**Year 12 Earth and Environmental Science[[1]](#footnote-1) scope and sequence**

## Module 5: Earth’s Processes

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| Weeks | Inquiry question | Suggested activities |
| 1-4 | How did today’s biosphere originate and develop? | * Develop hypotheses on the scientific causes for the origins of organic molecules. Access via secondary sources and assess the credibility of the sources. * Students research and make predictions on the significance of the discovery of black smoker communities for understanding early life on Earth. Assess the importance of technologies in furthering our understanding of the ancient past. * Use scaling activities that require mathematical calculations to construct versions of the geological timescale to solve problems. These activities can build numeracy skills. * Evaluate the success of the early plant and vertebrate land colonisers, including the challenges they faced and how they have evolved to overcome them. |
| 5-6 | How did the changes to the biosphere affect the Earth’s geosphere, atmosphere and hydrosphere? | * Interpret graphical data on the composition of the atmosphere over time, e.g. analyse how and why oxygen concentrations have changed over time, including the evolution of photosynthetic life. * Investigate the reaction between iron nails and oxygen and the different conditions under which the reaction occurs fastest. Relate to the development of photosynthetic life and banded iron formations. * Investigate how an ecosystem is affected when plants and animals are introduced or removed. This could potentially be modelled in a closed jar system. Relate this to how the biosphere can impact the surrounding environment, e.g. the atmospheric composition. |
| 7-8 | What effect does the plate tectonic supercycle have on the Earth? | * Revise boundary types and plate tectonic theory from Year 11 course. * Model the plate tectonic supercycle. Students could design and create their models (e.g. using playdough) that link changes in the cycle to climate variations and evolution using technologies. The strengths and limitations of models such as these could be evaluated. |
| 9-10 | What is the role of fossils in expanding what is known of geological time and past life on Earth? | * Analyse the fossil record and link fossil discoveries to changes in ecosystems through geological time. * Calculate the relative and absolute ages of fossils and rocks using various dating techniques. These can then be applied to significant geological events, e.g. mass extinctions, large volcanic eruptions. |

### Module 6: Hazards

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| Weeks | Inquiry question | Suggested activities |
| 1-4 | How and why do geological disasters occur? | * Design and conduct investigations to relate viscosity of fluids (e.g. water, oil, honey) to trapping of gases or pressure release to model explosive and effusive eruptions. * Model the different types of plate boundaries and the geological and tectonic features that exist (e.g. using Stopmotion, playdough3D model, short film). Students could test their model and determine the uses and limitations. * Use mapping activities to relate the incidence of certain earthquakes and volcanoes to plate boundary types. * Access data to plot locations of earthquake foci along a known convergent plate boundary to predict the existence of a subduction zone. Draw a labelled model of the inferred subduction zone. * Research and report on various types of hazards associated with earthquakes (including ground motion, soil liquefaction, building collapse, tsunamis) and explosive volcanoes (including pyroclastic flows, lahars, poisonous gas emissions). * Access real seismograph data to determine the magnitude and location of an earthquake and predict the likely hazards, given these factors. * Produce graphs from data on the composition of volcanic material released in effusive and explosive eruptions. * Research and report on the evidence that exists for Aboriginal and Torres Strait Islander Peoples’ historical observations of large scale disasters such as volcanic eruptions, tsunamis, earthquakes and storm events. |
| 5-7 | How do natural disasters such as explosive volcanic eruptions, earthquakes and extreme weather events influence the biosphere and atmosphere? | * Design and investigate whether human activities (for example, land clearing, climate changes, and introduced species) influence the intensity or spread of bushfires by modelling in the laboratory. * Research evidence from secondary sources to describe examples where explosive eruptions have affected climate in the short and long term. Analyse graphical data on global temperature before and after large eruptions, such as Krakatoa or Pinatubo. * Research and investigate the question: “What would happen if a tsunami hit Sydney?” Use secondary sources and make predictions about possible observations based on events that have occurred in the past. * Present case studies on the cause and impacts of recent climatic phenomena such as Black Saturday bushfires, Newcastle/Wollongong storms/floods associated with East Coast Lows, Sydney hailstorms, and NSW droughts. * Investigate whether there has been an increased frequency of East Coast Lows in more recent years as a possible consequence of climate change. * Investigate and report on Indigenous Dreamtime stories that involve past climatic phenomena. |
| 8-10 | What technologies enable the prediction of natural disasters and minimisation of their effects on the biosphere? | * Design and construct a model seismometer or tiltmeter that could detect vibrations. Assess the effectiveness of the model, identifying benefits and limitations. * Research and report on technologies, such as seismometers and tiltmeters, and determine their use in predicting volcanic events. * Research and report on technologies that could be used to help predict earthquakes and tsunamis (e.g. radon gas detectors, tsunami detection devices) and those used to mitigate the impacts of such events (e.g. seawalls, evacuation procedures, building codes). * Conduct a literature review into anomalous animal behaviour preceding earthquakes to determine whether animals can predict or warn about major oncoming earthquakes * Research and report on practices used by Indigenous Peoples to mitigate problems associated with bush fires. |

