



NATURE'S RECYCLING PROGRAM

Summary

In this lesson, students will understand that trash in the landfills pollutes the wetlands and that composting food waste can minimize negative impacts. They learn what compost is made from, the role microorganisms play in decomposition, and how to take care of a worm bin. The activities include observation of decomposed materials, a worm bin scavenger hunt, a computer game and microscope use, as well as a gardening experiment. This lesson requires follow up observations.

Objectives

Students will:

- Know that compost is formed naturally from decomposing organic matter.
- Know that microorganisms and worms do the work of turning organic materials into compost.
- Know how to take care of a worm bin.

California Content Standards Addressed

Grade Six - *Science content 5.e*: "Students know the number and type of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as soil composition."

Grade Six - *Visual arts 2.1*: "Use various observational drawing skills to depict a variety of subject matter."

Grade Seven - *Science content 7.d*: "Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge."

Outline

There are seven parts to this lesson:

- 1) Introduction to Compost and Decomposition (15 minutes)
- 2a) Worm Bin Scavenger Hunt (15 minutes)
- 2b) Compost Creature Observation (15 minutes)
- 2c) The Adventures of Vermi the Worm computer game (15 minutes)
- 3) Compost Planting Experiment (20 minutes)
- 4) Compost Basketball (20 minutes)
- 5) Closing Circle (5 minutes)

The Basics:

Grade Level:

6 - 7

Subject areas:

Physical science, Life science, Art

Duration:

90 minutes

Materials: See materials section after outline

Number of Docents Needed:

1-2

Materials:

1. Introduction to Compost and Decomposition

- A few weeks before the field trip is scheduled, put an apple core or a banana peel or some other plant-based food scrap in a plastic bag. Put to the side and let it decompose. Do this again about a week before the field trip and again about two or three days before the field trip.
- Show students these bags with decomposed materials during the introduction and ask them to think about what is causing the food items to break down.
Note: make sure that each of the items in all three bags is the same kind of food scrap, for instance, an apple core in all three bags. Also feel free to create more bags at different stages of decomposition.
- Decomposer cartoon

2a. Worm Bin Scavenger Hunt

- Thermometer
- Compost Scavenger Hunt handout

2b. Microscope Observation:

- 4 or 5 dissecting microscopes (1 for every 2-3 students)
- One large newspaper heaped with fresh compost from the bin. Be sure that sample has many worms in it.
- Several petri dishes
- Plastic tweezers
- Several Compost Creatures Cards
- Colored pencils

2c. The Adventures of Vermi the Worm computer game

- This game should be downloaded to every classroom computer. It can be found on the WERCADMIN desktop and online at:
<http://www.ciwmb.ca.gov/vermi/>
- 1 set of headphones for each computer

3. Compost Planting Experiment

- 2 small pots for every 3-4 students
- 2 plant labels for every 3-4 students
- 2 native plant seedlings for every 3-4 students
- 1 shovel for every 3-5 students
- Pens

4. Compost Basketball:

- 2 large buckets
- 2 sets assorted garbage in large paper bags, including: eggshells, fast food wrapper, plastic baggies, banana peels, apple cores, newspaper, etc.
- 1 rubber glove for each student
- Timer
- White board with wax crayons to keep score

For each student:

- Pencil and clipboard
- Copy of Compost Scavenger Hunt Handout
- Copy of Compost Creature Observation worksheet

Vocabulary

Decomposition, Groundwater, Compost, Microorganism, Nutrient, Nitrogen, Carbon

Background Material

Recycling in Nature *by the Solid Waste Authority of Palm Beach County, Florida*

Recycling occurs in nature every day. For example, leaves that have fallen to the ground decompose and turn into compost, a nutrient-rich soil that helps plants to grow healthy and strong. In addition, the organic material serves as food for beetles and ants, and so on. You can just imagine how this food chain continues. But when you rake leaves and grass clippings and throw them away, you not only create waste that has to be collected and processed, but you interfere with an important cycle in nature. The environmentally-friendly thing to do is to make a compost pile using yard waste and other organic material. It's easy to maintain a compost pile in your backyard. Start with soil and then add equal amounts of "greens" and "browns." "Greens" are sources of protein which attract organisms to the pile to break down the material. The "greens" also provide nitrogen to the pile. Examples of "greens" include grass clippings and food scraps. "Browns" are carbohydrates and they provide carbon to the compost pile. Examples of "browns" include dry leaves and twigs.

