# Geography 11–12 – Earth’s natural systems 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](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) 2022). 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 may 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 may 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 – Earth’s natural systems. The lessons and sequences in this program of learning are designed to allow students to develop the knowledge and skills to investigate the diverse landscapes of the Earth’s surface and its distinctive physical features to inspire curiosity and wonder.

During Week 1 of the program, students examine the uniqueness and diversity of the Earth and gain a context for studying Earth’s natural systems.

During Week 2 of the program, students will investigate the characteristics of Earth’s natural systems, identify and examine the factors affecting their functioning and account for spatial variations.

During Weeks 3–7 of the program, students will delve deeper into the intricacies of Earth's natural systems, exploring the processes, cycles, and circulations that intricately connect atmospheric, hydrological, geomorphic and ecological systems. Students will develop a comprehensive understanding of the dynamic interplay between characteristics of Earth's natural systems, as well as the factors affecting their functioning.

During Weeks 8 and 9 of the program, students undertake a fieldwork activity examining the natural processes, cycles and circulations that have changed the land and water cover of Mount Kosciuszko, including using fieldwork data in completing an assessment task.

During Week 10 of the program, students are introduced to the geographical investigation and identify an area for geographical inquiry.

**Duration**: this program of learning is designed to be completed over a period of approximately 10 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.

## 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-11-05** 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?tab=assessment) © 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 Earth's natural systems, 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. By conducting fieldwork, students gain a broader perspective on the interconnected nature of Earth's systems and the potential impacts of human activities on these systems.

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.

### 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, 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 may be applicable to another.

**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 may 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 the uniqueness and diversity of the Earth

### Week 1 – nature as a source of wonder

**Teacher note:** the overview of the uniqueness and diversity of the earth should cover a **maximum** of **4 hours** of teaching time. This section is intended to provide students with a broad overview of the focus area.

Examples included in the syllabus are provided to support delivery of course content. These examples are not mandatory and teachers may choose to use the examples provided or select appropriate alternatives.

#### Learning intentions

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

Students:

* develop an understanding of the concepts of inspirational landscapes, biodiversity hotspots and great wildlife migrations
* explore the changing connections between people and nature, including the concepts of intrinsic value and global commons, and discuss the roles and responsibilities humans have in protecting the environment.

#### Success criteria

Students can:

* identify and describe key features of inspirational landscapes and explain why they are considered inspirational
* construct a well-reasoned paragraph on the importance of managing and protecting biodiversity hotspots, incorporating relevant facts and data
* engage in class discussions on the changing connections between people and nature, the intrinsic value of the environment, and the role of humans as stewards of the Earth
* collaboratively create a mind map summarising the key characteristics, types, challenges, and importance of global commons.

Table 1 – nature as a source of wonder

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-05**  **Nature as a source of wonder**  **Example(s):**   * Inspirational landscapes. * Biodiversity hotspots. * Great wildlife migrations across air, land and sea.   **Geographical tools/skills**   * Photographs | Access [UNESCO World Heritage List](https://whc.unesco.org/en/list/?&type=natural) and select an inspirational landscape image. Identify the key features of the landscape that make it inspirational.  Compile a list of features identified in the inspirational landscapes.  Construct a one paragraph response to the question, ‘Why is it important to manage and protect biodiversity hotspots?’  Access [Biodiversity hotspots](https://www.conservation.org/priorities/biodiversity-hotspots) and [Biodiversity hotspots defined](https://www.cepf.net/our-work/biodiversity-hotspots/hotspots-defined) to identify facts and data to support your response.  Share completed work with another student for [peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549) on:   * clear and logical response * arguments presented * examples provided to support the argument.   Conduct a [jigsaw activity](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/546) with the class and assign students to ‘home groups’ to research assigned animals. Complete a jigsaw activity to become an ‘expert’ and teach their peers about an assigned animal. The following resources can be used as a starting point for research:   * [Great Animal Migrations: Where and When to Witness Them](https://www.toursbylocals.com/blog/great-animal-migrations) * [Nature’s Most Impressive Animal Migrations](https://education.nationalgeographic.org/resource/natures-most-impressive-animal-migrations) * [Data from space unveils global view of animals on the move](https://www.mpg.de/18465516/data-from-space-unveils-a-global-view-of-animals-on-the-move) * [Sea Turtle Migration](https://www.seeturtles.org/sea-turtle-migration) * [12,000 Miles to Go: Migrating with Shearwaters](https://ocean.si.edu/ocean-life/seabirds/12000-miles-go-migrating-shearwaters) * [Yellowstone Bison](https://www.nps.gov/yell/learn/nature/bison.htm#:~:text=Bison%20migrate%20up%20to%2070,in%20the%20Greater%20Yellowstone%20Ecosystem.).   In the final stage of the jigsaw activity, complete Activity 1 – wildlife migration in the resource booklet.  Participate in a [peer discussion](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/547) to discuss the statement, ‘Migratory animals are potentially very effective indicators of environmental changes that affect us all’. | Students selected an inspirational landscape image and identified its key features resulting in a compiled list of features found in inspirational landscapes.  Students constructed a one paragraph response on the importance of managing and protecting biodiversity hotspots, using facts and data from accessed resources.  Students completed a table with the information gathered during the jigsaw activity, demonstrating their understanding of the assigned animals and their migratory patterns. | Pre-teach key vocabulary related to inspirational landscapes, biodiversity hotspots, great wildlife migrations and UNESCO World Heritage Sites.  Provide a glossary and allow the use of bilingual dictionaries for uncommon terms.  Provide visual examples of inspirational landscapes.  Ensure all students understand both technical and culturally based terms related to landscape features.  Model how to give constructive feedback.  Provide writing scaffolds to assist with paragraph structure.  Explicitly teach paragraph structure and provide writing scaffolds.  Use closed captions and transcripts when viewing videos. |  |
| People’s connection to the natural world and why it can vary  **Example(s**):   * Proximity to nature. * Worldview. * Aboriginal peoples’ connection to country. * The ‘overview effect’.   **Geographical tools/skills**   * Satellite images * Remote sensing data | Complete a class discussion about the changing connections between people and nature. Use the following statements to stimulate the discussion:   * We have reduced proximity to nature (urbanisation and town planning). * We have changes in types of leisure (indoor and virtual recreation options). * We have changes in transport and work.   Access [The Land Owns Us (6:14)](https://youtu.be/w0sWIVR1hXw) and discuss Aboriginal People’s connection to Country and how it varies from those already discussed in the previous activity.  Access NASA Earth Science and Remote Sensing Unit ‘[Highlights’ video (3:20)](https://eol.jsc.nasa.gov/ESRS/HDEV/#:~:text=PDF%20reader.)-,Highlights,-%3A) . Take notes to assist in completing the following guiding questions:   * What are you observing? For example, land mass, atmospheric conditions or human settlement. * How might viewing Earth from space change your perspective on, and connection to, the natural world?   In small groups, discuss the following questions:   * Why do we protect and conserve the natural world? * If the natural environment does not provide benefits to humans, does it have value? | Students demonstrated awareness of the unique relationship between Aboriginal people and the land.  Students completed discussions of traditional Aboriginal connections to Country with other perspectives.  Students answered questions related to observations and perspective on Earth from space and the ‘overview effect’. | Pre-teach key vocabulary such as proximity, Aboriginal peoples’ connection to Country, atmospheric conditions and conservation.  Consider multiple modes of delivering presentations and discussions.  Use closed captions and provide transcripts when viewing videos.  Encourage students to use target language in context during practical learning activities and discussions. |  |
| The universal value of Earth’s environments  **Example(s):**   * Intrinsic value. * The global commons. | **Teacher note:** establish a designated area within the classroom for implementing a [Line of Continuum](https://goalbookapp.com/toolkit/v/strategy/student-barometer) activity. Direct students to position themselves along the line based on where they think their viewpoint on the given question fits best. Encourage students to take turns explaining their chosen positions and allow them to adjust their stance if their peers' arguments lead them to reconsider their perspectives.  Complete a [Line of Continuum](https://goalbookapp.com/toolkit/v/strategy/student-barometer) activity, responding to the following question, ‘If the natural environment offers no advantages to humans, does it possess intrinsic value?’  Access [The Global Commons](https://globalcommonsalliance.org/global-commons/) and [Global commons](https://geography-revision.co.uk/a-level/human/global-commons/). In pairs, construct a [mind map](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542) summary of the articles. The mind map must include the:   * key characteristics of global commons as defined by the United Nations * four main types of global commons mentioned on the website * main challenges associated with the management of global commons.   Answer the following questions:   * How do global commons differ from other types of resources in terms of ownership and management? * Why are global commons important for the overall health of the Earth and its inhabitants? * What are some of the consequences of the ‘tragedy of the commons’ in the context of global commons? * How important is universal value of the environment (global commons) to you personally? * What role do you think humans have as stewards protecting the intrinsic value of the Earth?’ | Students completed the Line of Continuum activity and engaged in critical thinking related to their viewpoint on the questions.  Students completed a mind map that summarises the article about global commons.  Students identified key characteristics of global commons and explored the main challenges of management. | Pre-teach key vocabulary and concepts related to the environment, intrinsic value, and human perspectives.  Use closed captions if any videos are shown.  Provide alternative options when using thinking activities and graphical organisers for brainstorming.  Consider the space in the room and the mobility of students in the line of continuum activity.  Explicitly teach and model the process of creating a mind map.  Provide opportunities for independent or paired work for students who find working in groups challenging. |  |

## Processes, cycles and circulations connecting natural systems

### Week 2 – characteristics of Earth’s natural systems

**Teacher note**: students may have prior knowledge of latitude, altitude, and some aspects of climate and weather from Geography Stage 5. Depending on class context, it may be necessary to revise these concepts and skills before moving onto the following content. Students must develop an understanding of differential heating as it forms the basis of other concepts like global atmospheric circulations.

Examples included in the syllabus are provided to support delivery of course content. These examples are not mandatory and teachers may choose to use the examples provided or select appropriate alternatives.

**Learning intentions**

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

Students:

* understand the concepts of latitude, longitude, and their role in determining a location on Earth and global weather patterns
* analyse the impact of Earth’s tilt, rotation, and differential heating on climate variations and global weather patterns
* investigate the effect of altitude and elevation on temperature and ecosystems
* explore the influence of continentality and oceanity on regional climates
* examine the Earth’s seasonality, including the differences between Indigenous and Western seasonal calendars.

**Success criteria**

Students can:

* accurately define latitude and longitude and explain how they form a coordinate system and global weather pattern
* describe how Earth’s tilt and rotation influence the distribution of heat and the movement of the tropical rain belt
* explain how altitude and temperature impact various ecosystems
* discuss the factors that cause coastal regions to have different climate characteristics compared to inland areas, such as temperature range and precipitation patterns
* create and interpret climate graphs and analyse seasonal variations in relation to Earth’s tilt and orbit
* compare and contrast Indigenous and Western seasonal calendars and appreciate the importance of seasonal understanding in managing Country for Aboriginal and Torres Strait Islander peoples
* actively participate in group discussions, presentations and collaborative activities demonstrating their understanding of the concepts covered in the teaching activities.