### Module 7: Climate Science

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| Weeks | Inquiry question | Suggested activities |
| 1-3 | How long does it take for the climate to change naturally, and what causes these changes? | * Construct and analyse graphical (or other) data that compares the contribution of greenhouse gas emissions by country or industry. * Analyse historical showing the relationship between carbon dioxide and temperature. * Design and conduct a practical investigation that models that natural greenhouse effect. * Conduct a student-led inquiry: are some processes more important than others in affecting natural climate changes? Students could be posed this question in small groups, propose hypotheses and use secondary sources to assess the different processes involved, including volcanism, ocean circulation patterns and Earth and Sun movements. * Investigate the evidence (e.g. from rock art) which exists for the changes in the Australian environment witnessed by Aboriginal and Torres Strait Islander Peoples over the past 65 000 years, including sea-level rise, climatic variation and ecological change. |
| 4-5 | What scientific evidence is there of variations in the past? | * Apply the principles of dendrochronology to determine climate changes in the recent past. This could be done as a primary (with actual samples) or secondary investigation (with images and data sets). * Use secondary sources to gather evidence from around Australia of various rock art sites showing extinct species (e.g. megafauna), researching how they are dated and provide an annotated bibliography of the competing theories to explain their extinction. * Watch appropriate sections of “An Inconvenient Truth” to analyse the evidence of past temperatures using studies of oxygen isotopes in ice cores. |
| 6-7 | Is there scientific evidence to show that human activity has led to a variation in the Earth’s climate since the Industrial Revolution? | * Conduct data analyses into greenhouse gas and temperature changes since the Industrial Revolution. * Use models to predict polar ice melting and increase in sea levels due to anthropogenic global warming. * Investigate the effect of carbon dioxide concentration on the pH of water. Concerning ocean acidification, an investigation of the relationship between dissolved carbon dioxide concentration and the pH of water could be undertaken. * Investigate the effect of water pH on the structure of shelled animals to model ocean acidification. Students can design experiments to show that decreasing water pH has a negative effect on the structure of shelled animals. |
| 8-10 | Is there scientific evidence that demonstrates how humans could minimise and respond to the effects of increased global temperatures? | * Analyse data that examines the impacts of using alternative sources of energy (including renewables). * Evaluate the worldwide success of the Kyoto Protocol. * Examine projects undertaken by Aboriginal and Torres Strait Islander Peoples that aim to respond to the effects of climate change, e.g. carbon capture that utilises Indigenous methods of ecosystem maintenance and restoration and captures significant amounts of carbon in the environment. |

### Module 8: Resource Management

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| Weeks | Inquiry question | Suggested activities |
| 1-3 | How are Australia’s natural resources extracted, used and managed? | * Examine maps of Australia, investigating the distribution of natural resources. * Conduct an excursion to visit a mining site and asses their plans for reclamation once mining has finished. * Analyse graphical data to predict the longevity of non-renewable resources. |
| 4-6 | How is waste managed? | * Conduct an excursion to visit a waste management site. * Investigate methods of solid or liquid waste treatment in NSW (or compare coastal and inland regions) and their effectiveness at reducing pollution in the environment. * Conduct a practical investigation modelling some of the techniques used to treat waste. * Examine how modern landfill sites are being designed worldwide to have reduced environmental impact. * Investigate whether chemicals leached from mines has an impact on the biosphere. * Design and conduct a practical investigation into the composition of waste at school. If done in conjunction with watching “War on Waste” this could become a depth study with real benefits for the community and could even be presented to the local council. |
| 7-8 | How can humans manage the Earth’s natural resources sustainably? | * Analyse and compare Australia’s sustainability initiatives (e.g. recycling habits) with that of other countries. * Examine case studies where overharvesting in fisheries in Australia have led to ecosystem and economic problems. * Examine the concept of Ecologically Sustainable Development in detail regarding issues in the local environment. * Conduct a case study into the process of eutrophication as a result of water pollution. * Research and report on agreements and conflicts between mining interests and Aboriginal custodians, where conflict has been resolved versus where Aboriginal values have been ignored or degraded. |

1. This document references the [Earth and Environmental Science Stage 6 Syllabus](https://syllabus.nesa.nsw.edu.au/earth-and-environmental-science-stage6/) © 2019 [NSW Education Standards Authority (NESA)](http://syllabus.nesa.nsw.edu.au/copyright/) for and on behalf of the Crown in right of the State of New South Wales. [↑](#footnote-ref-1)