



# Lesson 2: Nature's Recyclers – Composting and Worm Farming

*NetWaste Teacher Resource for primary schools*

## Teacher overview

Australians waste a lot of food. In fact, Australian consumers throw away approximately 4 million tonnes of edible food a year. An average Australian household discards up to 20% of the food purchased, which equates to 1 out of every 5 bags of groceries. On average, our household kerbside general waste bins contain approximately 50% organic waste (food waste and green waste, including garden materials). When organic materials decompose in landfill, they release a greenhouse gas called methane, a gas 25 times more potent than carbon dioxide. In addition, when these organic materials combine with rainwater, they produce a nutrient-rich liquid pollutant called leachate.

Landfills are specifically designed and constructed to restrict the movement of pollutants into the surrounding environment. The landfill cell is lined with low permeability clay and geosynthetic material that traps pollutants and enables their collection. Leachate is collected from the bottom of the cell with the use of leachate collection pipes. Leachate can either be treated to remove harmful components, or sprayed back through the cell to speed up the decomposition of waste. In some landfills, the methane is captured and flared off while in some larger landfills, methane is captured and used to generate electricity and power the surrounding community. While landfills are currently necessary in our society, they are very expensive to build, and require ongoing management and monitoring to ensure they do not have detrimental impacts to the surrounding environment. Decomposing organic waste in landfills significantly contributes to the production of both leachate and methane and, as such, finding ways to reduce the volume of waste from entering landfill helps to reduce the volume and impact of these pollutants.

Organic waste materials should be considered a valuable resource, rather than a waste item. Reprocessing organic waste materials by establishing and maintaining backyard organic recycling systems, such as a compost bin or worm farm, produces a natural fertiliser that can be used on home and community gardens. Converting food and garden waste materials into a nutrient rich, natural fertiliser is an example of a closed loop system and helps to save resources.

Composting imitates nature's way of recycling and replicates a natural decomposition process. As organic waste in a compost bin decomposes in an aerobic (with oxygen) environment, this method does not create methane. Compost bins are able to recycle fruit and vegetable scraps, garden waste and paper materials. Correct management of a compost bin will produce a valuable soil improver within a relatively short period of time. Placing the compost bin in a warm and sunny position will allow for the faster decomposition of organic waste materials into a valuable natural fertiliser. Worm farming is another method to recycle kitchen and some garden waste. Compost worms are very effective at converting organic materials into both a liquid fertiliser (commonly called worm leachate or worm juice), and a solid fertiliser, called castings or vermicast. Worm farms are best located in a more sheltered area. Both these processes are affected by the seasons and decomposition will slow down in winter due to much lower temperatures.

We all have choices when it comes to the way we generate and dispose of waste materials. Considering waste as a resource and changing our waste management behaviours can reduce our environmental footprint, creating a more sustainable future.

*Note: This lesson outline is suitable for delivery to all primary school year levels. Teachers can extend or simplify the content and activities to suit the age and ability of their students.*



# Lesson 2: Nature's Recyclers – Composting and Worm Farming

NetWaste Teacher Resource for primary schools

## Learning Outcomes

- Understand and recognise the difference between organic (living) and non-organic (non-living) materials
- Appreciate the value of separating organic materials from general waste materials and diverting waste from landfill
- Understand what a landfill is and what happens to waste materials once they are disposed of in a landfill cell
- Discover how to establish and maintain a compost bin and worm farm
- Appreciate the environmental benefits of diverting organic waste from landfill
- Understand the concept that compost systems and worm farms are closed loop recycling systems

## Lesson Outline

To be used in conjunction with the Nature's Recyclers: Composting and Worm Farming PowerPoint presentation (PPT)