Table – characteristics of Earth’s natural systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-05, GE-11-08, GE-11-09**  Characteristics of Earth’s natural systems and factors affecting their functioning  **Example(s):**   * Latitude.   **Geographical tools/skills**   * Latitude and longitude | Access [Latitude and longitude explained (2:33)](https://www.youtube.com/watch?v=-8gg98ws2Eo), [Differential heating](https://www.futurelearn.com/info/courses/learn-about-weather/0/steps/28845) and [Annual Migration of Tropical Rain Belt](https://www.climate.gov/news-features/understanding-climate/annual-migration-tropical-rain-belt) to answer the following questions:   * What are latitude and longitude and how do they help us determine a location on Earth? * How does the Earth’s tilt affect the distribution of latitudes and their exposure to sunlight? * How do the latitude and longitude lines intersect to form a coordinate system? * How does differential heating contribute to climate variations across different latitudes? * In what ways does Earth’s rotation influence the distribution of heat from the equator to the poles? * How does the tropical rain belt affect global weather patterns? * What are the characteristics of the tropical rain belt’s climate?   Construct an annotated diagram that demonstrates the Earth’s hemispheres, the equator and the poles. The diagram should also show the difference in the concentration of the Earth’s rays due to the curvature of the Earth. Activity 2 – latitude and longitude in the resource booklet, provides directions. | Students identify the relationship between latitude, longitude and Earth’s tilt on climate variations. | Use visual and multimedia examples to support understanding of geographical concepts.  Provide visual aids, such as maps and diagrams, to support understanding of latitude and longitude concepts.  Offer opportunities for guided practice in identifying latitude and longitude coordinates on maps.  Allow the use of bilingual dictionaries for unfamiliar geographical terms.  Use closed captions and transcripts while viewing videos. |  |
| Characteristics of Earth’s natural systems and factors affecting their functioning  **Example(s):**   * Altitude.   **Geographical tools/skills**   * Scatter graphs * GIS * Mapping | Using the blank map provided in the resource booklet (Activity 3 – mapping), locate 5–8 different cities and record their altitude. In pairs, discuss, ‘How does the impact of latitude and altitude account for the variation in temperature among the specified cities?’  Access [Google Earth Ecuador](https://earth.google.com/web/search/ecuador/@-1.36031805,-83.8949062,15.09896049a,2381866.32911568d,35y,0h,0t,0r/data=CnIaSBJCCiUweDkwMjM4N2RkYTg5YTRiZDU6MHg5ZDc2YWYwNDExOWMzNzAyGU-OAkTBTP2_Ifj4hOy8i1PAKgdlY3VhZG9yGAIgASImCiQJWUjcXAeLOkARV0jcXAeLOsAZveYF9vhFRkAhXnalyTw2UMA) and record the latitude for the following cities:   * Cotopaxi * Quito * Latacunga * Ibarra * Esmeraldas * Guayaquil.   **Teacher note:** students will compare weather data for locations at different elevations to discover the effect that altitude has on temperature. The example used in this sequence is Ecuador, and has been adapted from the resources available at Centre for Innovation in Engineering and Science Education (CIESE) real time data projects. Teachers may wish to adapt to their local context or another location relevant to student context.  Refer to the information and table provided in the resource booklet (Activity 4 – scatter graphs) and use [The Weather Channel](https://weather.com/en-AU/weather/today/l/ASXX0023:1:AS?Goto=Redirected) to find the highest temperature recorded for each city on the specified day. Record these temperatures in the ‘Highest daily temperature’ column of the table provided.  Use the [CIESE Implementation Assistance](https://ciese.org/curriculum/weatherproj2/en/popup/graph.shtml) scatter plot to learn about scatter graphs.  Using [Weather Scope](https://ciese.org/curriculum/weatherproj2/en/popup/graph4.shtml), observe and discuss the characteristics and features of a scatter graph.  Use a spreadsheet program or create a scatter graph illustrating data presented in Table 2 in the resource booklet. Answer the following questions:   * How can a scatter graph help identify trends or patterns in a dataset? * When is it appropriate to use a scatter graph instead of other types of data visualisations? * How do you determine if there is a positive, negative, or no correlation between 2 variables in a scatter graph? (Correlation is used to describe the relationship between 2 variables). * Can a scatter graph be used to establish causation between 2 variables? Why or why not? (Causation means a change in one variable directly leads to a change in another variable).   Based on the table and graph, predict the temperature for the following elevations:   * 0 m * 1,000 m * 2,000 m * 3,000 m * 4,000 m.   Answer the following questions and integrate data from the table:   * How does temperature vary with elevation in the city according to the table and graph? * How does the temperature change with a 1,000 m increase in elevation in the city according to the table and graph? * What are the factors that influence temperature variation with elevation in the city?   Discuss the following prompt, ‘How does altitude influence the characteristics of Earth’s natural systems and their functioning?’  In small groups investigate a specific ecosystem such as forests, grasslands or alpine tundra found at different altitudes. Each group completes research to discover how altitude impacts the assigned ecosystem and presents their findings to the class. | Students discuss and analyse the impact of altitude on temperature in various cities.  Students completed the scatter graph activity to understand temperature and elevation correlation.  Students completed the jigsaw activity to learn about the characteristics of Earth's natural systems at different altitudes.  Students completed a response based on assigned ecosystems at various altitudes. | Provide additional support for students who find working in groups challenging or offer alternatives like working independently or in pairs.  Provide writing scaffolds for students who need assistance with paragraph structure. |  |
| Characteristics of Earth’s natural systems and factors affecting their functioning  **Example(s):**   * Continentality. * Oceanity.   **Geographical tools/skills**   * Climate statistics | Use the [BOM recent and historical rainfall](http://www.bom.gov.au/climate/maps/rainfall/?variable=rainfall&map=totals&period=48month&region=nat&year=2022&month=07&day=31) map to complete the following:   * Describe the pattern of rainfall. * What conclusions can you draw regarding the correlation between proximity to the coast and the amount of rainfall? Use [Continentality](https://glossary.lias.net/wiki/Continentality) and [Oceanity](https://glossary.lias.net/wiki/Oceanity) to further examine and improve your response. * Describe any correlation between latitude and rainfall on the map. * How might the rainfall pattern impact the diversity of flora and fauna? For example, in a tropical rainforest the high annual rainfall contributes to an incredibly diverse ecosystem.   Review [Climate statistics for Australian locations](http://www.bom.gov.au/climate/averages/tables/cw_070282.shtml) and compare the temperature range between an inland city like Canberra and a coastal city like Sydney.  In the response, consider the geography and climate of the cities. For example, Canberra is located inland, which means it experiences a continental climate with greater temperature fluctuations between seasons. Sydney is located on the coast, which means it experiences a maritime climate with more moderate temperatures.  Use a [graphic organiser](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599#.ZB0MeD4jTPU.link) to support your response and show the steps involved in analysing the temperature range of both cities. Create boxes for each step such as ‘Gather temperature data’ or ‘Process or interpret the data’. Connect them with arrows to demonstrate the process.  [Brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.ZB0NHH5gpTI.link) factors that account for why inland areas like Canberra experience a greater temperature range than coastal cities like Sydney. Examples of these factors include temperature range, elevation, distance from water bodies, prevailing winds and ocean currents.  In small groups, use the class discussion, school resources and the [Continentality](https://glossary.lias.net/wiki/Continentality) and [Oceanity](https://glossary.lias.net/wiki/Oceanity) webpages to answer the following questions:   * What causes coastal regions to have smaller temperature fluctuations compared to inland areas? * What factors contribute to increased precipitation in coastal areas compared to locations farther inland? * In what ways do continentality and oceanity influence a region’s climate? | Student can discuss factors contributing to temperature fluctuations in inland and coastal cities.  Students completed climate graphs for various locations. | Encourage students to practice target language in context during practical learning activities.  Utilise different options for students who struggle with graphic organisers or brainstorming activities.  Encourage the use of response cards or gestures for students to indicate their understanding of rainfall patterns. |  |
| Characteristics of Earth’s natural systems and factors affecting their functioning  **Example(s):**   * Seasonality.   **Geographical tools/skills**   * Climate graphs | Access [Seasons (5:38)](https://youtu.be/tX3Y5bzNDiU) and record the seasons in the northern and southern hemispheres in Table 3 provided in Activity 5 – climate graphs of the resource booklet. Using Figures 2–5, complete ‘Table 4 – climate graphs’.  Complete the following questions:   * What causes the Earth to have a 23.5° tilt in its axis of rotation? * How does the Earth’s elliptical orbit around the Sun affect its distance from the Sun throughout the year? * How does the Earth’s proximity to the Sun in January impact the season the Northern Hemisphere experiences? * How does the tilt of the Earth’s axis lead to the occurrence of seasons? * How do the seasons experienced in the northern and southern hemispheres relate to each other? * Which latitudes on Earth receive the most intense sunlight during solstices and equinoxes?   Access [Indigenous seasonal calendars,](https://www.csiro.au/en/research/indigenous-science/indigenous-knowledge/calendars) [Indigenous Weather Knowledge](http://www.bom.gov.au/iwk/index.shtml) and [About the Indigenous seasonal calendars](https://www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Calendars/About). Answer the following questions:   * How do the Indigenous seasonal calendars differ from the Western 4-season calendar in understanding and managing Country in Australia? * What role does seasonal understanding play in the activities and management of Country for Aboriginal and Torres Strait Islander Peoples? * How has CSIRO contributed to the development and application of the Indigenous seasonal calendars? * In what ways have the co-produced seasonal calendars been effective in representing Indigenous understanding of and connection to Country? | Students shared responses and insights from examination of the Indigenous seasonal calendar activity. | Use visual and multimedia examples to support understanding of geographical concepts.  Use closed captions and transcripts while viewing videos. |  |

### Week 3 – atmospheric systems

**Teacher note**: refresh students understanding of the processes, cycles and circulations studied in Stage 5.

Examples included in the syllabus are provided to support delivery of course content. These examples are not mandatory and teachers may choose to use the examples provided or select appropriate alternatives.

#### Learning intentions

Students:

* understand global atmospheric circulation and its impact on weather and climate patterns
* understand the layers of Earth's atmosphere, their characteristics and their relationship with temperature changes
* interpret Earth's energy budget and understand the factors that influence the balance of absorbed sunlight and radiated heat
* develop knowledge of the factors that influence weather forecasting, and the complex phenomena of El Niño and La Niña and their effects on global climate patterns.

#### Success criteria

Students can:

* accurately describe the processes of global atmospheric circulation and explain its influence on weather and climate patterns
* identify and explain the characteristics of each layer of the Earth's atmosphere, as well as graph and interpret temperature changes in these layers
* analyse Earth's energy budget and heat map and discuss the factors that affect the balance of absorbed sunlight and radiated heat in different areas
* explain the importance of Earth's surface albedo and how it affects the amount of solar radiation used for heating
* describe the 3 large atmospheric cells in both hemispheres and their role in global atmospheric circulation, including the effects of semi-permanent areas of high and low pressure on climatic zones
* demonstrate an understanding of weather forecasting, including the complexities of El Niño and La Niña, by creating a poster that explains the causes and effects of these climate patterns using real-time data.

Table – atmospheric processes, cycles and circulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-02, GE-11-05, GE-11-06, GE-11-09**  The processes, cycles and circulations connecting natural systems, including:   * atmospheric systems   **Example(s):**   * global atmospheric circulations   **Geographical tools/skills**   * Latitude and longitude * Thematic maps * Graphs | Access [What is Global atmospheric circulation, Part one – differential heating (2:50)](https://youtu.be/7fd03fBRsuU). Identify any terminology that is unfamiliar. Answer the following questions:   * How does global atmospheric circulation affect weather and climate patterns? * What is the main source of heat for the Earth? How does it travel to us? * What causes differential heating across the globe, and how is this related to the curvature of the Earth? * What is the importance of the reflectivity (or albedo) of the Earth's surface in determining how much of the sun's radiation is used for heating the Earth? * How does global atmospheric circulation act as an air conditioning system?   Explain the layers of the atmosphere including troposphere, stratosphere, mesosphere, thermosphere and exosphere, using [Earth's Atmosphere: A Multi-layered Cake](https://climate.nasa.gov/news/2919/earths-atmosphere-a-multi-layered-cake/).  Graph the temperature changes in each layer of the atmosphere. Use the instructions provided in Activity 6 – graphing, in the resource booklet.  Explain the characteristics of each layer of the atmosphere.  Access [Earth’s Energy Budget](https://earthobservatory.nasa.gov/features/EnergyBalance/page4.php) and interpret the heat map (thematic map) of outgoing energy. Discuss the following:   * What does the colour coding on the heat map represent? * Are there any areas of the map that appear to receive more absorbed sunlight than others? * Are there any factors, such as geographical location or time of day, that might affect the balance of absorbed sunlight and radiated heat in different areas of the map? * How does heat impact climate in a particular geographical location?   In pairs, answer the following questions:   * What is Earth's energy budget and how is it related to the temperature stability? * How much of the solar energy that reaches Earth is reflected back to space, and what are the primary factors responsible for this reflection? * What happens to the solar energy that is absorbed by the atmosphere, and what are the main atmospheric components that absorb this energy? * How does the Earth's surface absorb and distribute incoming solar radiation? * How does the temperature of the Earth's surface and atmosphere relate to the amount of heat radiated by each? A resource to further support this response is [Surface Energy Budget](https://earthobservatory.nasa.gov/features/EnergyBalance/page5.php). * What is radiative cooling, and how does it help prevent runaway heating on Earth? | Students completed structured paragraphs with supporting data and evidence.  Students can access and identify unfamiliar terminology.  Students graphed temperature changes in each layer of the atmosphere and explained the layers and their characteristics.  Students interpreted the heat map of outgoing energy and discussed factors that might affect the balance of absorbed sunlight and radiated heat in different areas. | Provide a glossary of relevant terms and encourage the use of bilingual dictionaries if needed.  Clarify technical and culturally based terms.  During practical activities, emphasise target language and encourage students to use it in context. |  |
| The processes, cycles and circulations connecting natural systems, including:   * atmospheric systems   **Example(s):**   * weather systems   **Geographical tools/skills**   * Weather maps (synoptic charts) | Access [What is global circulation? | Part Two | The three cells (3:35)](https://www.youtube.com/watch?v=xqM83_og1Fc) and [Prevailing winds](https://education.nationalgeographic.org/resource/prevailing-winds/). Identify any terminology that is unfamiliar. Answer the following questions:   * What are the 3 large atmospheric cells that exist in both hemispheres? * How does the unequal distribution of land and ocean affect the global atmospheric circulation? * What are the 3 cells that exist in both the northern and southern hemispheres, and what are their characteristics? * How do the mid-latitude cells (Ferral cells) differ from the other cells in the global circulation system, and what role do they play in transporting heat?   Activity 7 – global circulations, in the resource booklet, provides an optional extension activity.  Access [the art of the chart: how to read a weather map](https://media.bom.gov.au/social/blog/2391/the-art-of-the-chart-how-to-read-a-weather-map/) and view the embedded film clip. Complete the following questions:   * What are the main features of a weather map (synoptic chart)? * How do isobars (isoline) indicate the flow of air around weather systems? * What are high- and low-pressure systems, and what do their numbers indicate? * What are fronts and how do they appear on a weather map? * How can you use isobars on a weather map to interpret wind strength and direction?   Discuss low-pressure systems and the frequency and impact of east coast lows and cyclones.  Work in pairs with [Interactive Weather and Wave Forecast Maps](http://www.bom.gov.au/australia/charts/viewer/index.shtml) to predict the weather for any 3 capital cities for 24 hours, 48 hours, and 96 hours in the future. Record predictions and check them against the actual conditions in the future.  Construct and answer the following question, ‘Why is accurately forecasting the weather so complicated?’ | Students created a diagram or model of the global atmospheric circulation.  Students can identify and explain the main features of a weather map (synoptic chart), isobars, high- and low-pressure systems, and fronts.  Students discussed the frequency and impact of east coast lows and cyclones on coastal communities.  Students made predictions about the weather for a given location. | Use closed captions and provide a transcript when using videos.  Provide visual aids, such as diagrams or images, to support students' understanding of the concepts.  Offer alternative ways for students to present their work, such as through oral or digital presentations. |  |
| The processes, cycles and circulations connecting natural systems, including:   * atmospheric systems   **Example(s)**:   * atmosphere–ocean circulations   **Geographical tools/skills**   * Visual representations | **Access the** [Understanding El Niño–Southern Oscillation (ENSO) (4:13)](https://www.youtube.com/watch?v=dzat16LMtQk)**,** [What is El Niño and how does it impact Australia?](http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml) **and** [Understanding the Indian Ocean Dipole (3:32)](https://www.youtube.com/watch?v=J6hOVatamYs) **to explain the phenomenon of El Niño and La Niña These are large-scale climate patterns that affect global atmospheric circulations.**  Collaboratively develop a table that identifies the causes of El Niño and La Niña, the effects on weather and climate, and how they interact with other factors such as the jet stream.  **Using the table and further research on El Niño and La Niña, develop a poster to explain the causes and effects of these climate patterns. The poster should use data from the** [Climate Driver Update](http://www.bom.gov.au/climate/enso/#tabs=Overview) **including the current forecast of Pacific, Indian and Southern Oceans.** | Students can identify causes and effects of El Niño and La Niña.  Students can explain causes and effects of climate patterns.  Students can use geographical data.  Students completed a table of the causes of El Niño and La Niña and the effects on weather and climate. | Use closed captions and provide a transcript when using videos.  Provide visual aids, such as diagrams or images, to support students' understanding of the concepts.  Clarify technical and culturally-based terms.  Offer alternative ways for students to present their work, such as through oral or digital presentations. |  |

### Week 4 – hydrological systems

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

#### Learning Intentions

Students:

* understand the key features and processes of the water cycle and the factors that influence precipitation patterns in different locations
* interpret and process data on rainfall trends and heavy rainfall events in Australia and their implications
* explore different types of water storages and their benefits, drawbacks, and implications on the environment
* investigate catchment functioning, including the construction of cross sections, transects, and hydrographs, and analyse the factors that impact catchment functioning in different locations.

#### Success criteria

Students can:

* draw and label the key features of the water cycle and explain their functions
* discuss the closed nature of the water cycle and the role of plants and atmospheric circulations in the process
* create a Venn diagram comparing and contrasting precipitation patterns in 2 different locations and explain the factors causing variation
* analyse and interpret data from the [State of the Climate 2022](http://www.bom.gov.au/state-of-the-climate/) report to answer questions about rainfall trends and heavy rainfall events in Australia
* identify different types of water storages, discuss their benefits and drawbacks, and research the percentage of water stored in various systems in Australia and worldwide
* construct annotated diagrams of a catchment, create infographics on factors impacting catchment functioning, and present catchment stories based on their research.

