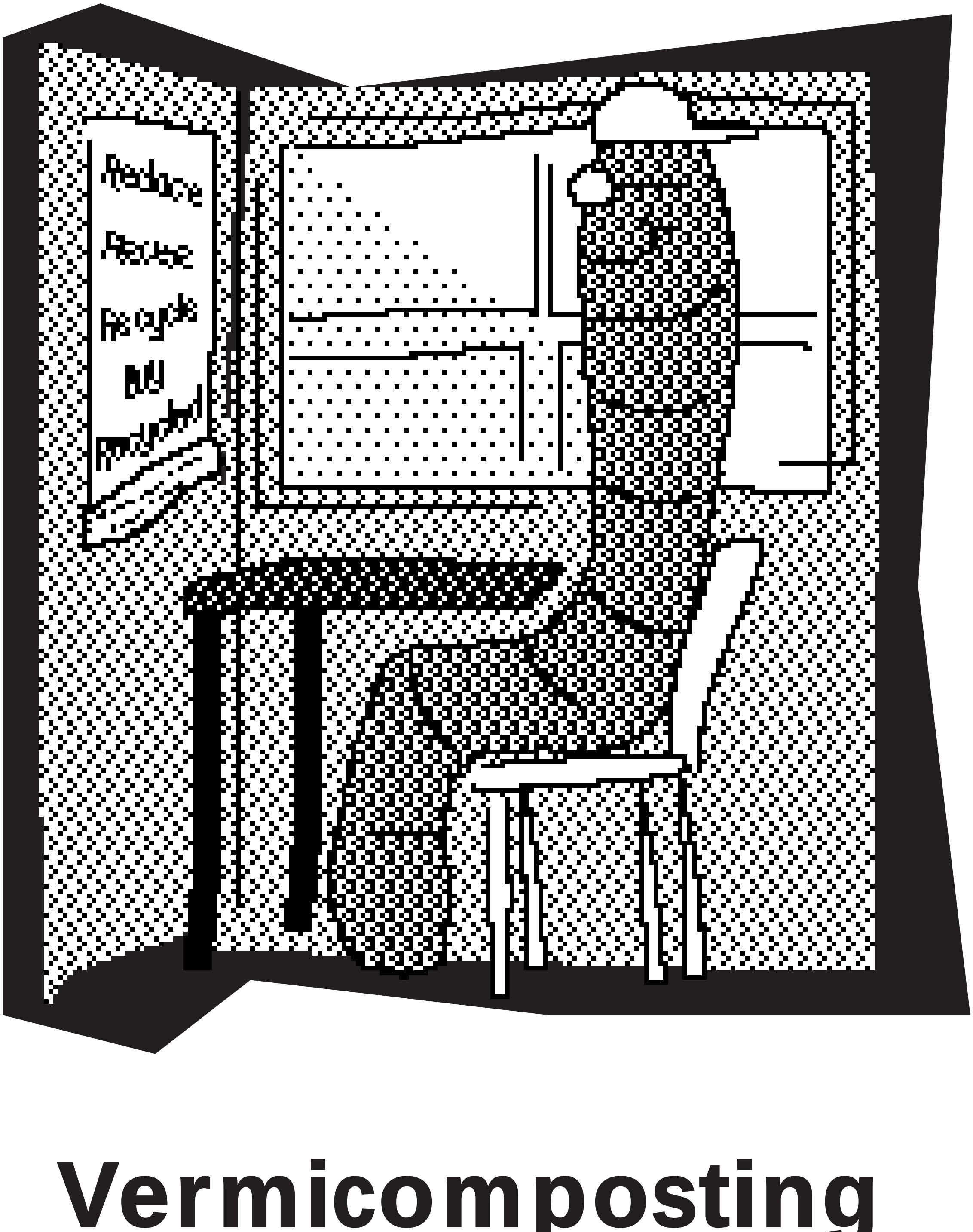


Vermicomposting Classroom Activities

Vermicomposting Project Activities

Brainstorming

A. Student groups brainstorm "What is vermicomposting?" Record ideas of each group for sharing.

After sharing, provide definition so students can compare with their ideas. (Vermicomposting is a system that uses redworms to process/eat kitchen waste, resulting in worm castings that are rich in nutrients and can be used as fertilizer for plants).

