

The Waste Wise Schools Program

Learning to be Waste Wise

Linked to the Australian Curriculum
Foundation to Year 6



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Learning to be Waste Wise Activity Guide for Primary Schools

Introduction

The Learning to be Waste Wise Activity Guide is a series of curriculum-linked activity packs written for the Waste Wise Schools Program. Each booklet covers a different topic including a general introduction to waste, the '3Rs' (Reduce, Reuse and Recycle), 'Worms' and 'Compost'. The activities are designed to complement the school's ongoing waste minimisation projects, and to support learning at every stage of a school's Waste Wise journey. In turn, Waste Wise projects provide real life context to curriculum outcomes while directly involving students in their own learning.

By reinforcing Waste Wise principles through the curriculum in an engaging and practical way, teachers will find it easier to incorporate waste reduction practices in their school. In addition, the involvement of students and the modelling of positive behaviours, reinforces the environmental principles and curriculum outcomes.

The activities are designed to be fun; to promote life-long learning; to empower and enable students, teachers and the rest of the school community to take responsibility for their waste minimisation actions; to develop positive environmental values and to promote long-term behaviour change.

Waste Wise, Sustainability and the Australian Curriculum

Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Actions to improve sustainability are both individual and collective endeavours shared across local and global communities. They necessitate a renewed and balanced approach to the way humans interact with each other and the environment.

Sustainability addresses the ongoing capacity of Earth to maintain all life.

Education for Sustainability (EfS) develops the knowledge, skills, values and worldviews necessary for people to act in ways that contribute to more sustainable patterns of living. It enables individuals and communities to reflect on ways of interpreting and engaging with the world. EfS is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence (Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)).

Sustainability is one of the cross-curriculum priorities in the Australian Curriculum, developed by ACARA, Australian Curriculum, Assessment and Reporting Authority (<http://www.australiancurriculum.edu.au>). Educating students about waste management through the Australian Curriculum learning areas is a great way to develop knowledge, skills, values and worldviews necessary for students to contribute to more sustainable patterns of living.

Waste is a topic that fits easily into every learning area. Waste can easily be integrated into curriculum rather than used as an 'add on'.

All activities in this guide are linked to the Australian Curriculum. Links have been identified in Maths, Science, English and Geography. Detailed links are highlighted at the beginning of each activity. A summary of these learning area links are included in a table before the introduction. The Waste Wise Schools Program is planning to update this guide by adding more Australian Curriculum links as subjects are progressively released (e.g. Art, Civics and Citizenship).

The activities in this guide can also be linked to the existing WA Curriculum Framework in subjects such as Technology and Enterprise, Physical Education and more. It is up to individual users to identify relevant links to the WA curriculum in this 2013 edition. However you can also refer to the earlier 2010 editions of the 'Learning to be Waste Wise' activity guides for Australian Curriculum linked activities.



How to use this booklet

The activities in this booklet have been designed for students in Foundation to Year Six. The majority of the activities are hands-on or interactive and can be completed consecutively to build on knowledge and skills gained. Ideas for extension and assessment are provided at the end of each activity.

We suggest you begin by reading the 'Teacher introduction' for each guide as it contains important background information on the topic. Key words are in bold throughout the guides and can be found in the glossary at the end of each guide. Our website also includes assessment rubrics for the different year levels as Excel spreadsheets so that you can tailor them to your needs.

Structure of each lesson

Each lesson includes the following information for you:

Aim:	Describes the lesson.
Suitable for:	Identifies the year groups the activity is suitable for (e.g. F – Year 6).
Duration:	Outlines the time needed to conduct the lesson. Note that this is a guide only.
Prior learning:	Links to previous lessons in the guide that should be completed before attempting the lesson.
General capabilities:	General capabilities in the lesson are identified – the list of symbols is included below.
Cross-curriculum priorities:	Cross-curriculum priorities are identified - the list of symbols is included below.
Background Information:	Provides a link to relevant sections in the Teacher Introduction.
Key words:	Key words identified. Definitions can be found in the glossary.
Resources:	Outlines resources and preparation needed.
Australian Curriculum Links:	Links are grouped in tables for F – Year 2, Years 3 – 4 and Years 5 – 6.
Set the scene:	A brief activity designed to set the scene for the activity.
Activity Instructions:	Full activity instructions.
Extension and assessment ideas:	Activities to extend. The curriculum links for these are also provided where relevant.

Reduced paper use

To reduce paper use, the activities in this booklet have been designed to be 'worksheet-free'. Questions can be written on the board, overhead projector or interactive whiteboard and students should record answers in a notebook. If photocopying is necessary, consider having students work in groups with one set of directions or questions to share.



Symbols

General Capabilities



Literacy



Numeracy



Information and communication technology (ICT) capability



Critical and creative thinking



Personal and social capability



Ethical understanding



Intercultural understanding

Cross-curriculum priorities












Please note, all activities in this guide link with the cross-curriculum priority of Sustainability. There may also be opportunities to link to Aboriginal and Torres Strait Islander histories and cultures, and Asia and Australia's engagement with Asia, by examining our waste practices through different perspectives.

Based on Australian Curriculum, Assessment and Reporting Authority (ACARA) materials.



Curriculum links

Learning area		Science								Geography				
Learning area outcomes	Science Understanding				Science as a Human Endeavour		Science Inquiry Skills				Geographical Knowledge and Understanding		Geographical Inquiry Skills	
	Biological sciences	Chemical sciences	Earth and space sciences	Nature and development of science	Use and influence of science	Questioning and predicting	Planning and conducting	Processing and analysing data and information	Evaluating	Communicating		Interpreting, analysing and concluding	Communicating	Reflecting and responding
Decomposition in nature	3-4	2	2	1-2	1-6					4				
What can I compost?	3	1, 2, 4, 6	2	1-6	1-6	1-6	F-6	F-6	1-2	F-6	4			
Make your own bottled compost	3	1, 6	2	F-6	1-6	1-6	F-6	1-4	1-2	F-6	4			3-4
Set up a compost system	3-4	2, 4, 6	2	2	2, 4-6					4	4			3-4
Collect and sort compost creatures	F-6				1-6		2-6			1-4	4			
Build a compost creature	1, 5		2											
Compost creatures food web game	3-6				3-4									
Recipe for compost		4	2								4			
Compost relay	4, 6	2			3-4						4			
Weigh your waste											4	4	3-4; 5-6	

Learning area	Mathematics				English			The Arts (draft)
Learning area outcomes	Number and Algebra	Measurement and Geometry	Statistics and probability	Language	Literacy	Visual Arts		
	Fractions and decimals	Using units of measurement	Data representation and interpretation	Text structure and organisation	Expressing and developing ideas	Interacting with others	Interpreting, analysing, evaluating	Creating texts
	Number and place value							
Decomposition in nature								
What can I compost?								
Make your own bottled compost		 3-4						
Set up a compost system								
Collect and sort compost creatures			 1-5					
Build a compost creature						 1-6	 F-6	
Compost creatures food web								
Recipe for compost				 2, 3, 5	 4			
Compost relay						 3, 5, 6		
Compost relay								
Weigh your waste		 5, 6	 3, 4, 5, 6	 5		 3, 4, 5, 6		



Teacher introduction

“Unless someone like you cares a whole awful lot, nothing is going to get better. It’s not.”

–The Lorax, by Dr. Seuss

1.0 What is compost?

Compost is the result of decomposing **organic** materials such as fruit and vegetable scraps, paper, cardboard and garden waste. Compost contains vital nutrients for plant growth and is an excellent soil conditioner as it improves soil structure and enhances water retention. The composting process occurs with the help of moisture, and naturally occurring bacteria, fungi and small **compost creatures** such as earthworms, slaters and millipedes.

Compost can be made on a small scale in your home or school, or on an industrial scale. Some of the councils in Australia compost our household waste to prevent it from going to landfill. For example, the Mindarie Regional Council

has a ‘Resources Recovery Facility’ at Neerabup which creates about 30,000 tonnes of compost from 100,000 tonnes of organic household waste each year.

2.0 Decomposition

Decomposition is a naturally occurring process, which can be aerobic or anaerobic.

Aerobic decomposition is the breakdown of organic waste by micro-organisms that thrive on oxygen. The process is relatively fast and produces heat (the key factor and indicator of a successful compost process). Aerobic compost piles need to be aerated regularly to ensure the survival of the micro-organisms and other compost creatures.

Anaerobic decomposition is the breakdown of organic waste by micro-organisms without oxygen. The process is considerably slower than the aerobic process and when not managed well, can result in unpleasant odours and the production of **methane** gas.

3.0 Organic and inorganic materials

Material is classified into either organic (living or once living) or inorganic (non-living). More than 60 per cent of both school and household waste is organic and has the potential to be diverted from landfill by composting, worm farming, mulching and other methods. .

Organic waste includes anything that once lived or was produced by something that lived and includes but is not limited to:

- fruit and vegetable scraps
- grass clippings and garden prunings
- paper and cardboard.

Inorganic waste includes:

- plastics
- glass
- metals
- other materials such as sand, bricks
- and **hazardous household waste**.



4.0 Why compost?

While organic waste is **biodegradable**, it won't necessarily decompose in a landfill. Excavations of landfills in the United States of America unearthed newspapers that were more than 40 years old and still readable, 10 year old carrots that were brown on the outside but orange on the inside and 20 year old steaks with meat still on the bone (Rathje & Murphy, 2001). The reality is that the conditions in landfills do not encourage decomposition. Landfills are often dry, airless and inhospitable environments for **decomposers**.

When organic waste does decompose in landfills, it is often through the anaerobic process which produces methane gas. Methane is a harmful greenhouse gas with a global warming potential of 25 times that of **carbon dioxide** and is therefore a significant contributor to the warming of the Earth's climate. Currently the waste sector produces about 15 million tonnes of **carbon pollution** each year, equivalent to three per cent of Australia's emissions. Aerobic composting done at home, school or on an industrial scale is therefore a more desirable way to process organic waste while reducing the amount of harmful methane gas entering the atmosphere.

Other benefits of composting include the following:

Compost:

- is a natural fertiliser and its use enables valuable organic matter to be returned to the soil, also reducing the need for commercial fertilisers, herbicides or pesticides
- increases structural stability of soil and reduces soil erosion by up to 30 per cent
- can reduce household waste going to landfill by 60 per cent
- improves the water retention of soil
- increases soil nutrient levels, which in turn assists plant growth, increases disease resistance and improves weed suppression
- can improve the flavour and nutrient content of fruits and vegetables
- can save you money – no need to buy fertilisers or soil conditioners.

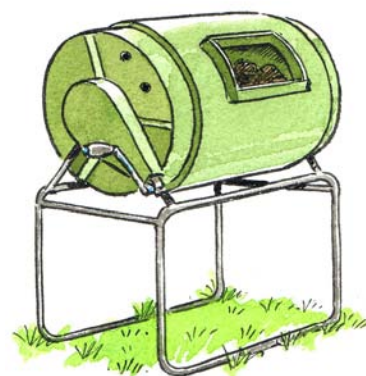
5.0 Choosing the right system for home or school composting

There are a number of ways to produce compost whether you use a commercially available compost tumbler, a compost bin or an open heap.

Pros and cons of different systems.

Tumbler bins are:

- the fastest compost method with compost ready to use in 3-4 weeks
- rodent proof
- aerated easily
- often designed to allow wheelbarrow access for ease of emptying
- an expensive option.



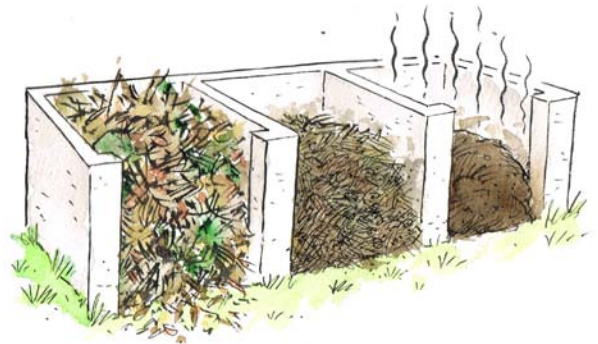
Sit on the ground plastic bins are:

- cheap
- allow for worm activity (providing it is on soil)
- can be aerated with the use of a compost mate (image required)
- rodent proof if the flange (base) is buried.



Compost heaps:

- are cheap or have no cost
- are varied in design
- are most efficient when heap size is at least 1 cubic metre (this helps generate heat that can exceed 60 degrees Celsius. The hotter your heap, the faster it will turn into compost).
- are exposed to the air so can dry out quickly



6.0 The right ingredients

Successful aerobic **compost systems** adhere to the ADAM principles as follows:

A = Aliveness (6.1):	Your compost needs bacteria, fungi and other compost creatures to function. If you have a compost bin, bury the flange (base) in the soil to allow the creatures to get in. For tumblers, add a shovelful of your own compost or soil as this will add the compost creatures and kick-start the process.
D = Diversity (6.2):	Make sure you have diverse ingredients to put in your compost.
A = Air (6.3):	Aerate your compost 2 to 3 times per week.
M = Moisture (6.4):	Water your compost to avoid it drying out.

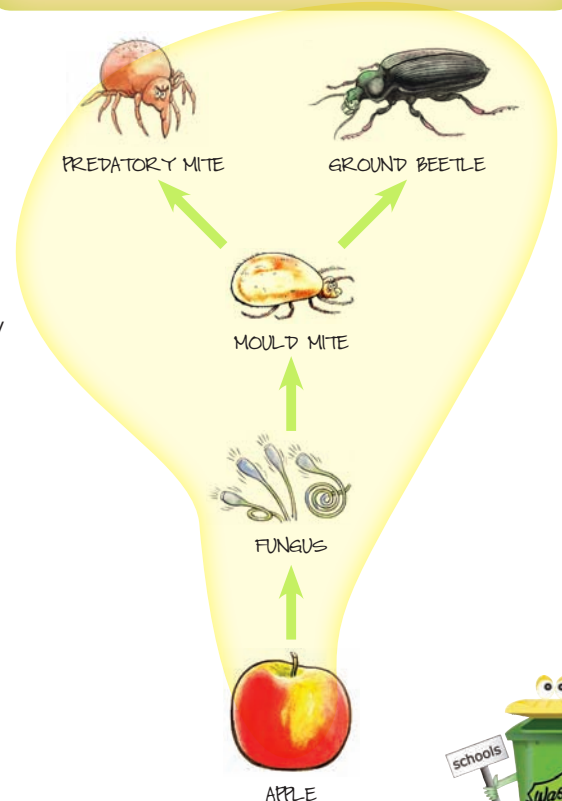
6.1 A = Aliveness

Every compost heap is home to a wide variety of compost creatures that range from microscopic bacteria and fungi to macro invertebrates such as worms, centipedes and beetles. All these creatures play an important role in creating healthy soil. Compost creatures form **food chains**, which together form an intricate **food web**.

Organisms called decomposers are present in food chains and webs. They break down the cells of dead plants and animals into simpler substances. Another way of describing organisms and their relationship in food chains and webs is to call them primary, secondary and tertiary **consumers**. Tertiary consumers eat secondary consumers, secondary consumers eat primary consumers and primary consumers eat **producers** or organic material (Museum Victoria Australia, 2007).

