UNIT 7 | PEOPLE AND WASTE

# SCRAPS INTO SOIL

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

## METHOD

Students gather materials and observe if and how they decompose over time in a natural setting.

## MATERIALS

- 1/2 gallon plastic milk jugs with caps (4 per small group)
- Scissors
- Masking tape or duct tape
- Soil (from outside, with no worms or bugs)
- Water (distilled preferable)
- Compostable items (see the list of Recommended Composting Materials)
- Spoons (1 per small group)
- Student Worksheet

## CONCEPT

Most of the organic waste created by a household can be composted and made into usable soil.

## GRADE LEVEL

Lower and upper elementary

## SUBJECTS

Science, Social Studies, Family and Consumer Sciences

## OBJECTIVES

Students will be able to:

- Differentiate between natural and man-made waste products.
- Examine the difference in decomposition rates between natural and man-made items.
- Determine how composting impacts the amount of waste that goes into landfills.

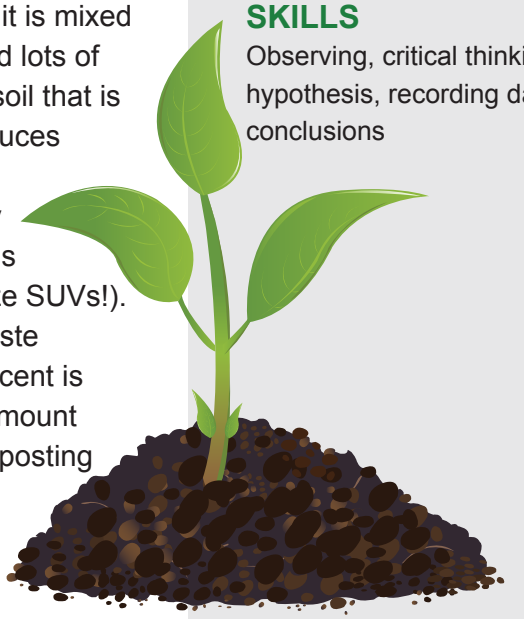
## SKILLS

Observing, critical thinking, creating a hypothesis, recording data, drawing conclusions

# INTRODUCTION

**Decomposition** is the natural breaking down of organic material (materials derived from plants or animals) into soil. **Composting** is a way that people speed up the natural process of decomposition. When we throw away garbage, from plastic wrap to a banana peel, it is taken to a landfill where it is buried and can take years to decompose. As a result, our landfills are quickly filling up. When natural, organic waste is separated into a compost pile, it is mixed with soil's beneficial bacteria and fungi, a little water, and lots of oxygen so that it quickly decomposes into nutrient-rich soil that is perfect for the garden. Composting is a win-win that reduces trash in our landfills while also creating healthy soil.

According to the U.S. Environmental Protection Agency (EPA), the average family of four produces 1,500 pounds of trash per year (that's the weight of about three full-size SUVs!). The EPA also estimates that about 24 percent of the waste generated by a household is compostablebut only 8 percent is actually composted. As the U.S.population grows, the amount of trash produced alsogrows. Increasing the use of composting would helpto minimize landfill garbage, even as our population and our rate of consumption increases.



In this activity, students conduct an experiment to compare the decomposition rates of natural vs. man-made items and will see that much of the "trash" that is typically thrown away can be composted instead.

# PROCEDURE

**1.** Before starting this experiment, you'll need to make your "compost bins." Ask each student to bring in a 1/2 gallon plastic milk jug, with the label removed, but cap on. Students will be working in small groups (four or five students per group), and you will need four jugs per group. Before giving the jugs to your students, poke five to seven holes in the top of each jug using scissors. Then, cut entirely around the jug at the point that is in the middle of the jug's handle. Do not cut the handle itself. When you are done, the handle should be the only thing connecting the bottom of the jug to the top and the top should easily bend backwards to open the jug.

**2.** Introduce the concept of composting to students. Invite students to share what they already know about composting and decomposition and then discuss the definitions.

**3.** As a class, generate a list of household items that are typically thrown away.

**4.** Explain to students that over the next few weeks, they will be working in small groups to observe if and how some of these "trash" items decompose, or break down. Divide students into small groups of four or five students each.

**5.** Tell students that within their groups, they will observe four different compost bins: one with yard waste, one with food scraps, one with paper products, and one with man-made products.

**6.** Instruct students that within their group, they will need to bring in one item from each category. Have them decide who will be responsible to bring in which item (one person should bring a yard waste item, another a food waste item, and so on).

