



# Lesson 4: Environmental Impacts of Waste

*NetWaste Teacher Resource for primary schools*

## Teacher overview

Australia is becoming more affluent, but also more wasteful. We consistently buy new 'stuff': gadgets, electrical items, mobile phones or cars, even when we have models that still work. As a society, we buy more clothes than we can wear and more food than we can eat, and throw away what we no longer require with little consideration for the environmental impacts of this wastefulness. Leading economists suggest that, as a society, we are suffering from acute 'affluenza'.

Each and every time our society needs to produce a new item: a plastic container, a glass bottle, an aluminium can or paper book, natural resources have to be harvested, mined, collected or extracted from the environment before being transported to a factory to be manufactured. Many of the resources used to make common day-to-day products are finite and non-renewable, meaning they will not last forever. Eventually, these resources will become depleted when usage exceeds the rates at which they can be renewed.

Extracting resources and manufacturing these resources to make plastic, glass, paper and metal products can have detrimental impacts on natural environments and habitats. Extracting resources from underground, for example, can modify watercourses and cause a reduction in the flow rates of some water sources. Furthermore, the extraction and manufacturing processes require huge amounts of energy and emit harmful pollutants into our environment.

Needlessly disposing of unwanted items into landfill means all the energy and resources that went into creating the product go to waste. As waste and organic materials decompose in landfill, it creates a gas called methane. Methane is a greenhouse gas that absorbs and emits radiant energy. This process traps heat between the earth's surface and atmosphere, causing the greenhouse effect and increasing average global temperatures. This effect has widely become known as global climate change and is having a detrimental impact on environments worldwide.

Carelessly discarding unwanted items creates litter, which is also having a devastating impact on flora and fauna globally. It is estimated that by the year 2050, there will be more plastic in our oceans than fish. Micro-plastics, which occur as plastic products slowly break apart over time, are flooding our oceans, and are unknowingly being consumed by marine animals. Micro-plastics are passed through the food chain and eventually end up in the seafood sold for human consumption.

The Waste Hierarchy is the internationally recognised framework for prioritising waste and resource management practices. Since all waste management options have some impact on the environment, the only way to avoid impact is to not produce waste in the first place. Waste avoidance and reduction are considered the most preferable options in the hierarchy. Reuse, followed by recycling, other recovery and treatment techniques follow, while disposal to landfill is considered the least preferable waste management option.

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 most suitable for delivery to Year 3 and above. Teachers can extend or simplify the content and activities to suit the age and ability of their students.*



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## Learning Outcomes

- Introduction to the concept of renewable and non-renewable resources
- Appreciate that every object society uses, eats, buys or wears originates from the natural environment
- Begin to recognise the range of natural resources used to make common everyday items
- Understand the different key impacts of waste creation and waste disposal and identify the source of waste created in day to day activities
- Understand ways to minimise environmental impact through consideration of the elements included within the waste hierarchy

## Lesson Outline

*To be used in conjunction with the Environmental Impacts of Waste PowerPoint presentation (PPT)*

### An introduction to Natural Resources

- Refer to slide 2. Introduce the idea of where materials come from. What are natural resources?
- Refer to slide 3. Explain that all the items we use, eat, buy and wear originally come from resources harvested from our natural environment. These can also be called raw materials. These resources need to be mined, extracted, forested or farmed before being manufactured and/ or processed in order to create the products we take for granted every day. Ask the students to brainstorm some of the possible environmental impacts of taking natural resources out of the environment.
- Refer to slides 4-6 to describe the life cycle process for some common materials:

#### **Paper**

Trees, a natural resource, are required to produce paper products.

Ask students to share their ideas on why trees are so important and what are some of the environmental impacts of cutting down trees, such as the examples given:

Trees remove carbon dioxide from the atmosphere and produce oxygen. Trees also provide important habitats (homes) for Australian native animals. It takes many years for a tree to mature to an age where it is able to provide these benefits.

Ask the students to consider the energy required to cut down, transport and manufacture the trees to produce paper products, and the emissions released during these processes.

As a class, discuss what may happen to these paper materials once they become waste i.e. they are no longer needed.

Paper products are ideally recycled. This reduces the need for trees to be cut down to create new products and creates a 'closed loop'. However, paper cannot be recycled indefinitely, and the addition of virgin material is required to maintain a high standard of paper fibre.

#### **Plastic Bottles**

Ask students if they know what natural resource plastic bottles are made from.

