddc3). Select a ‘hat’ representing different perspectives (information, emotions, caution, benefits, creativity and process). Discuss the impacts of climate change in the Southwest Pacific from these various perspectives.Access:* [Climate change impacts increase in the South-West Pacific](https://wmo.int/news/media-centre/climate-change-impacts-increase-south-west-pacific#:~:text=Sea%20level%20rise%20threatens%20the,World%20Meteorological%20Organization%20(WMO).) – review the article and discuss the specific threats posed by climate change in the South West Pacific.
* [The Kiribati Climate Action Network](https://kirican.wordpress.com/) – review this blog to understand grassroots efforts and local responses to climate change.
* [Lessons From the Pacific Islands – Adapting to Climate Change by Supporting Social and Ecological Resilience](https://www.frontiersin.org/articles/10.3389/fmars.2019.00289/full) – analyse responses and opportunities for adaptation and resilience in the Pacific Islands, think about both social and ecological aspects.
* [Pacific Islands are holding the front line of climate change, but this is a global fight](https://iceds.anu.edu.au/news-events/news/pacific-islands-are-holding-front-line-climate-change-global-fight) – discuss the global implications of climate change in the Pacific and the importance of international cooperation.
* [The IPCC report and the climate crisis in the Pacific](https://www.undp.org/pacific/blog/ipcc-report-and-climate-crisis-pacific) – summarise, focus on and identify the key points from the UNDP article on the IPCC report’s findings related to the Pacific. Discuss how these findings impact policy and public perception.
* [Trouble in paradise: how does climate change affect pacific island nations?](https://www.climaterealityproject.org/blog/trouble-paradise-how-does-climate-change-affect-pacific-island-nations) – focus on a specific Pacific Island nation and how climate change affects their specific nation.
* [Great power competition and climate security in the Pacific](https://www.chathamhouse.org/2022/07/great-power-competition-and-climate-security-pacific) – explore the intersection of geopolitics and climate security in the Pacific through a debate or panel discussion.
* [Mapping Exposure to Sea Level Rise – Tonga, Samoa, Vanuatu and Papua New Guinea](https://unfccc.int/climate-action/momentum-for-change/ict-solutions/mapping-exposure-to-sea-level-rise) – mapping exercises, visualising the impact of sea-level rise on Tonga, Samoa, Vanuatu and Papua New Guinea.
* [Accurate measurement of absolute sea level rise in the Pacific region](https://www.community-safety.ga.gov.au/projects/pacific-sea-level-rise) – analyse data on sea-level rise and incorporate it into the mapping projects to understand the tangible impacts of climate change.

Complete a reflection on the learning from these sources. As a class, discuss the future implications of climate change for the Pacific Islands and the world.For each article complete a 3-2-1 summary. Instructions for this summary can be accessed in [instructional strategies playlist](https://lead4ward.com/playlists/) under ‘evidence of learning templates’. Select ‘3-2-1 Summary’.Construct a [Google Jamboard](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/google-resources/google-jam-board.html?clearCache=6af6c7d-7d69-6906-8644-bf771ef1fcdb) titled ‘Challenges, opportunities and responses to climate change and rising sea levels on Pacific Island countries’. Label [Google Jamboard](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/google-resources/google-jam-board.html?clearCache=6af6c7d-7d69-6906-8644-bf771ef1fcdb) pages with the title of an article. Add the 3-2-1 summary notes to the page allocated for each article.Integrate maps of the Pacific Islands into the Jamboard pages to visually represent the areas discussed in the articles. Include graphs or charts that showcase relevant data, such as sea-level rise projections, temperature changes or demographic impacts.Complete [peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549?clearCache=cd89b962-3154-c21b-1f95-40e8cb2047ea) and discussion on the key points, questions and opinions presented. Highlight the importance of geographical ideas related to spatial awareness, environmental impact, human-geographical interactions, local, national and global action.Use a comparative tool to analyse differences and similarities in climate change impacts among different Pacific Island nations. In small groups, discuss how geographical skills like mapping, data analysis and comparative studies can be used in addressing global challenges and response to climate change.Drawing on the previous resources, discussions and activities, in small groups complete a [carousel cooperative learning strategy](https://shelleygrayteaching.com/carousel/) and rotate through all 4 in a carousel manner. Prepare 4 large sheets of paper or whiteboard spaces, to record challenges, opportunities and responses to climate change and rising sea levels on Pacific Island countries. Each sheet of paper or whiteboard should be titled with one of the brainstorm list topics:* Varying perspectives
* Mitigation in relation to rate and magnitude of change
* Minimising risk through adaptation, resilience and innovation
* Local, national and global action.