### Organic waste to landfill

- Refer to slide 2 and 3. Ask students to consider how much food they throw away. Do they throw away food once a week, once a day or from every meal? If everyone in Australia is throwing away the same volume of food, we are creating a lot of waste material - approximately 4 million tonnes of edible food goes to waste each year! So what happens to it?
- Refer to slide 4. Organic waste includes food waste materials and garden waste (or green waste) materials. Introduce the term organic materials and non-organic materials and ask students to explain the difference between each and to give some examples.
- Refer to slide 5 and 6. Introduce the term landfill. Explain that all the rubbish disposed into the red-lidded general waste bin is taken to the landfill. In Australia approximately 50% of all the waste in our general waste bins is organic, potentially compostable waste. Ask students to consider what happens to this waste after it has been taken to landfill.
- Refer to slide 5 and 6. Show students images of the landfill. Ask students to think about what happens to the rubbish at landfill. Would it just disappear when it is buried underground? What else might happen to it?
- Refer to slide 6. Briefly describe how a landfill works and what impacts landfills have on our environment. Landfills create two environmental pollutants: **leachate** – a liquid pollutant, and **methane** – a greenhouse gas. Introduce these two terms to the students. The breakdown of organic waste in a landfill occurs in an anaerobic environment (meaning without oxygen), and as such, significantly contributes to the production of pollutants in landfills. Have a class discussion about some of the potential environmental impacts of landfills, and why the landfills must be very carefully monitored and managed.

*Note: This topic is covered in further detail in Lesson1: Waste and Recycling*

- Refer to slide 7. Explain that as the population grows, we create more waste materials, our landfill cells are filling up. What might happen once the landfills are full? Where will we put our waste then?

# Lesson 2: Nature's Recyclers – Composting and Worm Farming

*NetWaste Teacher Resource for primary schools*

## The benefits of backyard organic recycling

- Refer to slide 8. Introduce the concept of organic waste (e.g. food and garden waste) as a resource. Ask the students if they can think of alternative options for the disposal of organic waste and what the potential benefits may be. Examples listed:
  - Extending the life of landfills – approximately 50% of the waste materials sent to landfills is organic waste. Diverting this waste stream from landfill would assist in increasing the life of our landfills.
  - A reduction in greenhouse gas emissions – organic waste decomposes in an anaerobic environment (without oxygen) in landfills producing methane, a greenhouse gas. Greenhouse gases accelerate climate change and the environmental variation that occurs as a result.
  - Valuable resource – organic recycling imitates the natural process of organics decomposition and creates a free natural fertiliser that improves soil structure and soil water retention properties.
- Refer to slide 9. Introduce the concept of 'Closing the Loop'. Organic waste that is recycled can be added as a natural fertiliser to soils and used to improve plant productivity. This allows for more fruit and vegetables to be produced, which can later be composted. As such, no materials or resources are wasted and the loop remains closed.

## An introduction to composting

- Refer to slide 10. Introduce the concept of composting. What is composting? Ask the students if any of them have a compost bin at home.
- Have a discussion around which organic materials are suitable for composting. Compost bins organically recycle all fruit and vegetable scraps, garden waste such as grass clippings, leaves and dead plants, small pieces of timber and paper based materials as well as eggshells, teabags, coffee grounds and vacuum cleaner dust.
- Refer to slide 11 to 15. Introduce the concept of the 'ADAM recipe' and inform students that it is important to follow this recipe to keep a healthy compost system. Use the analogy of baking a cake- a healthy compost needs the correct ingredients in the right ratios.
- ADAM:
  - **Aliveness** – a compost bin is a living system and should be home to billions of micro and macro-organisms. These organisms work together to breakdown the organic waste in the compost system.
  - **Diversity** – a healthy compost system needs a diverse range of materials. It is important to include a mix of green (nitrogen rich and generally moist) and brown (carbon rich and generally dry) materials to your compost.
    - Green materials include fruit and vegetable scraps, fresh grass clippings, manure, coffee grounds and tea bags.
    - Brown materials include; dry leaves and grass, cardboard and paper (shredded), straw and sugarcane mulch.
    - It is important not to put meat, cheese, bread or processed foods in your compost bin. These are likely to attract vermin and produce a strong smell.
  - **Aeration** – to work correctly, decomposition within a compost bin should occur in an aerobic state (meaning with oxygen). You can help to aerate your compost bin by regularly turning and separating the materials. This can be achieved with the use of a shovel, a pitchfork or pieces of timber.
    - Adding bulky, woody materials such as twigs and straw to the compost bin can also help to further aerate.