Table – hydrologic processes, cycles and circulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-02, GE-11-05, GE-11-09**  The processes, cycles and circulations connecting natural systems, including:   * hydrological systems   **Example(s):**   * precipitation patterns and cycles   **Geographical tools/skills**   * Choropleth maps * Visual representations * Graphs | Access [Natural and urban water cycle](https://www.melbournewater.com.au/education/activities-all-ages/natural-and-urban-water-cycle), and [From Clouds to Currents What is the Water Cycle?](https://www.smithsonianmag.com/blogs/national-museum-of-natural-history/2022/02/10/from-clouds-to-currents-what-is-the-water-cycle/) to draw and label the key features of the water cycle, or hydrological system, including:   * precipitation * condensation * groundwater * infiltration * transpiration * evaporation.   Research further water cycle features and define [evapotranspiration](http://www.bom.gov.au/watl/eto/about.shtml#:~:text=Evapotranspiration%20is%20the%20term%20used,of%20both%20transpiration%20and%20evaporation.), percolation, groundwater discharge, throughflow, aquifer, surface and sub-surface runoff. Add these features to the diagram.  Using the water cycle diagram, conduct a [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645#.Y3VE7fz2Dtc.link) to explore and discuss the following questions:   * Why is the water cycle referred to as a closed cycle? * What drives the water cycle? * Why are plants critical to the water cycle? * How do atmospheric circulations like La Niña and El Niño alter the operation of the water cycle?   Using the Bureau of Meteorology’s (BOM) [Average annual, seasonal and monthly rainfall](http://www.bom.gov.au/climate/change/about/rain_averagemaps.shtml), create a [Venn diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599#.Y7yqLPPUntE.link) that compares and contrasts precipitation in 2 NSW locations. The first location should be on the east coast and the second inland, for example Coffs Harbour or Cobar.  Write a paragraph explaining the impact of the [Rain Shadow Effect (4:26)](https://www.youtube.com/watch?v=DoKTTHd-XEQ) in varying precipitation between the 2 locations. Explain one other factor that may cause variation between these 2 locations.  Complete the questions included in Activity 8 – climate data in the resource booklet using the [State of the Climate 2022](http://www.bom.gov.au/state-of-the-climate/) report. Refer to the included rainfall information, graphs, choropleth maps and data.  Use [Asia Pacific Regional Reference Map](https://reliefweb.int/map/world/asia-pacific-regional-reference-map-annual-precipitation) and [Regional Climate Maps: Asia](https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/asia.html) to research the precipitation patterns for a selected location in Asia.  Briefly explain the factors that influence the precipitation of the chosen location. For example   * latitude * altitude * topography * distance from water bodies * air pressure * winds.   Identify the different types of water storages in the selected location in Asia, including dams, reservoirs, aquifers, and natural water bodies such as rivers and lakes. In pairs, locate where water is stored and flows.  Use the [Water in Australia 2019-20](http://www.bom.gov.au/water/waterinaustralia/) report and [Energy Education](https://energyeducation.ca/encyclopedia/Water_storage) to complete ‘Activity 9 – water storage’ in the resource booklet, identifying the percentage of water stored in Australia and worldwide for the following:   * freshwater systems * oceans * groundwater * icecaps and glaciers * lakes * swamps * rivers.   Access [Water Cycle – Stores and Flows (7:11)](https://youtu.be/H_noB4UYDJU) and pause the video at 4:45. Complete Table 6, by identifying the inputs, processes, outputs and stores likely to be occurring in a fjord.  Resume [Water Cycle – Stores and Flows (7:11)](https://youtu.be/H_noB4UYDJU) and identify inputs, processes, outputs and stores. As a class, discuss and complete the following questions:   * What are the main inputs and outputs of the water cycle? * How does precipitation contribute to the water cycle? * What is evaporation and how does it fit into the water cycle? * What role do plants play in the water cycle? * What is the difference between a closed and open system? | Students can draw and label the detailed features of the water cycle.  Students can compare and contrast average annual, seasonal and monthly rainfall data.  Students can analyse rainfall trends, factors that influence Australian rainfall, and the significance of rainfall in different months.  Students can explain heavy rainfall events in Australia and their relationship with flash flooding, weather systems and global warming.  Students can explain factors that influence precipitation in different locations.  Students can identify different types of water storage and the percentage of water stored in different systems in Australia and worldwide.  Students can identify inputs, processes, outputs, and stores of the water cycle. | Pre-teach key vocabulary and concepts.  Provide a simplified diagram or visual aid of the water cycle.  Offer writing scaffolds for paragraph structure.  Model the use of geographical tools.  Consider student needs in group work or offer options to work independently, or in pairs.  Use closed captions when viewing video content and provide transcripts.  Encourage students to use target language in context during practical activities. |  |
| The processes, cycles and circulations connecting natural systems, including:   * hydrological systems   **Example(s):**   * catchment functioning * water storages and flows   **Geographical tools/skills**   * Topographic maps * Cross sections * Hydrographs * Spatial technologies * Visual representations | **Teacher note:** schools may like to consider conducting fieldwork in this section of the learning sequence by undertaking a geographical inquiry in a local catchment or sub catchment. Fieldwork examples that would align with this section of the learning sequence would include constructing a transect, recording river flow and constructing a hydrograph, or interviews with experts in the field.  In groups examine a case study of a water storage project. Use the outline included in Activity 10 – water storage case study in the resource booklet to gain an overview of the case study options.  **Teacher note:** students will need access to tracing paper and a topographic map of a catchment area. [Google maps](https://www.google.com/maps/@-33.2069038,150.5107629,7.65z) in terrain mode may be a useful resource for this. For the task on water catchment stories, the resource [Water in New South Wales](https://www.industry.nsw.gov.au/water/basins-catchments/snapshots) may be shared with the class to provide students with inspiration for choice of catchments.  Using [National Geographic – Tributary](https://education.nationalgeographic.org/resource/tributary), tracing paper and topographic maps, construct an annotated diagram of a catchment that includes the following details:   * watershed with relevant spot heights identified * tributaries * rivers * overland flow direction.   Students access [Cross sections and transects (2:53)](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/hsie-curriculum-resources-k-12/hsie-7-10-curriculum-resources/cross-sections-and-transects) and the topographic map of your catchment to draw a cross-section.  Calculate vertical exaggeration for the cross-section.  **Teacher note:** students may need to access the video [Mapwork Vertical Exaggeration (6:14)](https://youtu.be/wGnoU0HbbP0) for an explanation on how to calculate vertical exaggeration. Consider accessing past examinations for skills questions requiring knowledge and understanding of vertical exaggeration.  Using the definitions found on the [Queensland Government Wetland Info](https://wetlandinfo.des.qld.gov.au/wetlands/ecology/processes-systems/water/hydrology/) webpage, and a local topographic map, conduct a [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645#.Y6EliJvfwO0.link) to identify examples of catchment scales in your regional area. For regional areas, identify examples of each catchment scale, such as:   * region * sub catchment * land unit * subunit.   Access [Queensland Government Wetland Info – River Flows (hydrograph)](https://wetlandinfo.des.qld.gov.au/wetlands/ecology/processes-systems/water/hydrology/river-flows/) and discuss the following questions as a class:   * What is a hydrograph and how is it used to describe river flows over time? * How is baseflow separated from direct runoff or quick flow in a hydrograph? * What is lag time and how is it related to the catchment's flashiness? * How does flooding occur and what are its effects on the river system? * What is bank storage/recharge and how does it occur during high flow or flood? * What is flood recession and why is it important for fish species and riverbanks? * How does the flow velocity in the river channel change from the riverbed to the river surface?   **Note:** Activity 11 – catchment story, in the resource booklet, provides an extension task. | Students collaborated and discussed the challenges associated with water storage.  Students identified relevant spot heights, tributaries, rivers, and overland flow direction.  Students can analyse a case study of a water storage project.  Students utilised Queensland Government Wetland Information and local topographic maps for accurate information.  Students participated in class discussions and provided answers to the posed questions, demonstrating their understanding of hydrographs and river flows.  Students explained the difference between baseflow and direct runoff in their own words showing comprehension of the 2 concepts.  Students completed a list of potential causes of flooding and discussed the impact of floods on river systems and surrounding areas.  Students described how flow velocity changes within river channels and the factors that contribute to these changes.  Students construct a cross section and calculate vertical exaggeration.  Students used a topographic map to annotate a catchment diagram. | Pre-teach key vocabulary related to water storage projects and geographical concepts.  Use visual aids and multimedia examples to explain the concepts.  Provide step-by-step instructions for using topographic map.  Allow students to work in pairs or small groups to complete the activities.  Provide closed captions and transcripts for the video, pausing to check student understanding.  Pre-teach key vocabulary: hydrograph, river flow, runoff, flashiness, flood recession, lag time, fish species, flow velocity, river channel and bank, riverbed, river surface.  Provide a visual example of a hydrograph.  Provide sentence starters or prompts to support students in expressing their thoughts and ideas during the discussion.  Provide writing scaffolds to assist with paragraph structure.  Consider multiple modes of delivering presentation. |  |

### Week 5 – geomorphic systems

**Teacher note:** in the sequence on tectonic boundaries, it is assumed that this will be revision of content covered in Stage 4 or 5. In classes where pre-testing or questioning indicates that this is not the case, teachers may need to provide more detail or scaffolding at the start.

Examples included in the syllabus are provided to support delivery of course content. These examples are not mandatory and teachers may choose to use the examples provided or select appropriate alternatives.

#### Learning Intentions

Students:

* understand the fundamental concepts of plate tectonics and their role in shaping the Earth's surface, including the formation of continents and geological features
* investigate the impact of plate tectonics, volcanic eruptions, and seismic activity on the Australian continent and surrounding regions
* explore the process of soil formation and the factors that influence soil profiles, as well as the importance of soil management
* examine the role of coastal and river processes in shaping landscapes and the formation of various landforms
* analyse the cycles of weathering, erosion, and deposition and their connection to the rock cycle, including the formation of different rock types.

#### Success criteria

Students can:

* accurately complete plate tectonics activities, using their knowledge of plate tectonic types and plate boundaries
* analyse secondary information and answer related questions, demonstrating an understanding of the geological time scale and key events in Earth's history
* describe the changes in the Australian continent over time and the impact of tectonic plate movements on its geography, using GIS Australia – Evolution of a Continent as a reference
* predict and analyse earthquake activity in Australia, using GIS map of historical earthquakes of Australia and Topography of Australia poster
* explain the formation of volcanoes and the role they play in shaping the Earth's surface, using resources such as ‘How volcanic eruptions shape Earth’ and ‘Volcano and Astounding facts about a volcanic landscape’
* identify and describe the main layers of soil profiles and the factors that influence soil formation, using resources like ‘Queensland Government – How soils form’ and engaging in a sediment analysis exercise
* research and present information about river and coastal processes and their impact on landforms, demonstrating their understanding of erosion, transportation, and deposition.