Divide each sheet into 3 columns: Challenges, Opportunities and Responses.Each group to brainstorm ideas for the starting topic, focusing on identifying challenges, opportunities and potential responses related to climate change and rising sea levels, include:* A set amount of time, groups rotate to the next brainstorm list, adding to the ideas already listed while also considering the perspectives and input of previous groups.
* Think critically and creatively, drawing on previous discussions, activities and resources.
* Use geographical terminology, concepts and statistical data, case studies and real-world examples in the brainstorming.
* Consider the geographical diversity of the Pacific Island countries and how this influences the challenges, opportunities and responses.
* Collaboration and discussion within and between groups to foster a deeper understanding of the interconnected nature of climate change issues.
* Use resources like maps and online geographical tools as a reference during the brainstorming.
* Reflect on how the activity developed understanding of the complexity of climate change issues in the Pacific.

Complete a [SWOT (strengths, weaknesses, opportunities and threats) analysis](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/660?clearCache=a02ecfda-3273-4c85-a7ab-eae8db2b373) of a Pacific island nation’s approach to managing climate change. The SWOT includes:* Strengths – identify positive aspects or effective strategies related to the Pacific Islands’ response to climate change and sea-level rise
* Weaknesses – note challenges or limitations in the current approaches to handling climate change in these regions
* Opportunities – consider potential for innovation, international support, technological advancements or other positive outcomes
* Threats – identify risks or negative impacts that climate change and rising sea levels pose to the Pacific Islands

Reference maps, data sets and case studies to support the points in the SWOT analysis.[Take notes](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/661?clearCache=81c488e8-58db-fdc2-6693-59f9c3074e99) on the different perspectives, challenges, opportunities and responses observed, focusing on how these can be categorised into the SWOT analysis. The notes should focus on:* Physical characteristics of the region, socio-economic factors, environmental impacts and policy responses.
* Geographical terms and concepts in their analysis.
* Highlight the importance of spatial thinking and how the location, place and scale influence the strengths, weaknesses, opportunities and threats.