**Recommended Composting Materials:**

- Jug 1: Yard waste (leaves/grass)
- Jug 2: Food waste (banana peel, apple core, slice of bread, clean egg shell, carrot) Do not allow students to bring in any dairy or meat item to compost. This would cause your bins to smell!
- Jug 3: Un-coated paper products (napkin, notebook paper, small paper bag, coffee filter)
- Jug 4: Man-made products (aluminum can, Styrofoam cup, plastic bag, small yogurt container)

Note: You may need to cut these items so that they fit into the jug.

**7.** When students return with their items to compost, gather one item from each of the four categories on a table so that all students can see. Have students work in their group to hypothesize which items they think will decompose and then rank them in order of fastest decomposition to slowest and explain their thinking.

8. Create your compost bins. Give each group four of the pre-cut jugs. Have the groups add two inches of soil to the bottom of each jug. Then, each group should place one item from each category in each of the four "compost bins" (one item per jug) and add another one or two inches of soil on top. Next, have each student use a couple pieces of tape to secure the top of the jug to the bottom and use a marker to label the object in each jug.

9. Have groups place their jugs in the same area of the room (similar lighting and temperature). Or, weather permitting, you could place all of your bins in an outdoor area. Then have every student record the variables and constants of the experiment on their Student Worksheet.

   *Variables: type of item composted. Constants: size of container, amount of soil put in at the beginning, and environment (sunlight, temperature).*

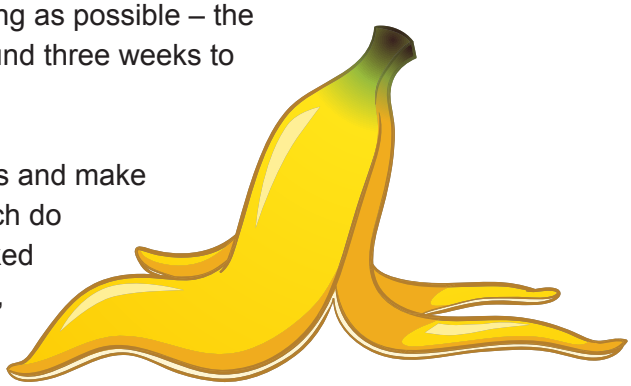
   After this process each day, have each group and use a spoon to add water until the soil is just moist, like a wrung out sponge. The water will speed up the decomposition process because the bacteria at work in the bins need water to survive. Next, students should mix their bins by gently stirring/turning the soil. Mixing the soil allows air to get in and speeds up decomposition.

10. After this process, have each group make observations of the appearance and smell of each of their objects: Has the object broken apart? Is it smaller? Is it slimy? Does it smell? They should use descriptive words to record all observations in either a science journal or on the provided Student Worksheet (print one per student per day and have students collect them in a notebook). It may be helpful to have the students take pictures of the jugs/objects to show progression. After observations, be sure students re-bury each item.

11. If time permits, allow groups to share observations with the class.

12. After about a week, students should be able to notice that natural materials are decomposing faster than non-natural items. At this point, allow students to revise their predictions about what items will decompose and which will decompose the fastest.

13. Continue to observe the jugs daily and let the experiment run as long as possible – the longer it runs, the more decomposition you will see. It will take around three weeks to see significant decomposition.



14. At the end of the experiment, have students adjust their hypotheses and make a final analysis on which types of items decompose easily and which do not. Ask students to brainstorm why they think the experiment worked out this way. Students should be able to tell that natural, or organic, items decomposed quickly (leaves, food scraps), while man-made, or inorganic items did not decompose. Students should also be able to see that items made from plants (un-coated paper products) also showed decomposition. Distinguish between organic and inorganic waste:

    **Organic waste:** materials derived from plants or animals (food scraps, yard trimmings, paper products)

**Inorganic waste:** derived from materials other than plant or animal matter, like sand, dust, glass, or synthetics (plastics, Styrofoam, rubbers, etc.)

**15.** Go over the Discussion Questions as a class.

**16.** During this process, you may want to have your students research how long it typically takes common household items to decompose in a landfill. See the list below for scientists' estimates, but keep in mind that these times vary depending on landfill conditions like water, temperature, and aeration.

| | |
|---|---|
| Toilet paper/napkins | 1-3 weeks |
| Paper plate | 1 week-2 months |
| Banana/orange peel | 2-5 weeks |
| Cotton rag | 1-5 months |
| Rope | 3-14 months |
| Newspaper | 3-6 months |
| Carry-out food bag | 4-8 months |
| Wool sock | 6 months-2 years |
| Cardboard | 2 years |
| Plastic bag | 10-20 years |
| Leather shoe | 25-50 years |
| Nylon fabric | 30-40 years |
| Plastic beverage container | 100 years |
| Aluminum can | 250-500 years |
| Disposable diaper | 300 years |
| Styrofoam egg carton | Undetermined; as much as 1,000,000 years or never |
| Glass jar/bottle | Undetermined; as much as 1,000,000 years or never |

**17.** To extend the project, the soil from jugs with organic materials can be added to an existing compost bin or school garden, or used to start a new school-wide compost bin or garden. (Inorganic materials should be removed from the soil and thrown away or recycled.)