Table – processes, cycles and circulations connecting natural systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-05, GE-11-07, GE-11-09**  The processes, cycles and circulations connecting natural systems, including:   * geomorphic systems   **Example(s):**   * processes at tectonic boundaries   **Geographical tools/skills**   * Geographical information systems (GIS) | Use [Plate tectonic types](https://earthhow.com/plate-tectonics-types-divergent-convergent-transform-plates/) and [Plate Boundaries](https://www.calacademy.org/explore-science/plate-boundaries-divergent-convergent-and-transform) to complete Table 7 which is included as part of Activity 12 – plate tectonics, in the resource booklet, and answer the following questions in Table 8.  Access and discuss the [History of the Earth poster](https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/68903) and respond to the following questions:   * What does the History of the Earth poster depict? * What is the geological time scale? * How has the Earth's surface changed over time according to the poster? * What are some of the key events in Earth's history that are highlighted in the poster? * How have the oceans, continents and boundaries changed over time?   Access GIS’s [Australia – Evolution of a Continent](https://www.ga.gov.au/static/palaeo/palaeo.html) and play the slideshow revealing Australia’s land mass changes through time. Complete the following questions:   * How has the Australia continent changed over time? * How have the movements of tectonic plates influenced the geography of Australia * What were the major events that occurred in Australia? * How did the breakup of the supercontinent Gondwana affect the geography of Australia? * How did the rise and fall of sea levels influence the geography of Australia? * What is the relationship between plate tectonics and the formation of Australia's Great Dividing Range?   As a class, discuss how the Australian continent has undergone significant landmass and tectonic plate changes over time, including the separation from other continents and geological events that shaped its mountains, rivers and deserts.  Complete 2 predicting questions about Australian earthquakes:   1. Is it likely that Australia would have many earthquakes? Why? 2. Where would you expect the most earthquakes to occur in Australia? Why?   Access the GIS map of [Historical earthquakes of Australia](https://geoscience-au.maps.arcgis.com/apps/MapSeries/index.html?appid=72ad590cc9364e41b06907406bb7712e) and [Topography of Australia poster [1.04 MB]](https://www.ga.gov.au/__data/assets/pdf_file/0003/86637/Topography-of-Australia-poster.pdf). Answer the following questions:   * What is the history of seismic activity in Australia? Which regions of Australia are most prone to earthquakes, and why? * How does the location of Australia's tectonic plate affect its susceptibility to earthquakes? * What is the ‘Ring of Fire’ and where is it located? * How does the topography and the 'Ring of Fire' contribute to seismic activity in Australia, and the Pacific and Indian Oceans? * Can earthquakes occur in regions outside of tectonic plate boundaries? If so, how? | Students can answer questions about the history of the earth.  Participation in class discussions.  Students can complete predicting questions to answer questions about seismic activity in Australia. | Scaffold tables with a pre-filled example.  Pair students with mixed abilities to support each other.  Encourage students to use bilingual dictionaries or translation tools as needed.  Allow students to answer questions in different formats (written, verbal, or visual).  Provide additional visual aids for understanding geological time scales.  Present key information through multiple modalities (eg videos, text, images).  Offer step-by-step instructions and modelling for using geographical tools.  Provide graphic organisers to help structure responses.  Differentiate group sizes based on student preferences and needs.  Offer flexible timeframes for completion to accommodate different processing speeds.  Use real-world examples or local contexts to make concepts more relatable and engaging. |  |
| The processes, cycles and circulations connecting natural systems, including:   * geomorphic systems   Example:   * volcanic eruptions | Access [How volcanic eruptions shape Earth (3:44)](https://youtu.be/bHNDRquJ8U8) to complete a [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) based on the following questions:   * Where are volcanoes found? * How are volcanoes formed? * What happens when magma reaches the surface of the Earth? * How does lava turn into igneous rock? * What are the different types of volcanic mountains and what are their characteristics? * What are craters and calderas and how are they formed?   **Teacher note:** the following questions could be completed as a modelled, guided and independent activity to demonstrate PEEL writing structures.  Review [Volcano](https://www.community-safety.ga.gov.au/hazards/volcano) and [Astounding Facts About A Volcanic Landscape](https://www.worldatlas.com/articles/astounding-facts-about-a-volcanic-landscape.html). Use a PEEL [writing scaffold](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/625#.ZCF_6hR7VfM.link) to answer each of the following questions:   * Explain how there are remnants of volcanos in Australia despite not being on the edge of tectonic plates. * Explain why volcanos can be described as both destructive and constructive. * Explain how the interaction between plate boundaries has shaped the earth. | Students can complete a Think-Pair-Share routine based on questions about volcanoes.  Students can write a definition of the 3 main types of volcanoes and explain why volcanoes can be described as both destructive and constructive. | Pre-teach key vocabulary and concepts.  Use closed captions when viewing the video and provide a transcript.  Pause the video at appropriate points to assess student understanding.  Explicitly teach PEEL writing structure and provide a template for students to follow. |  |
| The processes, cycles and circulations connecting natural systems, including:   * geomorphic systems   Example:   * soil formation   **Geographical tools/skills**   * Ternary graphs * Fieldwork | Use [Queensland Government – How soils form](https://www.qld.gov.au/environment/land/management/soil/soil-explained/forms) to discuss the image ‘soil profile’ showing the different layers or horizons. In groups, answer the following questions:   * What is a soil profile and what are the main layers of soil profiles? Relate your response to the image. * How does the accumulation of material through the action of water, wind and gravity contribute to soil formation? * How do physical, chemical and biological weathering affect soil formation? * What are the 5 main interacting factors affecting soil formation? * What is the influence of parent materials on soil properties? * How do organisms influence soil formation? * What is the role of climate in soil formation? * How does the topography of a slope affect soil formation? * What are the main horizons of soils and how do they differ in terms of texture, fertility and biological activity? * Why is soil considered a valuable resource and why is it important to manage it carefully? * How would the factors of time, parent material, climate, topography and organism influence a soil profile?   **Teacher note:** [What is the Process of Soil Formation and Factors That Affect Soil Formation](https://eartheclipse.com/environment/process-and-factors-of-soil-formation.html)? provides useful background information on soil formation and factors influencing soil formation. This resource might be useful for teacher professional learning. Teachers may also wish to create an alternative fieldwork task for this sequence. The illustration of soil profile could be replaced with an actual soil profile in the school or local environment. This could use the same discussion questions and include a horizon identification and soil ribbon task.  [Soil Profiling: The Proper Tools (4:55)](https://youtu.be/UtgTUXl4HMM) will support teacher understanding of the profiling process. At the end of this sequence on soil formation, teachers may consider including a HSC-style skills task pertaining to ternary graphs or provide soil data for students to construct a ternary graph. [Reading Ternary Diagrams](https://grapherhelp.goldensoftware.com/Graphs/Reading_Ternary_Diagrams.htm) and the videos [Other graphs (2:49)](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/hsie-curriculum-resources-k-12/hsie-7-10-curriculum-resources/other-graphs) and, [Ternary plot basics (9:19)](https://youtu.be/KvGJoLIp3Sk) are useful in outlining this skill.  [NESA HSC exam papers](https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/resources/hsc-exam-papers) provide a useful reference point for exam style skills questions.  As a class complete a sediment analysis exercise to identify and characterise the size and shape of soil materials in (a) given sample area(s) using [Grain size chart [PDF 461 KB]](https://www.ga.gov.au/__data/assets/pdf_file/0005/86549/Grain-size-card.pdf). Activity 13 – soil identification, in the resource booklet, provides a procedure to follow.  Access [Australian Soil Classification (ASC) soil type map of NSW](https://www.environment.nsw.gov.au/eSpade2Webapp/) and a blank map of NSW to construct a soil map of NSW. Research and discuss the following:   * identifiable characteristics in a soil profile for example, the B horizon of a Podosol soil is dominated by compounds of organic matter * parent material * porosity and water storage capacity * processes involved in soil formation of the soil type. | Students can complete questions about soil formation.  Students can identify, conduct and interpret a soil profile.  Students can identify and characterise the size and shape of soil materials in (a) given sample area(s) using Grain size chart.  Students can present research in multiple forms. | Pre-teach key vocabulary: soil profile, horizons, weathering, topography, parent material, organisms, and climate.  Explicitly demonstrate the correct use of soil profiling tools.  Model the process of soil profiling.  Include multiple opportunities to respond, such as verbally, non-verbally, or through gestures.  Consider multiple modes of delivering presentations such as oral, visual, or multimedia formats. |  |
| The processes, cycles and circulations connecting natural systems, including:   * geomorphic systems   **Example(s):**   * coastal and river processes   **Geographical tools/skills**   * Photo sketch * Visual representations | Access [River erosion, transportation and deposition (2:09)](https://youtu.be/NJ6bjQPMhIA) and [Erosion and sedimentation: How rivers change the landscape (3:04)](https://youtu.be/EMwGPPJ1Umk).  In small groups, research the following statement ‘How does a river change the land?’  Use the information gathered to create a presentation that provides the following:   * an overview of different types of processes that erode the land and change rivers, such as hydraulic action, abrasion, attrition, and solution. * an overview of different types of processes that transport the eroded material, such as traction, saltation, suspension and solution. * examples of landforms that are created by erosion and deposition along the course of the river, such as waterfalls or meanders. * reasons why the landforms are different in the upper, middle and lower courses of the river.   The presentation will be in a form of the group’s choice, for example a short presentation, a video, a Canva poster, a skit or play.  Use Activity 14 – mind map, in the resource booklet, to collate information from each presentation.  In 3 groups, research [coastal processes](http://www.geography.learnontheinternet.co.uk/topics/coastal_processes.html) that change the landscape. The groups will be erosion, transportation or deposition.  Each group will create a mind map for their coastal process. This mind map must define the process and describe the role of the process in changing the landscape.  Groups will also choose at least one landform created by this process and complete a [photo sketch](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/hsie-curriculum-resources-k-12/hsie-7-10-curriculum-resources/photo-sketch) of the feature that is annotated to explain how the feature is created.  Display the mind map and photo sketch in a [gallery walk](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/555#.Y782IS9Pphk.link). When observing the gallery walk, complete Activity 15 – coastal processes, in the resource booklet. | Students can use graphic organisers to organise information.  Students can explain processes that create landforms and complete an annotated photo sketch of landform features.  Students completed a presentation with overview, examples and reasons clearly shown.  Students completed a mind map of coastal processes.  Students can complete an annotated photo sketch that explains how the features were created.  Students completed a gallery walk that includes mind map, photo sketch and a summary of the role of coastal processes. | Provide a glossary of terms and allow the use of bilingual dictionaries.  Ensure all students understand both technical and culturally-based terms.  Use closed captions when viewing videos.  Consider student needs and alternative options when using thinking activities and graphical organisers.  Offer scaffolds for writing, such as paragraph structure templates.  Provide multiple opportunities for guided practice and skill development. |  |
| The processes, cycles and circulations connecting natural systems, including:   * geomorphic systems   **Example(s):**   * cycles of weathering, erosion and deposition | Create an infographic that shows the entire cycle of weathering, erosion and deposition. Include information that shows the different scales within the cycle.  Complete a [parking lot](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/570#.Y2G8l2DPhHw.link) with the strengths and opportunities for improvement for other groups’ infographics.  Using [Weathering Types,](https://geologyscience.com/geology/weathering-types/) further research and [Google Jamboard](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/593#.Y6J18Rcf1Dw.link) identify and describe:   * physical weathering * chemical weathering * biological weathering.   Discuss the following questions:   * What is physical weathering and how does it differ from chemical weathering? * How do temperature and pressure contribute to physical weathering? * What are the main processes involved in chemical weathering? How does oxidation contribute to chemical weathering? * How does organic or biological weathering differ from physical and chemical weathering?   **Teacher note:** provide students with a selection of rock samples or images that can be used for the following activities. Have students correctly match the samples to their labels before starting.  Access [National Geographic ‘The Rock Cycle'](https://education.nationalgeographic.org/resource/rock-cycle) to identify where in the cycle of weathering, erosion and deposition these samples belong and describe how each was formed, including the:   * identification based on their physical characteristics such as colour, texture, and composition * three main types of rocks: sedimentary, igneous, and metamorphic.   As a class, discuss the following questions:   * Why do we refer to the rock cycle as a cycle? * What is the relationship between the different stages of the rock cycle? * Why might the rock cycle be described as dynamic? | Students created an infographic that illustrates the entire cycle of weathering, erosion, and deposition including the different scales within the cycle.  Students completed a parking lot activity to assess the strengths and opportunities for improvement.  Students demonstrated their ability to compare and contrast the different types of weathering.  Students can represent geographical information in a range of forms such as, infographic, information poster, model, or annotated diagrams. | Pre-teach key vocabulary and concepts related to weathering, erosion, and deposition.  Model how to complete a parking lot, as students may be unfamiliar with this learning tool.  Provide writing scaffolds to assist with structure.  Provide sentence starters and scaffolds for students who need support with communication.  Explicitly teach the language and concepts related to the rock cycle and rock types. |  |

### Week 6 – ecological systems

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

#### Learning Intentions

Students:

* understand the importance of natural processes, such as the carbon and nutrient cycles, in sustaining life on Earth
* demonstrate how energy flows through ecological systems and identify the trophic levels in the flow of energy
* recognise the characteristics of different terrestrial and marine ecosystems and the biotic and abiotic factors that shape them
* analyse the patterns and reasons for animal migration and the links between migration and other natural systems
* develop visual representations, such as maps and diagrams, to communicate complex geographical concepts and tools.

#### Success criteria:

Students can:

* explain the role of the carbon cycle in sustaining life on Earth and the differences between the slow and fast carbon cycles
* identify the different trophic levels in the flow of energy and explain why energy is lost at each level
* describe the characteristics of different terrestrial and marine ecosystems and the factors that determine their type and location
* analyse the patterns and reasons for animal migration and the links between migration and other natural systems, using examples and evidence to support their arguments
* develop visual representations, such as maps and diagrams, to communicate complex scientific concepts accurately and clearly
* identify and describe the nutrients within an ecosystem and explain how decomposition and weathering contribute to the movement of nutrients
* show the factors that affect the biological productivity of terrestrial and ocean biomes and explain the relationship between biological productivity and biodiversity.