Share insights and how perceptions might have changed or expanded using the following driving questions:* Discuss how geographical tools helped them in analysing and understanding the complexities of climate change impacts on the Pacific Islands.
* Explain how their perceptions might have changed or expanded throughout the activity.
* Describe local, national and global action that could be undertaken.
 | **Students identified key environmental challenges such as rising sea levels and erosion, presenting data and images from ‘Weight of the World of Kiribati’ and ‘Kiribati: Battling for Survival’.****Students created maps and charts showing geographical changes and population displacement due to climate change, illustrating their understanding of the material in the video.****Students engaged in group discussions, synthesising information from the video to assess the socio-economic impacts on Kiribati’s residents, such as changes in fishing practices and economic instability.****Students contributed perspectives based on their assigned ‘hat’, showing diverse viewpoints on climate change effects in the Southwest Pacific.****Students created maps showing the impact of sea-level rise on selected Pacific Islands, integrating real data into their visualisations.****Students discussed the necessity of international cooperation, reflecting on the content of the article.****Students summarised and debated the IPCC report’s findings, showing an understanding of its impact on policy and public perception.****Analysis of sea-level data was evident in the accuracy and detail of students’ mapping projects.****Students reflected on their learning and engaged in thoughtful class discussions about future implications of climate change for the Pacific Islands and the world.****Completed Jamboards with summaries and integrated maps and graphs, showing comprehensive understanding of the articles.****Students used comparative tools effectively, showcasing their understanding of the varied impacts of climate change across different Pacific Island nations.****Students completed brainstorm lists with detailed points on varying perspectives, mitigation, adaptation and action, showcasing critical and creative thinking.****Detailed SWOT analyses with references to geographical data, case studies and real-world examples, reflecting a deep understanding of the complexities of climate change issues in the Pacific.** | Provide a glossary of environmental and geographical terms.Use bilingual dictionaries for students with different primary languages.Offer closed captions and transcripts for videos.Pause videos to check understanding and explain complex concepts.Encourage group discussions with assigned roles to ensure participation from all students.Provide sentence starters or writing frames for students who need more support.Allow students to use reading aids like highlighters and sticky notes to mark important information.Offer differentiated reading materials at various complexity levels.Provide templates or graphic organisers to help structure their summaries.Encourage the use of speech-to-text tools for students who struggle with writing.Allow students to work in pairs or small groups, ensuring a mix of abilities.Provide step-by-step instructions and examples for using Jamboard.Offer role cards with descriptions and questions to guide students in their assigned perspective.For students who find group work challenging, provide options to contribute via written responses or digital platforms.Set clear time limits and provide visual cues for rotations.Offer alternative ways to contribute, like writing on post-it notes or speaking into a voice recorder.Offer examples and guided practise on how to conduct a SWOT analysis.For students who need more support, provide a list of prompts or questions to guide their analysis.Offer guided questions to help students focus their analysis during the gallery walk.Allow students to record their thoughts digitally if they prefer.Encourage different modes of presentation (oral, digital, poster).Provide sentence starters and structured outlines for students who need additional support.Use interactive maps and online resources to engage students.Provide assistive technology where necessary, such as screen readers.Incorporate auditory, visual and kinesthetic learning strategies.Use technology to support learning where appropriate.Relate content to students’ backgrounds and experiences.Encourage students to share their perspectives and relate them to the study topics.Offer regular, constructive feedback.Use formative assessments to gauge understanding and adjust teaching strategies accordingly. |  |
| The effectiveness of people and organisations in managing ONE climate change challenge at a selected place**Geographical tools/skills*** Maps
* Visual representations
* Geographic Information Systems
 | **Climate change challenge of global warming on the Great Barrier Reef**Conduct a [KWL – Activating prior knowledge](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562?clearCache=d5da2d7a-79d9-bd72-95ab-ec6e83c143) task using the driving question ‘What are threats to coral reefs from climate change and how have they impacted the coral reef’? KWL includes:* K (Know) – start with a brainstorming session. Identify facts and information already known about coral reefs, climate change and their interrelation. Discuss geographic concepts like ecosystems, climate patterns and human impact.
* W (Want to know) – list questions about how climate change affects coral reefs. This could include queries about specific impacts, global distribution of coral reefs, the role of human activities and conservation efforts.
* L (Learned) – reflect on what has been learned throughout school about coral reefs. How do these insights align or differ from the initial thoughts? Note: this can be conducted after the following activity.

Explore the infographic titled ‘Threats to coral reefs: climate change’ found in [How does climate change affect coral reefs?](https://oceanservice.noaa.gov/facts/coralreef-climate.html#:~:text=Climate%20change%20dramatically%20affects%20coral%20reef%20ecosystems&text=A%20warming%20ocean%3A%20causes%20thermal,land%2Dbased%20sources%20of%20sediment.). Using further research respond to the following prompts:* Use maps showing global coral reef distributions, climate change patterns (like rising sea temperatures), and areas most affected by climate change.
* Interpret data related to coral reef health, climate change indicators (like CO2 levels) and biodiversity.
* Analyse and question the data and information they find. How do different sources of information compare? What are the possible biases?

