

**PGRD 2001**

**The Science of  
Living Soils Yrs 5/6**

Stage 3



**GRDC**

GRAINS RESEARCH &  
DEVELOPMENT CORPORATION

## Unit Instructions for Students



### THE SCIENCE OF LIVING SOILS

YEARS 5/6



NOTE: The Science of Living Soils is based upon the downloadable unit of the same name by [AgCommunicators](#).

The growth and survival of living things are affected by physical conditions of their environment (ACSSU094)

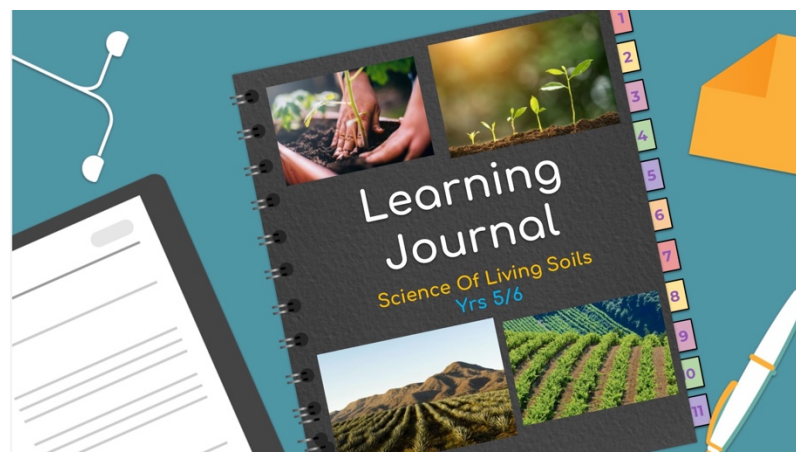
This online course has several individual activities or tasks that you **MUST** complete and submit to your teacher. These tasks form an important part of your final grade.

NOTE: You should contact your teacher to confirm how they want you to submit your work.

In each lesson, students will be asked to reflect on and record their learning in the learning journal, which they can submit to their teacher at the end of the course as evidence of understanding and progress. Click on the following link to access the learning journal:

Save the Learning Journal to Your Computer:

- PowerPoint: [LearningJournal-ScienceLivingSoils.pptx](#)



The learning journal can be used in the following ways. Students may choose to:

- Save the PowerPoint document in the Google Drive. The document can be opened and edited at any time in Google Slides. Changes will be saved automatically. At the



completion of the online course, students can email their teacher with a link to their learning journal as evidence of work completed.

- Save the PowerPoint document on the computer. The document can be opened, edited and saved at any time. At the completion of the online course, students can email their teacher with the PowerPoint document attached as evidence of work completed.
- Open the PowerPoint document, download and print the pages. Record learning with hand-written responses. At the completion of the online course, students can submit the hard copy of their work to their teacher as evidence of work completed.

To complete this unit, you need to complete all the lessons, videos & tasks.

NOTE: A certificate is issued as soon as you complete all lessons within your course. You will need to make sure to click Complete & Continue on every lesson to reach 100% completion. After that, you can simply click Get Your Certificate to download it as a PDF.

Enjoy learning all about living soils!



## Instructions for Teachers

The table below outlines the content and structure of the course, with links to the Australian Curriculums.

Students will need access to the Internet to follow links so that they can answer the questions in each of the lessons. They should record their answers in a document for marking. Marking could be completed as a class group to encourage discussion about the results.

Lesson	Learning content	Australian Curriculum links
1	What is Soil?	ACSSU043 ACSSU094
2	Texture of Soils	ACSSU043 ACSSU094
3	Soil Horizons	ACSSU043 ACSSU094
4	Soil Characteristics	ACSSU043 ACSSU094
5	What Is in Soil?	ACSSU043 ACSSU094
6	Soil Settlement	ACSSU043 ACSSU094
7	Soil Conservation	ACSSU043 ACSSU094
8	Improving Our Soil	ACSSU043 ACSSU094



## What Is Soil?

### Living in Soil

Soils host a quarter of the world's biodiversity. They are important for food security and are essential to support many diverse ecosystems. In fact, the FAO (Food & Agriculture Organisation of the United Nations) estimates that 95% of the world's food is directly and indirectly produced on soils. They also state that healthy soils are the basis for healthy food.