# DISCUSSION QUESTIONS

**1.** What conclusions did you draw from running this experiment? What materials can be composted?

*Yard waste, food waste, and paper products all decomposed – they can be added to a compost pile to make healthy soil instead of going to a landfill. Inorganic products did not decompose, meaning they cannot be composted.*

**2.** Three out of the four items in the experiment showed decomposition. Think about the garbage that you throw away at home or at school – is most of it natural, organic material or non-natural/inorganic? What would happen to the amount of waste you produce if you composted all of your organic waste?

*Answers will vary, but the amount of students' waste that goes to landfills would most likely decrease significantly if all organic materials were composted.*

**3.** When organic waste goes to a landfill, do you think it decomposes like it did in this experiment? Why or why not?

*Answers will vary. Explain that landfills are not "mixed" or "watered" and therefore have little flow of water or oxygen. This slows down the decomposition process – it takes much longer for materials in a landfill to break down than it would in a compost pile. Also, items in a landfill are often buried in the pile of garbage and not exposed to sunlight, further slowing decomposition.*

**4.** What are some benefits to composting instead of throwing natural waste in the garbage or down the garbage disposal?

*Answers will vary but may include: less space taken up in the landfill, less toxic gases released into the environment from landfills, less water and energy to separate out the food waste at water treatment plants, healthy soil to use for gardening.*

**5.** Are there things you can do with inorganic items so that they don't end up in the landfill either?

*Yes. Items like aluminum cans and plastics can be recycled or reused. This will further cut down on landfill waste.*

**6.** Do you think everything will eventually decompose in a landfill?

*Students may have different opinions. While items should eventually decompose, it may take millions of years or more because there is little water or oxygen in a landfill to speed up the decomposition process. Some items, like a glass bottle or Styrofoam cup, may never fully decompose.*

# MEASURING LEARNING

Have students create persuasive flyers to share what they've learned about composting with their peers and families. Flyers should note examples of items that can be composted and explain why certain items are not appropriate to put in a compost bin. Students should also note at least two environmental benefits to composting instead of throwing all garbage in a landfill.

# FOLLOW-UP ACTIVITIES

**1.** Now that you know organic items decompose faster than inorganic items, set up another experiment to explore the effects of adding worms to a compost pile. This is known as **vermicomposting**. Set up two larger compost bins, both with natural items, and add worms to one of the bins (the most commonly used composting worms are red wrigglers). Because of the worms involved, you will need to take some extra precautions during your vermicomposting (keeping the area dark, monitoring the temperature, etc.). Visit this website for an easy to follow, kid-friendly guide to setting up a vermicomposting bin: **http://pbskids.org/dragonflytv/show/wormfarm.html**.
Observe the difference in decomposition rates and discuss why the worms speed up decomposition (they eat the scraps and also aerate the soil as they move). Red wriggler worms can be purchased from a local tackle shop or easily ordered online through Amazon.com or garden supply retailers.

**2.** Research your own city's composting program. Then, compare your local plan with the large scale composting operations that are set up in cities like San Francisco, Seattle, or Toronto. Discuss how each work and how each community benefits from the programs in place.

**3.** Incorporate Language Arts by having students write descriptive "restaurant menus" for the microorganisms and fungi that do the hard work of decomposition by listing what they consume (what was in the container).

**4.** Many counties have soil conservation experts. Contact a soil expert in your local area and invite him or her to share their knowledge with your students. Your local Solid Waste Management division may be a good place to start.

Data Sources: Environmental Protection Agency, Composting Basic Information, www.epa.gov/osw/conserve/rrr/composting/basic.htm#todo; Highland Environmental Learning Center, Highland, CA.

Written by Lauren Bergh, Program Specialist, Environmental Learning Center, Highland, CA.

# SCRAPS INTO SOIL
## STUDENT WORKSHEET

Name: _____ Date: _____

Day of Experiment: _____

Constants: _____

Variables: _____

Time: _____

Draw and write about what your group observes in each of the compost jugs.

| | |
|---|---|
| **Item 1** | **Item 2** |
| **Item 3** | **Item 4** |

Overall Observations:

_____

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