COMPOST ACTIVITIES FOR SCHOOLS

TEACHERS GUIDE

by Rosemary MacLean, Pat Armstrong and Bob Winters

Use compost to study the amazing world of minibeasts — classification, food webs, food chains, and adaptation. Includes teaching ideas, background information and blackline masters. All activities are linked to learning outcomes in key learning areas. This book of teacher and student activities forms part of the 'Compost and Minibeast Teachers Kit'

Gould League

Compost Activities for Schools

Authors: Rosemary MacLean, Pat Armstrong and Bob Winters

Illustrations: Sharyn Madder

Design: Jo-Anne Ridgway, Polar Design

Editors: Alan Mayberry and Jim Grant

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Genoa Street, Moorabbin, Victoria, Australia 3189
Phone: (03) 9532 0909
Fax: (03) 9532 2860
Internet: http://www.schnet.edu.au/gould/gould.html
E-mail: gould@schnet.edu.au

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Precautions

Composting

Composted material, soil and potting mix contain a variety of living organisms that, on rare occasions, have been associated with illness in humans. For health reasons, it is very important to take the following precautions:

- To minimise the chances of micro-organisms becoming airborne, gently moisten the material to allow dust-free handling.
- Protect broken skin by wearing suitable gloves.
- Avoid handling dusty material in confined spaces.
- Wash hands after handling the material.

To avoid the risk of spreading organisms that cause disease, it is unwise to dispose of the droppings of carnivorous animals (e.g. dogs and cats) in a compost heap.

Chemicals

Children should not be permitted to handle chemicals which might be added to the compost heap from time to time, e.g. lime.

Wormeries

Wash hands after handling compost worms or worm castings.

Mulching

Weed seeds and pathogens (organisms that cause disease) may survive in the production of mulch from green waste, unless the material has been treated at sustained high temperatures.

Incorrectly prepared mulch can spread unwanted weeds and/or plant diseases, especially if it is used in bush restoration places or in gardens adjacent to bushland.

If your school or home is adjacent to native bushland, don't use mulch from another area unless your are sure that it has been correctly prepared.

Chipped green waste from your own school is suitable for use on your own school gardens as long as it does not contain weeds or diseased plants.

Contents

* Student Activity Sheet

Teaching With a Compost Bin

A compost bin can provide a huge variety of hands-on experiences and provide a stimulus for discussion about a wide range of environmental issues.

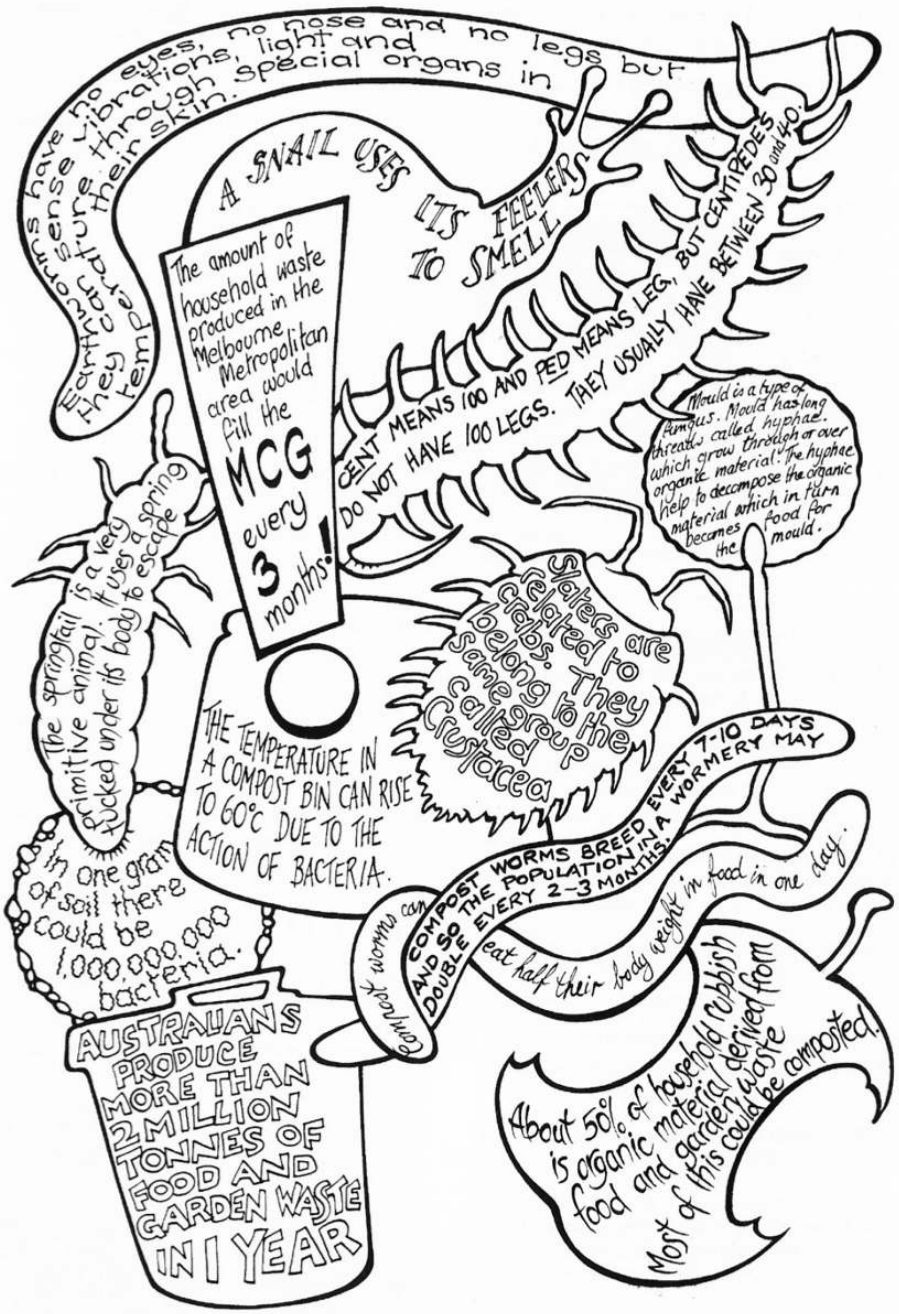
A compost bin is a field trip within the school grounds. It can be:

- a living breathing zoo, containing more organisms than your local zoo — a mine of biodiversity for surveys, classification, collection and microscopy.
- A safari into a world of predators and prey — of food chains and food webs.
- A living laboratory for classification, experiments, measurements and the study of adaptation.

- A stimulus for written language activities, text use and word games.
- An opportunity for oral language activities.
- A stimulus for debate, discussion and surveying.
- An example of resource use and re-use.
- An endless challenge for problem solvers — designing, creating and testing hypotheses, predicting results, interpreting data and forming conclusions.
- A real-life values clarification exercise.

- An opportunity for cooperative learning.
- AND it saves money, reduces demand for landfill sites which are filling rapidly, and composting produces great fertiliser!

Fascinating Facts

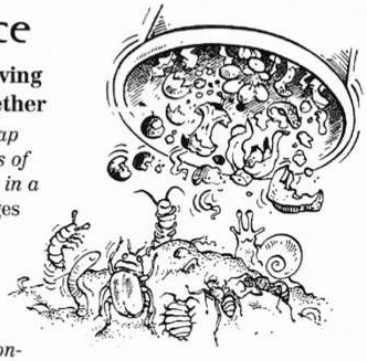


CSF LINKS

Listed below are the relevant learning outcomes for the Key Learning Areas as presented in the Victorian *Curriculum and Standards Framework* (CSF) documents.

The page numbers refer to the specific activities in this booklet which support that particular learning outcome.

Science



Life and Living

Living together

LEVEL 3. *Map relationships of living things in a habitat.* (Pages 9-10, 18-23, 25, 29)

LEVEL 4. *Identify living and non-living things that affect the survival of organisms in an ecosystem.* (Pages 9, 10, 18, 20-23, 29)

Structure and Function

LEVEL 2. *Identify and link observable features to their functions in living things.* (Pages 15-17, 19-22, 24)

Describe how body structures assist plants and animals to survive in their environment. (Pages 15-17, 19-22)

LEVEL 3. *Identify external and internal features that work together to form systems in plants and animals.* (Pages 9, 15-18, 20-23, 25)

Explain how animals use their senses to detect and respond to their environment. (Pages 9,18, 20, 21.)