Table – ecological systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-05, GE-11-09**  The processes, cycles and circulations connecting natural systems, including:   * ecological systems   **Example(s):**   * energy flows   **Geographical tools/skills**   * Graphs * Statistics * Fieldwork * Visual representations | Access [NASA Earth Observatory’s ‘The Carbon Cycle'](https://earthobservatory.nasa.gov/features/CarbonCycle) and discuss the following focus questions as a class:   * What role does the carbon cycle play in sustaining all life on earth? * How does the slow carbon cycle differ from the fast carbon cycle? * What role does the Earth’s orbit play in influencing the carbon cycle? * How does chemical weathering relate to the slow carbon cycle? * How do fast and slow carbon cycles maintain a steady concentration of carbon in the atmosphere, land, plants and ocean? * How has the carbon cycle changed in response to climate change in Earth's past? * How have variations in Earth's orbit affected the carbon cycle and led to ice ages and warm periods? * How has the correlation between carbon dioxide levels and temperature been demonstrated over the past 800,000 years, using Antarctic ice-core data? * How does deforestation affect the carbon cycle, and why do crops or pasture store less carbon than forests? * How have carbon dioxide and methane concentrations in the atmosphere changed since the beginning of the Industrial Revolution, and what are the implications of these changes? Include data in your response.   **Note:** the carbon cycle is nature's way of reusing carbon atoms, which travel from the atmosphere into organisms in the Earth and then back into the atmosphere repeatedly. Most carbon is stored in rocks and sediments, while the rest is stored in the ocean, atmosphere, and living organisms.  Access [Energy Flow (Ecosystem)](https://sciencing.com/energy-flow-ecosystem-definition-process-examples-with-diagram-13719231.html), [Ecological relationships and energy flow](https://www.bbc.co.uk/bitesize/guides/zp8d4qt/revision/1#:~:text=Energy%20flow-,The%20Sun%20is%20the%20original%20source%20of%20energy%20for%20almost,can%20be%20passed%20onto%20animals.) and [Photosynthesis.](https://education.nationalgeographic.org/resource/photosynthesis) Using the resources, complete the following questions:   * Define energy flow. * Explain the process of photosynthesis in 1–2 sentences. * Identify and describe each of the trophic levels in the flow of energy. * Explain why energy is lost at each trophic level. * Explain why energy flows are unidirectional and non-cyclical.   Using the research and notes on energy flows, create a food chain representing the energy flow between organisms in an ecosystem. This food chain should identify the different trophic levels and places where energy is lost from the flow.  In pairs, use bullet points to summarise:   * how energy flows through ecological systems * how producers and consumers fit into the food chain * the role of primary consumers in a food chain * how the number of trophic levels in a food chain affect the amount of energy available to higher-level consumers * how food webs differ from food chains, and how this affects the energy flow. | Students can discuss NASA Earth Observatory and other sources, focusing on the carbon cycle to complete related questions.  Students can draw a diagram of a food chain and identify trophic levels.  Students can explain the process of photosynthesis.  Students can summarise how energy flows through ecological systems and explain energy loss during this process. | Create a visual glossary with images of ‘photosynthesis’, ‘carbon cycle’ and ‘ecosystem’.  Teach target language explicitly and provide opportunities for guided practice.  Utilise visual aids and multimedia examples to support understanding of concepts related to the carbon cycle, energy flows, nutrient cycles, and biological productivity.  Use a ‘talking stick’ or similar object to facilitate discussions.  Offer multiple presentation formats, such as a PowerPoint presentation, a written essay, or a podcast recording. |  |
| The processes, cycles and circulations connecting natural systems, including:   * ecological systems   **Example(s):**   * nutrient cycles | Access [Living World – Nutrient Cycles (4:08)](https://www.youtube.com/watch?v=T3bJla9N0pc) for background information on the nutrient cycle. Answer the following questions:   * What are the 3 stores of nutrients within an ecosystem? * What is biomass, and how does it relate to the movement of nutrients within an ecosystem? * How does the decomposition of dead material, such as leaves and animal scat, contribute to the movement of nutrients within an ecosystem? * How can deforestation impact the nutrient content of the biomass within an ecosystem? * How can rainfall impact the movement of nutrients within an ecosystem, particularly litter and soil stores? * What is leaching, and how can it impact the nutrient content of the soil within an ecosystem? * What is weathering, and how can it add nutrients to the soil within an ecosystem? * What are some other ways in which nutrients can be added to or lost from the 3 stores within an ecosystem?   Use [Nutrient Cycling](https://mdocs.skidmore.edu/crandallparktrees/ecosystem/nutrient-cycling/) to record the different essential nutrients found in the soil in each category:   * non-mineral * macro minerals * micro-minerals.   Create a diagram identifying the nutrients found in soils (include the carbon, nitrogen, and oxygen cycles).  Use [The nutrient cycle in the rainforest](https://www.internetgeography.net/topics/the-nutrient-cycle-in-the-rainforest/) and [Under the Canopy: a guide to the rainforests of NSW](https://www.nationalparks.nsw.gov.au/education/teacher-resource-rainforests-nsw-stage-6-geography#:~:text=Under%20the%20Canopy%3A%20a%20guide%20to%20the%20rainforests%20of%20NSW%20(6.3MB%20pdf)) from NSW National parks and wildlife service, to identify examples of the interdependence between the 3 stores of nutrients in the rainforest. Respond to the following prompts:   * To what extent is the nutrient cycle critical to the functioning of rainforests? * Discuss the ways that humans can impact the nutrient cycles, both positively and negatively. | Students create a diagram identifying how nutrients move through ecological systems. | Use closed captions and provide the transcript when using video.  Provide scaffolded writing frames or outlines to support students in structuring their written responses.  Use interactive maps or digital tools to help students explore various terrestrial and marine ecosystems. |  |
| The processes, cycles and circulations connecting natural systems, including:   * ecological systems   **Example(s):**   * biological productivity | Use the data from [Table 1: Global and ecosystem-scale estimates](https://www.nature.com/scitable/knowledge/library/terrestrial-primary-production-fuel-for-life-17567411/#:~:text=Table%201%3A%20Global%20and%20ecosystem%2Dscale%20estimates) to rank terrestrial biomes in order of greatest biological productivity to least. Answer the following question:   * Does this ranking give an accurate impression of the value of the individual biomes? Why or why not?   In pairs, brainstorm what quantitative data could be used to measure the biological productivity of an ecosystem.  In small groups, review the following definition of biological productivity:  Primary biological productivity refers to the amount of living plant or organic material (biomass) produced by plants (autotrophs) during the process of photosynthesis. This is measured in units of energy like kilojoules or in units of weight like tonnes. Secondary primary productivity refers to the generation of biomass by heterotrophs (consumers of plants like bacteria, fungi and animals). Biological productivity varies across the world and across time.  Collaboratively create a visual representation of the definition, for example a mind map.  As a class, complete the following:   * Brainstorm factors that may affect the biological productivity of terrestrial and ocean biomes. * Discuss the contrast between the biological productivity of a region or ecosystem with the concept of biodiversity.   Use The World Bank article, [Improving Food Security and Agricultural Productivity: A Priority for Burkina Faso](https://www.worldbank.org/en/news/feature/2016/02/10/improving-food-security-and-agricultural-productivity-a-priority-for-burkina-faso) to respond to the following question:   * To what extent is food security for the planet reliant on biological productivity? | Students identify quantitative data that could be used to measure the biological productivity of an ecosystem. | Provide a glossary of terms and allow the use of bilingual dictionaries.  Ensure all students understand both technical terms.  Consider student needs and alternative options when using thinking activities and graphical organisers.  Offer scaffolds for writing, such as paragraph structure templates. |  |
| The processes, cycles and circulations connecting natural systems, including:   * ecological systems   **Example(s):**   * land-based and marine ecosystems   **Geographical tools/skills**   * Photo or field sketch | Use school resources and National Geographic’s [Biomes, Ecosystems, and Habitats](https://education.nationalgeographic.org/resource/biomes-ecosystems-and-habitats/) to:   * define habitat, ecosystem, and biome * discuss ‘What are the key differences between ecosystems, habitat and biomes?’   Use school resources and [Marine Ecosystems](https://education.nationalgeographic.org/resource/marine-ecosystems) to complete the following:   * Describe marine ecosystems and their unique biotic and abiotic factors. * Draw photo sketches or field sketches of the main marine ecosystems, including: estuaries, mangrove forests, coral reefs and the open ocean. * Annotate each of these photo sketches or field sketches with key features. (for example, where they are found, how they are created, and the main organisms the marine ecosystem supports).   **Teacher note**: provide images of the marine ecosystems for use by students in completing a [photo sketc](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/hsie-curriculum-resources-k-12/hsie-7-10-curriculum-resources/photo-sketch)h. Alternatively, if accessible to your school context swap the photo sketch learning activity for a [field sketch](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/hsie-curriculum-resources-k-12/hsie-7-10-curriculum-resources/conducting-a-field-sketch) activity.  Use school resources and [Terrestrial Ecosystem](https://education.nationalgeographic.org/resource/resource-library-terrestrial-ecosystem) to define terrestrial ecosystem and identify examples of biotic and abiotic factors that determine the type of terrestrial ecosystem that will be found in a particular location.  Access [The Vital Chain: Connecting Ecosystems of Land and Sea](https://e360.yale.edu/features/the_vital_chain_connecting_the_ecosystems_of_land_and_sea) and make brief notes on 5 big ideas from the article. Using these notes, write a paragraph response to the following question: ‘Explain the importance of recognising and managing links between land based and marine ecosystems’. | Students compare and contrast land-based and marine ecosystems.  Students work collaboratively to create visual representations.  Students can complete an annotated field or photo sketch. | Provide a glossary of terms and allow the use of bilingual dictionaries.  Ensure all students understand the relevant geographical terminology. |  |
| The processes, cycles and circulations connecting natural systems, including:   * ecological systems   **Example(s):**   * natural phenomena such as species migration   **Geographical tools/skills**   * Thematic map | In pairs, review [Animal Migration](https://education.nationalgeographic.org/resource/resource-library-animal-migration) and select 2 species that migrate. Complete a [Venn diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599#.Y79F5cCjPgA.link) to compare where, when, why and how the 2 species migrate. Use a blank map and the task outline in ‘Activity 16 – thematic map’, from the resource booklet, to develop a thematic map that identifies the migration pattern of the 2 species.  Use the Venn diagrams to collaboratively construct a simple mind map that summarises:   * the main reasons for species migration * the links between the migrations and other natural systems.   Construct a 1–2 paragraph response to the following question, ‘To what extent is animal migration linked to other natural systems?’. On completion, pass the response to a peer for feedback based on the following criteria:   * The response has a clear topic sentence that answers the question, that is, makes a qualified judgement about the extent to which animal migration is linked to other natural systems. * The response uses examples and evidence to support the main idea, for example the response may link whale migration to atmosphere-ocean circulations and the warmth of the oceans. | Students construct a Venn diagram comparing species migrations.  Students complete a structured response to a given question.  Peer feedback is given based on provided criteria. | Include multiple opportunities to respond, such as verbally, non-verbally, or through gestures.  Present key information through multiple modalities, eg videos, text, images.  Offer step-by-step instructions and modelling for using geographical tools.  Provide graphic organisers to help structure responses.  Offer flexible timeframes for completion to accommodate different processing speeds. |  |

## Natural systems and land cover change

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

### Week 7 – the nature and extent of Earth’s land cover

#### Learning intention

Students:

* develop an understanding of global land cover and land use patterns and the natural processes that influence them
* interpret and process data using various graphical representations and geographical tools
* investigate the impact of climatic and glacial cycles and ecological succession in shaping Earth's land and water cover
* understand the natural processes, cycles and circulations that have shaped the land and/or water cover of ONE place.

#### Success criteria

Students can:

* accurately estimate land cover percentages and create a pie graph to represent the data
* compare and contrast different types of graphs and maps, and their respective advantages and disadvantages
* effectively use the websites and maps to visualise and analyse land cover and land use data
* describe the nature and extent of Earth’s land and water cover and the factors that influence them
* explain the Last Glacial Maximum (LGM) and its impact on Earth's climate, sea level, and ice sheets
* create an illustrative timeline and response of invasion and the ecological succession of vegetation communities at Lake Mungo.

Table – the nature and extent of Earth's land cover

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-09**  The nature and extent of Earth’s land cover, including water  **Geographical tools/skills**   * Maps * Geographic Information Systems (GIS) * Sector (pie) graph | Working in pairs, use the definition the [Department of Agriculture, Fisheries and Forestry](https://www.agriculture.gov.au/abares/aclump/definitions#:~:text=Land%20cover%20refers%20to%20the,as%20agriculture%20and%20built%20environments.) provides of land cover and the National Ocean Service’s article ‘[What is the difference between land cover and land use](https://oceanservice.noaa.gov/facts/lclu.html#:~:text=Land%20cover%20data%20documents%20how,%2C%20conservation%2C%20or%20mixed%20uses.)’, and answer the following:   * identify examples of land cover * explain how land cover is different to land use.   Access [Global Land Cover](https://lcviewer.vito.be/2019) to estimate the percentage of the world’s landcover in the following categories.   * forests * shrubland * herbaceous vegetation * herbaceous wetland * moss and lichen * bare or sparse vegetation.   Use the percentages to create a sector graph.  Compare the sector graph with the world map graph from [How the world’s land is used](https://ourworldindata.org/land-use#how-the-world-s-land-is-used-total-area-sizes-by-type-of-use-cover). In pairs, complete the following:   * Do the 2 charts convey identical data? Provide an explanation. * What is the main source of data used for estimating global land use? * How does the distribution of land use categories in the sector graphs compare to their visual representation on the world map graph? * Which land cover classifications prove to be more valuable? Elaborate on the reasons. * What are the advantages and disadvantages with using the world map as a substitute for a sector graph? * What is the total land area occupied by agricultural land, and how does it break down between arable and permanent crops versus pastures? * What percentage of the world's land is covered by urban areas, and how does this compare to other land use types?   Access the interactive map [Global land cover and land use 2019](https://glad.earthengine.app/view/global-land-cover-land-use-v1#lon=0;lat=0;zoom=3;) (GLAD) to answer the following:   * How does the GLAD website use Google Earth Engine to visualise global land cover and land use data? What is the map's primary purpose? * Is this a small-scale or large-scale map? * What geographical tools and skills are required to effectively interpret the data provided by the GLAD website? * Who do you think is the intended audience of this map? * How can the data from the GLAD website be combined with other geographic data or tools to create more comprehensive analysis of land cover and land use trends?   Access Google’s [My Maps](https://www.google.com.au/maps/about/mymaps/) to construct a land use map illustrating land cover in a suburb or regional area. Include the following spatial data on the map:   * Earth’s physical/natural features (for example, forested areas, wetlands, water bodies) * anthropogenic elements that are derived from human activity and influence the environment (for example, plantations, crops and built environments).   Activity 17 – land use map, in the resource booklet, provides details of the types of maps that can be used to complete this activity.  Complete a one paragraph response to the following question: ‘Describe the nature and extent of Earth’s land cover, including water.’ The response should include reference to:   * the diverse nature and extent of land and water cover * anthropogenic elements (for example, crops). | Students can identify and explain the difference between land cover and land use.  Students compared sector graphs with world map data and discussed differences in land use representation.  Students create a land use map of their local area including both natural features and anthropogenic elements.  Students can annotate a map. | Provide a glossary of key vocabulary terms and definitions related to land cover and land use.  Use visual aids, such as images or videos, to illustrate examples of land cover and land use.  Offer alternative ways to create the sector graph, such as using digital tools or manipulatives.  Encourage students to use target language during discussions and provide sentence stems to guide their responses. |  |
| Natural processes, cycles and circulations that change Earth’s land and water cover, including:   * climatic and glacial cycles * sea-level changes * retreating ice sheets   **Geographical tools/skills**   * Thematic maps | Use the map, [The Global Last Glacial Maximum](https://www.antarcticglaciers.org/2017/06/global-last-glacial-maximum/), and a [blackline map of the world](https://www.teachersprintables.net/preview/Map_of_World) to draw an annotated map illustrating the glacial cover of earth at Last Glacial Maximum (LGM) roughly 20,000 years ago during the Pleistocene epoch. Answer the following questions:   * What is the LGM, and how did it impact the Earth's climate? * What were the main drivers of the Earth's climate during the LGM? * How did the LGM affect sea level and the extent of ice sheets around the world? * What role did Antarctica play during the LGM, and how did its ice sheet contribute to sea level changes? * How have scientists been able to reconstruct past climate conditions during the LGM, and what techniques have they used to study the Earth's climate history?   Access [Energy Education’s Glacial and interglacial periods](https://energyeducation.ca/encyclopedia/Glacial_and_interglacial_periods) and discuss with a partner the relevance of glacial cycles on the land and water cover we observe on Earth today. Include the following terms as prompts for discussion.   * Ice Age * glacial * interglacial.   Use Figure 2 from the article ‘[Energy Education’s Glacial and interglacial periods](https://energyeducation.ca/encyclopedia/Glacial_and_interglacial_periods)’ and ‘[Introduction to Climate Science](https://open.oregonstate.education/climatechange/chapter/paleoclimate/)’ to answer the following questions:   * Approximately how long ago was the LGM? * How much colder were global average surface air temperatures during the LGM? * How much lower was atmospheric CO2 during the LGM compared to the pre-industrial late Holocene? * What are glacial and interglacial periods, and how do they differ from each other? * What causes the Earth to go through these cycles of glacial and interglacial periods? * What evidence do we have of past glacial and interglacial periods, and how do we study them? * How do glacial and interglacial periods affect the Earth's climate and ecosystems? * Are we currently in an interglacial period, and if so, how long do these periods typically last? * How have human activities influenced the Earth's climate and the occurrence of glacial and interglacial periods?   Access [Milankovitch (Orbital) Cycles and Their Role in Earth's Climate](https://climate.nasa.gov/news/2948/milankovitch-orbital-cycles-and-their-role-in-earths-climate/#:~:text=He%20calculated%20that%20Ice%20Ages,years%2C%20matching%20Earth's%20eccentricity%20cycle.) to conduct a [mind mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542?clearCache=c5d2b2a2-65cb-48b4-2919-9540d84b9892) activity to answer the following questions:   * What are Milankovitch orbital cycles and how do they influence Earth's climate? * How did Milutin Milankovitch discover the correlation between Earth's climate and its orbital cycles? * What is the relationship between climatic and glacial cycles and changes in sea levels and ice sheets?   Use [Forces shaping Willandra Lakes (1:10)](http://www.visitmungo.com.au/landscape-in-action) to construct a flow chart summarising the sea-level and climate changes that occurred to form the current day Willandra Lakes region. Then use [45,000 years at Lake Mungo (1:08)](http://www.visitmungo.com.au/landscape-in-action) to describe in 1–2 paragraphs how sea level change influenced the Willandra Lakes land and water cover.  Create a series of study cards for the topic ‘Climatic and glacial cycles that change Earth’s land and water cover’. These study cards will act as revision prompts for this topic in the future. | Students can discuss the relevance of glacial cycles to land and water cover observed on Earth today.  Students can explain the processes, cycles, and circulations that have shaped the land or water cover in a chosen place in the world.  Students can construct a flow chart summarising sea-level and climate changes.  Students can explain the processes, cycles, and circulations that have shaped the land or water cover in a chosen place in the world. | Provide different methods of creating the map, either on paper or digitally.  Scaffold questions, starting with simpler ones and gradually increasing complexity.  Model how to navigate the websites and use their features.  Provide a writing scaffold to assist students with paragraph structure.  Encourage peer editing and revision to support the development of students' writing skills. |  |
| Natural processes, cycles and circulations that change Earth’s land and water cover, including:   * the invasion and ecological succession of vegetation communities | Access [Ecological Succession (3:08)](https://youtu.be/zLduuefGVSc) and [Succession (2:33)](https://youtu.be/9kkWxUgMHfA) to define the following terms:   * ecological succession * primary succession * secondary succession.   In pairs, use [Ecological succession](https://news.uchicago.edu/explainer/what-is-ecological-succession) and [Mungo Plants](https://www.donsmaps.com/mungoplants.html) to develop an illustrative timeline of invasion and the ecological succession of vegetation communities at Lake Mungo. The following questions should guide the inquiry:   * What was the climax community (definition below) that existed at Lake Mungo 45,000 years ago? * How did the retreat of the inland lake (Lake Bungunnia) in the Murray Basin result in ecological succession? * Describe the vegetation that exists at Lake Mungo today and how this community formed.   **Teacher note:** a ‘climax community’ is the stable and final stage of ecological succession in a particular habitat or ecosystem, characterised by a balance of species adapted to the prevailing environmental conditions.  Using previous activities and information, explain the influence of invasion and ecological succession on vegetation communities and change in land cover.  Work through the following scenario research task:  ‘As an environmental engineer for UNESCO, you have been asked to prepare a report on the natural processes, cycles and circulations that have shaped the land or water cover in ONE place in the world. This report should be 3–5 pages and should integrate geographical tools such as maps, graphs and diagrams.  The report should be broken into 4 sections, including:   * atmospheric systems * hydrological systems * geomorphic systems * ecological systems.   Have students reflect on what they have learnt about the natural processes, cycles and circulations using the following sentence stems as a guide:   * I used to think … * Now I think … | Students can explain the influence of invasion and ecological succession on vegetation communities and land cover changes.  Students can complete an accurate timeline on invasion and succession of vegetation communities. | Use closed captions and transcripts when viewing videos.  Provide visual aids, such as images or videos, to illustrate examples of ecological succession.  Provide students with key time periods or years to be included on the timeline.  Offer multiple modes for students to complete their reflections, such as orally, in writing, or using digital tools. |  |

