Earth and Environmental Science Syllabus resource links

This supporting document is provided to assist you in starting your research and collating resources, including articles and websites, in preparing programs, units of work and lesson plans. They are only provided as a suggestion.

Although this document may contain links to third party websites and resources, the NSW Department of Education is not responsible for the condition or content of these sites or resources as they are not under the control of the Department.

## Strengthened links to geological exploration and mining

It is strongly advised that teachers contact their local [AECG](https://education.nsw.gov.au/teaching-and-learning/aec/aboriginal-education-consultative-group-partnership-agreement) and Land Council to gather information regarding Aboriginal and Torres Strait Islander protocols and cultures

### Websites

* [quarrying.org/quarrying-explained](https://www.quarrying.org/about-quarrying/quarrying-explained)
* [greatmining.com/quarrying](https://www.greatmining.com/quarrying.html)
* [beep.ac.uk – Pollution, Mining and Quarrying](https://www.beep.ac.uk/content/231.0.html)
* [mine-engineer.com - Basics of an open pit mine](http://www.mine-engineer.com/mining/open_pit.htm)
* [greatmining.com/open-pit-mining](https://www.greatmining.com/open-pit-mining.html)
* Earth resources- [Mineral resources](http://www.earthsciencewa.com.au/) - ESWA
* [Solvent extraction of copper experiment](https://www.oresomeresources.com/resource/solvent-extraction-of-copper-experiment/) – Oresomeresources.com
* [Exploring mining in Queensland](https://www.oresomeresources.com/resource/exploring-mining-in-queensland/) - Oresomeresources.com
* [In situ leaching Learning Object](https://www.oresomeresources.com/resource/in-situ-leaching-learning-object/) - Oresomeresources.com
* [Operating mines in Australia interactive Google map](https://www.oresomeresources.com/resource/operating-mines-in-australia-interactive-google-map/) - Oresomeresources.com
* [Underground Mining Methods and Applications](http://www.ct.ufrgs.br/laprom/Underground%20Mining%20Methods.pdf) - ct.ufrgs.br/larom/ - The Mineral Processing Laboratory (LAPROM) in the Technology Center (CT) of the Federal University of Rio Grande do Sul (UFRGS), Brazil.
* [Underground Mining Methods](https://miningandblasting.files.wordpress.com/2009/09/mining_methods_underground_mining.pdf) - ct.ufrgs.br/larom/ - The Mineral Processing Laboratory (LAPROM) in the Technology Center (CT) of the Federal University of Rio Grande do Sul (UFRGS), Brazil.
* [Onshore Drilling Natural Gas](http://naturalgas.org/naturalgas/extraction-onshore/)
* [Onshore Drilling](http://www.vallourec.com/DRILLINGPRODUCTS/EN/Application/Pages/Onshore.aspx)
* [Renewable Energy Resources](http://www.ga.gov.au/scientific-topics/energy/resources/other-renewable-energy-resources) – Australian Government
* [Bioenergy and energy from waste](https://arena.gov.au/renewable-energy/bioenergy/) – Australian Renewable Energy Agency
* [Energy Basics](http://www.ga.gov.au/scientific-topics/energy/basics) – Geoscience Australia
* [Renewable energy and agribusiness](http://www.nswfarmers.org.au/NSWFA/NSWFA/Posts/The_Farmer/Environment/Promising_future_for_renewable_energy_in_Australian_agribusiness.aspx) – NSW Farmers
* [nationalmap.gov.au - Australian Renewable Energy Mapping Infrastructure](https://nationalmap.gov.au/renewables/)
* [NSW renewable energy resources map](https://www.resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/products-and-data/renewable-resources-map) – NSW Resources and Energy
* [Renewable resources data](https://www.resourcesandgeoscience.nsw.gov.au/) - Resources and geoscience in NSW
* [Australian Renewable Energy Mapping](https://research.csiro.au/data61/aremi/) – CSIRO – data relevant to the energy sector form government, industry and research.
* [Making agreements on Aboriginal land: Mining and development](https://www.clc.org.au/index.php?/articles/info/mining-and-development) – Central Land Council
* [Old habits die hard: Indigenous land rights and mining in Australia](https://www.culturalsurvival.org/publications/cultural-survival-quarterly/old-habits-die-hard-indigenous-land-rights-and-mining)
* [Essential skills for academic success](https://www.monash.edu/rlo) – Monash University
* [Australian non-renewable energy resources](https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook44p/EnergyResources) – Parliament of Australia
* [Non-renewable Energy](https://www.solarschools.net/knowledge-bank/non-renewable-energy) – Solar Schools
* [Australian Energy –](https://www.abc.net.au/btn/classroom/australian-energy/10528036) ABC Behind the news
* [Australia’s renewable energy future](https://www.science.org.au/supporting-science/science-sector-analysis/reports-and-publications/australia%E2%80%99s-renewable-energy) – Australian Academy of Science 2010 report