Write a [One-Minute Paper](https://www.rochester.edu/college/teaching/teaching-guidance/one-minute-paper.html#:~:text=A%20one%2Dminute%20paper%20is,of%20that%20day's%20class%20session.) response to ‘Threats to coral reefs from climate change and how they impact coral reefs’. The focus of this activity is to summarise information concisely and reflect on their learning process.View [Coral bleaching 101 - coral bleaching explained](https://youtu.be/dcWlVN02kDQ) (4:15). Complete the following questions:* What is coral bleaching, and how is it explained in the video?
* Identify the primary causes of coral bleaching. How do these causes relate to broader environmental issues?
* How does coral bleaching affect the Great Barrier Reef specifically?
* Why is coral bleaching a significant issue for marine ecosystems worldwide?
* What conservation efforts or strategies are mentioned in the video to combat coral bleaching?
* Explain the link between climate change and coral bleaching as illustrated in the video.
* Describe the role of human activities in exacerbating coral bleaching, based on the video’s content.
* How can the Great Barrier Reef be used as a case study to understand the global implications of coral bleaching?

Using [Cornell notes](https://thinkinsights.net/consulting/cornell-method-great-notes/), develop notes to the following questions, adding diagrams and drawings where appropriate.* What is coral?
* Define coral as marine invertebrates within the class Anthozoa of phylum Cnidaria.
* Explain the symbiotic relationship between coral and zooxanthellae (algae).
* Encourage the use of diagrams to illustrate the structure of a coral polyp and a coral reef.
* What is coral bleaching?
* Describe coral bleaching as the process of corals losing their colour due to stress factors affecting the algae that live within their tissues.
* Use diagrams to show healthy versus bleached coral.
* Causes of coral bleaching:
* Discuss factors such as water temperature changes, pollution, overexposure to sunlight and ocean acidification.
* Include charts or graphs showing the correlation between these factors and bleaching events.
* Impact of global temperatures on coral reefs:
* Explain the ecological and economic impacts of coral bleaching.
* Use case studies or real-world data to illustrate the severity and frequency of these events.

**Teacher note:** allocate different actions undertaken by the Great Barrier Reef Marine Park Authority in managing and protecting the Reef. Provide guidelines on how to research effectively and what to look for on the website.Visit [Great Barrier Reef Marine Park Authority – Our Work](https://www2.gbrmpa.gov.au/our-work). Select one of the actions of the Great Barrier Reef Marine Park Authority in managing and protecting the Reef.Complete a [concept map](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577?clearCache=d1cca449-4e0e-6053-358e-3dbeff7d93d), explaining the interconnections between the elements and present it to the class. Each concept map should include:* Initiatives – detail specific conservation or management initiatives.
* Impacts – explain the direct and indirect impacts of these initiatives on the reef ecosystem and surrounding communities.
* Relevant agencies and governing bodies – identify and describe the roles of various organisations involved in reef management.
* Data – incorporate relevant data and statistics to support the information.
* Documents – reference key documents, policies or scientific studies.

Participate in peer feedback and questions to foster a deeper understanding. Use digital tools for creating concept maps and presentations.In small groups, undertake a [brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=d6fc8c85-bc4d-ddf2-5df9-c787fd599e15) for each of the following articles:* [What would happen if there were no coral reefs?](https://reef-world.org/blog/no-coral-reefs#:~:text=For%20these%20creatures%2C%20the%20reef,and%20other%20creatures%20would%20disappear)
* [Coral or Coal: Planning around the Great Barrier Reef](https://www.mining-technology.com/features/coral-or-coal-planning-around-the-great-barrier-reef/?cf-view)
* [Link between fossil fuels and Great Barrier Reef bleaching clear and incontrovertible](https://www.theguardian.com/environment/planet-oz/2016/mar/30/link-between-fossil-fuels-and-great-barrier-reef-bleaching-clear-and-incontrovertible-say-scientists)
* [Why Coal and Climate Change Hurt Our Oceans](https://www.marineconservation.org.au/why-coal-and-climate-change-hurt-our-oceans/).