### Weeks 8–9 – case study and fieldwork

**Teacher note:** fieldwork is likely to take place over several days if located away from the school. Time has been provided within this learning sequence to accommodate a 3–4-day fieldwork activity. Introduce the fieldwork question, ‘Explain the natural processes, cycles and circulations that have shaped the land and water cover at Mt Kosciuszko’. Provide an overview of the alpine environment, geographical tools and instruments that will be used.

Consult the NSW Department of Education's [Excursion](https://education.nsw.gov.au/policy-library/policies/pd-2004-0010) policy, and ensure risk assessments are conducted prior to any fieldwork activities.

#### Learning intentions

Students:

* gain practical experience in conducting fieldwork by using geographical tools and techniques to collect, analyse and interpret data from a natural environment
* develop the ability to connect theoretical knowledge of natural processes, cycles and circulations to real-world observations and findings during fieldwork
* learn to use geographical tools and instruments to collect and interpret primary data in the field effectively.

#### Success criteria

Students can:

* accurately identify and describe the natural processes, cycles, and circulations that have shaped the land and water cover at Mt Kosciuszko
* effectively use geographical tools and instruments, such as GPS, topographic maps and vegetation transects to collect primary data in the field
* interpret and process the primary data collected during the fieldwork, discussing the reliability, validity and limitations of the data
* produce a well-structured written response to the fieldwork question using both primary and secondary data to support their argument.

Table 8 – case study and fieldwork

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-02, GE-11-05, GE-11-07**  The natural processes, cycles and circulations that have shaped the land and/or water cover of ONE place  **Geographical tools/skills**   * Latitude and longitude * Topographic maps * Transects * Observations * Climatic data * Quadrants * Photographs   **Geographic inquiry process**   1. Acquire 2. Process 3. Apply 4. Communicate | **Before the fieldwork**  Familiarise with the geographical tools and instruments of measurement that will be used to collect primary data in the field. Practice utilising these tools in the school environment.  Visit the National Parks and Wildlife Service website for more information on [Kosciuszko National Park (KNP)](https://www.nationalparks.nsw.gov.au/visit-a-park/parks/kosciuszko-national-park). Review the visitor information, topographic maps and overview for the [Thredbo-Perisher area](https://www.nationalparks.nsw.gov.au/visit-a-park/parks/thredbo-perisher-area) and the [Mount Kosciuszko Summit Walk](https://www.nationalparks.nsw.gov.au/things-to-do/walking-tracks/mount-kosciuszko-summit-walk).  **Teacher note:** a briefing should be conducted with students prior to departing the school. This will include final information on weather, accommodation, risk mitigation and expectations of student behaviour.  Lead fieldwork at Kosciuszko National Park as part of [Assessment task 1](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/planning-programming-and-assessing-hsie-11-12/planning-programming-assessing-geography-11-12). Alternative locations can be utilised, and fieldwork requirements adapted to suit the new context as required.  Complete a 3-day fieldwork activity, using geographical tools to collect primary data including:   * GPS to identify latitude and longitude * using a topographic map, recording an estimated altitude and identifying aspect * constructing a vegetation transect * record the characteristics of flora and implications for fauna * estimating percentage of ground cover and vegetation diversity * estimating percentage of canopy cover and species diversity * recording climatic data * drawing an annotated field sketch * recording observations of water storage and flows * collecting and interpreting photographic images.   **After the fieldwork**  Conduct a brainstorming session to identify the key learning from the fieldwork.  Contribute to a shared [Google Jamboard](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/593#.ZA6IoVq6VMg.link) to compile class brainstorming responses about the key learnings from the fieldwork.  Display a range of photographs taken during the fieldwork. Review the photographs and use sticky notes to annotate each image, identifying the following:   * processes, cycles and circulations * land cover * water cover * other relevant observations.   Select photos to be included as part of the primary data recorded on the fieldwork data sheets provided with [Assessment task 1](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/planning-programming-and-assessing-hsie-11-12/planning-programming-assessing-geography-11-12).  Discuss and respond to the following questions:   * What processes, cycles and circulations were evident during the fieldwork? * How are these processes, cycles and circulations impacted by the geographic location? * Why does the data collected help us to understand the land and water cover in KNP? * Is the data and information gathered reliable, valid, and useful? * Identify any limitations in the data collected.   **In-class assessment activity**  Students complete a written response to the fieldwork question:  ‘Explain the natural processes, cycles and circulations that have shaped the land and water cover at Mt Kosciuszko’. Use primary and secondary data to support your response.  The written response **and** fieldwork notes should be collected for marking.  Complete a class discussion, sharing observations, findings, and experiences from the fieldwork.  Identify any challenges, the limitations of the data, and the connections between the observed phenomena and the theoretical.  Create visual representations, such as graphs, charts, or maps, to illustrate the key findings from the fieldwork data.  Utilise these visualizations to better understand the natural processes, cycles, and circulations at play in the study area.  Conduct research using secondary sources to gather additional information on the study area and compare their fieldwork findings with other studies and data.  Prepare a written report or presentation to summarise the fieldwork findings, the data analysis, and conclusions about the natural processes, cycles, and circulations that have shaped the land and water cover at the study site. Include both primary and secondary data to support their arguments and address any limitations in their research.  Reflect on and evaluate individual performance and consider lessons learned, challenges faced, and how tools, skills and knowledge can be applied to future fieldwork or other geographical studies. | Students can use geographical tools in the field to collect primary data.  Students can interpret and annotate photographic images.  Students can evaluate and synthesise fieldwork data.  Students can communicate fieldwork findings in a structured written response supported by appropriate data and information. | Virtual fieldwork for students with physical disability or limitations.  Use [Outdooractive](https://www.outdooractive.com/en/knowledgepage/welcome-to-outdooractive-/61393841/) to track and develop virtual options or utilise [Google Streetview Trekker in NSW National Parks](https://www.nationalparks.nsw.gov.au/google-trekker) which provides a virtual experience of the summit walk.  Use target language during discussions.  Model how to navigate websites and use their features.  Provide a writing scaffold to assist students with paragraph structure. |  |

### Week 10 – the Geographical Investigation

**Teacher note:** begin with a brief introduction to Geographical Investigation, its importance and its role in understanding and managing places and environments, including:

* the nature of geographical inquiry and how it can contribute to the understanding and effective management of places and environments
* the nature of engagement with geographical opportunities and challenges in the public sphere, including the role and influence of research institutions, government, advocacy groups, the media and the individual

See the [Geographical Investigation sample assessment task](https://education.nsw.gov.au/teaching-and-learning/curriculum/hsie/planning-programming-and-assessing-hsie-11-12/planning-programming-assessing-geography-11-12) for further details and scaffolds to support delivery of this week’s activities. When discussing topics for investigation and ethical practices, consult the [Controversial issues in schools](https://education.nsw.gov.au/policy-library/policies/pd-2002-0045) policy for guidance.

#### Learning intentions

Students will:

* understand the nature and importance of geographical investigation and its role in understanding and managing places and environments, as well as develop their own geographical inquiry
* develop the necessary skills to plan, conduct, and present a geographical investigation using a variety of research methods, data collection techniques, and communication strategies
* engage in ethical practices during their geographical investigation and learn to critically analyse and evaluate the reliability and relevance of various sources of information.

#### Success criteria

Students can:

* articulate the purpose and relevance of geographical investigation in the context of understanding and managing places and environments and can identify potential stakeholders involved in the process
* effectively develop geographical questions related to their chosen area of inquiry and create a comprehensive research plan that includes research methods, data collection techniques, and a timeline for completing their investigation
* demonstrate competence in various data collection methods, such as fieldwork, mapping, remote sensing, interviews, and surveys, and can differentiate between primary and secondary data
* effectively organise, process, and analyse data from various sources, evaluate the reliability and relevance of the sources, and use the information to support their geographical investigation
* present and communicate their geographical investigation findings using appropriate methods, considering their context, skills, preferences, and individual circumstances, while also engaging in ethical practices throughout the process.

Table 9 – introducing the Geographical investigation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **GE-11-01, GE-11-02, GE-11-05, GE-11-06, GE-11-07, GE-11-08, GE-11-09**  Identify an area for geographical inquiry  **Geographical tools/skills**   * Latitude and longitude * Topographic maps * Observations * Climatic data * Photographs | Outline the steps that will need to be undertaken as part of the geographical investigation, including:   * How to plan and conduct ONE Geographical investigation to develop understanding of the nature of geographical inquiry through practical research and the application of geographical concepts, skills and tools. * How to present and communicate findings using methods that suit the context, skills, preferences and individual circumstances.   Explore the possible different stakeholders involved in a geographical inquiry, such as research institutions (CSIRO, ANU, Institute of Australian Geographers), government (local, state and federal), advocacy groups (Wilderness Society, Land Care), the media (ABC, Guardian), and individuals.  As a class, discuss the ethical practices involved in conducting a geographical investigation.  Work in groups to brainstorm and discuss geographical issues encountered in the news or in the local community.  Identify possible areas for geographical inquiry by discussing the selection criteria, such as relevance, interest, and feasibility.  As a class, brainstorm potential topics for a geographical investigation. Students identify their top 3 choices, with a brief explanation of why they find each topic interesting and relevant.  Choose a topic for the geographical investigation and formulate 2–3 research questions related to the chosen topic. Submit to teacher for review. | Students have completed a geographical investigation introduction.  Students can comprehend the nature and importance of geographical inquiry.  Students have formulated research questions and identified inquiry areas. | Provide a glossary and allow the use of bilingual dictionaries for uncommon terms.  Ensure all students understand both technical and culturally based terms by teaching the language explicitly and offering guided practice opportunities.  During practical learning activities, emphasise the target language required and encourage students to use this language in context. |  |
| Develop geographical questions and formulate a plan, including:   * What is the focus of the research? * What is the geographic extent of the investigation? * How should the investigation be sequenced? * What time should be allocated to the various steps? | Formulate 3–5 geographical questions related to the chosen area of inquiry. Create a mix of open-ended and closed-ended questions.  Share the questions with the class and receive feedback from peers.  Discuss and review the components of a research plan, including the focus of the research, geographic extent of the investigation, investigation sequencing, and time allocation for various steps.  Outline the importance of a well-structured research plan and how it helps guide the investigation process. This includes various research methods and data collection techniques commonly used in geographical investigations, such as fieldwork, mapping, remote sensing, interviews and surveys.  Create a research plan for the chosen topic.  Create a visual representation of the research plan, such as a flowchart, Gantt chart, or timeline to assist in planning the sequence of tasks and the time required for each step of the investigation.  Present the research plan and visual representation to the class.  **Note:** students to provide constructive feedback on their peers' plans and offer suggestions for improvement.  The teacher will also provide feedback and guidance as needed.  Discuss the difference between, and importance of using, appropriate primary and secondary data.  Review processes for how to collect, record, and process primary data through various methods.   * **Fieldwork:** discuss techniques such as sketching, mapping, and photography, as well as equipment like GPS devices and field notebooks. * **Surveys:** teach students how to design and conduct surveys, both online and offline, and how to analyse the collected data. * **Interviews:** explain the importance of interviews in gathering qualitative data and provide guidelines on how to prepare and conduct interviews effectively. * **Observations:** discuss how to make systematic observations and record them in a structured way for later analysis.   Examine how to organise and process secondary information from different sources, including:   * **Books and articles:** explain how to use libraries, databases, and online resources to find relevant books and articles, and how to take effective notes. * **Online resources**: introduce students to reputable websites, databases, and GIS platforms that offer valuable secondary information for geographical investigations. * **Government and non-government organisations' reports**: show students how to access and use reports from organisations such as the United Nations, World Bank, and NGOs. * **Maps, satellite images, and geospatial data:** teach students how to use and interpret various types of maps and geospatial data for their investigation.   Practice collecting primary data using one of the methods discussed in class (fieldwork, surveys, interviews, or observations).  Each group will choose a different method and they will share their experiences and challenges with the class.  Practice finding and organising secondary information related to the geographical investigations. Use different sources, such as books, articles, and online resources.  Present the findings to the class and discuss the reliability and relevance of the sources used. | Students can create focused, relevant questions for investigation.  Students created and presented research plans.  Students can develop and communicate investigation strategies.  Students have developed visual representations of research plans.  Students can organise and visualise investigation tasks and timeframes.  Students can evaluate reliability and relevance of various sources.  Students can critically analyse and evaluate others' work. | Provide visual and multimedia examples to illustrate concepts and check students' understanding.  Offer multiple opportunities for students to respond such as verbally, non-verbally or through gestures.  Encourage student reflection using various modes, such as orally, in writing, or using digital tools.  Consider multiple modes of delivering presentations, such as oral, visual, or multimedia presentations. |  |

## 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](mailto: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 may 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 may 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)), [hinge questions](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/560), [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 utilise 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/primary-school/teaching-strategies/differentiation).
* **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 may 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 2020a: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](mailto: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), [School Success Model](https://education.nsw.gov.au/public-schools/school-success-model/school-success-model-explained).