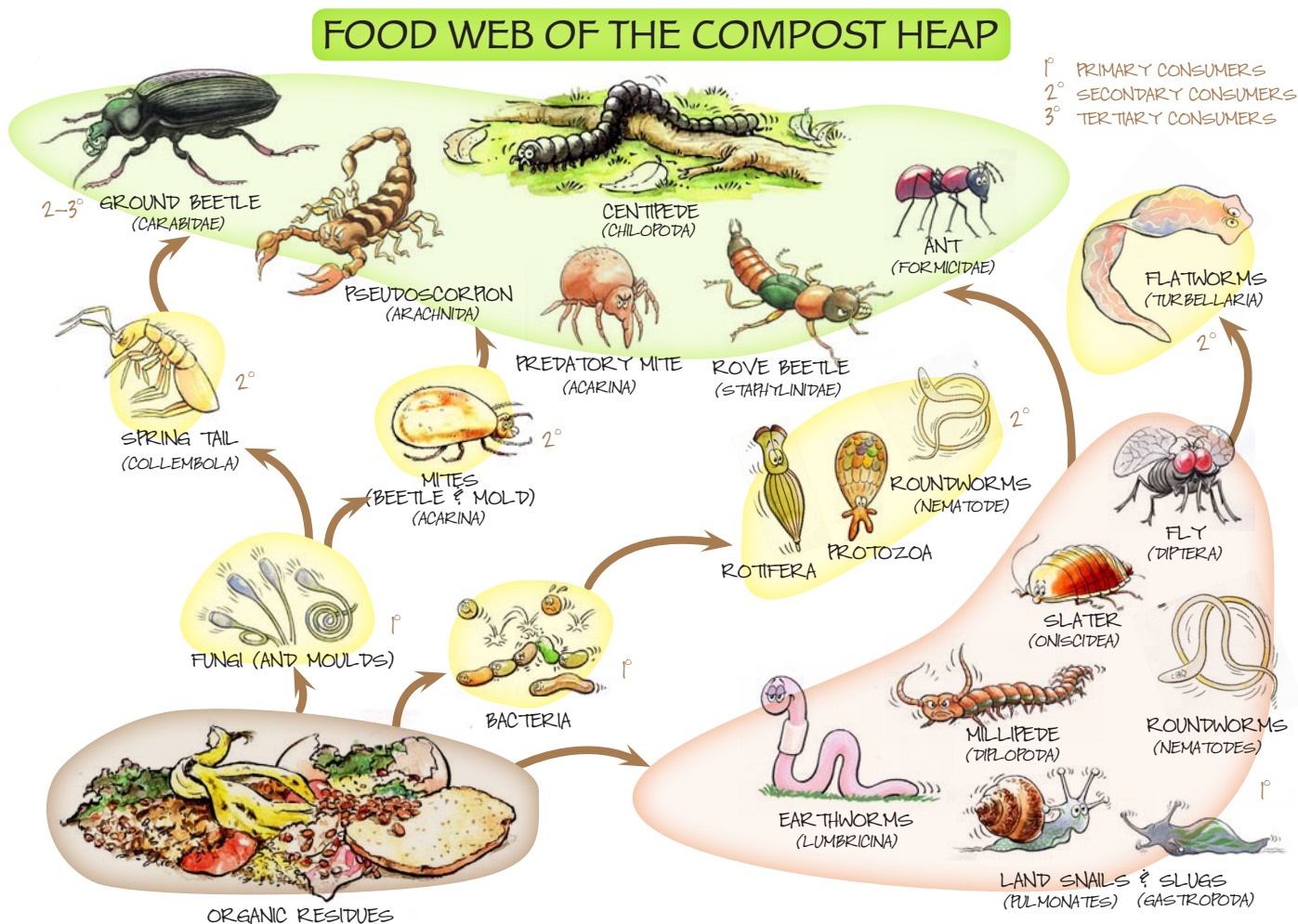
A **food chain** shows who eats what in any given environment. The following is an example of a food chain that exists in a compost system.

FOOD CHAIN OF THE COMPOST HEAP



A food web is a series of food chains that are interrelated by the habits of the predators (the organisms that do the eating) and their prey (the organisms that are eaten).

The following is an example of a food web that exists in the compost heap. For more information on these compost creatures visit the CSIRO website at www.ento.csiro.au/about_insects/index.html.



6.2 D = Diversity

Diversity is an important feature of compost and many other natural systems. Compost needs a mixture of 'green' (nitrogen rich) and 'brown' (carbon rich) materials to achieve good quality compost.

The carbon-rich materials in your compost will provide a source of aeration and structure while the nitrogen-rich materials will provide food for the bacteria and other creatures that break everything down. Too much carbon may result in a dry, slow-processing compost and too much nitrogen can lead to a wet, smelly pile.

Note: It is recommended that you use whatever is easily available to you. For example, you may only have grass clippings, fruit and vegetable scraps, shredded paper and dry leaves— this will be a sufficiently diverse range of materials to ensure that the finished compost will be a rich fertiliser containing a broad range of nutrients.

Compost tip: For one bucket of nitrogen (green) materials such as a fruit and vegetable scraps, add about 4 buckets of carbon (brown) materials such as dry leaves straw or newspaper, and adjust accordingly.



HIGH NITROGEN SOURCES (GREEN):

vegetables and fruit scraps
prunings and lawn clippings
tea bags and coffee grounds
vacuum dust*
crushed egg shells
flowers
manure
wood ash.

* (avoid vacuum dust from carpet as synthetic carpets won't break down and some contain harmful chemicals)

HIGH CARBON SOURCES (BROWN):

shredded paper
newspaper
cardboard
sawdust**
straw
hay
dry leaves
wood chips.

** from wood that has not been chemically treated

KEEP OUT:

meat and bones
dairy products
bread or cake
large branches or logs
diseased plants
pernicious weeds (the plants that re-sprout from a small piece of stem or root)
magazines
chemically treated wood
dog and cat faeces
coal, charcoal ash
plastic, foil and other packaging

It is recommended that these food items are kept out of compost because they are very attractive to pests, such as rats, and some contain fats that can restrict air in the compost. Magazine paper and bleached paper, along with treated wood or sawdust, can leach chemicals into your compost, where it can potentially be absorbed by plants, fruits and vegetables. Also, dog and cat faeces have the potential to infect humans and contaminate food plants through disease.

If in doubt, leave it out!

6.3 A = Air

Oxygen is essential for aerobic decomposition of organic materials by bacteria. An anaerobic compost system (without air) decomposes much slower and produces methane which is a powerful greenhouse gas. To maintain an aerobic environment and to ensure the survival of beneficial micro-organisms, the compost should be turned regularly to allow air to circulate. This can be done with a garden fork or a 'compost mate'.

6.4 M = Moisture

Water is a critical ingredient to the composting process. Without it, the compost won't break down and with too much the compost can become stagnant and smelly. Many of the ingredients used in the compost process however, naturally contain water, such as grass clippings and kitchen waste, and therefore this must be taken into consideration before adding water. The addition of 'brown' material to the compost works to absorb excess water. Compost should be between 40-60 per cent moisture which means it is as damp as a wrung out sponge. If you take a handful of compost from the centre of your compost system and can squeeze just a few drops of moisture out, the moisture content is just right.



7.0 How to make your compost—a compost recipe

There are hundreds of successful compost recipes. What works best for you will vary depending on the ingredients you wish to include and those ingredients that are readily available.

This recipe has been used at West Leeming Primary School for a number of years.

Add in alternating layers of green and brown:

- two lawn mower catcher loads of fresh lawn clippings
- 6-8 kilograms of fruit and vegetable scraps, including tea bags (the smaller the scraps the better)
- 4 litres of sawdust
- 4 litres of shredded paper
- 2 litres of small and/or broken up dry leaves

Note: Where sawdust is not available, just increase the amount of dried leaves and newspaper.

You can continue to add material for two weeks, tumbling or turning over the compost two to three times per week. After two weeks of adding material, just tumble/turn for another two weeks. If the compost is too wet or too dry, adjust materials accordingly.

It is best to have at least two compost systems in place so that you can always be adding material to one while the other matures. Compost should be ready in about four weeks time with this recipe.

Hint: To accelerate decomposition, chop up fruit and vegetable scraps using a spade and galvanised metal bucket.

8.0 Applying your compost to the garden

The best time to apply compost to the garden is in the spring, two to three weeks before you are going to plant. However, compost can be applied at any time. Dig in your compost rather than leave it exposed to sunlight where UV radiation will kill beneficial microbes.

Hint: When planting seedlings in your garden, add a handful of compost to the hole you're going to plant into to give seedlings a good start.



9.0 Compost troubleshooting

- **Too wet:** Improve the drainage and add some carbon-rich (brown) material like newspaper, dry leaves or straw.
- **Too dry:** A lot of ants in your compost can indicate dry conditions. Add water or green material, such as fruit and vegetable scraps or garden scraps.
- **Rodents:** Only add garden material to your open heap as food scraps can attract rodents. Use a tumbler or plastic cone (with the flange well buried) to avoid rodents when composting food scraps.
- **Takes too long to break down:** Check that you have enough green material, proper moisture content, and air.
- **Rotten egg smell:** Your compost is anaerobic (due to a lack of oxygen). It may also have too much water. Turn your compost at least two times per week. Add carbon-rich materials, which will soak up water and add volume for aeration. Ensure no meat or dairy products are included, as decomposition of these results in bad smells.
- **Ammonia smell:** Your compost contains too much nitrogen-rich material e.g. fruit and vegetable scraps. Add carbon-rich material and mix it in.
- **Cockroaches:** They will probably find a way in and can contribute to the composting process, so just let them be.

10.0 Composting precautions

Because compost is produced from natural materials, it contains a variety of living organisms. In general, if the temperature in your compost system gets above 65 degrees Celsius, pathogens (and weed seeds) will be killed.

For health reasons, it is important to consider the following:

- wash your hands after handling compost
- protect broken skin by wearing gloves
- avoid handling compost in confined spaces
- keep compost moist to prevent spores or bacteria becoming airborne and inhaled
- wear a face mask if concerned.

Sources

A Balancing Act (Carbon to Nitrogen Ratios) 2006, Composting 101, viewed 4 May 2009.
<<http://www.composting101.com/c-n-ratio.html>>.

Armstrong, P. and Laffin, J. 1993, *Waste Matters*, Gould League of Victoria, 1993.

Bugs: Food Chains 2007, Museum Victoria Australia, viewed 4 May 2009.
<<http://museumvictoria.com.au/bugs/foodchains/predation.aspx>>.

Foster, Clare 2002, *Compost*, Cassell Illustrated, Great Britain.

Marshall, T. 2003, *Composting: The Ultimate Organic Guide to Recycling Your Garden*, ABC Books, Sydney.

Rathje, W & Murphy, C. 2001, *Rubbish!: The Archaeology of Garbage*, The University of Arizona Press, United States of America

Thompson, Ken 2007, *Compost: the natural way to make food for your garden*, Dorling Kindersley Limited, Great Britain.



Other resources

CSIRO – About Insects

http://www.ento.csiro.au/about_insects/index.html

Gardening Australia – Fact sheet: Step by Step Compost Bin

<http://www.abc.net.au/gardening/stories/s855732.htm>

Home Composting

<http://www.wasteauthority.wa.gov.au/publications/organics-in-your-community>

Microbe Zoo Website – Investigate microbes

www.commtechlab.msu.edu/sites/dlc-me/zoo

Recycle Now – Compost at School

http://www.recyclenow.com/home_composting/compost_at_school/index.html

Organic school gardens – lesson ideas / readings

<http://www.organicschools.com.au>



Compost activity 1 – Decomposition in nature

Aim

Students will share what they already know about compost. They will discuss how composting at school is a natural process of decomposition and discover that it is similar to the process that occurs on the forest floor.

Suitable for: F – Year 6

Duration: One lesson (about 45 minutes)

Prior learning: None

General capabilities:   

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 3.0 Organic and Inorganic materials

You might like to read more on “The science of rot” here <http://www.bbc.co.uk/nature/uk/indepth/science-of-rotting.shtml>

Key words: Compost, decomposition, fungi

Resources

- An outside area with decaying leaves and a decaying log or large rock (with critters hiding under it).
- A projector screen, speakers, computer and access to the internet to show a short video.
- Science journal.
- Pencil.
- An object that has started to decompose (like a leaf from the garden or a piece of fruit).

Activity preparation tasks

- Locate an outside area where students can find decaying leaves and an area with an old log or large rock with creatures underneath it.
- Set up projector and load the following three videos:
 - Decomposition time-lapse: <http://www.bbc.co.uk/learningzone/clips/fungal-growth-using-time-lapse-photography/10485.html>
 - Decomposing fruit bowl: www.youtube.com/watch?v=c0En-BVbGc
 - Guide to composting: <http://www.youtube.com/watch?v=eNqRXM2c6L8>



Australian Curriculum links for F–2

Subject; Strand		
<i>Sub-strand</i> Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).	2	Students observe decomposing in nature and describe how this is like mixing ingredients for compost.
Earth and space science Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students suggest other ways to use food scraps at school (e.g. composting).
Science; Science as a Human Endeavour		
Nature and development of science Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE034).	1-2	Students describe changes as objects decompose and make suggestions about what causes it.
Use and influence of science People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035).	1-2	Students discuss what decomposition in nature teaches us about composting at home or at school.

Australian Curriculum links for Years 3–4

Subject; Strand		
<i>Sub-strand</i> Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044).	3	Students identify one thing that is living, one thing that was once living and one product of a living thing.
Living things including plants and animals, depend on each other and the environment to survive (ACSSU073).	4	Students describe how the trees depend on fungi and bacteria and vice versa.
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062).	3-4	Students discuss what decomposition in nature teaches us about composting at home or at school.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students discuss how natural processes can be used to manage the school's waste.



Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science as a Human Endeavour		
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083, ACSHE100).	5–6	Students discuss what decomposition in nature teaches us about composting at home or at school.
Scientific knowledge is used to inform personal and community decisions (ACSHE217, ACSHE220).	5–6	Students use their new knowledge to discuss what schools could do with their food scraps.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



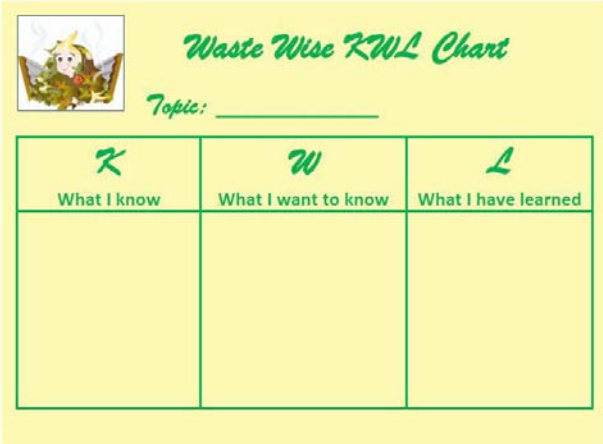
Set the scene

Ask students to record what they know (K) and what they would like to know (W) about composting. You could use a KWL chart (example below). Students can complete what they learned (L) about composting after completing several or all activities in this guide.

Activity for F-Year 6

Outside

1. Take students outside to see if they can locate leaves that have recently fallen to the ground and older leaves that have started to decompose. Ask students to describe the differences. Are they wet or dry? Green or brown? Whole or breaking down? Ask students to share their experiences of other objects that they have seen decomposing
2. Locate a decaying log or large rock. Ask students to watch as you carefully lift the log or large rock to reveal the creatures under it.
3. Ask them to describe what it's like under the log or rock.
 - a. How is the environment different to the area next to the rock?
 - b. Is it dark, cold or wet?
4. Ask them to describe any creatures they see under the log or rock.
 - a. How do they move?
 - b. What colour are they?
 - c. How many legs do they have?
 - d. What are they called?
 - e. Why do they live under the rock?



Waste Wise KWL Chart

Topic: _____

K What I know	W What I want to know	L What I have learned

Example of a KWL chart

Back in the classroom

Video 1: Watch and discuss

1. Watch the video on fungi and decomposition in nature:
<http://www.bbc.co.uk/learningzone/clips/fungal-growth-using-time-lapse-photography/10485.html>
2. Ask students to identify each of these in the decomposition cycle:
 - a. Something that is living.
 - b. Something that was once living.
 - c. A product of a living thing.
3. Discuss with students:
 - a. What kind of "waste" products get recycled in nature?
 - b. Who recycles the waste products, like dead leaves and animal droppings?
 - c. Who do you think provides the waste? And who do you think does the recycling work? Think about the plants and animals including the microorganisms like fungi and bacteria as well as compost creatures like snails, millipedes, earthworms and beetles.
 - d. How do the trees, fungi and bacteria depend on each other?

The trees provide leaf litter to the fungi and bacteria (food source). The fungi and bacteria break down the organic matter and return the nutrients to the soil for the trees.



Video 2: Watch and discuss

1. Watch the video of the decomposing fruit bowl:
www.youtube.com/watch?v=c0En-BVbGc
2. Discuss with students
 - What happened to the fruit in the bowl?
 - What do you think caused the fruit to decompose?
 - Which objects decomposed the fastest or slowest? Were these objects soft or hard?