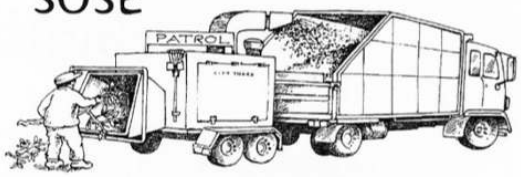
Biodiversity, change and continuity

LEVEL 2. *Identify features of living things that change over time.* (Pages 19, 22)

LEVEL 3. *Classify living things in a variety of ways.* (Pages 15-17)

Investigate the similarity and diversity of characteristics within and between groups of living things. (Pages 9, 10, 15-21, 24)

SOSE



Resources

LEVEL 2. *Explore ways of managing individual and group resources.* (Pages 6-8, 30, 31)

LEVEL 4. *Explain factors that affect resource use and development.* (Pages 6-8, 30, 31)

Demonstrate how information is used as a resource to make and record decisions. (Pages 28, 30, 31)

Time, continuity and change

LEVEL 3. *Construct a sequence from a set of events.* (Pages 18, 19, 31)

Place and space

LEVEL 2. *Explain choices people make in the use of places.* (Pages 6-8, 28, 30, 31)

Discuss how individuals and groups can participate in the care of places in a community. (Pages 6-8, 28-31)

LEVEL 3. *Investigate issues related to the care of places.* (Pages 6-8, 28-31)

LEVEL 4. *Explain different views of individuals and groups about issues related to the care of places.* (Pages 6-8, 28-31)

Natural and social systems

LEVEL 3. *Describe an example of a cycle within a natural system and the place of people in it.* (Pages 25, 28, 29, 31)

The Arts

Visual Arts — Creating, making and presenting

LEVEL 2. *Use experience and imagination to make visual art works.* (Pages 21, 24, 27, 31)

Make choices about elements in visual arts and organise them in expressive ways. (Pages 21, 24, 27)

Discuss the ways visual arts works are made and used for a range of purposes. (Pages 24, 27)

LEVEL 3. *Explore and use several art elements and use specific skills, techniques and processes appropriate to the visual arts form.* (Pages 24, 27)

Present visual arts works for a particular audience or purpose. (Pages 21, 24, 27, 31)

Technology

Materials

LEVEL 2. *Communicate ideas and explain reasons for choice of materials.* (Page 8)

Explain how a planned system will operate. (Pages 8, 12, 13)

Construct and operate the system. (Pages 8, 12, 13)

LEVEL 3. *Plan and carry out production processes appropriate to design with minimum waste of materials and safe use of tools and equipment.* (Pages 8, 12, 13)

LEVEL 4. *Prepare designs and justify selection of the preferred option.* (Page 8)

Produce information to design specifications using an appropriate range of information, equipment and techniques. (Page 8)

English

Texts

LEVEL 2. *Write brief texts which include some related ideas about familiar topics.* (Page 27)

LEVEL 3. *Interact for specific purposes with people in the classroom and school community using a small range of text types.* (Pages 27, 30)

Recognise that certain text types and features are associated with particular purposes and audiences. (Pages 27, 30)

Level 4. Use writing to develop familiar ideas, describe events and present information. (Pages 6, 7, 27, 30)

Strategies

LEVEL 3. *Integrate a variety of strategies for interpreting texts.* (Pages 26, 27)

LEVEL 4. *Use a range of strategies, knowledge and resources when spelling.* (Pages 26, 27)

Mathematics

Number

LEVEL 3. *Formally record solutions to multiplication and division problems using the symbols x and ÷.* (Pages 6, 8)

LEVEL 4. *Select and use appropriate sequences of operations to solve problems including several different operations.* (Pages 6, 8, 30)

Measurement

LEVEL 3. *Compare and order length, mass and capacity in common standard units.* (Pages 6, 8, 30)

LEVEL 4. *Read scales to the nearest measurement mark whether labelled or unlabelled.* (Pages 6, 8)

Make things of simple measurements in common units. (Page 8)

Chance and Data — Posing Questions and collecting Data

LEVEL 2. *Decide how to collect data to answer simple questions.* (Pages 6, 8, 20, 29, 30)

Pose questions suggested by collected data. (Pages 6, 8, 20, 22, 23, 28, 29)

LEVEL 3. *Clarify questions to decide what data to collect.* (Pages 6-8, 28, 29)

LEVEL 4. *Prepare a short questionnaire (two or three questions) to enable data collection.* (Page 30)

Identify areas of interest to his/her class and school, and contribute questions to help investigate the issue. (Pages 6, 8, 28, 30)

What Is Your School Doing?

What happens to the rubbish at your school? Students need to know how rubbish is produced and disposed of in their school before they can consider improvements to the system.

Procedure

Give each student a copy of the quiz 'What Happens To Our Rubbish At School?'

- Complete the quiz and compare answers. There will be a variety of responses as each child's knowledge may differ.
- Identify the areas where there is a lack of knowledge and areas in which the students show interest. Discuss the terms reduce, reuse, recycle and compost as possible ways they can deal with their rubbish.
- Brainstorm and list the type of rubbish that the school produces, e.g. old worksheets, food wrappers, used pens, food scraps, fruit juice boxes, etc.
- Consider the various sources of rubbish within the school: classroom, office, canteen, garden, etc.
- Group the types of rubbish.
- Draw a concept map for 'School Rubbish' (If the class is not familiar with concept mapping, explain how to do this and ask them to draw a concept map for 'School Rubbish'. See below.)

Discuss ways that the class could find out more about the actual rubbish that the school produces. The students may suggest the following:

- look inside the school hopper
- examine the contents of the various bins around the school, e.g. classroom, office, canteen (ensure that students wear gloves and use tongs)
- ask the cleaner and compile a checklist.

All of the above activities would provide the students with useful information. It is important to consider safety and supervision requirements when planning any of these activities.

Further Activities

Students can discuss which unit of measurement would give the best comparison.

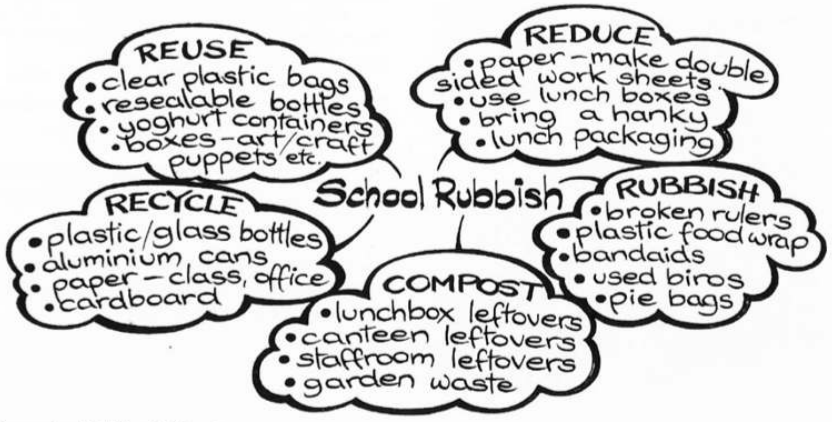
Are there things in the bin which could be reused, recycled or composted?

Why are they in the bin?

What is the most common material in the bin?

Ask the students to suggest ways to improve the rubbish situation, e.g. three bin system — compost, recyclables and rubbish.

Page 12 of *Waste Matters* has an interesting survey for students about home rubbish disposal.



Student Activity

What Happens To Our Rubbish At School?

A CLASSROOM "QUICK QUIZ"

1. Where do you eat lunch at school?

☐ In our classroom ☐ Outside

☐ Other _____

2. What type of rubbish do you separate in your classroom?

☐ Paper ☐ Glass

☐ Cans ☐ Bottles

☐ Food scraps for compost

☐ Other _____

3a. Who takes the bins out of your classroom?

_____

_____

_____

3b. Where are these bins emptied at your school?

_____

_____

_____

3c. How often does this happen?

☐ Once a day

☐ Twice a day

☐ Once a week

☐ Twice a week

4a. How often is rubbish collected from your school?

☐ Once a week

☐ Once a fortnight

☐ Other _____

4b. How is it collected?

_____

_____

_____

5. Does your school have a compost bin or heap?

☐ Yes ☐ No

6a. Does your school collect any materials for recycling or reusing?

☐ Yes ☐ No

6b. If yes, which materials?