**Alignment to the School Excellence Framework**: this resource supports the [School Excellence Framework](https://education.nsw.gov.au/teaching-and-learning/school-excellence-and-accountability/sef-evidence-guide/resources/about-sef) 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-11-05, 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**: [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). Support the diverse learning needs of students using inclusive teaching and learning strategies.

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## Evidence base

NSW Geography 11–12 Syllabus © 2022 NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales.

AITSL (Australian Institute for Teaching and School Leadership Limited) (n.d) [*Learning intentions and success criteria* [PDF 251KB]](https://www.aitsl.edu.au/docs/default-source/feedback/aitsl-learning-intentions-and-success-criteria-strategy.pdf?sfvrsn=382dec3c_2#:~:text=Learning%20Intentions%20are%20descriptions%20of,providing%20feedback%20and%20assessing%20achievement.), AITSL, accessed 26 June 2023.

AITSL (2017) ‘[Feedback Factsheet](https://www.aitsl.edu.au/teach/improve-practice/feedback#:~:text=FEEDBACK-,Factsheet,-A%20quick%20guide)’, AITSL, accessed 26 June 2023.

Brookhart S (2011) *How to Assess Higher-Order Thinking Skills in Your Classroom*, Hawker Brownlow Education, Victoria.

CESE (Centre for Education Statistics and Evaluation) (2020) ‘[What works best: 2020 update](https://education.nsw.gov.au/about-us/educational-data/cese/publications/research-reports/what-works-best-2020-update)’, CESE, NSW Department of Education, accessed 26 June 2023.

NESA (NSW Education Standards Authority) (2022) ‘[Advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units)’, *Understanding the curriculum,* NESA website, accessed 26 June 2023.

NESA (2022) ‘[Proficient Teacher: Standard descriptors](https://educationstandards.nsw.edu.au/wps/portal/nesa/teacher-accreditation/meeting-requirements/the-standards/proficient-teacher)’, The Standards, NESA website, accessed 26 June 2023.

NESA (2022) ‘[Programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming)’, *Understanding the curriculum*, NESA website, accessed 26 June 2023.

Rosenshine B (2012) ‘[P](https://www.aft.org/periodical/american-educator/spring-2012)rinciples of Instruction: Research-Based Strategies That All Teachers Should Know’, *American Educator*, 36(1):12-19, ISSN-0148-432X, accessed 26 June 2023.

Wiliam D (2013) [‘Assessment: The bridge between teaching and learning’](https://www.researchgate.net/publication/258423377_Assessment_The_bridge_between_teaching_and_learning), *Voices from the Middle*, 21(2):15–20, accessed 26 June 2023.

Wiliam D (2017) *Embedded Formative Assessment*, 2nd ed, Solution Tree Press, Bloomington, IN.

Wisniewski B, Zierer K and Hattie J (2020) [‘The Power of Feedback Revisited: A Meta-Analysis of Educational Feedback Research’](https://doi.org/10.3389/fpsyg.2019.03087), *Frontiers In Psychology*, 10:3087, doi:10.3389/fpsyg.2019.03087.

## References

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NESA holds the only official and up-to-date versions of the NSW Curriculum and syllabus documents. Please visit the NSW Education Standards Authority (NESA) website <https://educationstandards.nsw.edu.au/> and the NSW Curriculum website [https://curriculum.nsw.edu.au/home](https://curriculum.nsw.edu.au/).

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

State of New South Wales (Department of Education) (2021) [*Digital Learning Selector*](https://app.education.nsw.gov.au/digital-learning-selector/), NSW Department of Education website,accessed 29 March 2023.

[*Nurturing Wonder and Igniting Passion, designs for a new school curriculum: NSW Curriculum Review* [PDF 1.12MB]](https://nswcurriculumreform.nesa.nsw.edu.au/pdfs/phase-3/final-report/NSW_Curriculum_Review_Final_Report.pdf), © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2020, accessed 14 February 2023.

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Australian National Maritime Museum (8 June 2016) [‘Latitude and longitude explained’ [video]](https://www.youtube.com/watch?v=-8gg98ws2Eo), *Australian National Maritime Museum*, YouTube, accessed 29 March 2023.

BBC (British Broadcasting Corporation) (2023) [Ecological relationships and energy flow (CCEA)](https://www.bbc.co.uk/bitesize/guides/zp8d4qt/revision/1#:~:text=Energy%20flow-,The%20Sun%20is%20the%20original%20source%20of%20energy%20for%20almost,can%20be%20passed%20onto%20animals.), *BBC Bitesize*, accessed 29 March 2023.

Bowater J (3 December 2019) ['River erosion, Transportation and Deposition – Fluvial Processes – AQA GCSE 9-1 Geography 2019' [video]](https://youtu.be/NJ6bjQPMhIA), Mr B, YouTube, accessed 29 March 2023.

Buis A (2 October 2019) ‘[Earth's Atmosphere: A Multi-layered Cake](https://climate.nasa.gov/news/2919/earths-atmosphere-a-multi-layered-cake/)’, NASA (National Aeronautics and Space Administration) Global Climate Change: Vital Signs of the Planet News and Features, accessed 29 March 2023.

Buis A (27 February 2020) ‘[Milankovitch (Orbital) Cycles and Their Role in Earth's Climate](https://climate.nasa.gov/news/2948/milankovitch-orbital-cycles-and-their-role-in-earths-climate/#:~:text=He%20calculated%20that%20Ice%20Ages,years%2C%20matching%20Earth's%20eccentricity%20cycle.)’, *NASA Global Climate Change*, accessed 29 March 2023.

California Academy of Sciences (2023) [*Plate Boundaries: Divergent, Convergent, and Transform*,](https://www.calacademy.org/explore-science/plate-boundaries-divergent-convergent-and-transform) California Academy of Sciences website, accessed 29 March 2023.

Commonwealth of Australia (Geoscience Australia) (n.d.) ‘[Volcano](https://www.community-safety.ga.gov.au/hazards/volcano)’, *Hazards*, GeoscienceAustralia website, accessed 29 March 2023.

Commonwealth of Australia (Geoscience Australia) (n.d.) [*Australia – Evolution of a Continent*](https://www.ga.gov.au/static/palaeo/palaeo.html), Geoscience Australiawebsite*,* accessed 29 March 2023.

Commonwealth of Australia (Geoscience Australia) (n.d.) [*Historical earthquakes of Australia*](https://geoscience-au.maps.arcgis.com/apps/MapSeries/index.html?appid=72ad590cc9364e41b06907406bb7712e) [Earthstar Geographics map], Geoscience Australia website, accessed 29 March 2023.

Commonwealth of Australia (Geoscience Australia) (2007) [*Topography of Australia poster* [PDF 1.65KB]](https://www.ga.gov.au/__data/assets/pdf_file/0003/86637/Topography-of-Australia-poster.pdf), Geoscience Australia*,* accessed 29 March 2023.

Commonwealth of Australia (Geoscience Australia) (2009) [*History of the Earth poster*](https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/68903), Geoscience Australia website,accessed 29 March 2023.

Commonwealth of Australia (Geoscience Australia) (2011) [*Grain size chart*](https://www.ga.gov.au/__data/assets/pdf_file/0005/86549/Grain-size-card.pdf)[[PDF 461KB]](https://www.ga.gov.au/__data/assets/pdf_file/0003/86637/Topography-of-Australia-poster.pdf), Geoscience Australia*,* accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (n.d.)[*About evapotranspiration*](http://www.bom.gov.au/watl/eto/about.shtml#:~:text=Evapotranspiration%20is%20the%20term%20used,of%20both%20transpiration%20and%20evaporation.), BOM (Bureau of Meteorology) website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2014) **‘**[What is El Niño and how does it impact Australia?](http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml)’, Climate updates, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (16 December 2014) ['Understanding ENSO' [video]](https://www.youtube.com/watch?v=dzat16LMtQk), Bureau of Meteorology, YouTube, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2016)[*Indigenous Weather Knowledge*](http://www.bom.gov.au/iwk/index.shtml), BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (5 July 2016)['Understanding the Indian Ocean Dipole' [video]](https://www.youtube.com/watch?v=J6hOVatamYs), Bureau of Meteorology, YouTube, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2019–2020)‘[Water in Australia](http://www.bom.gov.au/water/waterinaustralia/)’, Water assessments, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (25 June 2020) **‘**[The art of the chart: how to read a weather map](https://media.bom.gov.au/social/blog/2391/the-art-of-the-chart-how-to-read-a-weather-map/)’, *BOM Bureau Blog*, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2022)‘[State of the Climate 2022](http://www.bom.gov.au/state-of-the-climate/)’, Long-range weather and climate, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2023)‘[Climate Driver Update](http://www.bom.gov.au/climate/enso/#tabs=Overview)’, Long-range forecasts and drivers, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2023)‘[Climate statistics for Australian locations](http://www.bom.gov.au/climate/averages/tables/cw_070282.shtml)’, *Monthly Statistics*, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2023)‘[Interactive Weather and Wave Forecast Maps](http://www.bom.gov.au/australia/charts/viewer/index.shtml)’, Weather Maps, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2023) ‘[Recent and historical rainfall maps](http://www.bom.gov.au/climate/maps/rainfall/?variable=rainfall&map=totals&period=48month&region=nat&year=2022&month=07&day=31)’, Maps – history to now, BOM website, accessed 29 March 2023.

Commonwealth of Australia, Bureau of Meteorology (2023)[*About the average rainfall maps*](http://www.bom.gov.au/climate/change/about/rain_averagemaps.shtml), BOM website, accessed 29 March 2023.

Conservation International Foundation (2023) [*Biodiversity Hotspots*](https://www.conservation.org/priorities/biodiversity-hotspots), Conservation International website, accessed 29 March 2023.

Conservation International Foundation (2023) ‘[Biodiversity Hotspots Defined](https://www.cepf.net/our-work/biodiversity-hotspots/hotspots-defined)’, Our Work, Critical Ecosystem Partnership Fund, accessed 29 March 2023.

Copernicus Service Information (2019) ‘[Global Land Cover](https://lcviewer.vito.be/2019)’ [map], *Land Cover Classification: Single class forest*, VITO Remote Sensing website, accessed 29 March 2023.

CSIRO (Commonwealth Scientific and Industrial Research Organization) (2015–2020) ‘[About the Indigenous seasonal calendars](https://www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Calendars/About)’, Indigenous seasonal calendars, CSIRO website, accessed 29 March 2023.

CSIRO (Commonwealth Scientific and Industrial Research Organization) (2015–2020) ‘[Indigenous seasonal calendars](https://www.csiro.au/en/research/indigenous-science/indigenous-knowledge/calendars)’, Indigenous knowledge, CSIRO website, accessed 29 March 2023.

DAFF (Department of Agriculture, Fisheries and Forestry) (2021) ‘[Definitions](https://www.agriculture.gov.au/abares/aclump/definitions#:~:text=Land%20cover%20refers%20to%20the,as%20agriculture%20and%20built%20environments.)’, *Land use and management*, DAFF ABARES website, accessed 29 March 2023.

Davies B (15 June 2017) ‘[The Global Last Glacial Maximum](https://www.antarcticglaciers.org/2017/06/global-last-glacial-maximum/)’, *Antarctic Glaciers: Glaciers and Glaciation in Antarctica and beyond*, accessed 29 March 2023.

Drollinger M (19 April 2013) [‘Succession’ [video]](https://youtu.be/9kkWxUgMHfA), Mark Drollinger, YouTube, accessed 29 March 2023.

Earth Eclipse (2023) ‘[What is the process of soil formation and factors that affect soil formation?](https://eartheclipse.com/environment/process-and-factors-of-soil-formation.html), *Environment*, Earth Eclipse website, accessed 29 March 2023.

Earth How (2022) ‘[Plate Tectonic Types: Divergent, Convergent and Transform Plates](https://earthhow.com/plate-tectonics-types-divergent-convergent-transform-plates/)’, *Plate Tectonics*, Earth How website, accessed 29 March 2023.

Engineer Clearly (6 October 2011) ['Ternary plot basics' [video]](https://youtu.be/KvGJoLIp3Sk), Engineer Clearly*,* YouTube, accessed 29 March 2023.

Fish (8 September 2018) ['Mapwork Vertical Exaggeration' [video]](https://youtu.be/wGnoU0HbbP0), Fish, YouTube, accessed 29 March 2023.

Geography Lessons (20 March 2019) ['Erosion and sedimentation: How rivers shape the landscape' [video]](https://youtu.be/EMwGPPJ1Umk), Geography Lessons, YouTube, accessed 29 March 2023.

Geography Revision (2008–2023) ‘[Global commons](https://geography-revision.co.uk/a-level/human/global-commons/)’, A Level Human Geography Notes, Geography Revision website, accessed 29 March 2023.

Geology Science (2018) [*Weathering Types*](https://geologyscience.com/geology/weathering-types/), Geology Science website, accessed 29 March 2023.

Global Commons Alliance (2020) [*The Global Commons*](https://globalcommonsalliance.org/global-commons/), The Global Commons Alliance website, accessed 29 March 2023.

Global Oneness Project (27 February 2009) ['The Land Owns Us' [video]](https://youtu.be/w0sWIVR1hXw), Global Oneness Project, YouTube, accessed 29 March 2023.

Goldberg M (10 February 2022) ‘[From Clouds to Currents, What is the Water Cycle?](https://www.smithsonianmag.com/blogs/national-museum-of-natural-history/2022/02/10/from-clouds-to-currents-what-is-the-water-cycle/) *Smithsonian Magazine*, accessed 29 March 2023.

Golden Software LLC (n.d.) [*Reading Ternary Diagrams*](https://grapherhelp.goldensoftware.com/Graphs/Reading_Ternary_Diagrams.htm), Grapher Help website, accessed 29 March 2023.

Google Earth (2015) [*Ecuador*](https://earth.google.com/web/search/ecuador/@-1.36031805,-83.8949062,15.09896049a,2381866.32911568d,35y,0h,0t,0r/data=CnIaSBJCCiUweDkwMjM4N2RkYTg5YTRiZDU6MHg5ZDc2YWYwNDExOWMzNzAyGU-OAkTBTP2_Ifj4hOy8i1PAKgdlY3VhZG9yGAIgASImCiQJWUjcXAeLOkARV0jcXAeLOsAZveYF9vhFRkAhXnalyTw2UMA) [Google Earth map], accessed 29 March 2023.