Plastic bottles and containers are made from crude oil. Crude oil is a naturally occurring, unrefined petroleum that has formed over millions of years from the decomposition of plants and animals compressed under a thick layer of mud and rock (under high pressure).

Ask students if they can identify some of the environmental risks of mining for crude oil e.g. oil spills.

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Mining, transporting and refining crude oil is highly energy intensive and produces a large amount of emissions.

As a class, discuss what may happen to these plastic materials once they become waste i.e. they are no longer needed?

Ideally, plastic bottles are recycled to reduce the volume of crude oil that is required to be extracted in order to produce new plastic products. Recycling plastic bottles and containers creates a 'closed loop' system, where crude oil as a resource, and the energy required to produce plastic, is not lost to landfill. Unfortunately, not all plastic materials can currently be recycled through the kerbside recycling service e.g. plastic bags and other soft plastics are considered non-recyclable in the kerbside service.

### **Apples**

Ask students to consider where apples come from and what is required to happen before the apples are ready to be picked and consumed.

Discuss the energy required to produce food. This includes the energy required to plant seedlings and maintain the growth of plants (including water, fertilisers, sunlight, man-power and energy required for machinery), the energy required for transporting and processing the food (fuels, maintenance of road networks, electricity and man-power), and the energy required to advertise and sell the food. Explain to students that food waste such as fruit and vegetables can also be called organic waste. When organic waste materials breakdown or decompose in landfill it produces a large quantity of methane gas and leachate.

For further information regarding landfill processes, please refer to Lesson 1: Waste and Recycling- Which bin does it go in?

Ask students if they can think of any other disposal options for fruit and vegetable scraps. Explain that recycling food scraps (using either a worm farm, compost bin or a food and garden waste bin) creates a free, nutrient rich fertiliser which can help to grow new fruit and vegetables, and therefore close the loop.

*For further information regarding composting and worm farm processes, please refer to Lesson 2: Nature's Recyclers: Composting and Worm Farming.*

### **What else do we use and where does it come from?**

- Refer to slide 7. Ask students to brainstorm or research other similar natural resources and the products we produce with them. Have students consider the impact we may have if we continue to extract natural resources from the environment e.g. Natural habitats become disrupted and destroyed, water courses disrupted or reduced, production lines and factories produce pollutants into our atmosphere.
- Have a class discussion about all the other factors required to mine and manufacture natural resources e.g. land, energy, water, time and people.
- Refer to slide 8. Introduce the term renewable resources and non-renewable resources to the students. Explain the difference between each and provide some examples. Can the student think of their own? Ask the students to think about some of the impacts of over using non-renewable resources.
- Introduce the students to the concept of consumerism and human behaviours in a 'throwaway society' (i.e. the concept of purchasing a product and the impact of only using it once before it is thrown away).

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### **The Journey and Impacts of Waste**

- Refer to slide 9. Discuss with students what happens when they put their waste in their general waste bin. Where is the waste taken? Remind students that waste disposed of in the general waste bin is collected in a rubbish truck and transported to the local landfill. Here the waste is put into a landfill cell and buried under a layer of dirt.
- Use the information provided in *Lesson 1: Waste and Recycling- Which bin does it go in?* To describe the construction of a landfill and the environmental pollutants that are created in a landfill such as methane – a greenhouse gas and Leachate – a liquid pollutant produced when rainwater mixes with decomposing waste.
- Refer to slide 10. Introduce students to the concept of Climate Change. Explain that methane, produced in landfill cells, is considered a greenhouse gas. A greenhouse gas is an atmospheric gas that absorbs and emits radiant energy (mostly from the sun's heat). This process traps heat between the earth's surface and atmosphere, causing the greenhouse effect and increasing average global temperatures.
- The greenhouse effect can be explained to students by having them imagine they are lying in bed. Continually layering blankets on the bed will increase the temperature until it becomes too hot to be comfortable. For older students, explain the greenhouse effect in more detail with reference to the PowerPoint.
- Ask students to think about what impact climate change has on our planet. Write their ideas on the whiteboard.
- Refer to slide 11. Explain that what may feel like a very slight increase in temperature for us has a large impact on the environment. The current recorded global temperature increase since pre-industrial times is 0.7°C. Although this may seem like a very small increase, it has resulted in some dramatic outcomes. This includes widespread coral bleaching, an increase in average global sea levels, the skew of sex ratios in temperature dependent species and an increase in extreme and unpredictable storms and weather patterns.
- Refer to slide 12. Ask the students if they have ever heard of The Great Pacific Garbage Patch. What do they think this could be?
- Explain that The Great Pacific Garbage Patch is a collection of marine debris (litter floating in the ocean) in the North Pacific Ocean. The patch is large (1.6 million square kilometres) – about twice the size of NSW. The patch is comprised mostly of micro-plastics. Micro-plastics are very small pieces of plastic (sometimes not even able to be seen by the naked eye) which occur as larger plastic items (e.g. plastic bottles and containers) break up.
- Watch *Journey to the Ocean via Rubbish* by Grace Kim <https://www.youtube.com/watch?v=vh6MDuxYing>. Grace, is a student from St. Philips College in Port Stephens created this film for a school project after learning about this growing problem and also learning that Take 3 were trying to educate the broader community.
- Have a class discussion about what happens when micro-plastics move up the food chain. Explain that small marine animals easily ingest micro-plastics. As this progresses up the food chain, and these small marine animals are eaten by larger marine animals, the amount of micro-plastics being ingested by each animal increases. This includes the seafood we eat and means that each time we consume seafood we are likely consuming micro-plastics. It is estimated that by the year 2050 there will be more plastic than fish in our oceans.
- Ask students to brainstorm other impacts of plastics in our oceans.