“Soil is the material that makes up the outermost layer of our planet. It is a mixture of broken rocks and minerals, living organisms, and decaying organic matter called humus. Natural processes can take more than 500 years to form 26mm of topsoil” (Poarch 2013).

Soil health is essential to farming as soils and food/fibre production have an important relationship. Soils provide plants with essential nutrients, water, and oxygen, and they provide an anchor point for the plant roots. Soils also provide a home for wide range of vertebrates, invertebrates, fungi and bacteria. Vegetation helps prevent erosion and degradation by stabilising the soil and maintaining water and nutrient cycling.

### What Is Soil?

Soil is the thin outer layer covering the land surface of the earth. It is made up of five main components:

- Mineral particles – such as sand, silt, and clay
- Organic Matter - dead and decaying plants, animals, and animal products
- Water
- Air – this fills the space (or pores) between the soil particles
- Organisms – living organisms such as vertebrates, invertebrates, fungi, and bacteria.

These five components constantly interact with one another and influence the overall soil composition and function.

### What Are the Physical Characteristics of Soil?

The simple physical characteristics of soils include what you can see and touch e.g.

- colour
- depth
- texture (as suggested by the feel)
- structure (how the particles hold together)
- porosity (the space between the particles)
- amount of stone



Good soil structure helps with soil and plant health allowing water and air into and through the ground. While some soils are naturally better structured than others, some characteristics can be changed with good farming practices. It is important to monitor the physical characteristics of your soil to understand your soil condition.



## Texture of Soils

Soil is made up of a mixture of stones, sand, clay, and loam. It also contains air and water. If you pick up some wet soil between your thumb and your forefinger, you can feel the size of the grains. As stones break down with natural weathering processes, they form particles called sand which are the largest particles. The "soil" found on beaches is typically made mainly of sand. Air and water can move easily through the sand so it dries out very quickly.

Clay is made up of very small particles; so small that we can hardly see them. They sit very close to each other. The spaces between them are very small and don't hold much air. If you pick up dry clay, it will feel powdery. Wet clay is sticky and dries slowly. It holds water tightly. Loam is intermediate in size between clay and sand. Besides these things, all soil also contains living things: plants, insects, worms, bacteria, and organic matter, which is made up of the decaying parts of plants, animals, and microbes.