During the brainstorming session for each article, use collaborative online tools like shared [digital whiteboards](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/636?clearCache=ac89436a-96a5-dbec-bfd-ad36a5a98c59) for simultaneous contribution of ideas and resources.**Teacher note:** students might require support and preparation for the Town Hall Circle. Suggested activities prior to this learning activity include:* Conduct workshops to prepare students for the Town Hall Circle, focusing on public speaking, argumentation and negotiation skills.
* Encourage students to fully immerse themselves in their roles, simulating real-world interactions and discussions.
* Support use of real data, maps, case studies and examples in their arguments. This could include data on coral bleaching, tourism statistics, maps of impacted regions, fishing industry data and so on.

Using the previous activity, identify stakeholders (for example, environmentalists, government officials, local communities, mining companies) who are connected to and reliant on coral reefs.In pairs, select one of the identified key stakeholders. Using the brainstormed articles and additional research, hold a [Town Hall Circle](https://www.facinghistory.org/resource-library/town-hall-circle) to share the perspectives of the selected stakeholder. Use the following question to drive the discussion: How do we manage use of the Great Barrier Reef for sustainability and security?After the Town Hall Circle, reflect on what lessons were learned, changed perspectives and the complexities of environmental management.As a class, develop collaborative solutions or proposals for the sustainable management of the Great Barrier Reef, integrating ideas from the various stakeholders.Using the information and ideas from the previous activity, develop an [elevator pitch](https://education.nsw.gov.au/schooling/students/student-voices/student-voice-and-leadership/student-resources) on ‘ways to ensure the Great Barrer Reef stays off UNESCO’s “in danger” list’. Access [World Heritage Committee keeps Great Barrier Reef off UNESCO list of sites in danger](https://www.abc.net.au/news/2023-09-14/great-barrier-reef-kept-off-unesco-world-heritage-in-danger-list/102855638), [Adaptive management of the Great Barrier Reef: A globally significant demonstration of the benefits of networks of marine reserves](https://www.pnas.org/doi/10.1073/pnas.0909335107) and [Global Climate Agreements: Successes and Failures](https://www.cfr.org/backgrounder/paris-global-climate-change-agreements). Additional sources, such as academic journals, government reports and international conservation organisation publications can also be used.The focus of the pitch should be on 4 themes and related questions:1. Current impact of global warming on the Great Barrier Reef:
2. How has global warming affected the biodiversity and ecological balance of the Great Barrier Reef in recent years?
3. Can you identify specific areas of the reef that have been most impacted by rising sea temperatures and acidification? Provide data or case studies.
4. How do these changes in the Great Barrier Reef reflect broader patterns observed in other coral reef systems around the world?
5. Effectiveness of local, national and global warming management practices and commitments:
6. What specific policies and actions have been implemented at local, national and international levels to mitigate the impact of global warming on the Great Barrier Reef?
7. How successful have these measures been in terms of measurable outcomes such as reduced coral bleaching or improved water quality?
8. Are there any innovative or unique strategies that have been particularly effective, and what lessons can be learned from them?
9. Local, national and global strategies for future management:
10. What new or enhanced strategies should be adopted at different levels (local, national, global) to more effectively manage the impact of global warming on the Great Barrier Reef?
11. How do these strategies integrate with broader efforts to combat climate change, such as carbon emission reductions and sustainable marine practices?
12. What role can local communities, Indigenous Australians and other stakeholders play in these future management strategies?
13. Predicted impact of suggested future management practices:
14. Based on current scientific models and research, what are the predicted outcomes of implementing your suggested management practices on the Great Barrier Reef?
15. How will these practices not only mitigate the effects of global warming but also promote the resilience and recovery of the reef ecosystem?
16. What are the potential challenges or barriers to implementing these practices, and how might they be addressed?