☐ Aluminium cans ☐ Glass

☐ Paper ☐ Plastic

☐ Used clothes or toys

☐ Other _____

Calculating With Compost

Materials Needed

- plastic bucket with lid
- kitchen scales
- rubber gloves
- pen paper

What To Do

- Discuss — How much material that can be composted does our class/school produce? How could we collect this at school? Where will we put this when we are finished with our investigations? Suggest ways of finding out.
- Investigate. Students sort their rubbish in the classroom and put appropriate food scraps into a compost bin/bucket.
- Estimate, then measure by weight, the container of compost material.
- Compare the relative weights for each day. Graph your results.
- Predict (by calculating), how much compost material, could be collected in a week, month, year, etc.
- Suggest what factors might affect the material collected each day? (Canteen open, fruit in season, number of students attending school, etc.)
- Set up compost containers in each classroom in the school for collection and weighing.

The whole school (canteen, staffroom, gardener) may wish to be involved and this would provide a range of excellent learning activities within the school. The collection, recording and analysis of data will involve measurement, graphing, problem solving, etc.

These activities could lead on to the designing and implementing of a permanent composting system at school which would necessitate the existence of school compost bins.

Design A School Compost System

Read pages 10-11 of *Composting Made Easy*.

- Discuss with the class whether you will make a compost heap, build or buy a compost container.
- Consider the following factors — cost, time and skill involved and the availability of resources. The amount of compost produced by the school will affect the location, size and cost of a bin.
- Calculate how much compostable material is produced by the class/school each week, month, etc.
- Decide when and how the compost material will be collected and by whom. A Compost Committee may be set up to suggest the best methods for doing this. Students may volunteer or the class may wish to vote for nominees. Parents could share their expertise and be involved.
- Look after your compost bin — regularly turn it over. Do not let it dry out or become waterlogged. Make sure that your compost is safe from unwanted pests, e.g. rats and mice.

Further Activity

Keep a record or journal of your students' work. Photos of the various stages of development could be taken and displayed in an album, library or other part of the school.

Enjoy your compost. Use it to start a vegetable garden at school. Grow seeds or seedlings in pots of compost for experiments or for a school or community revegetation project.

Conduct an organic waste audit. It costs your school money to have rubbish collected and disposed of. You can calculate how much money your school could save in a year by composting. See page 16 in *Composting Made Easy*.

Student Activity

What's In A Compost Bin?

Compost can contain living things (e.g. fruit and vegetable scraps and garden waste) and non-living things (e.g. soil). It is made when plant material rots or breaks down. Certain conditions must be present in the bin for this to happen. Bacteria and fungi are very important as they begin the rotting process. Tiny creatures which live in the soil help by feeding on the decaying material. Most living things need oxygen and water, so these are also very important in a compost bin. You can find out more about compost by reading pages 6–7 of *Composting Made Easy.*

Aim

To have a close-up look at compost.

Materials Needed

Each group will need:

- a pair of rubber gloves
- large sheet of newspaper
- record sheet
- pen/pencil
- compost samples
- old spoons or forks
- Compost Animal Chart student activity sheet (see pages 10-11)

Classroom Organisation

Students work in small groups of 4 or 5

What To Do

- Collect a sample of moist, well-rotted compost from your compost bin at home. (Use gloves and store the compost in a container with a lid.)
- Empty a small amount of compost onto a large sheet of plain white paper. Using a small spoon, sort through the material.
- Use your senses to learn more about the compost. Record your answers in the spaces opposite.

Does it have a smell? (circle) YES NO
(Do not smell dry, dusty compost.)

If so, is it an earthy smell or a bad smell? ____

What colour is it? _____

How does it feel? _____

Do the soil particles stick together? _____

- Identify what is
  (a) living, (b) non-living in the compost?

_____

_____

Use the Composting Animals Survey Sheet (page 10) to record the animals you find.

- Look for plant material (fruit scraps, leaves, sticks) or their remains. List what you found.

_____

_____

- Can you see any mould growing? (circle)
  If so, describe it. YES NO

_____

_____

Choose the best words to fill the gaps in the sentences below.

DARK BROWN, OXYGEN, EARTHY, BAD, EARTHWORMS, SOIL, WATER, BEETLES, YELLOW.

Compost usually has an _____ smell.

Centipedes, _____ and

_____, are living things

you may find in compost.

Most living things need _____ and

_____.

Healthy soil or compost is usually a

_____ colour.

Collect other compost or soil samples and compare types of living things found in each, e.g. leaf litter, mulch and garden soil. Record your findings on the Composting Animals Survey Sheet.

Survey Sheet—Compost Animals

Use this sheet to record the invertebrates found in samples of compost materials.

Sample area

Animals	1	2	3	4
Roundworm (Nematode)				
Earthworm				
Snail				
Slug				
Slater				
Amphipod				
Centipede				
Millipede				
Spider				
Mite				
Springtail				
Earwig				
Beetle larva				
Compost beetle				
Rove beetle				
Maggot				
Fly				
Ant				
Other				
Other				
Other				

Describe the sample area

Area 1 Area 3

Area 2 Area 4

Compost Animal Chart

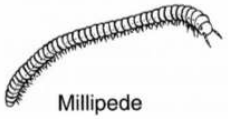
Adapted from artwork by Bob Winters

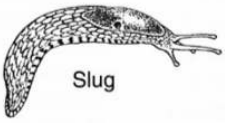
Compost Animals larger than 10 mm


Snail

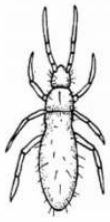

Centipede

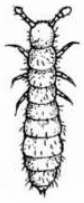

Earthworm


Millipede


Slug

Compost animals about 2 mm or less





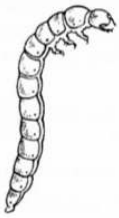

Springtails

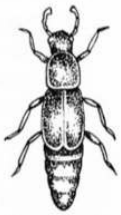

Mite


Roundwort

Compost animals between 2 mm and 10 mm


Earwig


Beetle larva

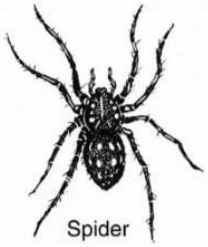

Rove beetle


Vinegar fly


Maggot


Slater


Compost beetle


Spider

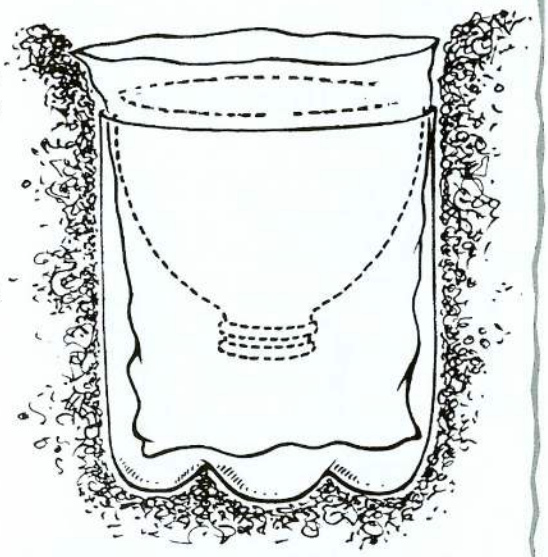

Ant


Amphipod

Pit-Fall Trap

Introduction

A pit-fall trap is used to trap small animals living in leaf litter or in compost bins. When the animals fall into the trap, they have difficulty getting out. The following method is very successful in compost bins where many invertebrates live on or near the surface. It is even more successful in combination with a light source at the bottom of the trap. Flies are attracted to the light and it would seem that some beetle larvae are also attracted. Larger, active animals, like spiders and centipedes, don't seem to fall into the device.



Materials needed

- hand lenses or low-power stereo microscopes
- PET soft drink bottles
- plastic bags
- scissors and tape
- small digging tool, e.g. a trowel or spoon
- petri dish
- optional — a small light source

What To Do

- Cut around the top of the bottle just below where it starts to narrow. This should provide both a large container and a funnel. Place a plastic bag in the container so that the top of the bag sticks out. Finally, place the funnel, pointed-end down, into the plastic bag. The funnel should be pressed firmly against the plastic bag and the container.
- Dig a hole into the compost bin and place the pit-fall trap in the hole. Replace the material around the bottle. The top of the trap should be just below the level of the composting material. After 24 hours, remove the funnel and extract the plastic bag. A new plastic bag can be placed in the container and the funnel replaced. The plastic bag with the invertebrates can be tied at the top to prevent the animals from escaping.
- The animals in the plastic bag should be moved to a bottle or a petri dish for closer examination with a hand lens or stereo microscope.
- Use the Compost Animals Chart to identify the animals collected.
- When you have finished observing the animals, return them to the compost bin.