## Lesson 2: Nature's Recyclers – Composting and Worm Farming

*NetWaste Teacher Resource for primary schools*

- **Moisture** – moisture in the compost bin assists materials to decompose, however, adding too much moisture may cause the compost bin to smell, so it is best to ensure that the compost bin has the moisture of a damp sponge. Moisture can be added to the compost in the form of used tea in pots and coffee plunger water, grey water, cooking water and water from old flower vases.
- Refer to slide 16. Remind the students of the 'baking a cake' analogy. To 'bake' the compost, where do they think the compost should be placed in the backyard?
  - Remember that the compost bin needs to be kept in a warm, sunny position. It does not matter if the compost bin is in a position where it will receive various weather conditions. Continue adding materials to your compost bin, following the ADAM recipe and you will soon begin to receive a nutrient rich soil to add to your garden.
- Refer to slide 17. Discuss what the finished product looks like. If you have access to a compost bin, collect some matured compost to show to the students. Ask the students what this compost can be used for and what they think the benefits for the garden would be.
- Refer to slide 18. Briefly go through some of the ways to help the compost stay productive and healthy.

### **An introduction to worm farming**

- Refer to slide 19. Introduce students to the concept of worm farming. Does anyone know what a worm farm is? How does a worm farm work? How is a worm farm different from a compost bin? What might be some benefits of using a worm farm instead of a compost bin?
- Explain to students that worm farms are ideal for homes with small or no gardens. They require only a small area and do not have to be in direct contact with the soil. Worm farms are low maintenance and often provide a faster process than composting.
- Refer to slide 20. Show students an example of a worm farm set up using recycled materials from their home or school. Some examples include polystyrene boxes, old bathtubs or a stack of old tyres. Ask the students if they can think of any other materials they might have at home that they could use to build a worm farm.
- Refer to slide 21. Ask students why they think it is important for worm farms to be kept in a sheltered area, which is dark, damp and cool. *This imitates the natural occurring conditions of their habitat.*
- Talk through some of the interesting facts about compost worms. Compost worms (commonly Tiger worms and Red worms) used in worm farms are smaller and more effective at composting organic material than the common earthworm. They prefer dark, damp and cool conditions, and so worm farms should be kept in sheltered, fully shaded areas that remain out of the weather. Compost worms do not have eyes, ears or a nose and instead use their skin to understand their environment and move about. As a result, it is very important not to touch these worms without either gloves or other equipment (e.g. a spoon) as the natural oils on our skin can damage the worms.
- Show students how to establish a worm farm. If the school has an existing worm farm, use this as an example, or consider creating a DIY version with the students. Refer to slide 22. A worm farm can be thought of as similar to our own homes:
  - **Liquid Collection Tray** - The base of the worm farm acts as the worms' **bathroom**. This tray collects the liquid fertiliser (commonly called worm tea)

## Lesson 2: Nature's Recyclers – Composting and Worm Farming

*NetWaste Teacher Resource for primary schools*

or worm wee). A tap often connects to this tray to allow the liquid to be taken from the farm and used as a fertiliser.

- **Bedding/Feeding Tray:**
  - This tray is normally lined with Coir for bedding (a product made from the skin of coconuts) or you can use shredded paper or torn up newspaper. The worms will live in this bedding material and slowly turn it into castings. Before placing the coir or paper into this tray, you should line the tray with some whole sheets of newspaper or cardboard to avoid worms falling through initially.
  - This tray also acts as the worms' **kitchen**, where the food scraps will be left for the worms to eat. To help the worms process the food faster and avoid flies and mould the food can be blended or broken up into smaller pieces and mixed through the bedding.
- **Lid** – as worms prefer a dark, damp and cool environment it is important to remember to keep the lid of the worm farm intact. This lid also protects the worm farm from animals scavenging through the food scraps or preying on the worms.
- Refer to slide 23. Ask the students to name the types of organic waste materials that worms may like to eat. Examples could include fruit and vegetable scraps, eggshells, teabags/ tea leaves, coffee grounds, moist paper and cardboard (in small amounts).
- Remind the students that worms do not have teeth, and as a result, shredding or lightly blending the organic materials before adding it to the worm farm can increase the speed at which the worms are able to process this material.
- Refer to slide 24. See if the students can name some of the materials that are not suitable to feed the worms. This could include the following:
  - Dairy products – these products are likely to attract vermin to your farm.
  - Citrus peel, onion and chilli – these products are likely to turn your worm farm too acidic.
  - Bread and pasta – these products will fill the worms very quickly, reducing the amount of other materials they can consume and slowing the process of your worm farm. These materials are also likely to begin to smell and attract vermin to your worm farm.
  - Grass clippings and other garden waste materials – unlike a compost bin it is not recommended to add grass clippings to the worm farm. Grass clippings decompose at a high temperature and are likely to burn the worms.
  - Meat – these products are likely to rot and attract vermin to your worm farm.
- Refer to slide 25. Show the students how the castings can be harvested from the worm farm. Ask the students what they think the castings could be used for.
- Refer to slide 26. Briefly go through some of the ways to help the worm farm stay productive and healthy.