### YouTube

* [Natural Stone Quarry/Open Pit mining animation](https://www.youtube.com/watch?v=lWPh5qKWjBs) (duration 4:09)
* [Overview of Deep Water Drilling](https://www.youtube.com/watch?v=YQtDiX2Dbr0) (duration 2:15)
* [3D Animation Onshore Gas Drilling](https://www.youtube.com/watch?v=YTzrua7IS5M) (duration 2:36)
* [Oil Drilling; Oil and Gas Animations](https://www.youtube.com/watch?v=SfazJ6P_g7w) (duration 8:21)

## Climate Science

It is strongly advised that teachers contact their local AECG and land councils for cultural protocols.

### Websites

* [Greenhouse effect](http://www.environment.gov.au/climate-change/climate-science-data/climate-science/greenhouse-effect) – Department of the Environment and Energy
* [The Greenhouse Effect and Climate Change](https://www.penrithlakeseec.com/sustainability/sustainability) – Sustainability resources uploaded to Penrith Lakes EZEC
* [The Greenhouse effect simulation](https://phet.colorado.edu/en/simulation/greenhouse) – PhET
* [Greenhouse effect in a greenhouse](https://learn.concord.org/resources/645/greenhouse-effect-in-a-greenhouse) – via Scootle
* [Greenhouse gases](https://learn.concord.org/resources/646/greenhouse-gases) – via Scootle
* [Basics of Climate Science](http://climateofconcern.org/basics-of-climate-science/) – Natural Variability of the Climate
* [niwa.co.nz/Natural variations in climate](https://niwa.co.nz/our-science/climate/information-and-resources/clivar/variations)
* [Plate tectonic super cycle](https://dhrititimelineofplatetectonics.weebly.com/tectonic-super-cycle.html)
* [Decan Traps, India](http://volcano.oregonstate.edu/oldroot/volcanoes/volc_images/europe_west_asia/india/deccan.html)
* [le.ac.uk/Siberian Traps - Introduction](https://www.le.ac.uk/gl/ads/SiberianTraps/Introduction.html)
* [volcano.oregonstate.edu/deccan-traps](http://volcano.oregonstate.edu/deccan-traps)
* [Deccan Volcanism – An adventure in Science](http://massextinction.princeton.edu/deccan-volcanism/01-deccan-volcanism-adventure-science)
* [australian.museum/mesozoic-era](https://australian.museum/learn/dinosaurs/mesozoic-era/)
* [Orbital variations](https://earthobservatory.nasa.gov/features/Milankovitch/milankovitch_2.php) – NASA
* [Study: Earth’s Orbit Causes Global Warming Today And Climate Change 1.4 Billion Years Ago](https://dailycaller.com/2015/03/11/study-earths-orbit-causes-global-warming-today-and-climate-change-1-4-billion-years-ago/)
* [Milankovitch cycles](http://ossfoundation.us/projects/environment/global-warming/milankovitch-cycles)
* [Climate education modules](http://climate.ncsu.edu/edu/home) – North Carolina Climate Office
* [Milankovitch cycles – animation](https://www.sciencecourseware.org/eec/GlobalWarming/Tutorials/Milankovitch/) (requires Flash)
* [Effects of Climate Change – Currents Tutorial](https://oceanservice.noaa.gov/education/tutorial_currents/05conveyor3.html)
* [How does the ocean affect climate and weather on land?](https://oceanexplorer.noaa.gov/facts/climate.html)
* [Ocean currents](https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-currents) – National Oceanic and Atmospheric Administration
* [Ocean currents and climate](https://www.nationalgeographic.org/media/ocean-currents-and-climate/) – National Geographic
* [Picture Climate: How pollen tells us about climate](https://www.ncdc.noaa.gov/news/picture-climate-how-pollen-tells-us-about-climate)
* [Pollen and Climate change](http://www.global-greenhouse-warming.com/pollen-and-climate-change.html) – Global Greenhouse Warming