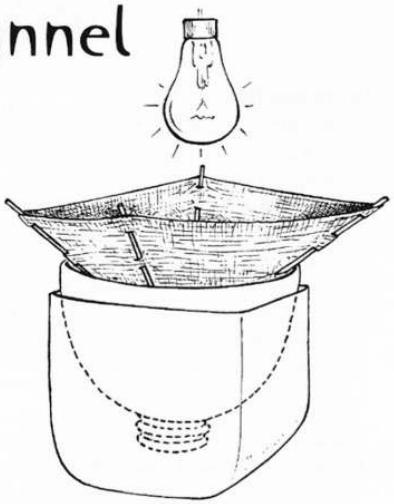
Find out

- What types of animals live near the surface of the compost bin?
- Are there many different types of animals in the trap?
- Do many of the same types of animal fall into the trap?
- What is the most common animal that you collected?

Further Idea

- Place a small torch at the bottom of the pit-fall trap, under the plastic bag. (It is preferable to use rechargeable batteries if these are available, as it is an opportunity to demonstrate good conservation practice.) This method will capture any animals attracted to light, as well as any animals that fall into the trap while it is dark.

Berlese Funnel



Introduction

A Berlese funnel is standard equipment for examining the range of life in soil samples. It consists of a wooden box with holes to allow some of the heat to escape. Heat and light is generated by a low wattage light globe attached to the top of the box. The globe shines onto a soil sample in a sieve held over a large funnel. At first, the animals in the soil sample attempt to escape the heat and light at the top of the soil by moving downwards. Eventually, some reach the sieve and fall through into the funnel and tumble down into the collection container at the end of the funnel. As the soil dries, more animals will try to escape and will be collected by the funnel. This method takes forty-eight hours to extract most of the soil animals in a sample.

It is simple to construct a Berlese funnel from plastic bottles and other household items. A desk light with the globe positioned closely to the sample will work well, taking about two to three days to collect the animals. Even without a light, the drying of the material will eventually have the same effect, but it will take seven to ten days.

Materials Needed for a Home-made Berlese Funnel

- 2 litre PET soft drink bottle
- 2 litre plastic milk bottles
- a clean, well-used absorbent cleaning cloth with large holes
- four wooden skewers
- optional: a desk light

What To Do

- Make a broad funnel from the PET bottle, cutting the bottle at the point where it starts to narrow.
- Cut the top from the milk container. The base will be used as a stand for the funnel and to collect the animals.
- Pierce the cloth with the four skewers about 10 cm from each corner.
- Place the end of the four skewers into the bottom of the funnel, letting the skewers rest on the side of the funnel. (This will create an effective sieve, allowing the animals to fall through.)
- Place the funnel and the sieve over the base.
- Gently scatter a sample of compost over the sieve. It should not be more than about 5 mm thick.
- If available, place a desk lamp with a 40 watt globe, over the soil sample.
- Collect animals from the milk bottle base every four hours for the first twelve hours, and then every 24 hours until no more animals fall through.
- Use the Compost Animals Chart to identify the animals found in your sample of compost or mulch. After identification, return the collected animals to the compost bin.

Further Ideas

Investigate if different kinds of animals escape from the sample at different times. It may be necessary to collect samples every few hours.

Compare the life in different parts of the compost heap: top, side, bottom and centre.

Investigate if the life in an undisturbed compost heap changes as the heap matures.

Discover what lives at different depths of a compost heap or in a thick layer of mulch.

Compare the life in compost, mulch, soils and leaf litter. Determine the relative abundance (how many animals per sample) and diversity (how many kinds of animals per sample) of animals.

Student Activity

Sieve Shake

Introduction

This method is used to quickly extract animals from samples of damp compost, mulch, leaf litter or soil. The samples are placed into a sieve which is gently tapped and shaken. Animals fall through the sieve onto paper. The method works well with damp samples, as the soil tends to hold together, so that hardly any soil and debris falls through the holes of the sieve along with the animals.

This technique can be used to:
i. Study many samples in a short time.
ii. Study many sites over a wide area.

Materials Needed

- household sieve
- sheet of white paper
- small digging tool, e.g. a spoon
- hand lens or low-power stereo microscope

What To Do

- Spread about 1 cm of compost, mulch, leaf litter or soil over the surface of the sieve.
- Place the paper under the sieve. It may be easier to lay the paper over the sample site, so that the animals can be quickly released back to their homes. On a white background, it will be easier to observe the animals as they move about. Most will be the size of a pin head or smaller.
- Hold the sieve over the paper and tap the metal frame and note which animals come out.
- Use the Compost Animal Chart to identify the animals you collected.
- Gently shake the sieve and note which animals are released.
- Finally shake the sieve vigorously and note which animals are released.

Classification

There are many different creatures which live in soil and compost. They can be sorted into groups according to their physical features.

Many of the compost creatures belong to a large group called Arthropoda, having a hard, jointed exoskeleton. Their appendages are also jointed. In this large group or phylum, are many sub groups or classes.

Class Crustacea e.g. slaters
Class Arachnida e.g. mites, spiders
Class Diplopoda e.g. millipedes
Class Chilopoda e.g. centipedes
Class Insecta e.g. beetles, earwigs, springtails, vinegar flies.

Snails and slugs are part of another phylum called Mollusca. Earthworms and other segmented worms are part of the *Phylum Annelida.*

Roundworms or nematodes, which are unsegmented, are part of the *Phylum Nematoda.*

In the following activities the students can investigate the similarity and diversity of characteristics within and between groups of living things i.e. the creatures that live in the compost.

Materials Needed

- compost creatures
- Compost Animal Chart
- classification activity sheet
- hand lenses (optional)
- coloured pencils

Investigations

(Students to use Activity Sheet on page 16.)

- The students collect a variety of compost creatures using either a pit-fall trap, Berlese funnel or sieve shake. (See pages 12-14)

After studying each creature carefully, they can draw an example of each.

Using the Compost Animal Chart, they can identify the names of the collected creatures.

- Discuss with the class the concept of grouping or classifying things. Explain that a group of 'things' will share common characteristics. Give examples, e.g. living/nonliving, plants/animals. Ask the students to group their creatures.
- The students can look for similarities in colour, size and shape of their compost creatures and record on the sheet what they discovered.

Consider why colour and size are not valid characteristics for classifying animals (they can vary between the same type of animal).

- The students study the number of legs of different compost creatures and complete the groups. (Point 5 on the Classification Activity Sheet). They may like to try and create their own groups based on the presence or absence of wings in adults, antennae, etc.
- Students identify creatures with jointed legs.
- Students identify and record the creatures without jointed legs.
- Introduce students to the Insect group. Show or display pictures or specimens of other common insects. They can identify the common features i.e. head, thorax and abdomen. The students can identify which compost creatures are insects and they can draw one on the sheet. Ask them to colour their creature and label the body parts.

Student Activity

Classification

- Collect a variety of compost creatures using either a pit fall trap, Berlese funnel or sieve shake. (See pages 12-14).

In the space below, draw the creatures that you found.

- Look at the Compost Animal Chart. Scientists usually group animals according to their physical features, but on our chart they were grouped according to size. On the back of this sheet, show how you would group the minibeasts that you have collected.
- Is colour or size a good way to group animals?

  YES NO (circle)

Explain why.

- Look at the size, colour and shape of your compost creatures. Look for body shapes and parts that they have in common, e.g. snails and slugs both have a muscular foot. What did you discover?

- We can group compost creatures using the number of legs each has. Can you complete the names of the animals in each group?

6 legs *ant*

8 legs _____

many legs *centipede*

no legs _____

Other body parts that you could use to classify compost creatures are wings in adults, antennae (feelers), single muscular foot.

- Scientists have their own way of grouping or classifying animals. Many of these animals belong to a large group called *Arthropoda*. They have a hard outer skeleton and their name means joint-legged. Which of your compost creatures have jointed legs?

- Which creatures do not have hard outer skeletons and jointed legs?

- Insects are a large group. They have three parts to their bodies: a head, thorax and abdomen. The adults have one or two pairs of wings, six legs and a pair of antennae or feelers. Can you find a compost creature which is an adult insect?

  Draw it in the space below.