DESCRIPTION OF SOIL AND ITS BEHAVIOUR WHEN MADE INTO WETTED BALL	LENGTH OF RIBBON	TEXTURE GRADE	APPROX. CLAY CONTENT
Ball is smooth and feels like plastic. When handled feels like rigid plasticine and can be moulded into rod without cracking.	>75mm Firm resistance when made into ribbon.	<b>Heavy clay</b>	>50%
Ball is smooth and feels like plastic. When handled feels like plasticine and can be moulded into rod without cracking.	>75 mm Moderate resistance when made into ribbon.	<b>Medium clay</b>	45 – 55%
Ball feels like plastic. Smooth to touch.	Approximately 75 mm Moderately hard to mould into ribbon.	<b>Light medium clay</b>	40 – 45%
Ball feels like plastic. Smooth to touch.	50 – 75mm Can be a little hard to mould into ribbon.	<b>Light clay</b>	
Ball feels like plastic. Small to medium grains of sand can be seen and felt in clay-like texture when made into a ribbon.	50 – 75mm	<b>Sandy clay</b>	35 – 40%
Holds together well, feels smooth. When moulded into ribbon feels plastic and often silky to touch.	40 – 50mm	<b>Silty, clay loam</b>	
Holds together well, feels like plastic. Medium size grains of sand can be seen.	40 – 50 mm	<b>Clay loam, sandy</b>	30 – 35%
Holds together well, feels like plastic. When made into ribbon feels smooth.	40 - 50 mm	<b>Clay loam</b>	<30%
Holds together strongly, sandy to touch, medium grains of sand.	25 – 40 mm	<b>Sandy clay loam</b>	
Holds together, when made into a ribbon feels smooth to silky.	Approximately 25mm	<b>Silty loam</b>	
Holds together well and feels spongy. When made into ribbon feels smooth. Does not feel very sandy. Sometimes feels greasy if it has a lot of organic matter (e.g. broken down leaves).	Approximately 25mm	<b>Loam</b>	25%
Holds together but sandy, medium sized grains of sand can be seen easily.	Small ribbon of approximately 5 – 25mm	<b>Sandy loam</b>	10 – 20%
Holds together slightly, sticky when wet, lots of sand grains stick to fingers, clay stains hands.	Small ribbon 5 – 15mm	<b>Clayey sand</b>	5 – 10%
Holds together slightly.	Small ribbon of approximately 5mm	<b>Loamy Sand</b>	
Ball easily breaks down, cannot be moulded, singular grains of sand stick to fingers.	Cannot be made into ribbon	<b>Sand</b>	< 5%



## Soil Health

The soil's qualities determine its ability to promote plant and animal growth, and maintain water and air quality in the ecosystem. Common constraints to plant growth in Australian soils include:

- acidity
- salinity
- hardness or compaction
- low levels of nutrients

These constraints and poor plant growth can result in the soil being washed away by heavy rainfall or blown away in wind.

[http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soilhealth\\_home](http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soilhealth_home)





## Soil Horizons

Soils are complex structures! They are made up of several layers called horizons, and each horizon is differentiated by a change in colour, composition and/or texture.

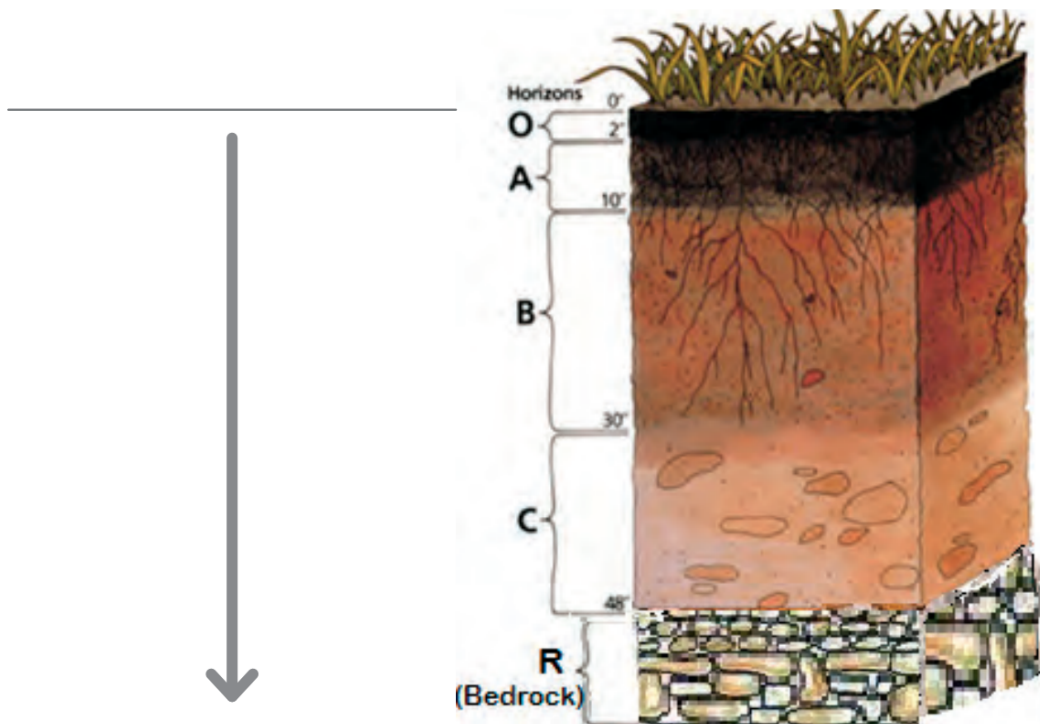
The soil profile is a vertical section of the soil that includes all of its horizons, extending from the soil surface to the parent rock material.