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- Ask students to suggest where all the plastic in our oceans is coming from. How is it getting there? What can we do to reduce the amount of plastic travelling to our oceans?

### The Waste Hierarchy: Avoid, Reduce, Reuse & Recycle

- Refer to slide 14. Introduce the concept of the Waste Hierarchy and the terms; avoid, reduce, reuse, recycle. See if the students can give a definition or examples for each of these words. Write them up on the whiteboard. These terms are often referred to as the 3Rs'.
- Ask the students how incorporating the 3Rs' into our daily routine can help to reduce the impact on the environment.
- **Reducing** the amount of products used, and immediately disposed of, will reduce the amount of non-renewable resources needed to make new products.
- **Reusing** products extends the life of that product. Reusing means less energy is required to dispose or recycle old products, and there is less demand for new products.
- **Recycling** reduces the amount of non-renewable resources required to produce new products. Recycling generally uses far less energy than manufacturing a material from natural raw materials.
- In the waste hierarchy, disposal to landfill is the least preferred option as this results in a loss of valuable resources and the production of pollutants such as methane and leachate.
- Refer to slide 15. Ask the students to brainstorm which items are suitable for recycling. Do they know what happens when they recycle a product?
- Introduce or remind students about the Materials Recovery Facility (MRF)
- When an item is placed in the yellow topped recycling bin it is transported to a MRF where all the products are sorted based on the materials they are composed of. Plastic bottles, for example, are sorted depending on the type of plastic they are comprised of. The plastic is then shredded, washed and melted. The melted plastic is set in a small mould to be transported to another factory where it is shaped into a new product, refilled and transported to stores for sale.
- *For further information regarding MRF processes, please refer to Lesson 1: Waste and Recycling- Which bin does it go in?*
- Have a class discussion of the benefits of recycling plastic materials and the benefits of recycling other materials.

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

- The Environmental Impacts of Waste PowerPoint Presentation

### Activity suggestions

#### 1. Recycling champions

Encourage students to become 'recycling legends'. Ask them to come up with a promotion campaign to encourage other students to reduce, reuse and recycle.



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### 2. Is there a better way?

Divide students into groups. Provide each group with a commonly used item (see suggested activity resources at bottom of page) and ask students to research and then discuss/ write down:

- What is the item and what natural resource is it made from?
  - Where does the resource originally come from?
  - What process needs to occur to manufacture the original resource into the final product?
  - What are the environmental impacts of producing the item?
  - What are some examples of ways to reduce, reuse and/or recycle the item?
- Get each group to present their findings to the class.

### 3. What's in my lunchbox?

Divide students into groups and, using the cards provided, ask them to divide the cards into two piles - those items that would produce less waste, and those items that would make more waste. Ask the students to share their findings with the class and explain their decisions. Have a class discussion about some of the benefits of packing a waste free lunch.

### 4. Cleaning up the Oceans

For a creative activity, ask students to design and label a contraption that will help clean the world's oceans.

### 5. Fix the problem

Ask students to develop a short film or role play about a waste issue that they see in their areas. Do they see litter? How could they fix that litter problem? Do their families throw a lot of food away? How could they stop that food from going to landfill?

## Suggested activity resources

- Commonly used items for 'Is there a better way?'
  - Pen
  - T shirt
  - Balloon
  - Plastic film wrap
  - Plastic bag
  - Mobile phone
- 'What's in my lunchbox?' cards – (pdf of images provided)