  Colour it correctly and label the body parts.

Student Activity

Build A Bug

The object of the game is to successfully answer as many questions as possible and carefully choose the correct combination of body parts to build a "bug" e.g. beetle — body in 3 parts + 6 legs + 2 pairs of wings +1 pair of antennae (4 cards)

Materials Needed

- plain card
- marker pens
- scissors
- 20 compost trivia questions
- 6 margarine containers
- Build a Bug sheet

Classroom Organisation

Small groups of 4 or 5

What To Do

The students or the teacher can write a set of trivia questions about compost creatures, e.g.

Which group of animals has 6 legs? (insects)

A beetle has 2 pairs of_____ *(antennae/feelers)*

What am I? I have a reddish-brown flattened body and many legs.

_____ *(centipede)*

You will need at least 20 questions.

Make up six sets of small cards (5 cm by 2 cm) with 15 cards in each set.
Write the name of the body parts on each card.
Store them in a small margarine container.

Body Part Names

1 pair of antennae	6 legs
many legs	long, thin body
1 pair of wings	short, fat body,
body in 2 parts	2 pairs of wings
2 pairs of antennae	8 legs
single foot	segmented body
shell	body in 3 parts
body in one part	

Give each group a container with the set of cards inside and a copy of the table below. The teacher asks each group in turn a different question. If the group successfully answers the question, they can choose a body part from the container. The winning group is the one that first builds a compost "bug" with all the necessary parts (as listed on the table below).

Animal	Number of legs	Single foot	Number of antennae	Segmented body	Type of body	Number of wings	Shell
Earthworm	-	-	-	yes	long, thin	-	-
Snail	-	yes	two pairs	-	short, fat	-	yes
Millipede	many	-	one pair	yes	long, thin	-	-
Spider	eight	-	-	yes	body in two parts	-	-
Mite	eight	-	-	yes	body in one part	-	-
Compost beetle	six	-	one pair	yes	body in three parts	two pairs	-
Vinegar fly	six	-	one pair	yes	body in three parts	one pair	-

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Vinegar fly	six	-	one pair	yes	body in three parts	one pair	-

Minibeast Menus

Look at the food web of the compost heap. A food web shows the relationships between the plants and animals in a particular habitat e.g. a compost bin.

The creatures in the compost need food to survive and multiply. Some of the minibeasts in the compost or soil are fierce hunters, while others eat the remains of dead animals and plants.

- Use the food web to show what compost minibeasts like to eat. Make lists under the following headings:

  Feed on plants
  e.g. snail

  Feed on animals
  e.g. centipede

  Feed on dead things
  e.g. mould mite

  Sometimes it is easier to see what eats what by drawing a food chain, e.g.:

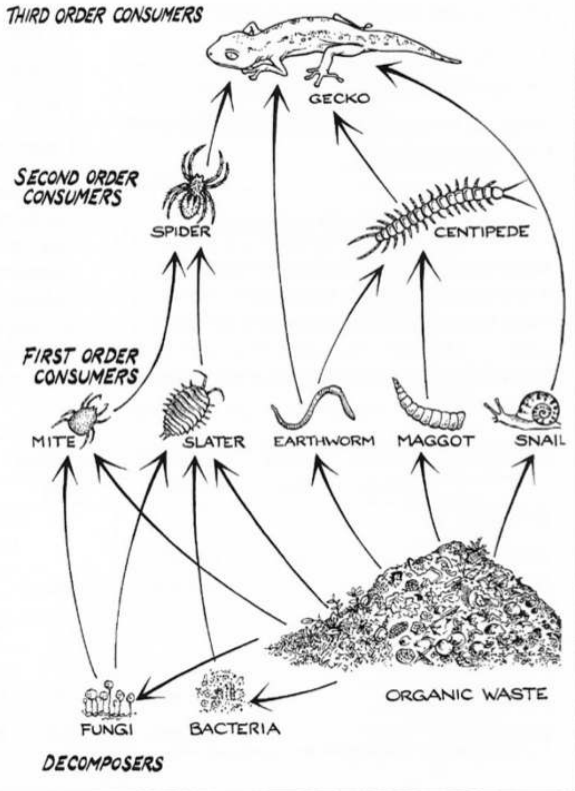
earthworm
↑
decaying plant material

spider
↑
mould mite
↑
mould
↑
decaying plant material

- Use the food web to draw your own food chain. Include illustrations.
- Some minibeasts are meat eaters, i.e. carnivorous, while those that eat plants are herbivorous. Collect some compost minibeasts and experiment to see which food types they prefer.
- Add a variety of food samples to your collection, e.g. cabbage leaf, soggy bread, orange segment, lettuce leaf, etc. During the day, observe what happens. Check the next day to see if any food is being/has been eaten. Record your findings.

Return your compost creatures to their homes.

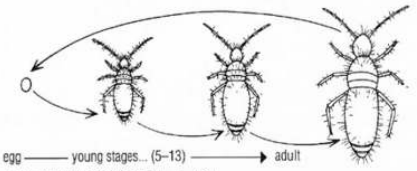
Food Web of the Compost Heap



Life Cycles In A Compost Bin

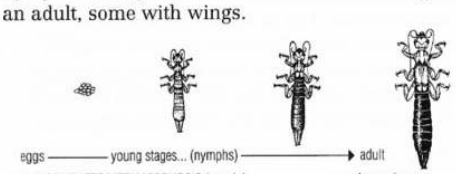
Some of the animals which live in the compost bin begin their life in a very different form. Although nearly all animals without bony skeletons (invertebrates) lay eggs, the other stages in an animal's life cycle do vary. In some cases the creatures, which hatch from the eggs, look like their parents, but others can look quite different as they lack certain body structures. In a compost bin/heap it is possible to study three different life cycles.

1. Metamorphosis absent Many compost creatures, e.g. snails, slaters, spiders, centipedes and worms look like miniature adults when they hatch from the eggs. Some of the creatures which have a hard, outer skeleton, shed their old 'skins' and make new 'skins' as their bodies grow, e.g. slaters. This process of moulting happens several times in a creature's life before it becomes fully grown.



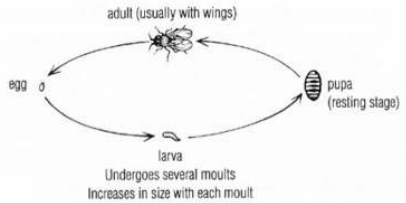
1. METAMORPHOSIS ABSENT (springtail)

2. Incomplete metamorphosis The eggs hatch into nymphs which are like immature adults without wings. There is no pupa or resting stage. The nymphs undergo several moults before turning into an adult, some with wings.



2. INCOMPLETE METAMORPHOSIS (earwig)

3. Complete metamorphosis The young or larvae do not resemble the adult form. Only the adults may have wings.



3. COMPLETE METAMORPHOSIS (vinegar fly)

Some of the compost creatures which go through these changes include beetles, vinegar flies and ants.

The students may have seen a grub (beetle larva) or maggots (fly larvae) in soil. At the larval stage, the immature creature eats to build up stores of food for the next important stage of its life cycle, becoming a pupa. The pupa does not feed, but uses its energy in developing new body structures. Eventually it will emerge from the pupa as an adult.

Investigations

- Discuss the term 'life cycle' and ask the students to explain what it means. Some students may be able to give examples of different animal life cycles. (The students are probably familiar with the life cycle of a butterfly and the frog.)
- Display pictures of animals in different stages of their life. Look for similarities in life cycles.

Introduce the terms — egg, larva(e), pupa(e). The students can draw an example of a life cycle.

For example:

Eggs → larvae (caterpillar) → pupae (in a cocoon) → adults (butterfly)

- Students could research information about other creatures which undergo complete metamorphosis.

They could find out which compost creatures moult as they grow. (Libraries and computers are great sources of information.)

- Earthworms lay capsules which contain eggs. After about three weeks the eggs will hatch into tiny worms which look like miniature adults. The students could collect capsules from a compost sample, record when hatching occurs and observe the growth of the baby worms.
- Build a class wormery. The students can observe the different stages in the life cycle of an earthworm. Pages 12-13 in *Composting Made Easy* gives clear instructions how to do this.
- Build a wormery in a bottle. (See *Waste Matters* page 54.)

Feelers, Feet And Fangs

There is a fascinating range of creatures that live in the compost. Unlike humans, these creatures are suited to living in the soil, leaf litter or in fruit, and have many adaptations to help them survive. Like all living things they need air, food, moisture and shelter. Most of these creatures have special ways that they can move, eat, breathe and escape from danger.