Video 3: Watch and discuss

1. Watch the video of Costa's guide to composting and worm farming:
<http://www.youtube.com/watch?v=eNqRXM2c6L8>
2. Ask students if they have a compost system at home or if they have seen someone composting at home. Discuss with students:
 - Some schools send their food scraps to landfill. Do you think this is a good way to return the nutrients to nature?
 - Natural processes break down and recycle organic materials (like the leaves and the fruit in the bowl). Do we already use, or do you think we could use, these natural processes to manage our school's fruit and vegetable waste? (Year 4 – ACHGK025).
 - What else could schools do with their food scraps?
 - What happens to the compost once it's ready? Are the nutrients returned to nature?



Application questions

1. Discuss with students:
 - How is composting at home or school similar to the decomposition we saw in the forest and in the fruit bowl?
 - What does decomposition in nature (both in the forest and in the fruit bowl) teach us about composting waste at home or school?
2. Ask student to review their KWL. Is there anything else they would like to know (K)? Did they learn anything from watching the videos (L)?





Compost activity 2 – Investigation: What can I compost?

Aim

Students will conduct an investigation to observe what types of materials are organic and what types are inorganic. Students will also observe the effects of primary consumers (bacteria and fungi) and how materials are physically changed.

Suitable for: F – Year 6

Duration: The initial activity and investigation set up will take about one hour with ongoing observations over at least four weeks. One hour is also needed for observation and discussion at the end of the investigation. More time may be needed for students to write a scientific report.

Prior learning: This activity is best done after the students have completed Compost activity 1 – Decomposition in nature.

General capabilities:    

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 3.0 Organic and Inorganic materials
- 6.0 Choosing the right ingredients
 - 6.1 Aliveness – compost creatures
 - 6.2 Diversity – getting a good balance of green and brown material
 - 6.3 Air
 - 6.4 Moisture

Key words: Compost, decomposition, inorganic, landfill, organic, variable

Resources

- Five clear wide-mouth glass jars
- Three or four pieces of organic material (O) and one or two pieces of inorganic material (I). Examples include orange peels (O), apple core (O), tea bag (O), piece of cardboard or newspaper (O), leaf (O), piece of plastic (I), glass (I) or brick (I)
- Soil to fill the jars (or even better, use some of your finished compost)
- Spray bottle.

Using compost rather than soil in this investigation will speed up the decomposition process because compost has more living organisms to help break down the organic materials.



Australian Curriculum links for F–2

Subject; Strand		
<i>Sub-strand</i> Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Everyday materials can be physically changed in a variety of ways (ACSSU018).	1	Students describe how materials have changed.
Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).	2	Students describe how materials have been changed (by mixing) and identify other materials that could be mixed to create compost.
Earth and space science Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students decide which items can be recycled and which can be composted.
Science; Science as a Human Endeavour		
Nature and development of science Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE034).	1-2	Students describe how materials have changed.
Use and influence of science People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035).	1-2	Students use the results of the investigation to decide which materials can be composted.
Science; Science Inquiry Skills		
Questioning and predicting Respond to and pose questions, and make predictions about familiar objects and events (ACISIS024, ACISIS037).	1-2	Students predict what will happen to each item.
Planning and conducting Explore and make observations by using the senses (ACISIS011).	F	Students use sight to observe items decomposing.
Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources (ACISIS025, ACISIS038).	1-2	Students participate in the investigation.
Processing and analysing data and information Engage in discussions about observations and use methods such as drawing to represent ideas (ACISIS233).	F	Students discuss their observations.
Use a range of methods to sort information, including drawings and provided tables (ACISIS027).	1-2	Students use observations to sort the materials into two groups.
Through discussion, compare observations with predictions (ACISIS212, ACISIS214).	1-2	Compare results with predictions and suggest possible reasons why some materials decompose.
Evaluating Compare observations with those of others (ACISIS213, ACISIS041).	1-2	Students discuss their observations as a class.
Communicating Share observations and ideas (ACISIS012).	F	Students share observations.
Represent and communicate ideas and findings in a variety of ways such as oral and written language, drawing and role play (ACISIS029, ACISIS042).	1-2	Students communicate ideas using oral language.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
<p>Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044).</p> <p>Chemical sciences Natural and processed materials have a range of physical properties. These properties can influence their use (ACSSU074).</p>	3 4	Students sort organic and inorganic materials based on the results. Students identify materials that can be composted.
Science; Science as a Human Endeavour		
<p>Nature and development of science Science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061).</p> <p>Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE050, ACSHE062).</p>	3-4 3-4	Students make predictions and look for a pattern in the results to decide which materials can be composted. Students consider what happens to inorganic materials when they are sent to landfill.
Science; Science Inquiry Skills		
<p>Questioning and predicting With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (AC SIS053, AC SIS064).</p> <p>Planning and conducting Suggest ways to plan and conduct investigations to find answers to questions (AC SIS054, AC SIS065).</p> <p>Safely use appropriate materials, tools or equipment, to make and record observations, using formal measurements and digital technologies as appropriate (AC SIS055, AC SIS066).</p> <p>Processing and analysing data and information Compare results with predictions, suggesting possible reasons for findings (AC SIS215, AC SIS216).</p> <p>Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (AC SIS060, AC SIS071).</p>	3-4 3-4 3-4 3-4 3-4	Students predict which materials will decompose. Students conduct the investigation. Students discuss safety rules. Students compare results with predictions and suggest possible reasons why some materials decompose. Students write a scientific report.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students identify materials that can be composted and discuss what to do with materials that didn't break down.



Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Changes to materials can be reversible such as melting, freezing, evaporating; or irreversible, such as burning and rusting (ACSSU095).	6	Students observe decomposition and consider if it is reversible.
Science; Science as a Human Endeavour		
Nature and development of science Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081, ACSHE098).	5-6	Students predict which materials will decompose and suggest why they decomposed.
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083, ACSHE100).	5-6	Students discuss what can be done with the inorganic materials (plastic, metal).
Science; Science Inquiry Skills		
Questioning and predicting With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231, ACSIS232).	5-6	Students predict which materials will decompose.
Planning and conducting With guidance plan appropriate investigation methods to answer questions or solve problems (ACSIS086, ACSIS103).	5-6	Given the equipment, students suggest ways to conduct the investigation.
Use equipment and materials safely, identifying risks (ACSIS087, ACSIS105).	5-6	Students identify hazards and discuss safety rules.
Processing and analysing data and information Compare data with predictions and use as evidence in developing explanations (ACSIS218, ACSIS221).	5-6	Students compare results with predictions and suggest possible reasons why some materials decompose.
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110).	5-6	Students write a scientific report.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



Set the scene

Discuss the differences between organic and inorganic materials.

Activity for F-Year 2

With guidance students will set up an investigation where they observe the potential decomposition of organic and inorganic materials. Foundation teachers can simplify this investigation by focussing on making and sharing observations.

Investigation instructions

1. Select three or four pieces of organic material (O) and one or two pieces of inorganic material (I) (see list in resources).
2. Fill each jar with soil or compost. Slide each item into the jars of soil, making sure that the item is up against the side of the jar where it can be observed. Spray a little water in each jar to ensure that the soil is moist but not soggy.
3. Take a photo (or draw) the jars so you know what the items looked like at the beginning of the investigation.
4. Over the next four weeks, keep the investigation jars moist using a spray bottle.

Make sure students do not overwater the jars. They should be moist but not soggy or flooded.



Predictions

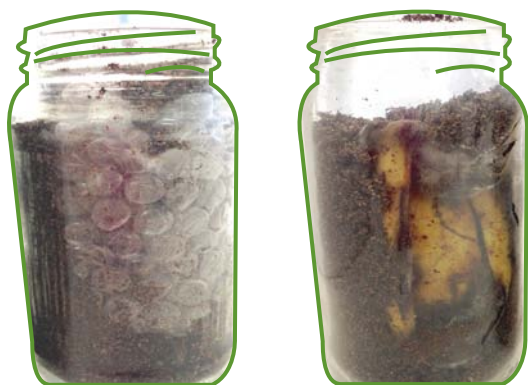
1. Ask students to predict what will happen to each material when it is put in a jar of soil for four weeks and kept moist.

Observations

1. Observe the jars several times during the four-week investigation period. Ask students to describe and record how the items change (or don't change) in each jar.
2. Discuss observations as a whole class to identify similarities and differences in students' observations.
3. After four weeks or more, take a photo of (or draw) each jar and compare these to the original photos (or drawings). Ask students to record observations.

Use the drawings or photographs to monitor the changes.

At the beginning of the experiment



At the end of the experiment (4 – 6 weeks later)



Discussion

Ask students to discuss:

- Which item(s) have changed and how have they changed?
- Compare your predictions with these results. Were your predictions correct?
- What do you think caused the items to change?
- Which item(s) didn't change?
- Why do you think some items changed while others did not?
- Group the items into two categories— organic (those that decompose) and inorganic (those that don't decompose).
- Based on the results, which materials can be put in your compost bin, heap or tumbler?
- Which materials can be recycled?

Application question

Composting is a good way to reduce most organic waste going to landfill – name several items of waste from your lunch, or someone else's lunch, that you could compost.



Activity for Years 3–6

In pairs, students will conduct the investigation outlined above (Activity for F – Year 2).

Investigation instructions

1. Give students the equipment, or the list of equipment, and ask them to design an investigation that investigates which materials decompose and which do not.
2. Discuss the different designs and suggest improvements.
3. Identify possible hazards in this investigation (Years 5 and 6) and discuss any safety rules (Years 3 and 4).
4. Get students to set up their investigation (as they suggested or as outlined in the activity for F – Year 2).

Some possible hazards include mould, glass and sharp objects.

Predictions

1. Ask students to predict which materials will decompose and which will not.

Observations

1. As outlined on the previous page in Activity for F – Year 2.

Discussion

Ask students to discuss:

- Were your predictions correct?
- Which items do you think are organic? Why?
- Suggest possible reasons for why some materials decomposed while others didn't.
- Do you think the changes are reversible? (ACSSU095–Year 6).

Application questions

- Composting is a good way to reduce most organic waste going to landfill. Name five materials you think could go in a compost heap, compost bin or tumbler (ACSSU074–Year 4).
- What would happen to the inorganic materials if you sent them to landfill (e.g. metal, plastic, glass)? Would they decompose? What could we do with these items instead of sending them to landfill? (Think about the 3Rs - reduce, reuse, recycle) (ACHGSO25–Year 3, ACHGSO32–year 4).

Scientific reporting

- Students can now use the investigation to write a scientific report.

Ideas for extension or assessment

The following could be set as a homework task: Do you sort your waste into different bins at home? How many different bins do you have? Research where each of your bins goes and what happens to the waste in each bin. Are any of your bins sent to a compost facility? Share your research with your class (you might be surprised at how different each area is). (ACHGSO31–Year 4)

This activity could be extended or assessed for Years 3 –6 by doing a controlled investigation using ten jars with five different types of organic material.



Extension/assessment activity for Years 3-6

Investigation instructions

1. Place an item and soil in all ten jars (e.g. two jars with apple cores, two with a piece of cardboard, etc so that you should have two identical sets of five jars).
2. Label one set of jars 'water added' and the other set 'no water added'.
3. Water one set of five jars (labelled 'water added') lightly to keep them moist. Do not water the other set of five jars at all (labelled 'no water added').

Ask students which variable should be changed to determine if moisture affects the rate that organic materials decompose (AC SIS087, AC SIS104–Years 5–6).

Observations

1. Over the four-week period, keep the 'water added' jars moist with a light spray bottle. Observe and record what happens to the items during this time.

Discussion

Ask students to discuss:

- Did one set of jars decompose more than the others? If so, which set (water added or no water added)?
- What does this scientific investigation teach us about composting at home or school? (ACSHE217, ACSHE220–Years 5-6)
- Why is it better to compost your lunch scraps instead of sending them to landfill?
- Was this a fair test? (ACSIS058, ACSIS069–Years 3–4)
- Compost needs to be kept moist. What do you think would happen to the compost creatures if you didn't water the compost? (ACSSU073–Year 4)
- Suggest ways to improve the investigation. (AC SIS091–Years 5–6)

Water is an important ingredient in the composting process. You need to keep your compost moist (refer to Introduction, 6.4 Moisture).





Compost activity 3 –

Investigation: Make your own bottled compost

Aim

Students will build their own mini compost in bottles and observe how organic material is broken down by primary consumers (such as fungi and bacteria) and turned into compost.

Suitable for: F – Year 6

Duration: The initial activity and investigation set up will take about one hour with ongoing observations over at least four weeks. One hour is also needed for observation and discussion at the end of the investigation. More time may be needed for students to write a scientific report.

Prior learning: This activity is best done after the students have completed other activities about compost. Some useful activities include: Compost activity 1 - Decomposition in nature and the Compost activity 2 - Investigation: What can I compost?

General capabilities:     

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 3.0 Organic and Inorganic materials
- 4.0 Why compost?

Key words: Compost, consumer, decomposition, organic

Resources

Years 3 - 6 will need one set of the following for each pair or group of students.

- Clear two-litre plastic soft drink bottle or fruit juice bottle (leave the cap on but remove the label)
- Masking tape
- One cup of compost or garden soil
- One cup of well-chopped fruit and/or vegetable scraps ('green' material)
- One cup of torn newspaper ('brown' material)

Note only a handful of soil is sometimes added to a compost to add beneficial bacteria.

- One cup of leaves ('brown' material)
- Two felt marking pens of different colours
- Water in a spray bottle.

It is better to use compost for this investigation rather than soil if you can. Often gardeners add mature compost to the new batch of compost when starting out. This helps kick-start the composting process as the mature compost adds lots of useful microorganisms like bacteria and fungi.



Australian Curriculum links for F–2

Subject; Strand		
<i>Sub-strand</i> Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Everyday materials can be physically changed in a variety of ways (ACSSU018).	1	Students observe how organic materials change over time.
Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).	2	Students combine ingredients to make compost.
Earth and space science Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students list materials from home that can be composted.
Science; Science as a Human Endeavour		
Nature and development of science Science involves exploring and observing the world using the senses (ACSHE013).	F	Students observe and share their observations.
Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE034).	1-2	Students describe changes in the bottled compost.
Use and Influence of Science People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035).	1-2	Students use the results to choose other items that can be composted.
Science; Science Inquiry Skills		
Questioning and predicting Respond to and pose questions, and make predictions about familiar objects and events (ACSIS024, ACSIS037).	1–2	Students predict what will happen to each item.
Planning and conducting Explore and make observations by using the senses (ACSIS011).	F	Students use sight to observe items decomposing.
Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources (ACSIS025, ACSIS038).	1–2	Students participate in the investigation.
Processing and analysing data and information Through discussion, compare observations with predictions (ACSIS212, ACSIS214).	1–2	Students compare observations with predictions of decomposition.
Evaluating Compare observations with those of others (ACSIS213, ACSIS041).	1–2	Students discuss their observations as a class.
Communicating Share observations and ideas (ACSIS012).	F	Students share observations.
Represent and communicate ideas and findings in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042).	1–2	Students communicate ideas using oral language.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things including plants and animals, depend on each other and the environment survive (ACSSU073).	4	Students test whether finely chopped vegetable scraps decompose faster than coarsely chopped and reasons why.
Science; Science as a Human Endeavour		
Nature and development of science Science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061).	3-4	Students test their predictions to develop ideas about composting.
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE050, ACSHE062).	3-4	Students discuss what lessons about composting can be learnt from the investigation and discuss why it is important to compost.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (AC SIS053, AC SIS064).	3-4	Students predict which materials will decompose.
Planning and conducting Safely use appropriate materials, tools or equipment, to make and record observations, using formal measurements and digital technologies as appropriate (AC SIS055, AC SIS066).	3-4	Students set up compost bottle and measure changes with a ruler.
Processing and analysing data and information Compare results with predictions, suggesting possible reasons for findings (AC SIS215, AC SIS216).	3-4	Students compare observations with predictions of decomposition.
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (AC SIS060, AC SIS071).	3-4	Students write a scientific report including a cross-sectional diagram of the bottled compost.



Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students brainstorm ways to manage the school's fruit and vegetable scraps.
Geography; Geographical Inquiry and Skills		
Reflecting and responding Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS025, ACHGS032).	3-4	Students discuss which type of composting system is best for their school and why it is important to compost at school.
Mathematics; Measurement and Geometry		
Using units of measurement Measure, order and compare objects using familiar metric units of length, mass and capacity (ACMMG061).	3	Students use a ruler to measure changes in organic layers.
Use scaled instruments to measure and compare lengths, masses, capacities and temperature (ACMMG084).	4	

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Changes to materials can be reversible such as melting, freezing, evaporating; or irreversible, such as burning and rusting (ACSSU095).	6	Students observe decomposition and consider if it is reversible.
Science; Science as a Human Endeavour		
Nature and development of science Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081, ACSHE098).	5-6	Students test their predictions to develop ideas about composting.
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083, ACSHE100).	5-6	Students identify what the investigation teaches us about composting.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231, ACSIS232).	5-6	Students predict which materials will decompose.
Planning and conducting Decide which variable should be changed and measured in fair tests and accurately observe, measure and record data, using digital technologies as appropriate (ACSIS087, ACSIS104).	5-6	Students discuss which variables to keep constant and which to change. They use measurements and drawings/photographs to record results.
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110).	5-6	Students write a scientific report including a cross-sectional diagram of the bottled compost.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Activity preparation tasks

- Cut the juice bottle about a third of the way down. See illustration below.
- Prepare the compost materials. Depending on year level, you may want to get students to help with the preparation.
- Chop fruit and vegetable scraps
- Shred newspaper
- Collect Leaves

Set the scene

Ask the students to share what they have learned so far about compost including the ingredients that are needed and what happens to different materials during the composting process.

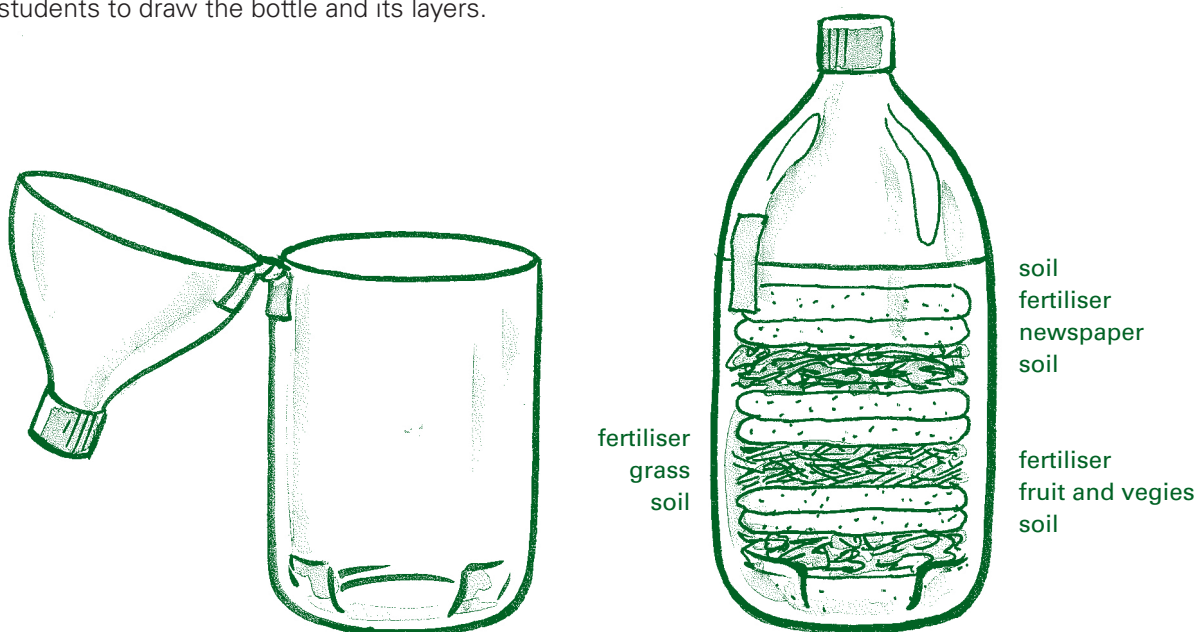
Activity for F-Year 2

With guidance students will set up an investigation which models the composting process. Foundation teachers can simplify this investigation by focussing on making and sharing observations.

Investigation instructions

1. Push the top part of the bottle back to allow filling of the bottle. Add 20-30 millimetres of soil or mature compost to the base of the bottle then add 20-30 millimetres of fruit and vegetable scraps. Cover with a 5 millimetre layer of soil or mature compost.
2. Add 20-30 millimetres of newspaper.
3. Add 20-30 millimetres of dry leaves and grass clippings.
4. Continue to add alternate layers of green and brown organic material until the bottle is full. Spray the top surface with water until the bottle is moist.
5. Pull the top over the base and secure it with masking tape.
6. With a felt pen, draw lines on the bottle to show the levels of the organic material and soil. Write the date on the bottle. Year 2 students may also like to measure each section and record on their diagram.
7. Take a 'before' photo to use for comparison later.
8. Ask students to draw the bottle and its layers.

Make sure students do not overwater. It should be moist but not soggy/flooded.



Predictions

1. Discuss the ingredients and predict what might happen to the contents over time.

Observations

1. Keep the bottled compost moist over the four-week investigation period using a spray bottle.
2. Observe the compost bottle every few days for four weeks. Ask students to record any changes in the layers and discuss. Use the 'before' photo and drawing to identify changes in colour, size and shape of the organic material.
3. After four weeks, mark the new levels of the organic material and soil layers on the bottle using a different coloured felt pen.

In this activity, you will not aerate the compost as this will interfere with observations. However, aeration is vital for organic materials to break down quickly in a compost heap.

Discussion

Ask students to discuss:

- What happened to the contents? Is this what you predicted?
- How much did the top mark on the bottle drop?
- What do you think caused the changes you observed?
- We can use this investigation to help care for our environment. List other materials from your home or school that could be combined to make compost (Year 2–ACSSU031)

Application question

What lessons can you learn about composting from this investigation? For example, compost needs to be kept moist. (adapted from Armstrong and Laffin, 1994).

Activity for Years 3–6

Students will conduct a controlled investigation to test the effect of material size on the rate of decomposition. They will set up the investigation above but with two bottles.

Bottle 1: Finely chopped fruit and vegetable scraps (diced)

Bottle 2: Coarsely chopped fruit and vegetable scraps (e.g. a whole or half an apple)

Finely chopped material will decompose faster than coarsely chopped material because the material has more surfaces (and hence more surface area) available for the bacteria and fungi to do their work on. Chopping your food and garden wastes with a shovel or running them through a blender or mulcher will increase their surface area, thus speeding up your compost process.



Investigation planning

1. Set up an example bottle of compost to show students (use instructions above).
2. Ask students to finely chop one cup of fruit and vegetable scraps. Leave the other scraps whole or coarsely chop them.
3. Ask the students to predict which material will breakdown faster, the finely chopped scraps or the large food scraps.
4. Ask students to write a question to investigate e.g. Will the finely chopped apple decompose quicker or slower than the large chunks of apple?
5. Show students the equipment and ingredients. Ask students to identify the variables that will need to stay the same and the variable that will be changed in this investigation.

Investigation instructions

1. Set up the investigation (you might like to do this as a class or in smaller groups). Make sure the bottles are clearly labelled 'coarsely chopped' and 'finely chopped'.
2. Once the investigation is set up, ask students to draw and label a cross-sectional diagram of each bottle (including labels and measurements for each section).
3. Take a 'before' photo of both bottles.

Remember to keep the compost bottles moist over the four-week investigation period using a spray bottle.

Observations

After four weeks, observe changes and:

- take an 'after' photo
- ask students to draw and label a second set of cross-sectional diagrams of their bottles (including labels and measurements for each section).

Discussion

Ask students to discuss:

- How have the contents of the bottle changed over time? You might like to compare the bottles with your 'before' photos.
- Were your predictions correct?
- Compare the top mark on each of the bottles. How much did the top mark on each bottle drop in four weeks? Is there a noticeable difference between the two bottles you were testing?
- What do you think caused these changes?
- Which bottle showed the fastest rate of decomposition? Why do you think this bottle decomposed faster?
- Pour the contents of the bottle onto a sheet of newspaper. What are the contents of the bottle like?

Application questions

Our school produces a lot of organic waste such as fruit and vegetable scraps. Brainstorm ways we could manage this waste sustainably? Examples could include compost, worm farm, bokashi bin, chickens and reducing the waste by bringing less lunch. Why is this important to your school and community? (Year 3 - ACHGSO25, Year4 - ACHGS032)

Scientists use knowledge from investigations such as this to make sense of the world. What lessons did you learn about composting from this investigation?



Reporting

Write a scientific report on this investigation. Include the cross-sectional diagrams of the bottled compost.

Other variables you could test

You may like to test other variables in this way such as:

- *Moisture*: Dry conditions vs. moist conditions (e.g. keep one bottle moist by spraying with a bottle and do not water the other)
- *Soil/compost*: Omit soil and compost entirely from one bottle
- *Material type*: Use different types of plant materials such as twigs vs. leaves or soft fruit vs. hard fruit.

Ideas for extension or assessment

- Discuss how this investigation is a model of composting in the school environment. Ask students to make a model of a compost bin or ask them to draw a cross-sectional diagram of a compost bin, showing the layers they would add (Year 4-AC SIS093).
- Research: How does science help gardeners? (Years 3 -4, ACSHE051, ACSHE062).
- Take a photo of the bottled compost every morning and afternoon for four weeks and use them create a time-lapse 'video' of decomposition.
For inspiration look online for a time lapse video of a fruit bowl decomposing or go to http://www.youtube.com/watch?v=c0En_BVbGc.
- Plant a few seeds in a bottle of finished compost and also plant some in a bottle of soil that is nutrient poor (e.g. sand or poor quality soil). Record your observations for a few weeks. What do you observe?



Compost activity 4 – Set up a compost system

Aim

Students will set up a compost system (bin or tumbler). They will maintain and observe the compost throughout one school term.

Suitable for: Year 2 – Year 6

Duration: Two lessons; one to plan and one to set up the compost (about 80 minutes in total) plus ongoing maintenance and observations.

Prior learning: This activity is best done after the students have completed other activities about compost. Some useful activities include: Compost activity 1-Decomposition in nature, Compost activity 2-What can I compost and the Compost activity 3-Bottled compost

General capabilities: 

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant

- 5.0 Choosing the right system for home or school composting
- 6.0 The right ingredients
 - 6.1 Aliveness
 - 6.2 D = Diversity
 - 6.3 Air
 - 6.4 Moisture
- 7.0 How to make your compost – A compost recipe
- 9.0 Compost troubleshooting
- 10.0 Composting precautions

The Organic Schools website has information on making compost and what makes healthy soil. The text is designed to be read by students. It uses simple language that older primary students will understand.

<http://www.organicschools.com.au/teaching-resources/curriculum-materials/topic-2-living-soil/>

Key words: Compost, compost creatures, decomposition, landfill, organic

Resources

- An area outside where you can compost
- Compost cone or tumbler
- Garden fork or compost mate to turn and aerate the compost
- Gloves
- Thermometer (optional)



- Materials for the “green” and “brown” layers should be sourced from your school (or students could bring from home) and could include
 - Three buckets of small/medium twigs
 - Three buckets of fresh lawn clippings (or green garden prunings put through mulcher)
 - Six buckets of fruit and vegetable scraps, including tea bags (the smaller the scraps the better) – if you don’t want to use this, simply collect more green prunings / lawn clippings. Leave bread out of the compost
 - 20 buckets of small and/or broken up dry leaves or dry brown grass clippings or a bale of straw / lucerne
 - Two buckets of shredded paper (newspaper, office paper and cardboard)
 - A few scoops of mature compost or cow manure.

For more alternatives for green and brown materials see 6.2 D = Diversity

Alternatively, you could choose to do this activity by building a compost pile or compost bay. You will need to increase the volume of materials to do this and cover the compost with black plastic or a moist hessian sack to keep the compost from drying out.



Activity preparation tasks

- Get students to bring in newspaper and bags of leaves.
- Collect fruit and vegetable scraps from the canteen, students and staff. You might also like to collect scraps from your local fruit and vegetable shop.
- Decide on the best system for your school (tumbler, bin or heap e.g. three bays).
- Consider a suitable location to build your compost. You might like to discuss this with other staff and seek permission.
- Collect all the materials required for composting (see resources).



Australian Curriculum links for F-2

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).	2	Students combine different materials to make compost.
Earth and space science Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students observe how food scraps and other materials are used in composting.
Science; Science as a Human Endeavour		
Nature and development of science Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE034).	2	Students describe changes to the compost over time.
Use and Influence of Science People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035).	2	Students use science to create compost.



Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044).	3	Students identify living things in the compost and also list items that were once living that can be composted.
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073).	4	Students describe what compost creatures need to survive.
Chemical Sciences Natural and processed materials have a range of physical properties. These properties can influence their use (ACSSU074).	4	Students identify materials that can be composted.
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE050, ACSHE062).	3-4	Students consider what happens to organic materials when they are sent to landfill.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students build and observe a compost using organic waste.
Geography; Geographical Inquiry and Skills		
Reflecting and responding Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS025, ACHGS032).	3-4	Students propose actions they, or others, could take to prevent organic waste from schools, cafes and homes from going to landfill.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical sciences Changes to materials can be reversible such as melting, freezing, evaporating; or irreversible, such as burning and rusting (ACSSU095).	6	Students decide if composting is reversible.
Science; Science as a Human Endeavour		
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083, ACSHE100).	5-6	Students discuss actions they could take to prevent organic waste going to landfill.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



Set the scene

Discuss the ADAM principles with students

- 6.1 Aliveness
The compost needs bacteria, fungi and other compost creatures.
- 6.2 D = Diversity
We need to give the compost a variety of green and brown materials.
- 6.3 Air
Compost creatures need air so you will need to keep the compost aerated by turning it.
- 6.4 Moisture
Compost needs to be moist but not too wet.

Ask students to create a funny song or poem to help them remember the words (aliveness, diversity, air and moisture).

Activity for Year 2–Year 6

Setting up your compost bin

You will build the compost with layers of green and brown. It's a good idea to start with a coarse layer to allow the air to flow through the compost. Each layer should be about the width of your hand.

1. Take a photo of the compost materials so you can compare it to the final product.
2. Create a layer of twigs, larger leaves and/or cardboard (a coarse layer).
3. Add a layer of 'green' material (about half the width of your hand).
4. Add a layer of 'brown' material (if using newspaper or paper; scrunch it into loose balls and place in a single layer).
5. Continue adding layers of green and brown materials until they are all used.
6. Measure the temperature of the compost materials by putting the thermometer into the centre of the compost bin and record. Allow for several weeks decomposition and record temperature again.

Distribute several handfuls of mature compost or cow manure throughout each layer. If you don't have matured compost you could use cow manure.

Setting up your compost tumbler

Compost tumblers will make compost in 14 days if set-up correctly. To achieve this, the tumbler should be three-quarters filled with both green and brown materials (do not continuously add material). Exclude coarse material or process through a power shredder. Compost tumblers are great if you have a large volume of material for each fourteen-day tumbling session.

1. Take a photo of the compost materials so you can compare it to the final product.
2. Add alternative "green" and "brown" materials to your compost tumbler. As you go, add several handfuls of mature compost, cow manure or blood and bone. This will add "aliveness" and kickstart the composting process.
3. Agitate the tumbler daily by turning several revolutions.

Hint: To accelerate decomposition, you may want to chop up fruit and vegetable scraps using a spade and galvanised metal bucket.



Back in the classroom

1. Ask students to record the materials and steps used to create the compost (e.g. labelled drawing).
2. Anything that was once living can be added to the compost bin or tumbler. Ask students to list at least five things that were once living that we could add to the compost bin or tumbler.

Maintaining and observing the compost

1. Turn the compost twice a week either by tumbling or with a compost mate (from hardware stores) or by getting a garden fork in and mixing it up. Alternatively, you can pick the bin up and move it then put the materials back in to the empty bin.
2. Adjust your compost if needed. If the compost looks dry, add water and if it looks too wet add dry materials like shredded paper or hay. For other troubleshooting options see 9.0 Compost troubleshooting.
3. Ask students to take regular photos of the compost and observe how the compost changes each week.
 - Does the volume of compost seem to be shrinking? What could explain this?
 - What is the compost like e.g. warm or cold, moist or dry?
 - What does the compost look like? (e.g. dark soil)
 - What does the compost smell like? (It should smell earthy – if not, try troubleshooting).
 - Is the compost changing colour?
 - Can you still recognise all of the ingredients?
 - What kind of living things can you see in the compost?
 - What do the compost creatures need to survive (e.g. air, moisture, nutrients and shelter)? How does the compost provide these things?
 - Are there more compost creatures now compared to when the compost was started?
 - Is the composting process reversible (Year 6)?
4. Measure the temperature of the compost each week and record (try to measure in the centre of the compost where the heat is generated).
5. Ask students to create a blog, photo journal or diary of the composting process.