Summarise the presentation: using focus questions, ask students to identify things they have learned and clarify their understanding of key terms and concepts.

### Accompanying lesson resources

- Nature's Recyclers PowerPoint Presentation

# Lesson 2: Nature's Recyclers – Composting and Worm Farming

*NetWaste Teacher Resource for primary schools*

## Additional recommended resources

- A worm farm, worm bedding and compost worms
  - Having a working worm farm in/ near the classroom provides students with hands-on learning concerning the establishment and maintenance of a worm farm, the role of compost worms in the organic recycling and an understanding of the correct waste materials to organically recycle in a worm farm
  - A coir brick, shredded paper or torn up newspaper can be used as bedding within the worm farm and is placed in the worm farm before the compost worms are added
- Spoons and magnifying glasses
  - Touching worms with our hands can cause damage to the worm's skin and body. As such, spoons are a good tool to handle the worms. Magnifying glasses are a good tool for students to gain a better understanding of the worms and worm eggs.
- A compost bin
  - Having a compost bin near the classroom provides students with hands-on learning concerning the establishment and maintenance of a compost bin, an understanding of the correct waste materials to place in a compost bin and a better grasp of the composting processes

## Activity suggestions

### 1. **Diary of a Worm** (reading activity)

Read the 'Diary of a worm' by Doreen Cronin (ideal for P-3). Also available via YouTube: <https://www.youtube.com/watch?v=sVSCs8pTJ3M>

### 2. **Compost and Worm Farm Quiz**

Using a piece of paper, ask each student to write down one thing they learned from the lesson and PowerPoint presentation. Ask them to turn this fact into a question. Collect all the questions from the students and then split the class into two teams. Using the student's questions, have a class quiz and see which team can answer the most questions correctly.

### 3. **Create Compost in a Bottle**

In this activity, students can make a mini-compost bin inside a plastic bottle and watch how the materials inside decompose over a period of time.

- i) Ask the students to bring in a 1.25L or larger plastic bottle.
- ii) Cut around the top of the bottle, approximately 1/3 of the way down the bottle, leaving one side connected to form a hinge.
- iii) Take the students around the school grounds to collect green (wet) and brown (dry) and save a small amount of food scraps from lunch. Cut or break these materials into small pieces
- iv) Start adding the green and brown materials in layers until the bottle is full, then add a small amount of moisture.
- v) Tape the sides of the bottle that have been cut back together, leaving the lid of the bottle removed to allow aeration.
- vi) Ask the students to draw a line around the bottle where the top layer of the materials is. Date this line.



## Lesson 2: Nature's Recyclers – Composting and Worm Farming

*NetWaste Teacher Resource for primary schools*

- vii) Place the bottles in a sunny position. Every 3-4 days, get the students to mark and date the bottle to show how the materials decompose over time.
- viii) Extension: Place some of the bottles in the shade and some in a dark place. Compare these bottles to the ones that are in the full sun. What is the difference?

#### **4. Marketing and fundraising**

Imagine your class decided to sell the liquid fertiliser from the worm farm at the school fete. Ask students to design labels for a bottle and develop marketing strategies for the liquid fertiliser. Students should focus on the benefits of the worm farm liquid, the importance of diverting organic waste from landfills and the positive outcomes of a closed loop system.

#### ***Teacher's note:***

*If your school has an established worm farm, consider making this a real activity with the aim of selling the worm farm liquid during the next school fete.*

### **Suggested activity resources**

- Clean plastic bottles (1.25L or larger)
- Scissors – younger students may need some assistance
- Marker pens
- Sticky tape
- Organic materials