You may also make compost using worm bins. A worm bin is a bin or box of any size that is full of red worms as opposed to earth worms. Red worms are very efficient digesters that eat a wide range of plant materials. Their poop, which is called "castings", is high in nitrogen and other nutrients. Castings are perfect to amend soil and to use while gardening so that young plants get a nutrient boost. All that is needed to start a worm bin is a bin, a large handful of red worms, ventilation, and some burlap, straw, or newspaper to cover the worms and keep them moist. Then start feeding them by putting in food scraps, recycled paper, dead plants, or anything else you would put into a compost pile. Try to keep out plant items that have chemicals on them so that the worms do not get sick and die.

Compost to Reduce Landfills *by Deborah Mitchell*

Composting food waste and organic yard debris reduce the landfill challenges facing the US today. Not only are landfills leading contributors to global warming (landfills emit large amounts of methane gas), they also pollute groundwater, waste precious resources, require a great deal of energy to manage, and discourage recycling, reuse, and composting.

In our society, we often make it easier to throw things away rather than reuse or recycle them. The average American tosses away 4.5 pounds of trash per day, adding to the grand total of more than 236 million tons of refuse the US accumulates per year. Of that amount, approximately 25 percent is composed nearly equally of food scraps and yard debris, according to the Environmental Protection Agency. These are the very materials which, once in the landfills, produce ozone-damaging methane, a greenhouse gas that is twenty-one times more potent than carbon dioxide, another global-warming threat.

But these organic materials can also be turned into rich, life-supporting compost. Whether you live in an apartment, in a home with a backyard, or on a farm, you can help reduce the emission of damaging greenhouse gases by composting.

Composting decomposes organic materials, such as food scraps and lawn and garden debris (e.g., Grass Cuttings, leaves, weeds, pine needles) with microorganisms (e.g., bacteria and fungi) and transforms into a dark, humus-like substance. The benefits of composting go far beyond keeping millions of tons of waste out of our landfills. Compost is an ideal medium for growing fruits and vegetables, flowers, shrubs, and trees. Because it is a rich source of nutrients, use of compost significantly reduces or eliminates the need for fertilizer. Compost improves soil texture and its ability to hold onto moisture, thus protecting against drought. Compost also helps control erosion and weed growth, and acts as a protective barrier against toxins in the soil.

Procedure

1) Introduction to Compost and Decomposition (15 minutes)

- Gather the class either in the outdoor or indoor classroom and have each docent and mentor introduce him/herself.
- Ask the students if any of them have ever heard the word “compost” and if any of them have ever done any composting either at home or anywhere else.
- Spend a few minutes talking about where garbage ends up and that composting helps to reduce the size of our landfills. Share with the students that the Watsonville landfill is located adjacent to the west side of Harkins Slough on the uplands of the Watsonville slough system. Show them on a map or if you’re outside, point to the general direction. Pollution from the landfill gets absorbed into the groundwater which then percolates into Harkins Slough. Yuck! Composting is a way to recycle our food waste (about 25% of landfill waste material) into food (organic fertilizer) for plants and minimize the impact on our landfill.
- Pass around the oldest bag of decomposed food without telling students what it is. Only tell them how long ago you placed the item in the bag. See if they can figure out what it is and ask them to start thinking about how it got that way.
- Next, pass out the second oldest bag and so on and tell them when you placed the items in the bags. There’s no need to wait until every student has seen each bag before moving on to the next one. This can be done rather quickly.
- A common assumption may be that “sun” and “water” broke down the food items. These are correct answers but ask the students what they think would happen if the food was placed in a dark, dry place. Would they notice a difference?
- They are witnessing decomposition. Has anyone heard that word before? Show them the decomposition cartoon explain that fungi, bacteria and worms are common decomposers. We can only see bacteria under a microscope. Decomposers do all the work to break down food and other organic materials that we put into our compost bins.
- Here at the WERC, we use a worm compost bin. Adding red worms to a compost bin helps to break stuff down faster. We use the compost that is made

in the worm bin to amend our potting soil for the greenhouse plants. The compost helps to make the plants big and strong so that they are very healthy when we plant them in the wetlands. Today we'll learn more about how most is made and the different things it can be used for.