**O horizon:** Loose soil, full of decaying plant matter.

**A horizon:** This topsoil is full of minerals with some further decayed plant material (humus).

**B horizon:** This layer often has more clay. Material from the above layers leaches into this subsoil horizon through drainage.

**C horizon:** This rocky parent material of the soil is partially degraded from the bedrock below.



Watch this video which will show you a range of soil horizons:

- [https://www.youtube.com/watch?v=og9A\\_Apr534](https://www.youtube.com/watch?v=og9A_Apr534)

## Soil classifications

Soil types can be highly variable and differ over short distances. For example, the soil in one part of your backyard can be quite different to the soil in your front yard.



# Soil Characteristics

## Lesson 1

You will need:

- Internet access
- Journal / computer / tablet

**Complete the following:**

1. Open your journal
2. Write out the following questions & your responses in paragraphs.



- Discuss what different soils you/your group might have seen around home/the school.
- Discuss what you think makes soils different colours.
- Why is soil important to the growth of food and fibre (e.g., wheat)?
- What do you think are the characteristics of healthy soil?

According to the Soil Health Knowledge Bank there are six characteristics of a healthy soil. Below are some key words from each of these six measurable characteristics. Use the internet to answer the following questions.

3. Discuss each of these characteristics in a paragraph and talk about what each of these would mean to a farmer.
  - Organic matter: What sort of organic matter is found in soil?
  - Biological function: What sorts of disease harmful to plants and animals can be harboured in soil?
  - Nutrition and fertility: What are macro and micro nutrients?
  - Structure, water storage and drainage: Why can too much drainage of water (e.g., in sandy soils) be detrimental?
  - Soil ecosystems: What types of animals and microbes might live in the soils like that found in your garden?
  - Environmental and community health: Is the soil useful for growing food and safe to use?
4. If you were a farmer, list five things you could do to maintain the health of your soil.
5. Take a photo of some soil from your local area and include it in your journal.

**Healthy soils = healthy plants = healthy people!**



## What Is in Soil?

### Lesson 2

You will need:

- Paper/Newspaper
- Spade
- Bucket
- Magnifying glass
- Camera
- Journal / computer / tablet



Find an area in your garden or around the school where you have permission to collect a small amount of dry soil (about three handfuls).

NOTE: Do NOT throw out your soil when you finish this activity. You will need it in the next one.

1. Dig up about three handfuls of soil from the ground and place it in your bucket.
2. On your desk or countertop, tip the soil onto a piece of paper or newspaper.
3. Using your eyes and a magnifying glass, sort the soil into three separate piles - living things, things that are now dead, things that weren't ever alive.
4. List what you see in your journal.
5. Photograph the three piles individually.
6. Open your journal to take notes.
7. Answer the following in paragraphs: discuss what you found in each pile, how the different piles compared in size, and anything else you observed as you separated your soil.
8. Add the photos of your final three piles to your file.
9. Save your file and add it to your portfolio.

# Soil Settlement Test

## Lesson 3

You will need:

- One (1) handful of the soil collected in previous activity
- Pencils
- Paper
- Empty plastic soft drink bottle (remove label) or jam jar with a screw top lid
- Magnifying glass
- Water
- Camera
- Journal / computer / tablet



Before you start: mix all the soil that you separated in the last activity together into one pile.