Use the [storyboard](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/559?clearCache=d8c9eea5-c40-8770-98dd-71cac5efcfff) scaffold to assist in planning. Use of infographics using [Canva for Education](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/canva-for-education.html?clearCache=684df347-3951-68d3-1eba-b4a19702c07bto%20) is also recommended.**Climate change debate**Examine different policies and measures proposed to combat climate change globally and locally.**Teacher note:** to prepare students for a class debate, the following activities can be undertaken:* Conduct sessions on research methodologies, critical thinking and effective communication. Focus on how to interpret scientific data related to climate change.
* Provide a list of additional resources beyond the [United Nations Framework Convention on Climate Change](https://unfccc.int/) and [Intergovernmental Panel on Climate Change](https://www.ipcc.ch/). Include academic journals, government reports and data from climate research organisations.
* Focus on digital tools for data analysis and visualisation tools like GIS, Google Earth or climate modelling software can be valuable for understanding climate change impacts geographically.
* Assign roles that represent various stakeholders in climate policy (for example, government officials, scientists, activists, industry representatives). Encourage students to explore different perspectives.

During the debate:* Use a formal debate format with opening statements, rebuttals and closing arguments. Ensure that each group gets equal time to present their case.
* Include geographic elements into the arguments, such as the impact of climate change on specific regions, adaptation measures in different geographical contexts and so on.
* Represent different viewpoints on climate change policies.

Post-debate activities:* Write reflective reports, emphasising not just the content of the debate but also the process of understanding and analysing complex policies.
* Conduct a feedback session to discuss lessons learned, challenges they faced and how understanding of climate change policies has evolved.
* Review each other’s reflective reports to foster a community of learning.

Create an online forum or platform where students can continue discussing climate change policies and share relevant news or articles. | **Students’ initial brainstorming lists demonstrated a basic understanding of coral reefs and climate change. Their questions showed curiosity about specific impacts and conservation efforts, indicating a desire to learn more.****Students used maps to connect global coral reef distributions with climate change patterns. Their analysis and questioning of data reflected critical thinking skills and awareness of potential biases.****Concise summaries in students’ papers, showcasing their ability to distil complex information into essential points, reflecting their understanding of the threats to coral reefs.****Students’ answered questions to demonstrate comprehension of coral bleaching, its causes, impacts on the Great Barrier Reef and global marine ecosystems. They discussed conservation efforts showing an understanding of environmental challenges and solutions.****Detailed notes, diagrams and comparisons of healthy versus bleached coral indicated students’ grasp of biological and environmental concepts related to coral reefs.****Concept maps created by groups illustrated understanding of the Authority’s actions, the impacts of these initiatives and the roles of various organisations.****Actively participated in brainstorming sessions using digital tools, showing engagement and collaborative learning.****Students participated in the Town Hall Circle, their use of real data and case studies in arguments, and reflective debriefing sessions exhibited their ability to engage in complex discussions, consider multiple viewpoints and understand environmental management intricacies.****The integration of ideas from various stakeholders into collaborative solutions showed students ability to synthesise information and work together to address complex environmental issues.****Students’ pitches, incorporating research and addressing 4 key themes, demonstrated an in-depth understanding of the impact of global warming on the Great Barrier Reef, effectiveness of management practices and future strategies.****Participation in debates, use of geographic elements in arguments and reflective reports indicated students’ ability to research, understand and critically analyse climate change policies from various perspectives.** | Provide vocabulary lists and glossaries for technical terms related to coral reefs and climate change. Offer multilingual support where necessary.Use visual aids and interactive digital platforms for brainstorming and listing questions. Provide templates for students who need structured guidance.Use closed captions and transcripts for any associated video content. Provide a step-by-step guide on how to interpret maps and data.Allow students to choose between various formats (digital, paper) for their One-Minute Paper response, with speech-to-text options available.Ensure the video is available with closed captions. Provide a guided template for note-taking using the Cornell method, with emphasis on visual representation for students who benefit from visual learning.Offer alternative ways of responding to video content, such as verbal discussion or creating a visual representation of the information.Provide a structured guide on how to navigate and extract information from the website. Offer assistive technology for students with special needs.Use digital tools for creating concept maps and presentations, ensuring accessibility for all students.Facilitate the use of online collaborative tools for brainstorming, ensuring that every student has the opportunity to contribute.Provide structured templates for brainstorming, and encourage various forms of expression (written, oral, graphic).Conduct workshops to prepare students, focusing on public speaking and argumentation for students who might find these areas challenging.Offer a variety of roles within the Town Hall Circle to accommodate different student strengths and comfort levels.Use storyboard scaffolds and visual aids like infographics to assist in planning.Provide access to a range of research materials, including academic journals and government reports.Allow students to present in different formats (digital presentations, oral speeches, written reports).Provide sessions on research methodologies and critical thinking tailored to different learning styles.During debates, ensure equitable participation and offer various formats for presenting arguments (visual aids, digital presentations).Offer multiple response options (verbal, non-verbal) and writing scaffolds to cater to different learning styles and needs. |  |