Use the final product to enrich your garden beds.



Application questions

1. Ask students to discuss:
 - what things did you find easy in the composting process and what things did you find difficult?
 - what did you learn about composting?
2. Do you think a banana skin would break down more quickly in a compost pile or in landfill? Discuss why composting is important in managing and reducing organic waste that is sent to landfills. Propose actions you, or others, could take to prevent organic waste from schools, cafes and homes from going to landfill.

Many people think it's OK to send organic waste to landfill because it breaks down. This however is not entirely true. Decomposition in a landfill is slow as there is little air, materials are varied and compacted and it is an inhospitable environment for compost creatures.

This lesson was adapted from a lesson designed by Rous Water called Composting with the 'Green House' Lesson Plan. Accessed 22 June 2013.

Ideas for extension or assessment

- Plant a few seeds in three different containers.
 - one with mature compost
 - one with a mixture of 50% compost and 50% garden soil
 - one with nutrient poor sand (or poor quality soil).
- Record your observations for a few weeks. What do you observe?

Dwarf beans are good for this investigation because they grow quickly.

Lines of humus not hubris

*When my last breath is drawn
Take not time to weep.
Lay me, bare as I was born
On my compost heap.*

*Babble not of dust to dust,
Make no holy fuss,
Let my epitaph be just
"Human to humus".*

*Pray you, as you go your ways,
Weilding spade or hoe.
Spare me just one word of praise
Busy there below.*

J.D.G Medley, 1952





Compost activity 5 – Collect and sort compost creatures

Aim

In this activity, students will collect compost creatures using one of three methods; a Berlese funnel, pitfall trap or desk tray. Students will examine the creatures that they find.

Note: The best option for collecting compost creatures is from a compost heap rather than a tumbler as more creatures will inhabit a compost heap.

Suitable for: F – Year 6

Duration: Set-up could be done in the morning (30 minutes) and sorting could be done in the afternoon (approximately one hour).

Prior learning: This activity is best done after the students have completed other activities about compost. Some useful activities include watching the video links in Compost activity 1-Decomposition in nature.

General capabilities:    

Collecting compost creatures

This activity requires your class to collect compost creatures. There are three methods you can use including:

1. Berlese funnel
2. Pitfall trap
3. Desk top tray.

A description of each method is included after the activity instructions.

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 6.1 Aliveness
- 10.0 Composting precautions

Key words: Berlese funnel, compost, compost creatures, pitfall trap



Be kind

Be sure to treat the compost creatures gently and with respect while observing them as they are very fragile. Be sure to release the compost creatures back into the compost heap after examining them.

Resources

Different resources are needed for the Berlese funnel, pitfall trap or desk top tray. These resources are listed with the description of each method at the end of the activity.

Australian Curriculum links for F-2

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences		
The way objects move depends on a variety of factors, including their size and shape (ACSSU005).	F	Students observe the movement of living things and describe how they move.
Living things have a variety of external features (ACSSU017).	1	Students draw a compost creature.
Living things including plants and animals, depend on each other and the environment survive (ACSSU073).	1	Students describe how the light changes the compost creatures' environment.
Earth and space science		
Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students discuss how compost creatures help reduce food waste going to landfill.
Science; Science as a Human Endeavour		
Use and Influence of Science		
People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035).	1-2	Students discuss how compost creatures help reduce food waste going to landfill.
Science; Science Inquiry Skills		
Processing and analysing data and information		
Use a range of methods to sort information, including drawings and provided tables (AC SIS040).	2	Students sort compost creatures and construct a picture graph with teacher guidance.
Communicating		
Represent and communicate ideas and findings in a variety of ways such as oral and written language, drawing and role play (AC SIS029, AC SIS042).	1-2	Students draw and label a compost creature.
Mathematics; Statistics and probability		
Data representation and interpretation		
Represent data with objects and drawings where one object or drawing represents one data value. Describe the displays (ACMSP263).	1	Students collect compost creatures, organise into categories and draw a picture graph.
Create displays of data using lists, table and picture graphs and interpret them (ACMSP050).	2	Students collect compost creatures, organise into categories and draw a picture graph.



Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044).	3	Students identify different features of the compost creatures and use this to group them.
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073).	4	Students discuss the conditions compost creatures need in a compost heap.
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE050, ACSHE062).	3-4	Students discuss how compost creatures help reduce food waste going to landfill.
Science; Science Inquiry Skills		
Processing and analysing data and information Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS057, ACSIS068).	3-4	Students produce a table of class results.
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071).	3-4	Students draw and label a compost creature and graph the results.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students discuss how compost creatures reduce waste going to landfill.
Mathematics; Measurement and Geometry		
Using units of measurement Identify a question of interest based on one categorical variable. Gather data relevant to the question (ACMSP068).	3	Students collect categorical data (on compost creatures) and organise into categories.
Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069).	3	Students draw a picture graph (one-to-many) for the class results.
Interpret and compare data displays (ACMSP070).	3	Students compare their graphs with others.
Select and trial methods for data collection, including survey questions and recording sheets (ACMSP095).	4	Students collect data on compost creatures.
Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values (ACMSP096).	4	Students construct a table with class results and decide the best way to graph results.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things have structural features that help them to survive in their environment (ACSSU043).	5	Students identify structural features that compost creatures need to survive.
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094).	6	Students identify the conditions compost creatures need to survive.
Science; Science as a Human Endeavour		
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083, ACSHE100).	5-6	Students discuss how compost creatures help reduce food waste going to landfill.
Science; Science Inquiry Skills		
Processing and analysing data and information Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (AC SIS090, AC SIS107).	5-6	Students construct a table and graph of results.
Mathematics; Measurement and Geometry		
Using units of measurement Pose questions and collect categorical or numerical data by observation and survey (ACMSP118).	5	Students collect categorical data by survey.
Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies (ACMSP119).	5	Students construct a table with class results and decide the best way to graph results.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



Set the scene

Ask students what creatures they think they might find in the compost and why they think they live there.

Activity for F–Year 6

Collect the compost creatures

Collect compost creatures using either the Burslese funnel, pitfall trap or in a desk tray. A description of each method is included after the activity instructions.

1. Discuss with students how the chosen method works. You might like to have different groups of students try out the different methods.
2. Place any creatures in jars, on a petri dish or in magnification boxes for all to see.

Observe the compost creatures

Observe the compost creatures and ask students to answer these questions:

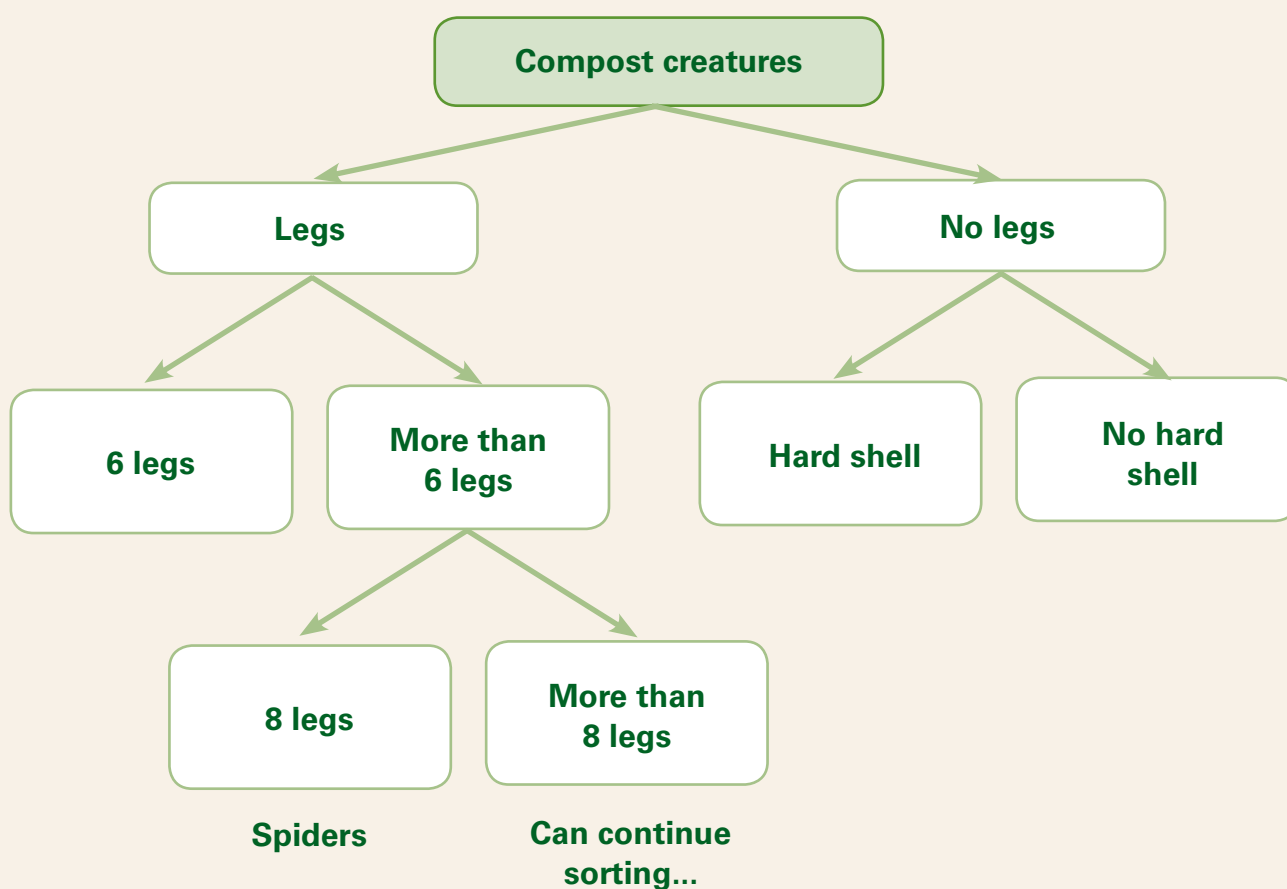
- How many compost creatures did you collect?
- How many of your creatures have a hard exterior (exoskeleton)?
- Are there any creatures with more than 8 legs?
- Do any of the creatures have wings?
- Describe how one creature moves (F – ACSSU005).
- Draw one creature, name it and label it.
- Name as many other creatures as you can.
- Which creature is most common?
- What structural features do compost creatures have that help them to survive in the compost heap? (Year 5 – ACSSU043)



Sort the compost creatures

Separate the compost creatures into groups such as worms, centipedes and millipedes (lots of legs), snails, slugs, insects (three pairs of legs), spiders (four pairs of legs).









Students could use dichotomous sorting to sort the creatures. In dichotomous sorting activities, students are asked to divide a set of objects into two groups: those that have a particular attribute, and those that do not. Students might decide to group creatures that have legs and those that have no legs. Students can then divide each new group into two groups (e.g. wings and no wings). They can continue to do this until they are happy with their categories. Students could draw a dichotomous key such as:



Results Years 1 - 2

As a class, students can draw a picture graph (where one drawing represents one creature). You may like to print off the compost creature images from the compost creatures food web game and use those to create a graph.

Compost creatures collected

Ants						
Snails						
Slaters						
Earwig						

Key:  = 1 compost creature

Results Years 3 - 6

1. Ask students to decide the best way to record the data so that it represents their individual findings e.g. use a table or a column graph/picture graph. Get them to construct a graph for their individual results.
2. Have students compare their graphs and discuss (e.g. compare which creature was most common).
3. Collate each group's results into a table for the whole class.
4. Create a graph of class results.

Once the results have been collected you can return the compost creatures to the compost.

Discussion

Ask students to discuss:

- What kind of conditions do compost creatures need to survive? You might like to prompt by asking what conditions humans need to survive and see if there are any similarities.
- Why is it important to return the compost creatures to the compost?
- What role do these creatures play in the formation of compost?
- If using the Burslese funnel, ask students: Why do you think the creatures moved out of the compost and into the funnel? Encourage students to describe how the conditions under the light are different to conditions in the compost heap (e.g.: the light has created a hotter drier environment) and describe how the creatures responded to the changed conditions.
- If using pitfall traps, ask students: What types of creatures live on or near the surface of the compost heap? Why do you think they live there?

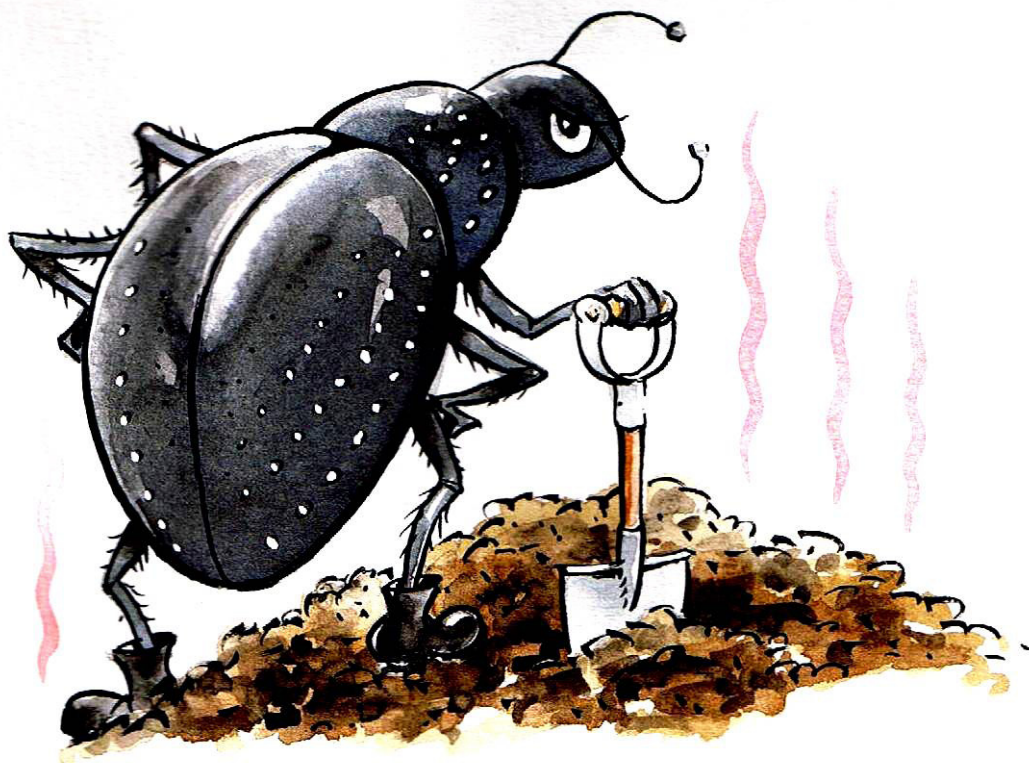


Application question

Our food waste doesn't have to go to landfill. How can compost creatures help reduce the food waste we send to landfill?

Ideas for extension or assessment

- Research to find out what kind of scientists collect data on insects using these methods. Why do they collect this kind of data? (ACSHE051, ACSHE062, ACSHE083, ACSHE100 – Years 3 – 6).
- Our organic waste is a resource (even though we call it waste). It can be reused on the garden. We don't usually put the waste straight on the garden. We put it in the compost and let the compost creatures turn it into a rich fertilizer. Draw a diagram that shows the cycle of how the scraps of a carrot can be turned into fertilizer to grow food. The following wiki has a good diagram you could share with students <http://exploringsciencewiki.wikidot.com/sustainability:compost>.
- Have students classify the creatures that they find. There are some great online keys to help students identify compost creatures e.g. http://www.ento.csiro.au/education/key/couplet_01.html.



Methods for collecting compost creatures (Compost Activity 5)

Option 1. The Berlese funnel

The Berlese (ber-lay-zee) funnel is named after an Italian entomologist who invented the trap over 100 years ago. It is used by scientists to study small organisms that live in soil and prefer moist, cool conditions. The Berlese funnel works by changing the conditions of the soil thus forcing the organisms out of the soil and into the trap. The light heats and dries the soil and as the organisms seek out a moister, cooler place they fall into the bottom of the trap.