After the introduction, split the class into three groups. One group will do the worm bin scavenger hunt, one does the computer game, and one does the microscope observation. Rotate the groups every 15 minutes until each group has completed each activity.

2a) Worm Bin Signs Scavenger Hunt (15 minutes)

- Outside worm compost bin. Students turn to the "Compost Scavenger Hunt" handout on their clipboards. Students and high school mentors investigate the worm bins and interpretive signs near the outdoor classroom using the handout as a guide.

2b) Compost creature observation (15 minutes)

Indoor classroom.

Introduction to using the microscope:

- Walk students through the proper use of the microscope, emphasizing that these are expensive scientific tools and should be treated with care.
- Microscope basics - show students how to:
 1. Turn on the light
 2. Rotate the nosepiece to the lowest magnification.
 3. Place a slide or Petri dish on the stage
 4. Adjust the large coarse focus knob until the object is in focus.
 5. Adjust the small fine focus knob until it is clearly in focus.
 6. Scan the slide or dish to get an idea what you have to see. If you find something you want to get a closer look at, rotate the nosepiece to a higher magnification
 7. Adjust the large coarse focus knob and then the small fine focus knob until the object is clear.
- Give each student a "Compost Creature Observation Lab" worksheet
- Ask students to use the tweezers to explore the fresh compost and to take turns observing it under the microscope. They may use the colored pencils to draw what they see.
- Ask students to use the Compost Creatures Cards to identify any compost creatures they see.

2c) The Adventures of Vermi the Worm Computer Game (15 minutes)

- Each student in this group chooses one of the computers in the classroom. Students put on head phones and load the vermin-composting game on the WERCADMIN desktop. Play the game until the 15 minutes are up. They may not get through the whole game in that time. Let them know that it is okay not to finish ahead of time.

3) Compost Planting Experiment (20 minutes)

- While remaining in their groups, ask the students to come together and have a seat at the outdoor classroom. Explain that we will now conduct an experiment to see if compost makes a good plant fertilizer. Ask them what they think and why. Each group will receive two plants of the same type to plant in a small pot of pure compost and another in soil from the ESHA. Ask the students to predict which plant will grow bigger and faster. (You may wish to break the groups into even smaller groups if it is a large class.) Explain that they will have the opportunity to find out over the course of each of their visits.
- Explain that each group will get two labels for their pots. They must write four things on each plant label: the name of the plant, the date, no compost vs. with compost, and names of the students. Pass out to each group a shovel, two small pots, two native plant seedling plugs, two labels, and a marker
- Each small group transplants one native plant into compost and another plant into soil from the ESHA that they dig up themselves. Once they are done transplanting and labeling, the plants should be watered and put in a corner of the greenhouse.
- The students record how each plant is doing each time they visit during the semester.

4) Compost basketball (20 minutes)

- Gather the students together again outside.
- Ask students who remembers some of the things that can go into a worm bin? Who remembers some of the things they cannot compost?
- Divide students into 2 teams and give each student a pair of latex gloves.
- Ask each group to form a single-file line in back of a paper bag full of garbage.
- Place a compost bin “basket” about 7 feet in front of each team.
- Tell students: The object of this game is to get the most points. Each team gets points by tossing the most compostable items in their bin. Teams earn 2 points for each correct item in the bin. We’ll subtract 1 point for every non-compostable item in your bin.
- Explain the rules to the students: When teacher blows the whistle, the person first in line reaches in to the bin and pulls out a piece of garbage. If you can compost that garbage, toss it in the “basket.” Then you run to the back of the line. Then it is the next person’s turn.
- Tell students: You’ll have 2 minutes. Any questions?
- After the game, go through and add points based on the correct number of compostable items in the bin. Discuss: Was there any confusion? What was consistently incorrect?
- You can play this game 2-3 times.

5) Closing circle (5 minutes)

- Pass a rock around the circle and ask each student to say one interesting thing they discovered today. Collect science handouts with all the students’ work.



Compost Scavenger Hunt

Name _____

Using the WERC worm bins and interpretive signs, find the answers to the questions and directions below.

1) Circle all the phrases that correctly finish this sentence. "Compost is..."

"... full of good nutrients that plants can use to grow big and strong."

"... is only found in compost bins. It does not occur in nature."

"...not useful to humans at all but only to plants."

