

Appendix A: Model Compost Design Brief

Designing a Model Compost Pile



After Hurricane Irma

The recent destructive winds of Hurricanes Irma and Maria have destroyed significant amounts of the vegetation in many areas of Puerto Rico. These huge quantities of plant materials need to be removed from these areas before additional recovery work can take place. Rather than dumping the materials into landfills or into the ocean, the local government is interested in a more ecologically friendly solution: compost. Once this compost is made, it can be used to replenish the soil and aid in the recovery of the vegetation in these areas.

An environmental engineering firm has received a contract to develop large-scale systems for composting the tons of plant material left over from the hurricanes. However, the firm wants to hire your table group to develop a plan for a model compost system in a 2-liter bottle that can then be tested and hopefully scaled up to quickly and completely compost the massive quantities of vegetation.

To develop your plan, your table group will do the following:

1. Conduct online research to learn more about compost, what it is, and how it is made;
2. Using this research and the labs that we have already done this semester, develop a plan that will include:
 - A labeled sketch of what the model compost pile in the 2-liter bottle looks like at the start of the process;
 - A list of the kinds and quantities of materials that should be added to the compost;
 - A description of how these materials should be arranged in the model;
 - A description of the steps to be followed to provide the best conditions for the most rapid and complete decomposition; and
 - Answers to the reflection question.

Desired Features of Your Model:

Your proposed solution must be repeatable.

Limitations (or Boundaries) to your Model:

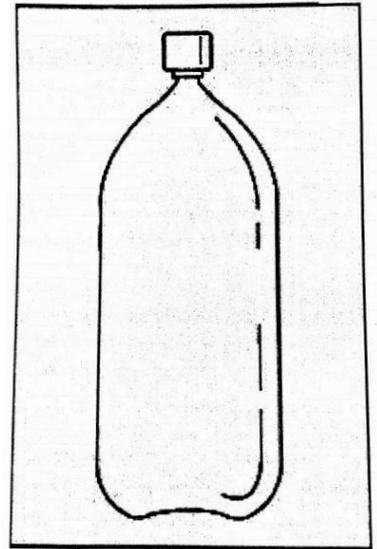
The materials to be added to your model are limited to those usually found in the affected area (Puerto Rico).

Activity 1: Background Research

- Your teaching assistants will set up a Google doc/slide with space for each table to contribute information related to compost.
- Each table group must do online research in class to find 5 facts (with citations) related to compost materials, process, condition, etc. and add them to their section's Google doc/slide.

Activity 2: Model Compost Pile Plan

On the drawing below (to the right), sketch what the model compost pile will look like in your 2L bottle at the start of the process. Be sure to label your sketch, including all labels and materials.

**Activity 2a: Model Compost Plan**

On a separate sheet of paper, provide the following information:

- A. Make a list of the kinds and quantities of materials that should be added to the compost. Be sure to include reasons for your decisions about all aspects of your plan.
- B. Give a description of how these materials should be arranged in the model compost pile. Be sure to include reasons for your decisions about all aspects of your plan.
- C. Give a description of the steps to be followed to provide the best conditions for the most rapid and complete decomposition of all materials in your model compost pile. Be sure to include reasons for your decisions about all aspects of your plan.
- D. Provide answers to the following reflection questions:
 1. What is the purpose of designing this model? How does the way that this model is used for this compost scenario compare to how other models have been used during this semester?
 2. Did developing your plan for the model compost pile help you improve your understanding of biology topics such as cellular respiration, decomposition, trophic levels, or other course concepts? If so, please explain how.

Additional Background Information

Information excerpted from the University of Illinois Extension publication, “Composting in the Home Garden” <https://extension.illinois.edu/compost/process.cfm>

The Composting Process

The composting process involves four main components: **organic matter, moisture, oxygen, and bacteria.**

Organic matter includes plant materials and some animal manures. Organic materials used for compost should include a mixture of **brown organic material** (dead leaves, twigs, manure) and **green organic material** (lawn clippings, fruit rinds, etc.). Brown materials supply carbon, while green materials supply nitrogen. The best ratio is 1 part green to 1 part brown material. Shredding, chopping or mowing these materials into smaller pieces will help speed the composting process by increasing the surface area.

Moisture is important to support the composting process. Compost should be comparable to the wetness of a wrung-out sponge.

If the pile is too dry, materials will decompose very slowly. Add water during dry periods or when adding large amounts of brown organic material.

If the pile is too wet, turn the pile and mix the materials. Another option is to add dry, brown organic materials.

Oxygen is needed to support the breakdown of plant material by bacteria. To supply oxygen, you will need to turn the compost pile so that materials at the edges are brought to the center of the pile. Turning the pile is important for complete composting and for controlling odor.

Wait at least two weeks before turning the pile, to allow the center of the pile to “heat up” and decompose. Once the pile has cooled in the center, decomposition of the materials has taken place. Frequent turning will help speed the composting process.

Bacteria and other microorganisms are the real workers in the compost process. By supplying organic materials, water, and oxygen, the already present bacteria will break down the plant material into useful compost for the garden. As the bacteria decompose the materials, they release heat, which is concentrated in the center of the pile.

You may also add layers of soil or finished compost to supply more bacteria and speed the composting process.

In addition to bacteria, larger organisms including insects and earthworms are active composters. These organisms break down large materials in the compost pile.