# Additional information

**Resource evaluation and support**: Please complete the following feedback form to help us improve our resources and support.

For additional support or advice, contact the HSIE curriculum team by emailing HSIE@det.nsw.edu.au.

## Further implementation support

Curriculum design and implementation is a dynamic and contextually-specific process. The department is committed to supporting teachers to meet the needs of all students. The advice below on assessment and planning for the needs of every student might be useful when considering the material presented in this sample program of learning.

## Assessment for learning

Possible formative assessment strategies that could be included:

* Learning intentions and success criteria assist educators to articulate the purpose of a learning task to make judgements about the quality of student learning. These help students focus on the task or activity taking place and what they are learning and provide a framework for reflection and feedback. [Online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622) can assist implementation of this formative assessment strategy.
* Eliciting evidence strategies allow teachers to determine the next steps in learning and assist teachers in evaluating the impact of teaching and learning activities. Strategies that might be added to a learning sequence to elicit evidence include all student response systems, [exit tickets](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/543), mini whiteboards (actual or [digital](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/575)), [Kahoot](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/621), [Socrative](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/587), or quick quizzes to ensure that individual student progress can be monitored and the lesson sequence adjusted based on formative data collected.
* Feedback is designed to close the gap between current and desired performance by informing teacher and student behaviour (AITSL 2017). AITSL provides a [factsheet to support evidence-based feedback](https://www.aitsl.edu.au/teach/improve-practice/feedback#:~:text=FEEDBACK-,Factsheet,-A%20quick%20guide).
* [Peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549) is a structured process where students evaluate the work of their peers by providing valuable feedback in relation to learning intentions and success criteria. It can be supported by [online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Browser?cache_id=1d29b).
* Self-regulated learning opportunities assist students in taking ownership of their own learning. A variety of strategies can be employed and some examples include reflection tasks, [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645), [KWLH charts](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562), [learning portfolios](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583) and [learning logs](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583).

The primary role of assessment is to establish where individuals are in their learning so that teaching can be differentiated, and further learning progress can be monitored over time.

Feedback that focuses on improving tasks, processes and student self-regulation is the most effective. Students engaging with feedback can take many forms including formal, informal, formative, summative, interactive, demonstrable, visual, written, verbal and non-verbal.

[What works best 2020 update](https://education.nsw.gov.au/about-us/educational-data/cese/publications/research-reports/what-works-best-2020-update) (CESE 2020)

## Differentiation

Differentiated learning can be enabled by differentiating the teaching approach to content, process, product and the learning environment. For more information on differentiation go to [Differentiating learning](https://education.nsw.gov.au/teaching-and-learning/professional-learning/teacher-quality-and-accreditation/strong-start-great-teachers/refining-practice/differentiating-learning) and [Differentiation](https://education.nsw.gov.au/campaigns/inclusive-practice-hub/primary-school/teaching-strategies/differentiation).

