Stage 6 Agriculture

## Factors contributing to degradation teacher resource.

This unit allows students to investigate the impacts of past and current agricultural land use on soil and water. Students will study one soil degradation issue in Australia in depth and the practices that have led to it.

## Outcome

**H1.1** explains the influence of the physical, biological, social, historical and economic factors on sustainable agricultural production.

[Agriculture](https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/technologies/agriculture-syllabus) Stage 6 Syllabus © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2013.

## Delivery strategies

This resource is adaptable for teachers to use with online platforms such as Google classroom. Links to the videos and websites could be posted for students to access during learning at home. The activities and questions could be set as classwork documents within Google classroom that the students complete and submit for a grade or feedback. Alternatively, students could receive the activities and questions as worksheets to complete and submit later.

### Section one:

Students investigate past and present agricultural practices and how they have impacted the land.

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| Focus area | Factors contributing to the degradation of soil and water. |
| Syllabus Content | Describe the impacts of historical land use practices in the development of Australian agricultural systems. |
| Resources | * [The Australian collaboration, land degradation](http://www.australiancollaboration.com.au/pdf/FactSheets/Land-degradation-FactSheet.pdf)
* [Fire, ABC Education](https://education.abc.net.au/home#!/media/3124176/fire) (video duration 3:32)
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| Activities/questions | 1. Using the article [“The Australian collaboration, land degradation”](http://www.australiancollaboration.com.au/pdf/FactSheets/Land-degradation-FactSheet.pdf) define the terms degradation and land.
2. Recall three statistics about the amount of and/or type of land affected by degradation.
3. For the four listed types of degradation in the article, name and describe each. Outline how it occurs.
4. Describe what the article states is the predominant cause of land degradation in Australia.
5. Watch the video [Fire, ABC Education](https://education.abc.net.au/home#!/media/3124176/fire) (video duration 3:32) and compare (show similarities and differences of) the influences of Aboriginal people on the land before European settlement and the changes seen over the past 200 years. You may want to use a table to show the comparisons.
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| Suggested answers | 1. Degradation: undesirable changes that are additional to those that occur naturally, usually bought about by human activity.

Land: the rocks, soils, minerals and all the vegetation and animal habitats that it supports.1. A quarter of all global farmland is affected by degradation, in Australia about two thirds of agricultural land is affected by degradation and about 2.4 million hectares of land across Australia is salinity affected.
2. Soil erosion occurs when vegetation is removed from soil surfaces through activities such as cultivation, deforestation, overgrazing and it then becomes unprotected to be picked up and moved by wind or water actions.

Soil salinity is described as the rising level of salts in the soil to such concentrations that adversely affect plant production. It has been brought about by vegetation clearance.Soil acidification occurs when anions from fertilisers leach through the soil profile accompanied by positively charged cations, leaving behind an excess of positively charged hydrogen ions which lowers the pH of the soil.Contaminated soils occur when heavy metal impurities in fertilisers, residues from pesticides and left-over wastes from service industries build up in the soils.1. The article states the predominant cause of land degradation in Australia is the removal of vegetation, particularly in the wheat/sheep and higher rainfall areas and the way the cleared land is then used.
2. Prior to European settlement fire was used as just one technique of soil management to restore carbon in the soil without the use of fertilisers which has been a feature of more recent agricultural techniques. When Aboriginal people needed a clear land/path the use of fire provided this, leaving the roots and soil in place, over the past 200 years of agricultural practice, clearing of land and paths has been conducted through ripping out vegetation to clear way, cultivation of soil or the use of hard hooved animals to eat away at vegetation.
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### Section two:

Students examine soil erosion as their case study soil degradation problem.

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| Focus area | Factors contributing to the degradation of soil and water. |
| Syllabus Content | Investigate using secondary sources the practices that have led to one important soil degradation problem, the outcomes of these practices on the land/water system and current recommended procedures to alleviate the problem |
| Resources | * [Soil and soil erosion](https://www.kidcyber.com.au/soil-and-soil-erosion)
* [Soil erosion and degradation](https://www.worldwildlife.org/threats/soil-erosion-and-degradation)
* [What is soil erosion?](https://www.conserve-energy-future.com/causes-effects-solutions-of-soil-erosion.php)
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| Activities/questions | 1. Use information from the links above, textbooks and other research articles or websites to create an illustrated digital report on erosion for farmers. Include the following (Canva, Smore, Google slides or Prezi are all options of mediums that can be used):
	1. Outline what soil erosion is and the different types?
	2. Describe practices that have led to increased erosion in Australia.
	3. Explain how these practices have affected the land and/or water systems.
	4. Evaluate (make a judgement based on criteria) at least two current methods/procedures that are used to alleviate the problem.
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| Suggested answers | * Students will use digital medium to create an illustrated information article using language accessible by the average farmer and pictures to support the information.
* Students will outline what soil erosion is and name the different types, including sheet, rill, gully and tunnel erosion.
* Students will explain how erosion removes nutrient rich topsoil from the land stripping it on nutrients and mineral needed for vegetation to grow. Topsoil deposited in waterways lowers water quality for humans and stock. Soil deposited along fence lines makes them ineffective in controlling stock and causes rust.
* A range of different methods/procedures can be evaluated for the last section, including:
	+ maintaining vegetation cover through stubble retention or replanting of trees
	+ maintaining and improving soil organic matter
	+ terrace farming
	+ use of minimum tillage, reduced tillage or zero tillage
	+ crop rotation
	+ reducing stocking numbers or overgrazing
	+ mulching.
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### Section three

Students learn about a range of farming practices that impact waterways.