Some have compound eyes with hundreds of lenses, while others have no eyes at all! If the students observe carefully, they can discover many interesting adaptations about creatures that live in the soil and compost.

Materials Needed

- compost creatures (snails, slugs, beetles, slaters, earthworms, ants)
- hand lenses, magnifying glasses, microscope
- 6 shallow plastic/polystyrene trays (preferably white)
- chopped fruit scraps/leaves
- compost
- sand
- sandpaper
- water
- refrigerator
- desk lamp

REMINDER

Remember to treat your compost creatures with respect. Handle them carefully during experiments and return them to the compost bin when you have finished.

Class Organisation

Work in groups of 4 or 5

Investigations

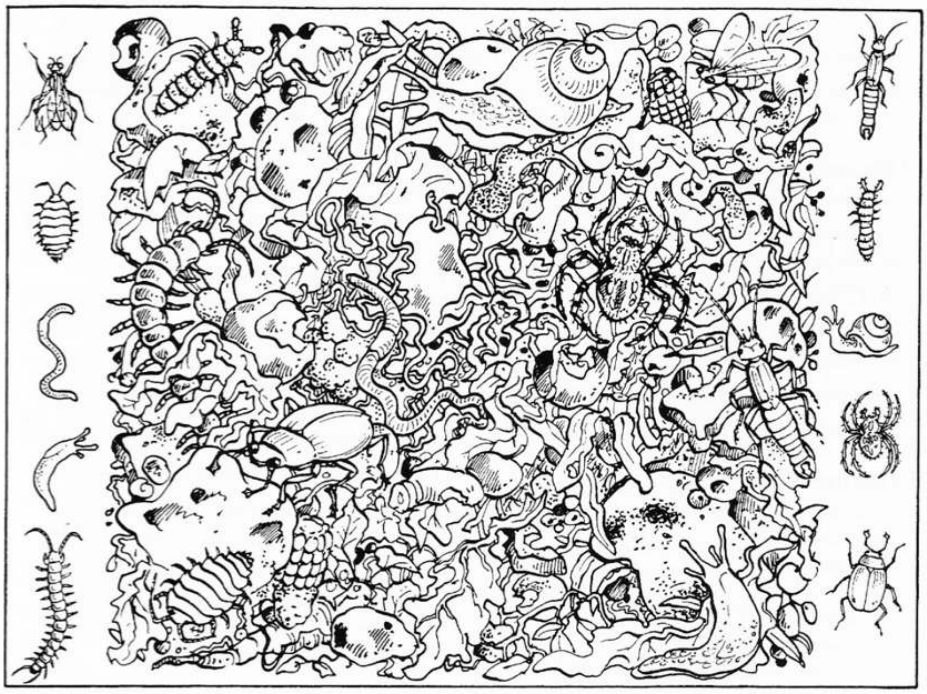
- Students can place some compost creatures on a white tray and observe the different methods of movement, e.g. some minibeasts slide, crawl, fly, spring, etc. Can they find which is the fastest compost creature and explain how its speed may help it to survive? Many compost creatures have very small legs or no legs at all. The students could consider why this might be an advantage in a compost/soil environment.
- Students can test what happens to the animals' movement when the surface of the tray is changed. Sand, glass and sandpaper are interesting to try. Students may wish to experiment with other surfaces.
- Using a hand lens or microscope will enable the students to study particular features of their creatures, e.g. legs, antennae, body segmentation. The students can compare similarities and differences between compost creatures and suggest how the body structures assist their survival. Ask the students to record their observations by drawing sketches.
- Many insects and other invertebrates use *camouflage* to protect themselves. The students can list the compost creatures which are well camouflaged and suggest reasons why this may help them to survive.
- Students can investigate how different minibeasts respond to changes in temperature, water availability and light exposure. They can design simple experiments to see what happens when the temperature in the compost rises or falls, the compost becomes dry or waterlogged, or a light is shone on them. The students can *hypothesise* (make an educated guess as to what might happen) how the creatures' behaviour may change.

Student Activity

Hidden Creatures

How many compost creatures can you find hiding in the compost bin below?

Colour the creatures that you find.



Match the adaptations to the minibeasts:

centipede	has a long, thin body with no legs
snail	has poison fangs
earthworm	has pincers on the tip of its abdomen
earwig	has chewing mouthparts
spider	has many legs and can run swiftly
slater	some curl up in a tight ball
beetle	has two sets of feelers

Compost Jigsaw

On a sheet of A4 paper, rule a 1 cm border. Draw a large sketch of a compost creature. Colour it appropriately. Camouflage by colouring a suitable background. Paste onto card and cut into twenty jigsaw pieces. Swap with a friend. Can they complete the puzzle and find and identify the hidden creature?

Student Activity

Mouldy Oldies

Years 3–6

A practical activity enabling you to compare:

- the decomposition of five common plant materials
- the rate of decomposition of these materials with and without soil present.

Materials Needed

- ten glass jars with lids
- five different materials that are commonly placed in a compost bin — orange peel, apple core, bread, grass clippings, leaves
- rich garden soil
- a spoon
- a spray bottle of water
- record sheet (see below)

Experiment A: No soil

- Place a piece of the five materials into separate glass jars. Keep each piece the same size as the apple core. Write down what you think might happen.

- Spray a little water over each piece of material, then screw on each lid.
- Label each jar.

Experiment B: With soil

- Place a 30 mm layer of soil in each jar before adding the material, and then repeat the steps as for the first experiment. Write down what you think might happen this time.
- Observe the materials in the jars every second day for two weeks. Look for changes in size, colour, shape, and for the presence of mould.
- Write observations on the record sheet.
- In the first experiment, which materials changed the most over the two weeks?
- The materials in the jars show signs of decay, because of the action of moulds and bacteria. Where do you think the moulds and bacteria came from:

  in the jars with soil?

  in the jars without soils?

- In which experiment did the materials change the most?

Repeat the experiment with other foodstuffs, moist and dry conditions or different packaging materials — plastic, glass, paper.

DAY	ORANGE SKIN	APPLE CORE	BREAD	GRASS	LEAVES
2					
4					
6					
8					
10					
12					
14					

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4					
6					
8					
10					
12					
14					

Bottled Compost

You can make your own compost in a bottle. This is an easy and fun experiment where you can see how decomposition works. Not all materials will break down or decompose. Using a plastic PET bottle as your compost container, you can observe the changes that take place inside and compare what happens to different materials.

Materials

- a large PET soft drink bottle
- spoon
- tape
- marker pen
- spray bottle of water
- 1 cup
- grass clippings
- 1 cup crushed dry leaves
- 1 cup torn newspaper
- 1 desert spoon organic fertiliser
- 2 cups of garden soil
- 2 cups of finely chopped fruit/vegetable scraps

What To Do

- Place a layer of soil in the prepared bottle (see diagram).
- Add some fruit or vegetable scraps.
- Cover with soil and sprinkle some fertiliser over the top.
- Build up more layers using leaves, grass and newspaper. Finish with a layer of soil and fertiliser.
- Spray the surface with water. Tape the top of the bottle to the base.
- Write the date on the bottle and mark the final level.
- Write down what changes you might see.
- Observe the 'compost' every day for three or four weeks. Record any changes in the layers. Look for changes in colour, size and shape of the plant material. Can you see any mould growing or any small creatures feeding on the plant material?

Investigations

- How much did the top layer/mark on the bottle drop in three weeks? What do you think caused this?
- Compare what happens when you make the following changes:
  - use different types of plant material
  - use coarsely-chopped plant material
  - use sand instead of garden soil
  - make several air holes in the side of the bottle
  - do not add any water to the bottle
  - place some inorganic material in the bottle, e.g. shredded plastic bag, chopped milk, carton, metal bottle top, etc.
- Some people have found that potato and onion do not always decompose in their compost bins. Design an experiment to test whether potato and onion will decompose. Compare what happens to small pieces, peeled skin or the whole vegetable, both raw and cooked.
- As the bacteria and fungi break down the materials, a lot of heat is given off. Find out if the temperature changes in your bottle over the next few days/weeks.