* [global-climate-change.org.uk– Pollen analysis](https://www.global-climate-change.org.uk/3-3-6.php)
* [origins.swau.edu - Precambrian Pollen in the Grand Canyon](https://origins.swau.edu/papers/dinos/pollen/eng/index.html)
* [www.bgs.ac.uk - Past climates – evidence](https://www.bgs.ac.uk/discoveringGeology/climateChange/general/pastClimatesEvidence.html)
* [Geologic History of the Western US: Reconstructing the Geologic Past](http://geology.teacherfriendlyguide.org/index.php/geohist-w)
* [Sedimentary rocks contain clues to ancient environments](https://www.windows2universe.org/earth/geology/sed_facies.html)
* [What is the geological time scale?](https://australian.museum/learn/australia-over-time/evolving-landscape/the-geological-time-scale/)– Australian Museum
* [ucmp.berkeley.edu - Microfossils](https://ucmp.berkeley.edu/fosrec/Lipps1.html)
* [Microfossils – Earth Science Australia](http://www.earthsci.org/expeditions/microfossils/microfossils.html)
* [The most ancient evidence for life on Earth?](https://cosmosmagazine.com/palaeontology/most-ancient-evidence-life-earth) – COSMOS
* [This may be the oldest known sign of life on Earth](https://www.nationalgeographic.com/news/2017/03/oldest-life-earth-iron-fossils-canada-vents-science/) – National Geographic
* [Isotope Geochemistry](http://www.geology.cz/projekt681900/english/learning-resources/Lecture_4_Isotope_Geochemistry.pdf)
* [Ice core basics](http://www.antarcticglaciers.org/glaciers-and-climate/ice-cores/ice-core-basics/) – Antarctic Glaciers
* [Ice core 101](https://climatechange.umaine.edu/icecores/Ice_Core_101.html) – Climate Change Institute
* [Climate Change – How do we know?](https://climate.nasa.gov/evidence/) – NASA
* [Dendrochronology: What Tree Rings Tell Us About Past and Present](http://www.environmentalscience.org/dendrochronology-tree-rings-tell-us) – Environmental Science
* [About tree rings](https://ltrr.arizona.edu/about/treerings) – Laboratory of tree-ring research
* [Greenhouse gases](https://www.climatechangeinaustralia.gov.au/en/climate-campus/climate-system/greenhouse-gases/) – Climate change in Australia
* [What is Ocean Acidification?](https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification)
* [Ocean Acidification](https://ocean.si.edu/ocean-life/invertebrates/ocean-acidification) – Smithsonian Ocean Portal
* [Berrup Peninsula rock art shows extinct megafauna and Tasmanian tiger](https://www.abc.net.au/radionational/programs/backgroundbriefing/burrup-peninsula-rock-art-shows-extinct-megafauna/6561788)
* [Bulgandry Aboriginal Art Site](https://www.nationalparks.nsw.gov.au/things-to-do/aboriginal-sites/bulgandry-art-site-aboriginal-place) – NSW National Parks
* [The depiction of species in macropod track engravings](https://journals.australian.museum/mcdonald-1993-rec-aust-mus-suppl-17-105115/) – The Australian Museum
* [Kakadu culture and history-rock art](https://www.environment.gov.au/topics/national-parks/kakadu-national-park/culture-and-history/rock-art) – Department of the Environment
* [Earth in the Future: Predicting Climate Change and Its Impacts](https://open.ems.psu.edu/node/1313) – Penn State College of earth and mineral sciences.
* [Ocean acidification and its effects](https://coastadapt.com.au/ocean-acidification-and-its-effects)
* [Ocean Acidification animation](https://www.pmel.noaa.gov/co2/story/OA+Educational+Tools)
* [Data in the classroom](https://dataintheclassroom.noaa.gov/) – NOAA