In this activity, you're going to mix your soil with water to see how it settles into different layers.

1. Half fill your jar or bottle with water and carefully add one large handful of your soil.
2. Slowly swirl it to mix the water and soil.
3. Fill the rest of the jar or bottle with water until the water is about 2cm from the top.
4. Screw the lid on tightly.
5. Vigorously shake your jar or bottle to thoroughly mix your soil and water.
6. Place your jar or bottle in a safe place so that it won't be moved.
7. Take a photo of it before you let it settle.
8. Leave overnight.
9. Carefully take your jar or bottle off the shelf and place it in a well-lit spot so you can examine it.
10. Using pencil and paper, draw a diagram showing what you see. Label your diagram.
11. Answer the following in your journal: What do you notice about the different layers? What are they made up of? Describe the layers.
12. Photograph your jar or bottle and your diagram.
13. Include the photos in your journal.



## Soil Conservation

Australian gardeners, farmers and soil scientists are always working to develop more sustainable, cost-effective ways to improve the quality of soil, overcome constraints to plant growth and prevent erosion and loss of topsoil from their farms.

Soil pH is a measure of the acidity or alkalinity of the soil. Soils can be classified according to their pH value:

- 6.5 to 7.5—neutral
- over 7.5—alkaline
- less than 6.5—acidic, and soils with pH less than 5.5 are considered strongly acidic.

Soil degradation can occur where the properties of the soil decline over time due to natural processes and/or poor management, so that plants have difficulty growing properly. Wind or water erosion may remove the fertile topsoil where most of the plant nutrients are found. One key to controlling soil erosion by water is increasing the protective cover (living plants, litter, and mulch) on the surface.

<https://www.youtube.com/watch?v=DsdpMCjCVSo>



# How Farmers Improve Their Soil

## Lesson 4

A range of new technologies and farming practises mean scientists and farmers are now able to access much more detailed information about the properties of the soil and how to manipulate and improve it for greater productivity.

They have been trialing and testing improved pasture management over many years leading to improved success in saving and protecting the soil.



## Activity A

1. Watch this [video](https://www.youtube.com/watch?v=DsdpMCjCVSo), and answer the questions about soil in your learning journal.

- <https://www.youtube.com/watch?v=DsdpMCjCVSo>
- What is a farmer's most valuable asset?
- What happened in 1888?
- What was the soil on Steve Wicks's farm like when he bought it?
- What did they learn that started to change the soil?
- How did he describe what the soil is like now?
- On Andrew Hansen's farm what is the soil prone to?
- How did no-till farming affect his land?
- What is part of the role of DEWNR?
- In 2002 the days per year of erosion protection were ..... In 2015 it had risen to .....
- What practises have farmers adopted that have dramatically improved the soil conservation across the state?

2. Save your answers.



## Checklist of Activities

This online course has a number of individual activities or tasks that you **MUST** complete and submit to your teacher. Here is a list of tasks to tick off against your portfolio to ensure you've included everything:

### About Soils Activities

- What is Soil?
- Texture of Soils
- Soil Horizons
- Soil Characteristics
- What Is in Soil?
- Soil Settlement
- Soil Conservation
- Improving Our Soil

*NOTE: You should contact your teacher to confirm how they want you to submit your work.*

You will need to use the file: [LearningJournal-ScienceLivingSoils.pptx](#) that includes all of your assessment files. Make sure that you include *all text, drawings, tables, brainstorm, farm model photos, etc* that are asked for in the tasks. Once you have completed all of the activities, you will need to upload this one (1) file to your teacher for marking.

It is your choice what software you will use to build your Learning Journal. We recommend:

- Microsoft PowerPoint

Other tools you could use to present your portfolio include:

- Keynote
- Pages
- Google Slides

To complete this unit, you need to complete all of the lessons, videos & tasks.