When using these resources in the classroom, it is important for teachers to consider the needs of all students in their class, including:

* **Aboriginal and Torres Strait Islander students**. Targeted [strategies](https://education.nsw.gov.au/teaching-and-learning/aec/aboriginal-education-in-nsw-public-schools) can be used to achieve outcomes for Aboriginal students in K–12 and increase knowledge and understanding of Aboriginal histories and cultures. Teachers should use students’ Personalised Learning Pathways to support individual student needs and goals.
* **EAL/D learners**. EAL/D learners will require explicit English language support and scaffolding, informed by the [EAL/D enhanced teaching and learning cycle](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald/enhanced-teaching-and-learning-cycle) and the student’s phase on the [EAL/D Learning Progression](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency). In addition, teachers can access information about [supporting EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency) and [literacy and numeracy support specific to EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald).
* **Students with additional learning needs**. Learning adjustments enable students with disability and additional learning and support needs to access syllabus outcomes and content on the same basis as their peers. Teachers can use a range of [adjustments](https://education.nsw.gov.au/teaching-and-learning/disability-learning-and-support/personalised-support-for-learning/adjustments-to-teaching-and-learning) to ensure a personalised approach to student learning. In addition, the [Universal Design for Learning planning tool](https://education.nsw.gov.au/teaching-and-learning/learning-from-home/teaching-at-home/teaching-and-learning-resources/universal-design-for-learning) can be used to support the diverse learning needs of students using inclusive teaching and learning strategies. Subject specific curriculum considerations can be found on the [Inclusive Practice hub](https://education.nsw.gov.au/campaigns/inclusive-practice-hub).
* **High potential and gifted learners**. [Assessing and identifying high potential and gifted learners](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/assess-and-identify#Assessment1) will help teachers decide which students might benefit from extension and additional challenge. [Effective strategies and contributors to achievement](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/evaluate) for high potential and gifted learners help teachers to identify and target areas for growth and improvement. In addition, the [Differentiation Adjustment Tool](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/implement/differentiation-adjustment-strategies) can be used to support the specific learning needs of high potential and gifted students. The [High Potential and Gifted Education Professional Learning and Resource Hub](https://schoolsnsw.sharepoint.com/sites/HPGEHub/SitePages/Home.aspx) supports school leaders and teachers to effectively implement the High Potential and Gifted Education Policy in their unique contexts.

All students need to be challenged and engaged to develop their potential fully. A culture of high expectations needs to be supported by strategies that both challenge and support student learning needs, such as through appropriate curriculum differentiation (CESE 2020:6).

## Support and alignment

**Resource evaluation and support**: all curriculum resources are prepared through a rigorous process. Resources are periodically reviewed as part of our ongoing evaluation plan to ensure currency, relevance, and effectiveness. For additional support or advice contact the HSIE curriculum team by emailing HSIE@det.nsw.edu.au.

**Alignment to system priorities and/or needs**: [School Excellence Policy](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468)

**Alignment to the School Excellence Framework**: this resource supports the [School Excellence Framework](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468) elements of curriculum (curriculum provision) and effective classroom practice (lesson planning, explicit teaching).

**Alignment to Australian Professional Teaching Standards**: this resource supports teachers to address [Australian Professional Teaching Standards](https://educationstandards.nsw.edu.au/wps/portal/nesa/teacher-accreditation/meeting-requirements/the-standards/proficient-teacher) 3.2.2, 3.3.2.

**Consulted with**: Curriculum and Reform, Inclusive Education, Multicultural Education, Aboriginal Outcomes and Partnerships and subject matter experts.

**NSW syllabus**: Geography 11–12

**Syllabus outcomes**: GE-11-01, GE-11-02, GE-11-03, GE-11-04, GE-11-05, GE-11-06, GE-11-07, GE-11-08, GE-11-09

**Author**: Curriculum Secondary Learners

**Publisher**: State of NSW, Department of Education

**Resource**: Program of learning

**Related resources**: further resources to support Geography 11–12 can be found on the HSIE curriculum page.

**Professional learning**: relevant professional learning is available through MyPL and the HSIE statewide staffroom.

**Universal Design for Learning**: [Curriculum planning for every student](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/advice-on-curriculum-planning-for-every-student-k-12). Support the diverse learning needs of students using inclusive teaching and learning strategies.

**Creation date**: 8 September 2023

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# Evidence base

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