Gough C (2011) ‘Terrestrial Primary Production: Fuel for Life’ [Table 1: Global and ecosystem-scale estimates](https://www.nature.com/scitable/knowledge/library/terrestrial-primary-production-fuel-for-life-17567411/#:~:text=Table%201%3A%20Global%20and%20ecosystem%2Dscale%20estimates), *Nature Education Knowledge 3*(10):28, accessed 29 March 2023.

Hitchcock D (2009) [*Mungo Plants*](https://www.donsmaps.com/mungoplants.html), Dons Maps website, accessed 29 March 2023.

Internet Geography (2016) ‘[Coastal processes](http://www.geography.learnontheinternet.co.uk/topics/coastal_processes.html)’, *Coasts*, Internet Geography website,accessed 29 March 2023.

Internet Geography (2022) [*The nutrient cycle in the rainforest*](https://www.internetgeography.net/topics/the-nutrient-cycle-in-the-rainforest/), Internet Geography website, accessed 29 March 2023.

Kansas State University (13 April 2011) ['Soil Profiling: The Proper Tools' [video]](https://youtu.be/UtgTUXl4HMM), K-State Research and Extension, YouTube, accessed 29 March 2023.

LIAS (A global information system for lichenized and non-lichenized Ascomycetes) Glossary contributors (2005) [*Continentality*](https://glossary.lias.net/wiki/Continentality), LIAS Glossary website, accessed 29 March 2023.

LIAS (A global information system for lichenized and non-lichenized Ascomycetes) Glossary contributors (2005) [*Oceanity*](https://glossary.lias.net/wiki/Oceanity), LIAS Glossary website, accessed 29 March 2023.

Lincoln Learning Solutions (1 August 2017) ['How Volcanic Eruptions Shape Earth' [video]](https://youtu.be/bHNDRquJ8U8), Lincoln Learning Solutions*,* YouTube, accessed 29 March 2023.

Lindsey R and Kennedy C (4 May 2011) U.S. Department of Commerce (n.d.) ‘[Annual Migration of Tropical Rain Belt](https://www.climate.gov/news-features/understanding-climate/annual-migration-tropical-rain-belt)’, *NOAA (National Oceanic and Atmospheric Administration) Climate.gov: Understanding Climate*, accessed 29 March 2023.

Max Planck Society (2022) ‘[Data from space unveils a global view of animals on the move](https://www.mpg.de/18465516/data-from-space-unveils-a-global-view-of-animals-on-the-move)’, *Newsroom: Research News*, Max-Planck-Gesellschaft website, accessed 29 March 2023.

McKeon S (2013) [12,000 Miles to Go: Migrating with Shearwaters](https://ocean.si.edu/ocean-life/seabirds/12000-miles-go-migrating-shearwaters), *Seabirds,* Smithsonian Ocean website, accessed 29 March 2023.

Melbourne Water (2021) ‘[Natural and urban water cycle](https://www.melbournewater.com.au/education/activities-all-ages/natural-and-urban-water-cycle)’, Activities for all ages, Melbourne Water website, accessed 29 March 2023.

Met Office (10 February 2018) ['What is global circulation? | Part One | Differential heating' [video]](https://youtu.be/7fd03fBRsuU), Met Office – Learn About Weather, YouTube, accessed 29 March 2023.

Met Office (21 February 2018) ['What is global circulation? | Part Two | The three cells' [video]](https://www.youtube.com/watch?v=xqM83_og1Fc),Met Office – Learn About Weather, YouTube, accessed 29 March 2023.

NASA (National Aeronautics and Space Administration) Earth Observatory (14 January 2009) ‘[Earth’s Energy Budget](https://earthobservatory.nasa.gov/features/EnergyBalance/page4.php)’, NASA Earth Observatory Articles, accessed 29 March 2023.

NASA Earth Observatory (14 January 2009) ‘[Surface Energy Budget](https://earthobservatory.nasa.gov/features/EnergyBalance/page5.php)’, NASA Earth Observatory Articles, accessed 29 March 2023.

NASA (29 March 2023) ['Live High-Definition Views from the International Space Station (Official NASA Stream)' [video]](https://eol.jsc.nasa.gov/ESRS/HDEV/), NASA Earth Science and Remote Sensing Unit, Earth Science and Remote Sensing Unit, NASA Johnson Space Center website, accessed 29 March 2023.

National Geographic Society (1996–2023) [*Animal Migration*](https://education.nationalgeographic.org/resource/resource-library-animal-migration), National Geographic Education website, accessed 29 March 2023.

National Geographic Society (1996–2023) [*Terrestrial Ecosystem*](https://education.nationalgeographic.org/resource/resource-library-terrestrial-ecosystem), National Geographic Education website, accessed 29 March 2023.

National Geographic Society (2022) ‘[Prevailing Winds](https://education.nationalgeographic.org/resource/prevailing-winds/)’ [map], Resources, National Geographic Education website, accessed 29 March 2023.

National Geographic Society (20 May 2022) ‘[Biomes, Ecosystems, and Habitats](https://education.nationalgeographic.org/resource/biomes-ecosystems-and-habitats)’, *National Geographic Education*, accessed 29 March 2023.

National Geographic Society (20 May 2022) ‘[Marine ecosystems](https://education.nationalgeographic.org/resource/marine-ecosystems)’, *National Geographic Education*, accessed 29 March 2023.

National Geographic Society (20 May 2022) ‘[Nature's Most Impressive Animal Migrations](https://education.nationalgeographic.org/resource/natures-most-impressive-animal-migrations/)’, *National Geographic Education*, accessed 29 March 2023.

National Geographic Society (16 July 2022) ‘[Photosynthesis’](https://education.nationalgeographic.org/resource/photosynthesis/), *National Geographic Education*, accessed 29 March 2023.

National Geographic Society (16 July 2022) ‘[The Rock Cycle](https://education.nationalgeographic.org/resource/rock-cycle)’, *National Geographic Education*, accessed 29 March 2023.

National Geographic Society (6 April 2023) ‘[Tributary](https://education.nationalgeographic.org/resource/tributary/)’ (Evers J ed), *National Geographic Education: Article*, accessed 29 March 2023.

National Park Service (U.S. Department of the Interior) (2023) ‘[Bison](https://www.nps.gov/yell/learn/nature/bison.htm#:~:text=Bison%20migrate%20up%20to%2070,in%20the%20Greater%20Yellowstone%20Ecosystem)’, *Wildlife: Mammals*, National Park Service website, accessed 29 March 2023.

NOAA (National Oceanic and Atmospheric Administration) and National Weather Service (2002) ‘[Asia](https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/asia.html)’, Regional Climate Maps, NOAA National Weather Service: Climate Prediction Office website, accessed 29 March 2023.

NOAA (National Oceanic and Atmospheric Administration) and U.S. Department of Commerce (20 January 2023) ‘[What is the difference between land cover and land use?’,](https://oceanservice.noaa.gov/facts/lclu.html#:~:text=Land%20cover%20data%20documents%20how,%2C%20conservation%2C%20or%20mixed%20uses.) *National Ocean Service NOAA*, accessed 29 March 2023.

NSW Government (2023) ‘[Under the Canopy: a guide to the rainforests of NSW’](https://www.nationalparks.nsw.gov.au/education/teacher-resource-rainforests-nsw-stage-6-geography), NSW National Parks and Wildlife service, accessed 29 March 2023.

NSW Government (2023) [*Mount Kosciuszko Summit Walk*](https://www.nationalparks.nsw.gov.au/things-to-do/walking-tracks/mount-kosciuszko-summit-walk), NSW National Parks and Wildlife Service, accessed 29 March 2023.

NSW Government (2023) [*Thredbo-Perisher area*](https://www.nationalparks.nsw.gov.au/visit-a-park/parks/thredbo-perisher-area), NSW National Parks and Wildlife Service website, accessed 29 March 2023.

[Office of Environment and Heritage (n.d.) *The Landscape in Action: Forces shaping Willandra Lakes*](http://www.visitmungo.com.au/landscape-in-action#forces-shaping), Visit Mungo website, accessed 29 March 2023.

Office of Environment and Heritage (n.d.) *The Landscape in Action:* [*45,000 years at Lake Mungo*](http://www.visitmungo.com.au/landscape-in-action#forces-shaping), Visit Mungo website, accessed 29 March 2023.

ReliefWeb, OCHA (United Nations Office for the Coordination of Humanitarian Affairs) (2015) ‘[Asia Pacific Regional Reference Map: Annual Precipitation](https://reliefweb.int/map/world/asia-pacific-regional-reference-map-annual-precipitation)’ [map], *Maps and Infographics*, ReliefWeb website, accessed 29 March 2023.

Riebeek H (16 June 2011) ‘[The Carbon Cycle](https://earthobservatory.nasa.gov/features/CarbonCycle)’, *NASA Earth Observatory*, accessed 29 March 2023.

Ritchie H and Roser M (2019) *Land Use:* [*How the world’s land is used: total area sizes by type of use & cover*](https://ourworldindata.org/land-use#how-the-world-s-land-is-used-total-area-sizes-by-type-of-use-cover), Our World In Data website, accessed 29 March 2023.

Savetz Publishing (2006–2023) ‘[Blackline Map of the World](https://www.teachersprintables.net/preview/Map_of_World)’, Teacher Printables, accessed 29 March 2023.

[Schmittner A (n.d.) ‘Introduction to climate science](https://open.oregonstate.education/climatechange/chapter/paleoclimate/)’, *Oregon State University*, accessed 29 March 2023.

SEE Turtles (n.d.) [*Sea turtle migration*](https://www.seeturtles.org/sea-turtle-migration), SEE Turtles website, accessed 29 March 2023.

Simpson V (28 June 2020) ‘[Astounding Facts About A Volcanic Landscape](https://www.worldatlas.com/articles/astounding-facts-about-a-volcanic-landscape.html)’, *WorldAtlas*, accessed 29 March 2023.

Skidmore College (n.d.) [*Nutrient cycling*](https://mdocs.skidmore.edu/crandallparktrees/ecosystem/nutrient-cycling/), *John B. Moore Documentary Studies Collaborative*, Crandall Park Trees website, accessed 29 March 2023.

State of New South Wales (Department of Education) (2009) ‘[*Excursions*](https://education.nsw.gov.au/policy-library/policies/pd-2004-0010)’, Policy Library, NSW Department of Education website,accessed 29 March 2023.

State of New South Wales (Department of Education) (2021) [*Digital Learning Selector*](https://app.education.nsw.gov.au/digital-learning-selector/), NSW Department of Education website,accessed 29 March 2023.

State of New South Wales (Department of Planning and Environment) (n.d.) ‘[Water in New South Wales](https://www.industry.nsw.gov.au/water/basins-catchments/snapshots)’, Basins and catchments, NSW Department of Planning and Environment website,accessed 29 March 2023.

Stevens Institute of Technology and CIESE (Center for Innovation in Engineering and Science Education) (2007) ‘[Graphing Tips](https://ciese.org/curriculum/weatherproj2/en/popup/graph.shtml)’, Weather Scope Teacher Guide: Implementation Assistance, CIESE website, accessed 29 March 2023.

Stevens Institute of Technology and CIESE (Center for Innovation in Engineering and Science Education) (2007) ‘[Scatter Plot](https://ciese.org/curriculum/weatherproj2/en/popup/graph4.shtml)’, Weather Scope Implementation Assistance: Graphing Tips, CIESE website, accessed 29 March 2023.

Taylor R (29 April 2020) [‘Ecological Succession’ [video]](https://youtu.be/zLduuefGVSc), By: Rachel Taylor, YouTube, accessed 29 March 2023.

The State of Queensland (1995–2023) [‘How soils form](https://www.qld.gov.au/environment/land/management/soil/soil-explained/forms)’, *Soils explained*, QueenslandGovernment website, accessed 29 March 2023.

The State of Queensland (Department of Environment and Science) (2021) ‘[Hydrology’,](https://wetlandinfo.des.qld.gov.au/wetlands/ecology/processes-systems/water/hydrology/) *Water processes,* Queensland Government Wetland*Info* website, accessed 29 March 2023.

The State of Queensland (Department of Environment and Science) (2022) ['River flows (hydrograph)'](https://wetlandinfo.des.qld.gov.au/wetlands/ecology/processes-systems/water/hydrology/river-flows/), *Hydrology,* Queensland Government Wetland*Info* website, accessed 29 March 2023.

The Thomas Hardye School (Geography department) (2021) [‘Living World – Nutrient Cycles’ [video]](https://www.youtube.com/watch?v=T3bJla9N0pc), THS Geog*,* YouTube, accessed 29 March 2023.

Tours By Locals (6 July 2021) [Great Animal Migrations: Where and When to Witness Them](https://www.toursbylocals.com/blog/great-animal-migrations), *Tours by Locals*, accessed 29 March 2023.

TWC (The Weather Company) Product and Technology LLC (2023) [*Canberra, ACT*](https://weather.com/en-AU/weather/today/l/ASXX0023:1:AS?Goto=Redirected), The Weather Channel website, accessed 29 March 2023.

UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Centre (1992–2023) [*World Heritage List*](https://whc.unesco.org/en/list/?&type=natural), UNESCO World Heritage Centre website, accessed 29 March 2023.

University of Calgary (Department of Physics and Astronomy) (n.d.) [*Water storage*](https://energyeducation.ca/encyclopedia/Water_storage), Energy Education website, accessed 29 March 2023.

University of Calgary (n.d.) [*Glacial and interglacial periods*](https://energyeducation.ca/encyclopedia/Glacial_and_interglacial_periods), Energy Education website, accessed 29 March 2023.

University of Exeter and Met Office (n.d.) ‘[Differential heating](https://www.futurelearn.com/info/courses/learn-about-weather/0/steps/28845),’, Learn About Weather, FutureLearn website, accessed 29 March 2023.

Viking Geo (21 January 2021) ['Water Cycle – Stores and Flows (Open and Closed Systems) (A-Level Geography)' [video]](https://youtu.be/H_noB4UYDJU), Viking Geo*,* YouTube, accessed 29 March 2023.

Walsh E (24 June 2019) ‘[Energy flow (Ecosystem): Definition, Process & Examples’,](https://sciencing.com/energy-flow-ecosystem-definition-process-examples-with-diagram-13719231.html) *Sciencing*, accessed 29 March 2023.

Wiese K, City College of San Francisco (10 February 2015) ['Seasons' [video]](https://youtu.be/tX3Y5bzNDiU), Earth Rocks!*,* YouTube, accessed 29 March 2023.

Witynski M (n.d.) [Ecological succession, explained](https://news.uchicago.edu/explainer/what-is-ecological-succession), *Chicago News*, accessed 29 March 2023.

Zimmer C (17 May 2012) ‘[The Vital Chain: Connecting Ecosystems of Land and Sea](https://e360.yale.edu/features/the_vital_chain_connecting_the_ecosystems_of_land_and_sea)’ *Yale Environment 360*, Yale School of the Environment, accessed 29 March 2023.

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