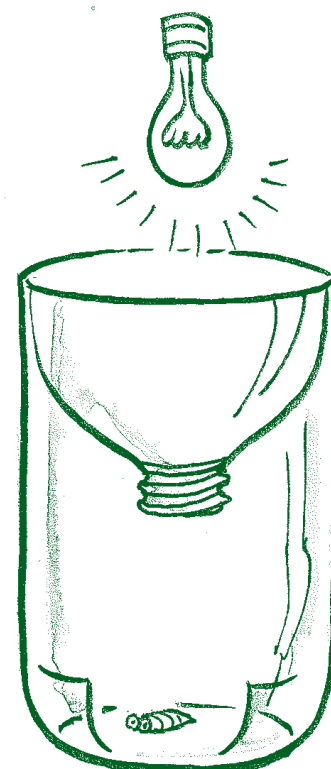
Resources for the Berlese funnel

- Two-litre plastic bottle
- Scissors
- Moist paper towel, preferably white
- Circular piece of coarse wire mesh about five centimetres in diameter (the holes in the mesh must be large enough for insects to fall through, window screen is too small)
- Desk light with an incandescent lightbulb – fluorescent lights don't work!
- Handful of compost
- Magnifying glass or magnifying bug box.

This activity should be set up early in the day to allow time for the creatures to leave the soil and drop into the bottle.

Instructions for the Berlese funnel

1. Assemble the Berlese funnel from re-use materials as follows:
 - Cut the top off the plastic bottle where the bottle starts to curve
 - Place the moist paper towel in the bottom of the plastic bottle
 - Place the top of the plastic bottle upside down in the base of the bottle to form a funnel
 - Place the wire mesh in the bottom of the funnel
 - Gently place the compost on top of the wire mesh
 - Place the funnel under the desk light and ensure that the light is at least 10 cm away from the funnel.
2. Allow the funnel to sit for a while and then observe the creatures that have been caught using the activity above.



Option 2. Pitfall trap

Pitfall traps are a common scientific method of collecting small invertebrates which otherwise may not be seen. They are used to show the number and variety of invertebrates in an area being studied.

Resources for pitfall trap

- Two-litre plastic bottle per pair of students
- Scissors
- Clear plastic bag
- Ice cream container lid
- Four sticks of equal length
- Gardening trowel

Duration: This activity could be set up in morning and left overnight to allow time for the creatures to leave the soil and drop into the bottle.

Instructions for pitfall trap

1. Cut the top off the plastic bottle where it begins to curve.
2. Prepare a 'roof' for the trap by punching four holes in the ice cream container lid, one hole in each corner. Insert a stick into each hole to support the 'roof'.
3. To set the trap, dig a hole in the compost heap so that the top of the plastic bottle is even with the surface of the compost heap.
4. Line the plastic bottle with the plastic bag and insert the top of the bottle upside down in the body of the bottle to create a funnel.
5. Cover the edges of the plastic bag with compost to ensure an even surface (if the edge of the trap sticks up above the compost, the creatures will run into the edge of the trap and you won't catch very much).
6. Place the roof above the trap to keep out rain and strong sunlight. Be sure to leave at least five centimetres between the trap and the roof so creatures can fall into the trap.
7. Consider placing a weight, such as a rock or piece of wood, on the roof to keep it firmly in place.
8. Set your trap and check it the next day. Any creatures that are caught can be collected in the plastic bag and brought inside for closer examination.
9. The trap can then be relined after the creatures are returned to the compost heap or with a different bag. Make sure that you check the bag daily and release any creatures after examining them.

Trouble catching anything with your pitfall trap?

- Make sure your trap is well buried in the heap and that the edges are flush with the compost.
- Check to make sure your roof isn't preventing creatures from entering the trap.
- If you have a new compost heap, remember it can take time for creatures to colonise your heap.
- Even scientists sometimes have trouble catching creatures in pitfall traps. Place more than one trap to increase the odds of catching a number of compost creatures.



Option 3: Using a desk tray and lamp

Resources for desk tray method

- a moist paper towel, preferably white
- a desk light with an incandescent lightbulb— fluorescent lights don't work!
- magnifying glass or box
- a tray full of compost
- a book or tea towel to cover half the tray.

Instructions for desk tray method

Set up trays and lamps.

1. Place the compost sample in one side of the tray and spread in a thin layer.
2. Place the book or tea towel so that it covers the other half of the tray.
3. Place the desk light approximately 10 centimetres away from the compost sample.
4. Turn the light on and leave for one hour.
5. Return with magnifying glass.
6. Remove book and observe compost creatures that have moved from the light to the dark.
7. Students may wish to carefully remove individual compost creatures and place on paper towel for closer observation.



Compost activity 6 – Build a compost creature

Aim

Students will use reuse materials to build a compost creature and then write a story describing a 'day in the life' of their creature including its habitat and diet.

Suitable for: Year 1 – Year 6

Duration: One lesson (about one hour) to build the compost creature and one lesson for the students to write a story about their compost creature.

Prior learning: This activity is best done after the students have completed other activities about compost creatures. Some useful activities include: Activity 4 - Collect and sort compost creatures.

General capabilities:  

Background information

This is a perfect activity to do while students are visiting the REmida centre. REmida is a creative reuse centre located in West Perth which collects clean waste items from local industry for members to reuse in creative ways. To learn more about becoming a member go to the website: www.remidawa.com.

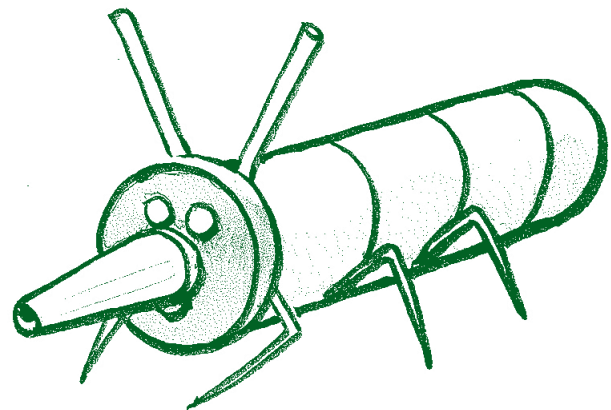
Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 6.1 Aliveness

Key words: compost creature, predator

Resources

- glue, sticky tape, staples
- scissors
- paint
- reuse items from REmida, or items that you have collected yourself, such as:
 - plastic bottles
 - margarine containers
 - ice cream containers
 - paper rolls
 - cereal boxes
 - straws
 - sticks
 - egg cartons
 - milk cartons
 - magazines
 - bottle tops
 - jar lids
 - foil.



Australian Curriculum links for F-2

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things have a variety of external features (ACSSU017).	1	Students use knowledge of external features to construct their own compost creature.
Living things live in different places where their needs are met (ACSSU211).	1	Students describe where their compost creature lives and what it eats.
Earth and space science Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students reuse materials to build a compost creature.
English; Literacy		
Creating texts Create short imaginative and information texts that show emerging use of appropriate text structure, sentence level grammar, word choice, spelling, punctuation and appropriate multimodal elements, for example illustrations and diagrams (ACELY1661).	1	Students write about a day in the life of a compost creature.
Create short imaginative, informative and persuasive texts using growing knowledge of text structures and language features for familiar and some less familiar audiences, selecting print and multimodal elements appropriate to the audience and purpose (ACELY1671).	2	Students write about a day in the life of a compost creature.
The Arts; Visual Arts (draft)		
Making and responding Make visual arts works about people, objects and experiences that are familiar, imagined or remembered (2.4).	F-2	Students make a visual art work of a compost creature.



Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
English; Literacy		
Creating texts Plan, draft and publish imaginative, informative and persuasive texts demonstrating increasing control over text structures and language features and selecting print, and multimodal elements appropriate to the audience and purpose (ACELY1682).	3	Students write about a day in the life of a compost creature.
	4	Students write about a day in the life of a compost creature.
The Arts; Visual Arts (draft)		
Making and responding Experiment with techniques, tools and forms to develop their skills and refine their artmaking (4.4).	3-4	Students make a visual art work of a compost creature.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things have structural features that help them to survive in their environment (ACSSU043).	5	Students identify a feature of their compost creature and describe how it helps the creature to survive.
English; Literacy		
Creating texts Plan, draft and publish imaginative, informative and persuasive print and multimodal text, choosing text structures, language features images and sound appropriate to purpose and audience (ACELY1704).	5	Students write about a day in the life of a compost creature.
	6	
The Arts; Visual Arts (draft)		
Making and responding Experiment with and create 2D, 3D and 4D images and objects based on imagination and a deepening understanding of their world (6.1).	5-6	Students make a visual art work of a compost creature.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

Show students photos and images of compost creatures. Discuss the role compost creatures play in turning organic material into compost and what physical features they have.

Activity for Years 1–6

Build a compost creature

1. Ask students to choose a compost creature to build. Senior students could create their own creature taking into account the environment the creature lives in (Year 5 - ACSSU043).
2. Show students a range of reuse materials and then allow them time to design their own compost creature to be made of these materials. Ask students to draw and label their compost creature design.
3. Have students build their compost creature.

Write a story about your compost creature

1. Ask students to name their creature and to write (or tell) a creative story about a day in the life of their compost creature. Students should include some facts in their story including what their compost creature likes to eat and where it lives. Students should consider the following:
 - what is the creature's home like and what is it made of?
 - what conditions does the creature like to live in?
 - what does it like to eat?
 - who are its friends and enemies (predators)?
 - are there any features which help the creature to survive (ACSSU043-Year 5)
2. Encourage the students to be creative and use appropriate language features. They can present their stories to each other or at the school assembly.

Ideas for extension or assessment

- Ask students to research artists that use the natural world as inspiration for their works (Years 5–6). Ask students to comment on the things in the natural world that inspire them.
- Students work in groups to build a food web or chain with their creatures. Students should be able to explain why each creature is in the web or chain.
- Turn your story into an entire picture book. Illustrate the pages and make your character come to life!
- Host a story time in the library and share your writing and compost creatures. Consider inviting other classes, parents, the principal etc.
- Ask students to research the features of a compost creature and use this knowledge to build their own compost creature using the 'Monster Bugs' game at www.scholastic.com/magicschoolbus/games/bugs/index.htm#. Students can then describe how the features of their compost creature help it to survive (Year 5 - ACSSU043).
- Use this in a lesson within a 'minibeast' theme and have an ongoing project that students can complete in their free time.



Compost activity 7

— Compost creatures food web game

Aim

Students will play a compost card game and then construct a compost food chain. Students will gain knowledge of some common compost creatures and an understanding of compost food chains and food webs.

Suitable for: Years 3–6

Duration: 30 minutes

Prior learning: This activity is best done after the students have completed other activities about compost creatures. Some useful activities include: Compost activity 4 – Collect and sort compost creatures and Compost activity 5 – Build a compost creature.

General capabilities:  

Background information

This game can be used to introduce the concept of food webs or be used as a fun way to complete learning about compost creatures.

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 4.0 Why compost?
- 6.1 Aliveness (includes diagrams of food chains and food webs)

Description

In this activity, teams of three or four students will play a card game. The playing cards show how the compost creatures and organic material are linked in food webs.

Resources

- Print and cut out two copies of the compost creature cards for each group of students (these are provided). This will mean there are two of each card but it gives the students more cards to play with.



Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044).	3	Students group the cards into living and non-living things.
Living things including plants and animals, depend on each other and the environment to survive (ACSSU073).	4	Students draw a food chain and consider how changing the conditions will affect the food chain.
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062).	3-4	Students consider how changing the conditions of the compost will affect the food chain.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things have structural features that help them to survive in their environment (ACSSU043).	5	Students describe the structural features that help a rove beetle survive.
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094).	6	Students describe what would happen to the food chain under different conditions.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

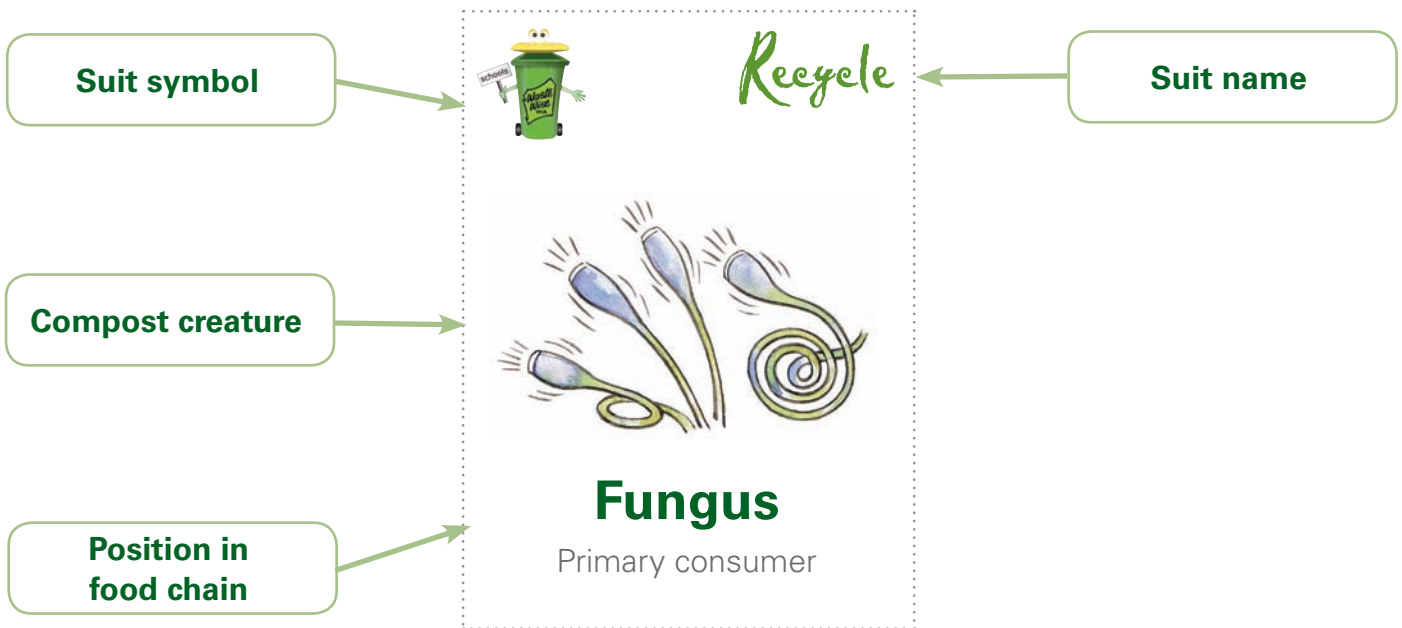


Object of the game

The object is to collect five different cards from one suit, which will describe a compost food chain. For example, if you were dealt two cards from the 'Recycle' suit, you may wish to collect all the 'Recycle' cards from that suit.

The cards

There are four different suits in the deck. The suits are Shop Smart, Recycle, 3 Rs, and Compost. The suit is shown in the top right hand corner of each card. Each suit represents one food chain in the compost system.



Watch out for the 'Disconnect' card and 'Reconnect' card. The Disconnect card represents what happens when the compost isn't well cared for. The entire compost ecosystem (and game) will be disrupted and there will be consequences! The Reconnect card represents what happens when the compost is healthy and balanced.

Disconnect

There isn't enough air in your compost and now it smells.

Discard all the cards in your hand and pick up five new ones.

Reconnect

Your compost is nice and hot!

Swap a card.
Ask one player for a card that you want and give them one you no longer need.



Set the scene

Show students a food chain and food web and discuss the terms organic matter, primary consumer, secondary consumer and tertiary consumer. In groups of four, ask students to find and remove from the pack all five 'Recycle' cards and decide which compost creature is at the top of the food chain and which is at the bottom. You can use the food web in the Introduction to help (Section 6.1 Aliveness)

Rules of the game

1. Decide who will be the dealer. The dealer shuffles the pile of cards and deals each player five cards face down. The remaining cards are placed face down in a pile. The dealer turns the first card up from this pile and puts it beside the deck to start a discard pile.
2. When it is your turn, pick up the top card from the pile. If you don't need it, place it face up on the discard pile. If you wish to keep it, discard a different card from your hand. Make sure you finish each turn with five cards in your hand.
3. Disconnect card and Reconnect card – If you pick up the Disconnect card, use it during that turn. If you are dealt a Disconnect card, use it during your first turn. You can use a Reconnect card at any time.
4. If the player before you discards a card that you want, you may pick it up instead of drawing from the face-down pile.
5. The first person to collect **five different cards in one suit** wins. If no one wins the first time through the deck, the dealer shuffles the cards in the discard pile and you continue playing.