Compost Creatures

Materials Needed

- craft equipment
- scissors, tape, glue
- magnifying glasses
- compost
- four plastic icecream containers
- toothpicks
- reuse materials, i.e. small boxes, cardboard tubes, plastic bottles, etc
- recording sheet and materials
- compost animal chart

Classroom Organisation

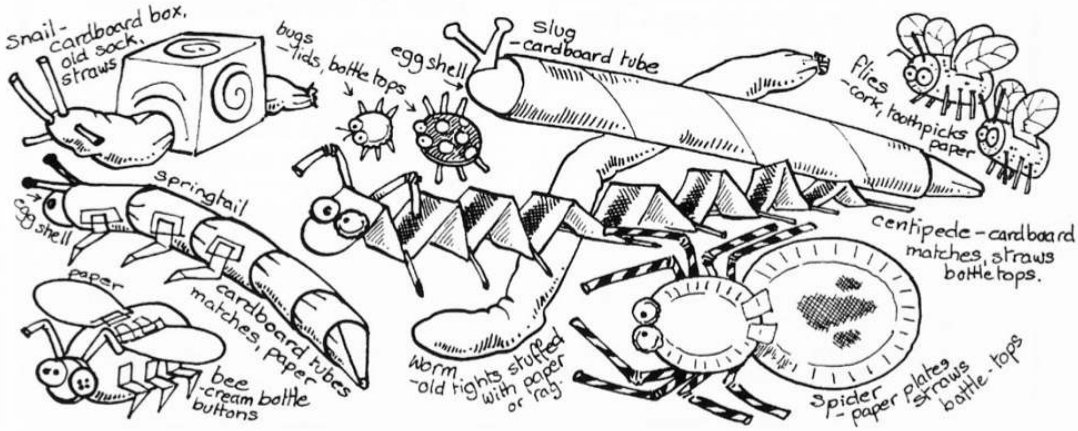
Group

Activity

- Discuss compost and the part creatures play in its decomposition.
- Display compost animal chart.
- Divide class into 4 to 6 groups around the containers of compost.
- Children use toothpicks to locate any creatures which may be in the compost. They should observe how they feed, protect themselves and move.
- The children work within their group to design a creature that lives in compost making it from at least three materials. Their design should show how the creature feeds, protects itself and moves.
- Children make their creatures, followed by a class sharing and evaluation time.

Further Activities

- Build a mural of the layers in a compost heap on a moveable display board, i.e. soil, fruit and vegetables, soil and fertiliser, grass clippings, soil and fertiliser. Continue the layers following this method.
  - Attach the children's models to the mural. Add appropriate labels and information.
  - Move the display throughout the school so the children can promote composting.
- Transform your classroom into a giant compost bin.
  - Darken the room with green cellophane over the windows.
  - Paint murals of compost scenes to decorate the walls of the classroom.
  - Make oversized 3D paper maché models of fruit and vegetable scraps to hang from the ceiling.
  - Decorate your room with posters and cartoons about composting.



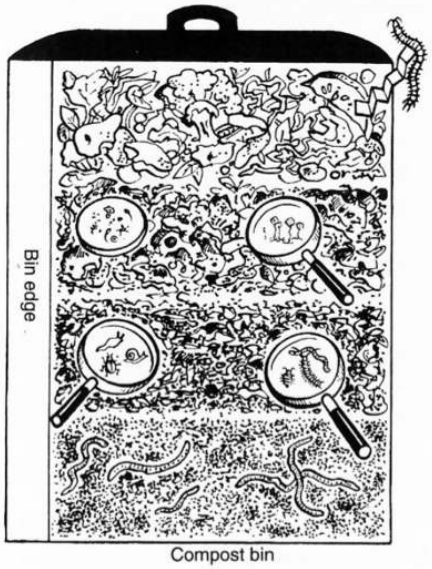
Student Activity

The Ins and Outs of Composting — For the Good of the Earth

Composting and You!

Don't throw all of your rubbish in the bin without thinking.

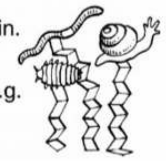
More than half of household rubbish can be composted instead of being taken to the tip. This activity will help you to understand the best way to compost and so reduce the amount of rubbish your family throws away.



Compost bin

What To Do

- Colour in the contents of the compost bin opposite.
- Cut out and fold the compost bin and the side door from the drawing below.
- Fold the door and cut into four sections.
- Glue the two ends together.
- Staple or tape the door to the bin.
- Make some compost creatures and add them to the drawing, e.g.



- Show your model compost bin to your family and friends and try to encourage them to compost.

Follow Up

Collect all your family's kitchen scraps that can be composted. Store them in an icecream container with a lid.

How long did it take to fill the container?

Add the kitchen scraps to your compost bin.

If you don't have one, work out a plan with your family to either buy or make one.

See *Waste Matters* for more information on composting as well as *Composting Made Easy, Compost Creatures Poster*

Fold

Cut out. Staple or tape to bin edge

What goes in a compost bin?	Kitchen scraps (except dairy foods and meat) Garden scraps (except weeds and diseased plants)
Best conditions for good compost are . . .	Organic materials Moisture Oxygen Microbes
Compost creatures are . . .	Earthworms, slaters, slugs, beetles, springtails, earwigs, millipedes, snails
Uses of compost are . . .	Soil improver In worm farms In potting mixes In vegie gardens

Language Activities

compost	mould	decay	organic	invertebrate	soil
decomposition	fungi	humus	fertiliser	bacteria	mulch
rot	micro-organism	reduce	manure	recycle	natural
aerobic	conserve	microbe	nutrient	landfill	

- Make a Word Find using the above vocabulary. Swap with a friend.
- Design a crossword using the above words as answers. You will have to write the clues and number the spaces correctly.
- From the list, find the synonyms (words that have similar meaning).

  decay *rot*

  mould _____

  fertiliser _____

  bacteria _____

- How many words can you make from decomposition?

  List them below. Design a scoring system, e.g.

  3 letter word = 1 point,
  4 letter word = 2 points, etc.

  _____

  _____

  _____

  _____

  _____

  _____

  _____

- Circle the prefixes in the list words. (Prefixes can be one or more letters that are added to the start of a word. They change or add meaning to the word e.g. *de*serve *re*serve).

- How many other words can you list with the same prefixes? Arrange them in lists:

  de _____

  re _____

  in _____

  micro _____

  an _____

  com _____

- Look at the word list. How does the prefix change the meaning of the base word? Write sentences to show the differences in meaning, e.g.

  Nature has many cycles including the water cycle.

  Composting is a great way to recycle the nutrients in plants.

- Sometimes a prefix added to a word can give it the opposite meaning, e.g. clean/ unclean.

  Add or remove a prefix to form the opposite/ antonym of the following:

  organic _____

  aerobic _____

  decomposition _____

- How many compost words can you find in the border? _____

- Which word from the list above was not in the border?

  _____

Creative Compositions

There will be many occasions when students will use language in oral or written form when involved in learning activities about compost.

An excellent activity which demonstrates the students' knowledge, skills and creativity is the making and designing of a picture storybook with a composting message. A number of factors need to be considered, such as the content, purpose and audience of the book. Apart from having a basic understanding of composting, the students should be exposed to a variety of text styles in picture story books so as to learn useful strategies in producing their own book.

Materials Needed

- sheets of A4 plain paper/computer paper
- cartridge paper/card for book cover
- coloured pencils/felt markers for illustrations

What To Do

- Discuss content, purpose and audience of the book with the class.

  Content: a picture storybook with a composting theme or message.

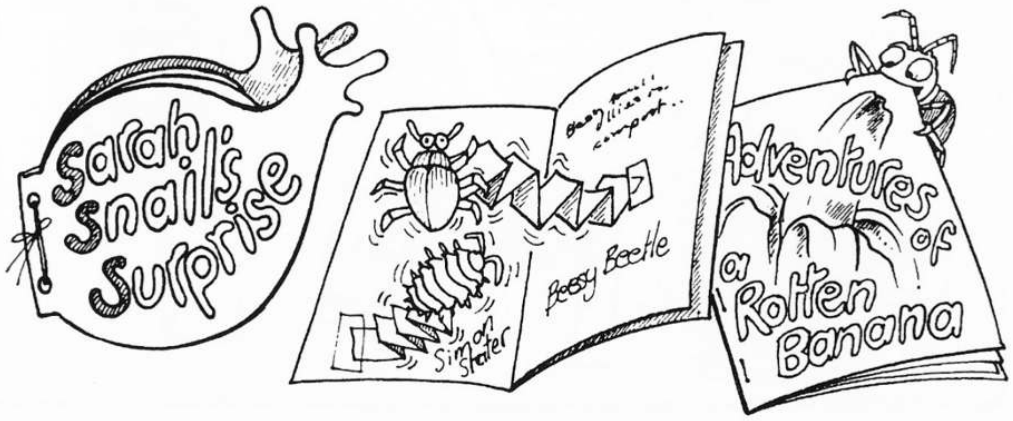
  Purpose: to promote composting

  Audience: Prep–Year 1 students

- Students decide on the format of their book — cartoon form, ABC or counting book, adventure story, shape book, pop-up, etc. This will affect the page layout, font, borders, illustrations, etc.
- Students make up a draft or dummy book, (include text, illustrations, borders, etc.).
- Review and edit where necessary.
- Complete final copy.

