



Lesson Title	Unit
Build a Landfill	Food Waste and Compost
Grade Level(s)	Common Core Standard(s)
3-5	3-LS4-3, Can be expanded to 5-ESS3-1, 5-LS2-1,2
Objectives	Essential Questions
Students will understand the difference between <b>aerobic</b> and <b>anaerobic</b> , and will understand the environmental impact of landfills versus compost.	Why should we compost food waste instead of throwing it away?
Duration	Materials Needed
Each lesson is roughly .5 hours, but total project period is 1-2 weeks	One 5-gal bucket with a lid, or 10-12 plastic containers (tupperware, large soda bottles, etc.) with tight lids. Soil, food scraps, whiteboard or chalkboard
Background Information	Setup Required
What it means for something to <b>decompose</b> , and what organisms are considered <b>decomposers</b> .	Bring materials to classroom/garden space ahead of time.

Overview
This lesson is a week long project that will demonstrate the difference between throwing our food waste in a compost pile versus in a landfill. The class as a whole or student groups will build a small model of a landfill by piling waste in a sealed, oxygen free environment and letting it sit for 1-2 weeks unattended.



## Procedure

### Intro

Begin your lesson with a quick review about food waste. Who throws food away, and why? What happens to food when we throw it away? We can either throw it into a compost bin, or if we throw it in the trash it will be brought to a **landfill**. In a compost bin, our food will be broken down into nutritious soil with help from the **FBI** (**F**ungus, **B**acteria, and **I**nvertebrates) that can then be used in gardens. But what happens in a landfill?

Many people think that once food goes into a landfill, composting will still take place, so even though other materials will be mixed in and we won't be able to use the resulting soil, food in a landfill will not make that big of a difference. What do your students think?

As it turns out, **decomposition** will still happen inside a landfill, but it happens very differently compared to compost piles. Landfills are typically sealed off to prevent bad smells from leaking into surrounding communities and keep hungry critters out, so what does that mean for the trash and food within? What is missing from inside the landfill that is still present in a properly managed compost pile?

Air! What difference do you think air makes in the decomposition process? Gather a couple ideas from your students. The biggest difference it makes is the type of bacteria that will be present in both locations. In a compost pile, **aerobic** bacteria will be present (or, bacteria that requires oxygen to live), whereas **anaerobic** bacteria (bacteria that can live without oxygen) will be present in landfills. These two different types of bacteria process food very differently.

### Activity

To demonstrate the difference between these two types of bacteria, we will build mini landfills to compare and contrast with our garden compost. You can either choose to do this activity as an entire class and do a simple experiment where you build a small landfill model in one large 5 gallon bucket, or you can split your class into pairs or groups of three and make smaller models in plastic containers like tupperware or large bottles.

Start by explaining that landfills are usually created by digging a shallow hole into an existing patch of earth. For our model, we will line the bottom layer of our bucket or bottles with a little bit of soil, and make a shallow well in the middle. Why must the holes in landfills be shallow? Encourage your students to think about what important resource might be underground that we don't want affected by piles of trash. It's water! Do a quick brainstorm about whether or not most food waste compost piles need to be considerate of groundwater as well.

Next, we must fill up our landfill. You can use food scraps from the cafeteria and some paper if you want (if you wanted to expand the lesson, you could include pieces of plastic or metal to show how slowly they decompose, but since this lesson is mostly about what happens specifically to food waste, it's usually simpler to stick to just food and paper). Next, most landfills are covered with a layer of dirt each day that it accepts trash, so you can layer a thin amount of soil on top of your trash pile in your bottle or bucket.

Now we will imagine that our landfill is at capacity, and needs to be sealed. Place a tight lid over your container to make sure no air can get in to the pile. If you are using small containers in groups, you



could potentially leave them in the classroom so students can make observations throughout the next week or two if the teacher is willing. If using a bucket, it'd probably be best to leave it in the garden next to the compost pile with a sign to make sure nobody opens it.

After a couple of weeks, meet again with your class (preferably outside - this part might get smelly). If they have clear plastic containers, have the students make some observations about what's in their landfill. Do they see any mold, or slime, or fungus?

Now it's time to open up the containers and see what else they may notice. In the large buckets, it should becoming clear very quickly that something smells pretty terrible. Give them a moment to gauge their reactions. Does this smell resemble anything you've noticed around the garden's compost pile? The compost piles may sometimes smell a little earthy, but it shouldn't be anywhere near what happened inside their miniature landfills.

### Wrap Up

So what is that smell? Think back to the types of bacteria introduced a couple weeks ago. We said that the different types of bacteria (aerobic and anaerobic) might produce different products. Based purely on sight and smell, which system (compost or landfills) seems better for our food waste?

It turns out that anaerobic bacteria (the bacteria mostly present in landfills) creates a lot of foul smelling gases, but it creates a lot of a particular gas called **methane**. Methane in large quantities can be very bad for the environment.

Depending on your students familiarity with climate change and greenhouse gases, you can say that methane is 25% more potent of a greenhouse gas than carbon dioxide, which is created naturally in compost piles. If your students ask why it's so much worse, the answer is complicated. Due to the chemical composition of methane, it is far more effective at blocking light leaving our atmosphere, so it reflects more heat and energy back down towards earth than carbon dioxide.

The amount of methane created by landfills can often be captured and burned for power, but only a very small percentage of the methane being produced from landfills around the world is actually captured.

Allow a few minutes for discussion if students have questions or comments. Then as a final wrap up to the lesson, as a group come up with a pros/con list for both compost piles and landfills. At the end, which seems like a more environmentally sound and efficient way to dispose of our food scraps?



### Extensions and Variations

This activity could be a simple way to introduce composting to your students, or it could be the surrounding activity for a more in depth lesson on life cycles and design.

To fulfill 5th Grade Life Cycle curriculum, start with a first lesson about the movement of energy between producers, consumers, decomposers, and the environment. (**5-LS2-1**). Then the activity described here could illustrate about how landfills remove food waste from this natural cycle, and emphasize the importance of oxygen in effective compost design. This information could then be used by students to design their own compost bins (**5-LS2-2**).

To fulfill the **5-ESS3-1** standard, encourage students to research municipal composting programs around the country. What do large scale compost programs like the Island Food Recovery program and other programs hope to change about human impact on our environment and resources? What will change if we divert those 130 billion tons of food waste to composting programs instead of landfills?