After the game

1. Ask the students to sort the cards into their suits. Each student should select one suit to examine (remember, there are doubles of each card, so make sure each student has **five different** cards from the same suit).
2. Ask students to draw a food chain showing how these creatures and organic matter are linked. The arrows should be drawn in the direction of the flow of energy.
3. Ask students to discuss what might happen to their food chain if:
 - organic matter was not added to the compost for a very long time
 - the compost was too dry? What could you do to fix this problem?
 - the compost was not aerated (turned)? Hint: this would mean there wasn't enough air for the compost creatures. What could you do to fix this problem?
4. In their groups, ask students to:
 - group the cards into living and non-living things
 - locate the rove beetle. What features does it have that might help it survive? How might the rove beetle use these features? (e.g. antennae to feel or pincers to sting)
 - collect all the cards with organic matter on them. Can you name two more types of organic matter that you can put in a compost bin?
 - Ask students if a plastic bag or cling wrap was accidentally added to the compost, would the primary consumers eat it? Why or why not?

Ideas for extension or assessment

- Research the creatures in your food chain. What other items/creatures do they eat? Extend the food web to include these new food items.
- Make your own compost creature cards for this game. Research the compost creatures that you find in your compost and the food webs they are a part of. http://www.ento.csiro.au/about_insects/index.html





Recycle



Apple core

Organic matter



Recycle

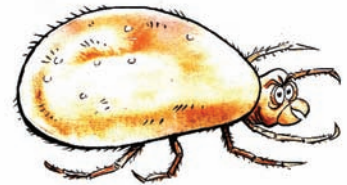


Fungus

Primary consumer



Recycle



Mould mites

Secondary consumer



Recycle



Predatory mites



Recycle



Ground beetle

Tertiary consumer



3Rs



Carrot peels

Organic matter



3Rs



Slugs

Primary consumer



3Rs

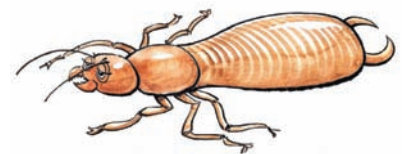


Snails

Primary consumer



3Rs

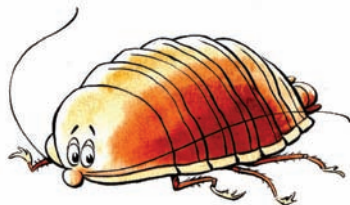


Rove beetles

Secondary consumer



3Rs



Slater

Primary consumer



Compost

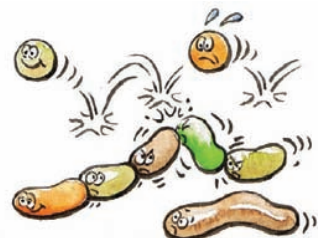


Newspaper

Organic matter



Compost



Bacteria

Primary consumer



Compost



Roundworm

Secondary consumer



Compost



Protozoa

Secondary consumer



Compost



Rotifera

Secondary consumer



Shop Smart



Grass clippings

Organic matter



Shop Smart



Earthworm

Primary consumer



Shop Smart



Millipede

Primary consumer



Shop Smart

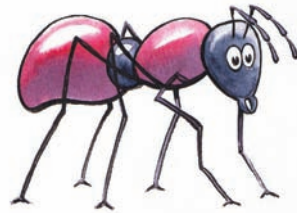


Centipede

Tertiary consumer



Shop Smart



Ants

Secondary consumer



Reconnect

Your compost is nice and hot!

Swap a card.
Ask one player for a card that you want and give them one you no longer need.



Disconnect

There isn't enough air in your compost and now it smells.

Discard all the cards in your hand and pick up five new ones.





Compost activity 8 – Recipe for compost

Aim

Students will use appropriate text and language features to demonstrate their knowledge of composting by writing a recipe for compost. The recipe will follow a procedure format and will identify the ingredients and steps necessary to produce quality compost.

Suitable for: Years 2–6

Duration: One lesson to research and one or two lessons to write a compost recipe, depending on the class. More time will be needed if using a word processor.

Prior learning: This activity is best done after the students have completed other activities about compost. Some useful activities include: Compost activity 1-Decomposition in nature, Compost activity 2-What can I compost? Compost activity 3-Make your own bottled compost and Compost activity 5-Build a compost creature.

General capabilities:  

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 6.0 The right ingredients
 - 6.1 Aliveness
 - 6.2 Diversity
 - 6.3 Air
 - 6.4 Moisture
- 7.0 How to Make Your Compost – A Compost Recipe

Key words: Compost

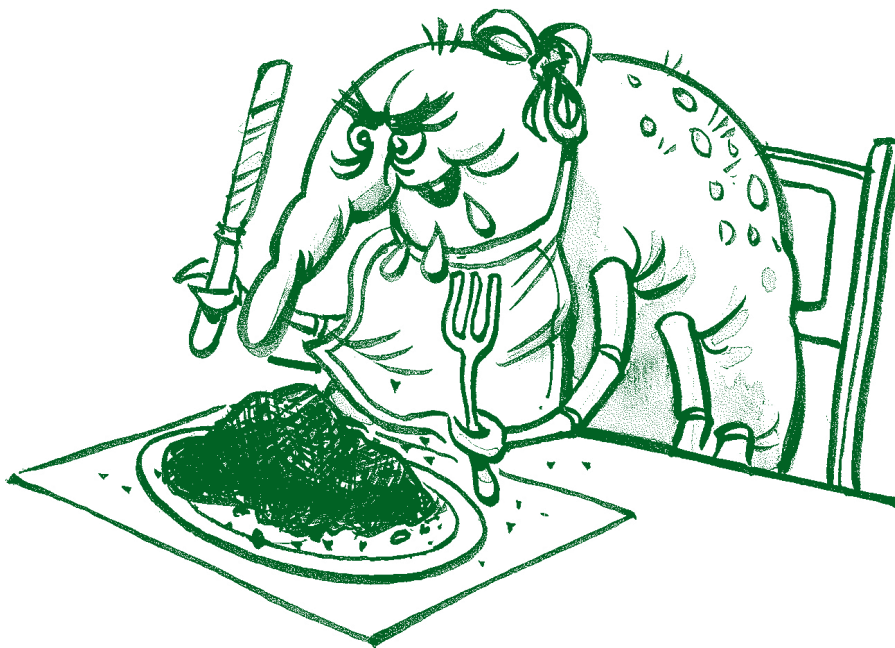
Resources

Other books and websites on compost can be found in the 'Other resources' section at the end of the compost introduction.



Australian Curriculum links for Year 2

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Earth and space science Earth's resources, including water, are used in a variety of ways (ACSSU032).	2	Students identify resources that can be composted.
English; Language		
Text structure and organisation Understand that the purposes texts serve shape their structure in predictable ways (ACELA1447).	2	Students use the structure of a recipe to write a set of instructions for composting.
English; Literacy		
Creating texts Create short imaginative, informative and persuasive texts using growing knowledge of text structures and language features for familiar and some less familiar audiences, selecting print and multimodal elements appropriate to audience and purpose (ACELY1671).	2	With guidance, students write a compost recipe.



Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Chemical science Natural and processed materials have a range of physical properties. These properties can influence their use(ACSSU074).	4	Students identify materials that can be composted.
English; Language		
Text structure and organisation Understand how different types of text vary in use of language choices, depending on their purpose and context (ACELA1478).	3	Students use the structure of a recipe to write a set of instructions for composting.
Expressing and developing ideas Incorporate new vocabulary from a range of sources into students' own texts including vocabulary encountered in research (ACELA1498).	4	
English; Literacy		
Interpreting, analysing, evaluating Identify the audience and purpose of imaginative, informative and persuasive texts (ACELY 1677).	3	Students identify the audience and purpose of the compost recipe.
Creating texts Plan, draft and publish imaginative, informative and persuasive texts demonstrating increasing control over text structures and language features and selecting print, and multimodal elements appropriate to the audience and purpose (ACELY1682).	3	Years 3 – 4 Students use print and digital resources to gather information on composting. They use word processing software to construct and edit a compost recipe.
Use software including word processing programs with growing speed and efficiency to construct and edit texts featuring visual, print and audio elements (ACELY1685).	3	
Plan, draft and publish imaginative, informative and persuasive texts containing key information and supporting details for a widening range of audiences, demonstrating increasing control over text structures and language features (ACELY1694).	4	
Use a range of software including word processing programs to construct, edit and publish written text, and select, edit and place visual, print and audio elements (ACELY1697).	4	
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students identify waste materials, from school and home, which can be composted.



Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
English; Language		
Text structure and organisation Understand how texts vary in purpose, structure and topic as well as the degree of formality (ACELA1504).	5	Students use the structure of a recipe to write a set of instructions for composting.
English; Literacy		
Creating texts Plan, draft and publish imaginative, informative and persuasive print and multimodal text, choosing text structures, language features images and sound appropriate to purpose and audience (ACELY1704).	5	Years 5 – 6 Students use word processing software to plan, draft and publish a compost recipe.
Use a range of software including word processing programs with fluency to construct, edit and publish written text, and select, edit and place visual, print and audio elements (ACELY1707).	5	
Plan, draft and publish imaginative, informative and persuasive texts, choosing and experimenting with text structures, language features, images and digital resources appropriate to purpose and audience (ACELY1714).	6	
Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for defined audiences and purposes, making appropriate choices for modality and emphasis (ACELY1710).	6	
Interpreting, analysing, evaluating Use comprehension strategies to analyse information, integrating and linking ideas from a variety of print and digital sources (ACELY1703).	5	Years 5 – 6 Students use print and digital resources to research what goes into creating successful compost.
Use comprehension strategies to interpret and analyse information and ideas, comparing content from a variety of textual sources including media and digital texts (ACELY1713).	6	

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



Set the scene

Share a cake recipe (or other recipe) with students and identify the parts (title, list of ingredients, set of instructions, etc). Ask students 'what is the purpose of a recipe?' and discuss how to write a recipe.

Activity for Years 2–6

Write a Compost Recipe

1. Ask students to identify waste materials from school and home that can be composted e.g. fruit and vegetable scraps, school paper, newspaper, lawn clippings and fallen leaves.
2. Ask students to research what else goes into creating successful compost (using print and digital resources).
3. As a class discuss:
 - o The ingredients that go into the compost. Remind students that they will need to add both brown and green materials. Discuss with students why each ingredient is important.
 - o How long the compost needs to mature or 'bake' and what a conditions it needs.
 - o Why you need to keep the compost moist and aerate it by turning it.
 - o What compost creatures will inhabit the compost? (You might even like to add a pinch of compost creatures to your recipe)
4. Ask students 'Who would you like to write a compost recipe for? Why? What is the purpose of your recipe?' For example, you might write a compost recipe to show how easy it is to compost at home.
5. Ask students to write their own compost recipes. Ask them to list the ingredients and include the steps that should be followed to make the compost. Students should be encouraged to draw diagrams for each step.
6. Optional: Get students to write their compost recipes using a word processing program (including images).
7. Application question: Would you write a different compost recipe for someone who worked on a dairy farm in Margaret River? What sorts of ingredients might they put in the compost?



Ideas for extension or assessment

- Students could 'publish' their compost recipes to be distributed to the school community.
- Students could present their compost recipes to other classes or at an assembly (Year 2 - ACELY1667, Year 3 - ACELY1677, Year 4 - ACELY1689, Year 5 - ACELY1700, Year 6 - ACELY1710).
- Materials like paper and newspaper could be reused or recycled instead of putting them in the compost. Ask students to research and decide whether they think it is better to recycle paper or to compost it? Ask them to present their argument in their chosen way – video, essay, speech (Year 4 – ACHGK025) <http://jpgreenword.wordpress.com/2011/12/31/compost-vs-recycling-of-paper/>.





Compost activity 9 – Compost relay

Aim

Students will participate in a compost relay race. As they compete, students will recall the ingredients, conditions and creatures that all contribute to successful composting.

Suitable for: Years 2–6. This activity is a great revision exercise.

Duration: Preparation time plus up to one hour to complete the relay and discuss.

Prior learning: This activity is best done as a revision activity after the students have completed other activities about compost. Some useful activities include: Compost activity 1 – Decomposition in nature, Compost activity 2 – What can I compost?, Compost activity 3 – Make your own bottled compost, and Compost activity 5 – Build a compost creature.

General capabilities: 

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 What is compost?
- 2.0 Decomposition
- 3.0 Organic and inorganic materials
- 4.0 Why compost?
- 6.0 Choosing the right ingredients
 - 6.1 Aliveness – compost creatures
 - 6.2 Diversity – getting a good balance of green and brown material
 - 6.3 Air
 - 6.4 Moisture

Key words: Compost, compost creatures

Resources

- Four hoops, boxes or circles of string for each team of students (three to six students per team)
- One set of images per team (provided).



You may like to collect and use real objects instead of the images provided. If so, you will need:

- At least six items per team of things that can be composted such as grass, newspaper, vegetable and fruit scraps, cardboard, tea bags and leaves
- At least two items per team of things that should be left out of compost such as plastic bags, glass, meat, dairy, bricks, large pieces of wood
- Two sets of cards per team on which is written (or illustrated) air, no air, warm, cold, damp, and dry (provided)
- At least six pictures per team of creatures that live in the compost such as spider, fungi, bacteria, beetle, worm and millipede (provided)
- At least two pictures per team of creatures that do not live in the compost heap such as butterfly, dragonfly, goldfish and elephant (provided).

Australian Curriculum links for Year 2–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Science; Science Understanding		
Biological sciences Living things including plants and animals, depend on each other and the environment to survive (ACSSU073).	4	Students describe the best conditions for compost creatures to survive.
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094).	6	Students describe the physical conditions for compost creatures to survive.
Chemical sciences Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).	2	Students identify materials that can be combined to make compost.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



Set the scene

It's a good idea to revise students' knowledge of a compost heap before conducting the relay. You could ask them:

- What types of material can you add to a compost heap?
- What types of creatures do you find in a compost heap? What role do these creatures play in the compost heap (what is their job)?
- What conditions make up a good compost heap:
 - Moist or dry? How do we encourage moisture in the compost heap? What would happen to the compost creatures if the compost is too dry?
 - Air or no air? How do we encourage air in the compost heap?

Activity Instructions

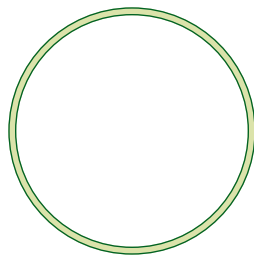
Setting Up the relay races

For each team of students you will need to set up the following hoops or boxes.

Team 1

Hoop 1

Compost ingredients

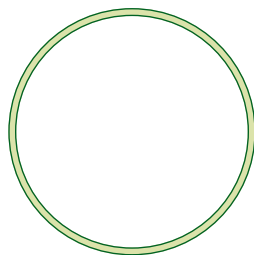


In Hoop 1, put at least six items that can be composted such as grass, newspaper, vegetable and fruit scraps, cardboard, tea bags and leaves

AND at least two items that cannot be composted such as plastic bags, glass, meat, dairy, bricks, large pieces of wood

Hoop 2

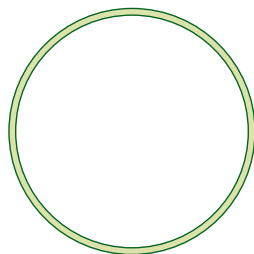
Compost conditions



In Hoop 2, put two sets of cards, on which is written: air, no air, warm, cold, damp, and dry.

Hoop 3

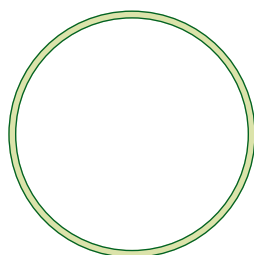
Compost creatures



In Hoop 3, put at least six picture of creatures that live in the compost spider, fungi, bacteria, beetle, worm and millipede
AND at least two of creatures that do not live in the compost heap such as butterfly, dragonfly, goldfish and elephant.

Hoop 4

Compost heap



Hoop 4 is left empty to represent the compost bin which will be filled throughout the relay.



Relay instructions:

Divide the class into teams of three to six students. You will need a set of hoops and items for each team of students.