"...broken-down bits of plant material that has decomposed."

"...created with the help of fungus, bacteria, insects, and worms."



2) Draw and label the parts of the worm in the box to the right.

3) How do red worms help to make compost?

4) Circle all the items that **can** go into a worm bin.

egg shells coffee grounds colored paper banana peels
melon rind

newspaper chicken bones plastic wrapper apple cores
plain rice

salad dressing flower stems wood chips dried grass ham sandwich

5) Imagine you have your own worm bin and it has produced 10 pounds of compost. Write down 3 things you want to do with the compost.



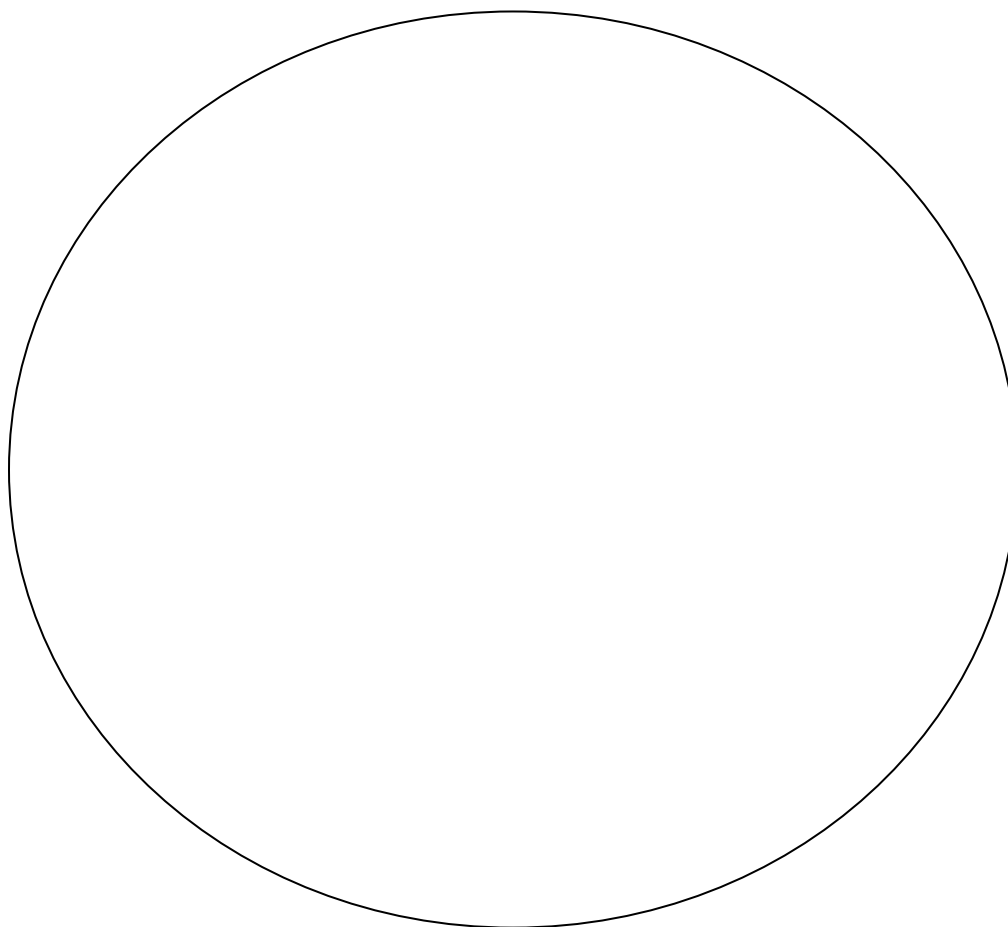
Compost Creature Observation

What is Compost?

Name _____

Compost is nature's way of recycling- it is a mixture of decaying organic matter (like leaves, paper, and food scraps), air, and water. Compost is used to add nutrients to the soil- this is important because it helps many plants grow. Micro-organisms (tiny fungus, bacteria, insects, and worms) do the work of turning organic matter into compost.

**Observe a sample of compost under a microscope.
Draw and name the compost creatures you see:**



How is compost different from soil on the ground? Any observations?

DECOMPOSERS

They consume (eat) dead plants & animals and decomposes them - reduces them to simpler forms of matter.



PRIMARY DECOMPOSERS

Fungi & Bacteria