Further Ideas

- Display the books in the school or local library.
- Students read their books to Prep. children. They could also design a follow-up activity that supports the storyline, e.g. make a cardboard compost bin and ask the Prep child to draw what goes in the bin.
- Make audiotapes to accompany the books. This is a fun way to encourage reading and helps to enhance listening skills.
- Lend your students' books to other grades and spread the word on composting.



Student Activity

Why I Compost

Complete this sheet and compare your results with the class. Remember there are no right or wrong answers. People have different opinions and values which makes life interesting.

There are many good reasons to compost. Which five reasons from the list below are the most important to you? Mark these with numbers from 1 to 5, number 1 being the most important to you.

- ☐ Composting helps improve garden soils.
- ☐ Composting reduces the need for fertilisers.
- ☐ Composting saves tip space and therefore lengthens the life of landfill sites (tips).
- ☐ Composting reduces the amount of the greenhouse gas, methane, that is produced by rotting rubbish in tips.
- ☐ I enjoy gardening, and composting is a great way to get rid of garden waste.
- ☐ Composting reduces the cost to councils of disposing of rubbish.
- ☐ I want to have a fantastic vegetable garden and composting is great for vegetables.
- ☐ Composting stops people from burning leaves and other garden waste and therefore reduces air pollution.
- ☐ It's important that everyone does what they can to help the environment.
- ☐ I prefer to use natural organic materials in the garden.

Further Activity

Organise a class debate — It should be law that vegetable scraps and garden waste are not disposed of in landfill sites.

Student Activity

Marvellous Mulch

Councils collect a lot of green waste from their parks, roadside and from homes. Some have found an alternative to dumping green waste into landfill. The leaves, branches and small trunks are ground up in a large mulching machine. The pieces of chopped-up plants are small enough to make an even covering over the ground, but large enough to not blow away easily.

Mulch can then be purchased by the local residents to cover their gardens. A thick layer of mulch on the garden will:

- reduce many of the weeds,
- increase the moisture in the soil,
- reduce the run off of water, and
- make weeding, when necessary, much easier.

As it breaks down, the mulch will also increase the depth of soil. Unlike compost which has been allowed to decompose before use, mulch will continue to break down after it has been spread on soil. Mulches may be used by Councils to reduce their maintenance costs, e.g. it can reduce the need to mow, weed or spray poisons in an area. Mulches are essential for revegetation projects to help stop the regrowth of weeds which compete with the young seedlings for water and nutrients. Planting with mulches increases plant growth and reduces the loss of plants.

With the following simple experiments, you can test the benefits of mulch.

Materials Needed

- 2 thermometers
- PET bottles of water
- grass seed
- two 4-litre icecream containers
- garden soil
- various mulches
- nails

What To Do

Experiment 1

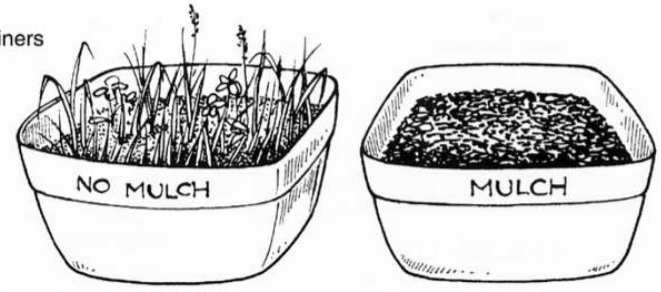
- Use nails to punch some drainage holes in the base of the two icecream containers.
- Quarter fill the two icecream containers with garden soil.
- Sprinkle some grass seed over the soil in the containers.
- Water the seed well and stand the containers on trays.
- Cover the seed in one container with a thick layer of mulch.
- Place outside and water regularly.
- Observe what happens over the next three or four weeks. (Did grass grow in either of the two containers?)
- Vary the type of mulch used and compare the effectiveness of each in stopping 'weed' growth.

Experiment 2

- Fill two icecream containers with garden soil.
- Spread a thick layer of mulch over the top of one container.
- Measure the soil temperature in each container.
- Place containers in a sunny spot, e.g. a window sill. Measure and record the soil temperature at regular intervals during the day. What did you notice? Explain your results.

Experiment 3

Design your own experiment to compare the amount of water run off in soil, with and without mulch.



Student Activity

How Can People Be Encouraged To Compost?

Many people compost their garden fruit and vegetable wastes. But many people don't, and throw these materials in the rubbish bin instead. Below are listed some ways that a Council could use to encourage more people to throw out less food or garden waste in the rubbish bin. Using a tick (✓), rate each idea as either good, not sure or bad.

	Good idea	Not sure	Bad idea
1. Council increases rates and gives everyone a compost bin.			
2. Council sells compost bins cheaply to ratepayers.			
3. Council charges people by weight for the amount of rubbish in their rubbish bin.			
4. Council charges people by volume for the amount of rubbish in their rubbish bin.			
5. Council fines people for putting materials that can be composted in their rubbish bin.			
6. Council collects garden waste from homes in a regular kerbside collection and converts it into mulch.			
7. Council collects all garden and food waste from homes and place it in a special tip that gives off methane. They then use the methane to generate electricity.			
8. Council sets up special drop-off centres for garden waste. They then chip the material and sell it as mulch.			
9. Council runs a regular service for chipping garden waste left on the nature strip. The chipped material can either be taken away by Council for composting or left on the householder's nature strip.			
10. Council collects all garden and food waste from homes and composts it in large composting plants.			
11. Council educates local people about how to compost.			
12. Council doesn't collect bins containing garden waste.			

Investigate

What is your council doing? You can write or speak to the relevant council people concerned with waste management. Find out which of the above strategies the council currently uses. The Litter and Recycling Research Association (LRRA , now the Beverage Industry Environment Council) *Recycling Audit and Garbage Bin Analysis*, June-Sept. 1996, page 22, is an excellent resource for comparing the management of organic waste by various councils.

- Survey the people in your street. Find out:
  Who composts (a) food scraps?
  (b) garden waste?

  Who uses the kerbside mulching service?

  How often do people use the local tip transfer station? What do they take there?

  What improvements could be made to the service provided by the council to dispose of food and garden waste?

  Graph your results.

  Follow up with a letter of recommendations to your council. (Include a copy of your survey results).

Student Activity

Composting Past, Present And Future

During the past 210 years there have been many changes in the way people have disposed of food and garden waste.

The scenes above show how a typical family may have managed its organic waste.

What To Do

- Look at the scenes above and compare the disposal of food and garden waste from the year 1780 to the early 1990s.
- List the ways that people got rid of their food and garden waste at each period in time.
- Compare the amount of food and garden waste produced by each family, for each picture.
- In which picture is the greatest amount of organic waste being produced? What do you think has caused the increase?
- On a separate piece of paper, draw a scene which shows a typical family's methods of getting rid of food and garden waste for
  (a) the present day and
  (b) Year 2030.
- Display your work in the classroom and compare your ideas.

Compost Activities for Schools

This book has been designed to encourage schools to comp
and to study the amazing world of minibeasts. All activities are linked to learning outcomes in key learning areas.

A compost bin is a field trip within the school grounds. It can be:

- A living breathing zoo — containing more organisms than your local zoo — a mine of biodiversity for surveys, classification, collection and microscopy.
- A safari into a world of predators and prey — of food chains and food webs.
- A living laboratory for classification, experiments, measurements and the study of adaptation.
- A stimulus for written language activities, text use and word games.
- An opportunity for cooperative learning.
- AND it saves money, reduces demand for landfill sites which are filling rapidly, and produces great fertiliser!

Many States have a goal to achieve a 50 per cent reduction in the amount of waste going to landfill by the year 2000. Education about composting can help reach this goal.

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