Relay race 1: Teams run a relay choosing the best items from Hoop 1 to add to the compost heap (Hoop 4). When all team members have chosen an item and dropped it off at the compost heap, look at the resulting heaps and discuss the items that have been composted. Discuss 'brown' versus 'green' ingredients. Identify any items that should not go in a compost heap (refer to Introduction Section 6.2 Diversity).

Relay race 2: Teams run again, this time choosing the necessary conditions from Hoop 2 and placing them in Hoop 4. When the three correct conditions (air, damp, warm) have been put in Hoop 4, take a look at the compost heap and discuss the conditions necessary for successful composting (refer to Introduction Section 6.3 Air and 6.4 Water)

Include two sets of cards per team so that all six team members can run.

Relay race 3: Teams run again, this time deciding which creatures from Hoop 3 live in the compost heap. Each team member chooses one creature to add to the compost in Hoop 4. When all compost creatures are in Hoop 4, look at the resulting heap and discuss the role that compost creatures play in creating compost.

Final relay race: Return all of the items in Hoop 4 to their original hoops. Have students run one final time. This time, students will visit Hoops 1, 2 and 3 in the same run. They may choose one item from each hoop to add to the compost heap in Hoop 4 and they will run until they feel that their group has built the best compost heap that they can.

After the races:

When the final race has been run, examine the contents of the compost 'heaps' in Hoop 4. Discuss who has built the best compost (did you add the right ingredients? Were the conditions right? Did you add the right creatures?)

A good compost 'hoop' might include:

Fruit & vegetable scraps

Leaves

Grass

Newspaper

Cardboard

Tea bags

Spider

Worm

Fungi

Beetle

Bacteria

Millipede

Air

Warm

Damp



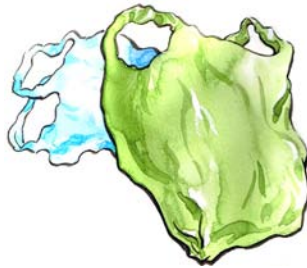
Adapted from:

Waste Education in Action
– a resource for Camden
teachers, Camden Council,
page 68, viewed 1 March 2013,
<<https://www.camden.gov.uk>>.





Grass



Plastic bags



Air



Spider



Butterfly



Newspaper



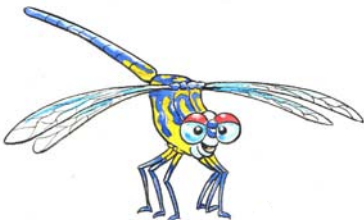
Glass



No air



Fungi



Dragonfly



**Fruit and
vegie scraps**



Meat





Warm



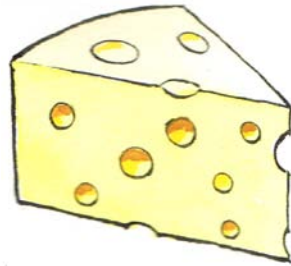
Bacteria



Goldfish



Cardboard



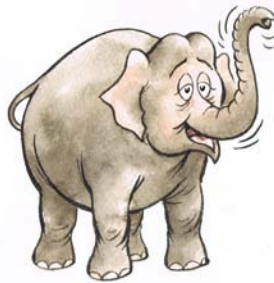
Dairy



Cold



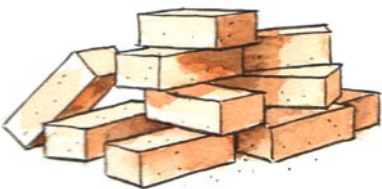
Beetle



Elephant



Tea bags



Bricks



Damp



Worm





**Twigs
and leaves**



**Large pieces
of wood**



Dry

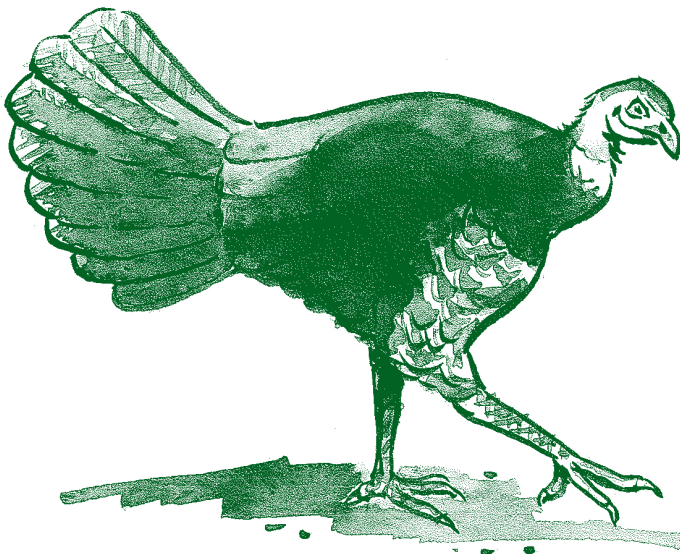


Millipede



Ideas for extension or assessment

- Conduct a waste audit at your school and examine the results. Identify materials from the audit that could be composted (ACSSU032 – Year 2). Use the results of the audit to calculate the weight of the materials that could be composted over the course of the year.



AUSTRALIAN BRUSH TURKEY

The Brush Turkey

Did you know that the Australian Brush Turkey (*Alectura lathamii*) makes compost? The male turkeys build large compost heaps to house their eggs. The heat given off by the rotting organic matter incubates the eggs. Amazingly, the Brush Turkey can sense the temperature of the mound with its beak and it removes and adds organic material to maintain the correct temperature.



Compost activity 10 – Weigh your waste:

How much waste could our school compost?

Aim

Students will weigh the school's fruit and vegetable waste and calculate how much of this could be diverted from landfill by composting (or worm farming). Students present the results to the rest of the school.

Suitable for: Years 3–6

Duration: One hour to weigh, record and discuss results plus lunch-time to collect food scraps. Students will also need at least one hour to prepare a presentation for the school.

General capabilities:    

Background information

Before conducting this activity, you might like to read the compost introduction at the beginning of this guide. The following section is particularly relevant:

- 4.0 Why compost?

Key words: Landfill

Resources

- Set of kitchen scales (non-digital for Year 4 so they can read the graduated scales)
- Buckets to collect fruit and vegetable scraps
- Labels for the buckets (you can create your own or use the images below)
- Paper to record results



Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Mathematics; Measurement and Geometry		
Using units of measurement Measure, order and compare objects using familiar metric units of length, mass and capacity (ACMMG061).	3	Students use scales to measure the mass of organic waste.
Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (ACMMG084).	4	Students use scaled instruments to measure the mass of organic waste.
Mathematics; Statistics and Probability		
Data representation and interpretation Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069).	3	Students collect data using a table.
Select and trial methods for data collection, including survey questions and recording sheets (ACMSP095).	4	Students create a table and collect data on fruit and vegetable scraps.
English; Literacy		
Interacting with others Plan and deliver short presentations, providing some key details in logical sequence (ACELY1677).	3	Years 3 – 4 Students present the results to the school.
Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular purposes and audiences (ACELY1689).	4	
Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025).	4	Students explore what kinds of compost system could be used to manage the schools fruit and vegetable scraps.
Geographical Inquiry Skills		
Interpreting, analysing and concluding Interpret geographical data to identify distributions and patterns and draw conclusions (ACHGS030).	4	Students interpret the data they have collected in their tables and present the findings on the waste produced in their school.
Communicating Present findings in a range of communication forms, for example written, oral, digital, graphic, tabular and visual and use geographical terminology (ACHGS024, ACHGS031).	3-4	Students present their findings to the school to promote taking action to compost the fruit and vegetable scraps rather than send them to landfill.



Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	Year	Lesson outcome
Mathematics; Number and Algebra		
Number and place value Use efficient mental and written strategies and apply appropriate digital technologies to solve problems (ACMNA291). Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers (ACMNA123).	5	Years 5 - 6 Students select and use written or digital strategies to calculate the mass of fruit and vegetable scraps that could be collected in a week or a term.
	6	
Fractions and decimals Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies (ACMNA127).	6	Students calculate how much would be composted if half, quarter and three quarters of the school's food waste was composted.
Mathematics; Measurement and Geometry		
Using units of measurement Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108). Convert between common metric units of length, mass and capacity (ACMMG136).	5	Students discuss and choose the most appropriate unit of measurement.
	6	Students convert between kilograms and tonnes.
Mathematics; Statistics and Probability		
Data representation and interpretation Pose questions and collect categorical or numerical data by observation or survey (ACMSP118).	5	Student collect numerical data by survey.
English; Literacy		
Interacting with others Plan, rehearse and deliver presentations for defined audiences and purposes incorporating accurate and sequenced content and multimodal elements (ACELY1700). Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for defined audiences and purposes, making appropriate choices for modality and emphasis (ACELY1710).	5	Years 5 – 6 Students present the results to the school.
	6	
Geographical Inquiry Skills		
Communicating Present findings in a range of communication forms, for example written, oral, digital, graphic, tabular and visual and use geographical terminology (ACHGS038, ACHGS045).	5-6	Students use the evidence they have collected to present their findings to the school to promote taking action to compost the fruit and vegetable scraps rather than send them to landfill.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)



Set the scene

Discuss what happens to fruit and vegetable scraps when they are sent to landfill (e.g. they don't break down very well in the absence of oxygen).

Ideas for collecting fruit and vegetable scraps

You will need to collect fruit and vegetable scraps to complete this activity. If your school doesn't already separate fruit and vegetable scraps you will need to choose a day to collect them and let others know. You could:

- announce how, when and why fruit and vegetable scraps will be collected at assembly or over the loud speaker (try to time the lesson for the same day as, or the day after an assembly or announcement)
- organise for your class to act as monitors by checking what is going in the buckets and encouraging students to use them
- organise for your students to walk around with the buckets in hand collecting the scraps as students eat
- alternatively, you could just collect 'crunch and sip' scraps from all classrooms or only collect fruit and vegetable scraps from your class.



Activity

Collecting the food scraps

1. Weigh the empty buckets and record the weight for each bucket (you will need to subtract this weight to determine the weight of your fruit and vegetables).
2. Label the buckets with fruit and vegetable images.
3. Place buckets around eating areas and ask all students to put all of their fruit and vegetable scraps in the buckets.

Try to avoid collecting sandwich scraps as these don't compost well.

You might like to compare the scraps collected from different year groups (e.g. compare food scraps of Year 1 with food scraps of Year 6) or by location (e.g. compare food scraps collected from near the canteen to food scraps near the library)

Recording results

1. Ask students to decide the most appropriate unit to measure the fruit and vegetable scraps (grams, kilograms, tonnes, litres). This activity is designed to use grams/kilograms but you could also measure the waste in litres.
2. Weigh the buckets with the fruit and vegetable scraps and record their weight using a table like the one below.
3. Determine the weight of fruit and vegetable scraps collected by subtracting the weight of the bucket.

Bucket number	Mass of empty bucket (kg)	Mass of bucket and fruit and vegetable scraps (kg)	Mass of fruit and vegetable scraps (kg)
1			
2			
3			
TOTAL MASS (kg)			

Discussion and calculations

1. Calculate how many kilograms of fruit and vegetable scraps are produced by your school in a day.
2. Use the answer above to estimate how many kilograms of fruit and vegetable scraps would be collected in a week, a term and a year.
3. Use written or digital strategies to check the estimations above.
4. Convert the yearly fruit and vegetable scraps to tonnes (Year 6).
5. How many students are at your school? On average, how many kilograms of fruit and vegetable scraps are produced by each person in a year?

Application questions

1. Where do the school's fruit and vegetable scraps currently go after they've been put in the bin?
2. What kind of compost system could you use to manage the school's fruit and vegetable scraps? You might like to consider a worm farm too.
3. Challenge: Calculate how many kilograms of fruit and vegetable scraps your school could prevent from going to landfill in one year if you collected and composted
 - a) half of the fruit and vegetable scraps?
 - b) quarter of the fruit and vegetable scraps?
 - c) three quarters of the fruit and vegetable scraps?
 - d) All of the fruit and vegetable scraps?

Present the results

Ask students to develop a persuasive audio-visual text to present the results and promote composting at school. (Year 4 – ACHGS031, Year 5-6).

Ideas for extension or assessment

- Research – Are your bins at home sent to a waste compost facility?
For more information about waste composting facilities in Perth visit
 - o <http://www.smrc.com.au/go/what-we-do/regional-resource-recovery-centre-rrrc-/waste-composting-facility-wcf>
 - o <http://mrc.wa.gov.au/Resource-Recovery/Operations.aspx>
 - o <http://www.emrc.org.au>
 - o <http://www.wmrc.wa.gov.au>.



Labels for collecting scraps

You can use this image to label the buckets for collecting fruit and vegetable scraps or make your own label.



FRUIT and VEGETABLE SCRAPS

End your unit on compost with a compost party!

- o Make edible compost using chocolate biscuit crumbs, vanilla yoghurt, gummy worms.
- o Use coloured sprinkles to represent different compost creatures.

Ingredients

Vanilla yoghurt

Chocolate biscuits, broken into pieces

Green food colouring

Gummy worms and coloured sprinkles.

Use the green food colouring to dye the yoghurt or pudding green. In a large bowl, layer the 'brown' cookies and 'green' yogurt. Scatter coloured sprinkles among the layers to represent compost creatures. Top with gummy worms!

Glossary

Aerobic decomposition: Organic matter being broken down in the presence of oxygen.

Anaerobic decomposition: Organic matter being broken down without the presence of oxygen.

Biodegradable: Something that can be consumed by **microorganisms** and returned to compounds found in nature.

Burlese funnel: A Burlese funnel is used to separate and preserve small insects found in ground litter and consists of a sieve placed over a funnel connected at the bottom to a preserving bottle

Carbon Dioxide (CO₂): A greenhouse gas found naturally in the Earth's atmosphere, also released when fossil fuels are burnt to create energy.

Carbon pollution: Refers to all forms of carbon emissions including **methane, carbon dioxide** and more.

Carbon sources: Carbon (C) is a common element found in all living things. When we compost we need to add materials with a high carbon presence. These materials are usually brown and can include shredded paper, newspaper, cardboard, dry leaves, hay and sawdust (from untreated wood).

Compost: Decayed organic material (such as food scraps and garden clippings), often used as a plant fertilizer.

Compost creatures: The organisms, both **decomposers** and **consumers**, which inhabit **compost systems such as bacteria, fungi, centipedes, millipedes, worms, spiders, lizards and more.**

Compost systems: Refers to all types of compost systems (bins, heaps and tumblers).

Consumer: An organism that eats other organisms. They may be primary, secondary or tertiary consumers. Tertiary consumers eat secondary consumers, secondary consumers eat primary consumers and primary consumers eat producers or organic material like plants and decaying matter.

Decomposer: In ecology, a bacterium or fungus which breaks down the cells of dead plants and animals into simpler substances.

Decomposition: The process by which bacteria and fungi (decomposers) release enzymes to break down matter.

Food chain: A series of organisms in which the smallest is eaten by a larger one, which in turn is eaten by a still larger one, etc.

Food web: A series of **food chains** that are interrelated by the habits of the predators (the organisms that do the eating) and their prey (the organisms that are eaten).

Fungi: A fungus is a member of a large group of spore-producing organisms that includes microorganisms such as yeasts and molds, as well as the more familiar mushrooms.

Hazardous Household Waste: Includes paint, batteries, cleaning products that can cause harm to the environment if disposed incorrectly. Check with your local council for correct disposal options.

Inorganic: Not made of, or derived from, living matter or things (e.g. metals, plastic).

Landfill: A place to dispose waste material by burying it and covering it with soil.



Methane (CH₄): a colourless, odourless, flammable gas produced during anaerobic composting.

Microorganisms: a microscopic organism.

Nitrogen sources: Nitrogen (N) sources need to be added to compost. These materials are usually green and can include fruit and vegetable scraps, lawn clippings, tea bags, flowers, egg shells and more.

Organic: Made of, or derived from living matter (e.g. organisms or the products of their living processes).

Organism: any living thing.

Pitfall trap: A pitfall trap is a container built into the ground that is used to trap small animals, such as insects, amphibians and reptiles. Once the animals enter the pitfall trap they are unable to escape. Pitfall traps are mainly used for ecology studies.

Predator: An animal that survives by capturing and eating other animals.

Producer: an organism that produces its own food.

Variable: A factor that can be changed, kept the same or measured in an investigation e.g. time, distance, light, temperature.