### YouTube

* [The Greenhouse Effect](https://www.youtube.com/watch?v=ZzCA60WnoMk) (duration 3:29)
* [The Deccan Traps and Deccan Plateau](https://www.youtube.com/watch?v=qtch77zwUOc) (duration 17:34)
* [Siberian Traps likely triggered end-Permian mass extinction](https://www.youtube.com/watch?v=PNs9U4qVOII) (duration 2:02)
* [The Siberian Traps](https://www.youtube.com/watch?v=BAUYmR2BYSE) (duration 10:41)
* [Milankovitch Cycles](https://www.youtube.com/watch?v=6lbJrvtxWNE) (duration 3:13)
* [Milankovitch cycles precession and obliquity](https://www.khanacademy.org/science/cosmology-and-astronomy/earth-history-topic/earth-title-topic/v/milankovitch-cycles-precession-and-obliquity) (duration 12:56) – Khan Academy
* [Milankovitch cycles and Ice Age Explained](https://www.youtube.com/watch?v=anZJZCvGoZE) (duration 8:45)
* [The Milankovitch Cycles and Climate Change](https://www.youtube.com/watch?v=PFfwIOzVlh8)
* [NASA – The Ocean: A driving force for weather and climate](https://www.youtube.com/watch?v=6vgvTeuoDWY) (duration 6:00)
* [Ocean Currents and Climate Change](https://www.youtube.com/watch?v=_ieOmHcRXhk) (duration 2:51)
* [Flow: Currents and Climate](https://www.youtube.com/watch?v=HgoANl_97kM) (duration 8:09)
* [Studying ice cores in Antarctica – Natural History Museum](https://www.youtube.com/watch?v=VjTsj-fi-p0) (duration 2:40)
* [Climate Change from Ice Cores](https://www.youtube.com/watch?v=r5Xm_v-22sE) (duration 34:01)
* [Earth’s Climate History from Glaciers and Ice Cores](https://www.youtube.com/watch?v=_-fLHQKpXxA) (duration 34:11)
* [Richard Dawkins – Dating the Earth - Dendrochronology](https://www.youtube.com/watch?v=AlMfqzihNTE) (duration 5:00)
* [Dendrochronology](https://www.youtube.com/watch?v=YRLjK8Mj04o) (duration 13:39)
* [Difference between natural and anthropogenic greenhouse effects?](https://www.youtube.com/watch?v=zKpLGgBC5io) (duration 5:53)
* [Acid Test: The Global Challenge of Ocean Acidification](https://www.youtube.com/watch?v=5cqCvcX7buo) (duration 21:34)
* [What is ocean acidification?](https://www.youtube.com/watch?v=Qdj6z5my58U) (duration 3:17)

## Mitigation and adaptation strategies for a changing environment

### Websites

* [NASA Responding to Climate Change - mitigation and adaption](https://climate.nasa.gov/solutions/adaptation-mitigation/)
* [Climate Mitigation and Adaptation](http://www.global-greenhouse-warming.com/climate-mitigation-and-adaptation.html) – Global Greenhouse Warming
* [Climate change](https://www.scootle.edu.au/ec/search?q=climate+change&field=title&field=text.all&field=topic) – Scootle
* [Adapting for Climate Change](https://www.cityofsydney.nsw.gov.au/vision/environmental-action/energy-climate-change/sydney-climate-crisis) Strategy – City of Sydney – pdf
* [Geoengineering the climate: science, governance and uncertainty](https://royalsociety.org/topics-policy/publications/2009/geoengineering-climate/)  – The Royal Society – pdf of full report
* [Mitigation, Geoengineering and Adaptation](http://www.geo.arizona.edu/geo4xx/geos478/GC10_Geoengineering.pdf) – pdf
* [Mitigation](https://nca2014.globalchange.gov/report/response-strategies/mitigation) – National Climate Assessment
* [How overharvesting affects biodiversity](http://cearahkindallbiodiversity.weebly.com/how-overharvesting-impacts-biodiversity.html)

### YouTube

* [An innovative strategy for climate change mitigation and adaptation](https://www.youtube.com/watch?v=jSDCU4Gy_2U) (duration 5:35)
* [Climate Change: Mitigation, Adaptation and Geoengineering](https://www.youtube.com/watch?v=fUhs0vSflZE) (duration 10:47)
* [Overharvesting](https://www.youtube.com/watch?v=CTC8hXWWnU4)(duration 3:26)
* [How does climate change affect biodiversity](https://www.youtube.com/watch?v=XFmovUAWQUQ)- California Academy of Sciences