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| Focus area | Factors contributing to the degradation of soil and water. |
| Syllabus Content | Describe farming/agricultural practices that have affected water quality and quantity including fertiliser usage, the effects of stock, effluent management, chemicals, grassed waterways, riparian zones, dam construction and irrigation methods. |
| Resources | * Department of Primary Industries - [Fertilisers and the environment](https://www.dpi.nsw.gov.au/agriculture/soils/improvement/environment)
* [Murray Darling Basin Authority](https://www.mdba.gov.au/sites/default/files/worksheet-quality-nutrients.pdf) worksheet
* Australian Government, Land and Water Australia - [Improving water quality](https://www.hort360.com.au/wordpress/wp-content/uploads/2015/03/Improving-Water-Quality.pdf) fact sheet
* News article on how [dams benefit big irrigators, but cost communities, taxpayers, and the environment](https://www.abc.net.au/news/science/2019-10-30/dams-irrigators-drought-environment/11585470)
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| Activities/questions | 1. Read “[fertilisers and the environment](https://www.dpi.nsw.gov.au/agriculture/soils/improvement/environment)” and watch the animation links on the [nutrients](https://www.mdba.gov.au/sites/default/files/worksheet-quality-nutrients.pdf) worksheet. Complete the activities on the nutrients about eutrophication.
2. Read [“improving water quality”](https://www.hort360.com.au/wordpress/wp-content/uploads/2015/03/Improving-Water-Quality.pdf). Use the information to complete the following activities:
	1. Describe (provide characteristics and features of) a riparian zone, use a labelled diagram to support your answer.
	2. Explain how riparian zones affect water quality.
	3. Explain how livestock can affect both water quality and riparian zones if these areas are not fenced off.
3. Read the news article [“dams benefit big irrigators, but cost communities, taxpayers, and the environment”.](https://www.abc.net.au/news/science/2019-10-30/dams-irrigators-drought-environment/11585470) Use the information to create a concept map describing the effects of irrigation and dams construction on water quality and quantity in the Murray-Darling. Break your concept map into affected groups/areas, including farmers, environment, community, and water quality/quantity.
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| Suggested answers | Worksheet answers for activity 1.1. Eutrophication is when a body of water becomes overly enriched with minerals and nutrients that induce excessive growth of plants and algae. This process may result in oxygen depletion of the water body.
2. Phosphorus, nitrogen.
3. Agriculture (fertilisers), aquaculture, septic tanks, urban wastewater, urban stormwater runoff, industry, and fossil fuel combustion.
4. Cyanobacteria (or just bacteria).
5. Plants and animals die, especially fish.
6. Blue-green algae.
7. For humans and livestock, the toxin can cause liver damage, stomach upsets, nervous system disorders, skin and eye irrigations. Wildlife and pets can be poisoned, even killed.
8. The only real current solution is to flush water down the rivers and wash the bloom away. Preventative solutions include using less fertiliser, detergents and agricultural products that contain phosphorus or nitrogen.
9. The cycle should show bacteria in water, nutrients washing off farmland or towns, sun (heating of water), slow-flowing water, and then algal growth. Students may also show fish death or similar.

Answers for activities 2 and 3.1. Improving water quality activities:
	1. Riparian zones are transitional areas between the land and waterway that is vegetated.
	2. Riparian zones can slow the overland movement of water, and cause sediment and nutrients to be deposited on the land before entering the waterway. This vegetation can also take up some of the excess nutrients and shade the streams to regulate temperatures, preventing algae growth.
	3. Uncontrolled livestock use of riparian zones contributes significantly to the amount of sediment and nutrients moving into the waterways. If not managed, stock can overgraze areas along the waterways and leave soils bare. Stock tracks along banks are a major source of erosion and direct inputs of nutrients from manure and urine add to the nitrogen and phosphorus in waterway.
2. Concept map should include effects such as loss of biodiversity, increased salinity from the mouth of the river, loss of quantity of water downstream as flow slows from damming, irrigators clearly benefit financially, communities downstream lose agricultural jobs as farmers sell up and the flow on effect it has for schools and local business.
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### Section four:

Resources to assist students in revising classwork.

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| Focus area | Factors contributing to the degradation of soil and water. |
| Related material/activities | * [Past HSC exam](https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/resources/hsc-exam-papers) questions can be used as formative assessment at the end of topics/sections, using the features on your chosen online platform such as Google classroom can collect and store data on student performance. Sample exam questions could include the following:
	+ 2014 HSC examination, agriculture. Question 21
	+ 2018 HSC examination, agriculture. Question 21, c

© NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2013.* Have students use online tools such as [“Cram”](https://www.cram.com/flashcards/create) to create digital flashcards and test themselves. Flashcards created digitally can be shared between class members through email or export. Each class member can be assigned a topic to complete five cards to share with the group.
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