B. Student groups brainstorm questions they have about vermicomposting. Have the groups share and list the most common questions. Assign each group to research assigned questions from the list and share with the class.

Preparation

A. Assign roles to students such as planners, bedding collectors, bedding preparers, feeders, worm keepers, etc.

B. Students draw a diagram of the worm bin from an overhead view. Students divide bin into sections and number the sections. Students use this diagram for placing food waste in different sections of the bin. This will enable students to keep track of where and when the food waste is placed.

C. Provide an overview of tasks to be completed in building and maintaining the worm bin.

Research

A. Give pairs of students materials that an earthworm processes to produce worm castings (soil, sand, newspaper in very small amounts, and grass clippings). Have them experiment with these materials to see if they can produce something similar to castings. Have students share the results of their experiments.

B. Assign teams to think about and then draw an illustration of the vermicomposting cycle (building a bin, preparing the bedding, adding the worms, adding the food waste, harvesting the castings, fertilizing the garden, growing vegetables, eating the vegetables, feeding vegetable waste to the worms). Assign students to think about the cycle and identify additional possibilities for expanding the cycle (e.g., rabbits in cages above the worm bins being fed lettuce grown from castings, rabbit droppings and lettuce waste feed earthworms).

Recordkeeping

A. Discuss with students how to use a thermometer. Have students practice recording temperatures. Assign students to record temperatures in worm bin, maintain a log of temperatures. Have students graph temperatures over a period of time.

B. Have students measure and record amount and types of food given to the worms. Have students graph amounts of food over a period of time. Ask students to identify foods that are easy/hard to vermicompost based on their observations.

Observation

A. Assign pairs of students to observe the activity of the worms when food waste is buried. Students record their observations in their journals and share with other students in their group.

B. Pairs of students collect a small sample of composted material from the worm bin to observe under a magnifying lens. Students record their observations in their journals and share with other students.

Assessment

A. Have students discuss these questions with a partner and then share their ideas with the class. "What does "closing the loop" mean to you?" "How do worms close the loop?" "Why are worms important?"

Name ______________________

Warming Up To Worms

Place your worm on a damp paper towel where you can observe it.

1. What color is the worm?

____

2. What shape is a worm? Describe it.

____

____

3. How does the worm's skin feel?

____

4. Is there a difference between the top side and bottom side of a worm? (Turn the worm over.) Describe what each side is like.

____

____

5. Can you tell which is the front end of a worm and which is the back end? How do you know?

____

____

Adapted from AIMS Education Foundation, *Critters,* 1992.

Set Up Record Sheet

Date set up ______________________________

Initial weight of works ______________________________

Type of bedding ______________________________

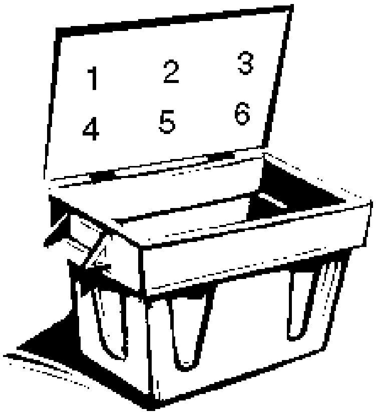
Size of bin ______________________________

Classroom size ______________________________

Garbage burying locations:

Label the worm bin so you can keep track of where and when you are feeding the worms.

1	2	3
6	5	4



Harvest Results

Date harvested ________________ No. of days total ________

Worm weight ______________________________

Calculate the following from the Feeding Record Sheet:

Total weight buried garbage ______________________________

Weight uneaten garbage ______________________________

Average oz. buried per day ______________________________

Average temp. _____________ Temp. range ________________

Feeding Record Sheet

Date	# oz. food	Total # oz. to date	Temp.	Water (# pints)	Burying location #	Type of food

Worm Population Count

We started on___________________with approximately ______worms.
(date)

On _____________________ there were ______ worms.
(date)

1. Are there more or less? _____________________

2. Why do you think the number of worms changed?

____

____

3. What did you observe about the contents of the worm bin?

____

____

4. What do you think the worms like to eat? Why?

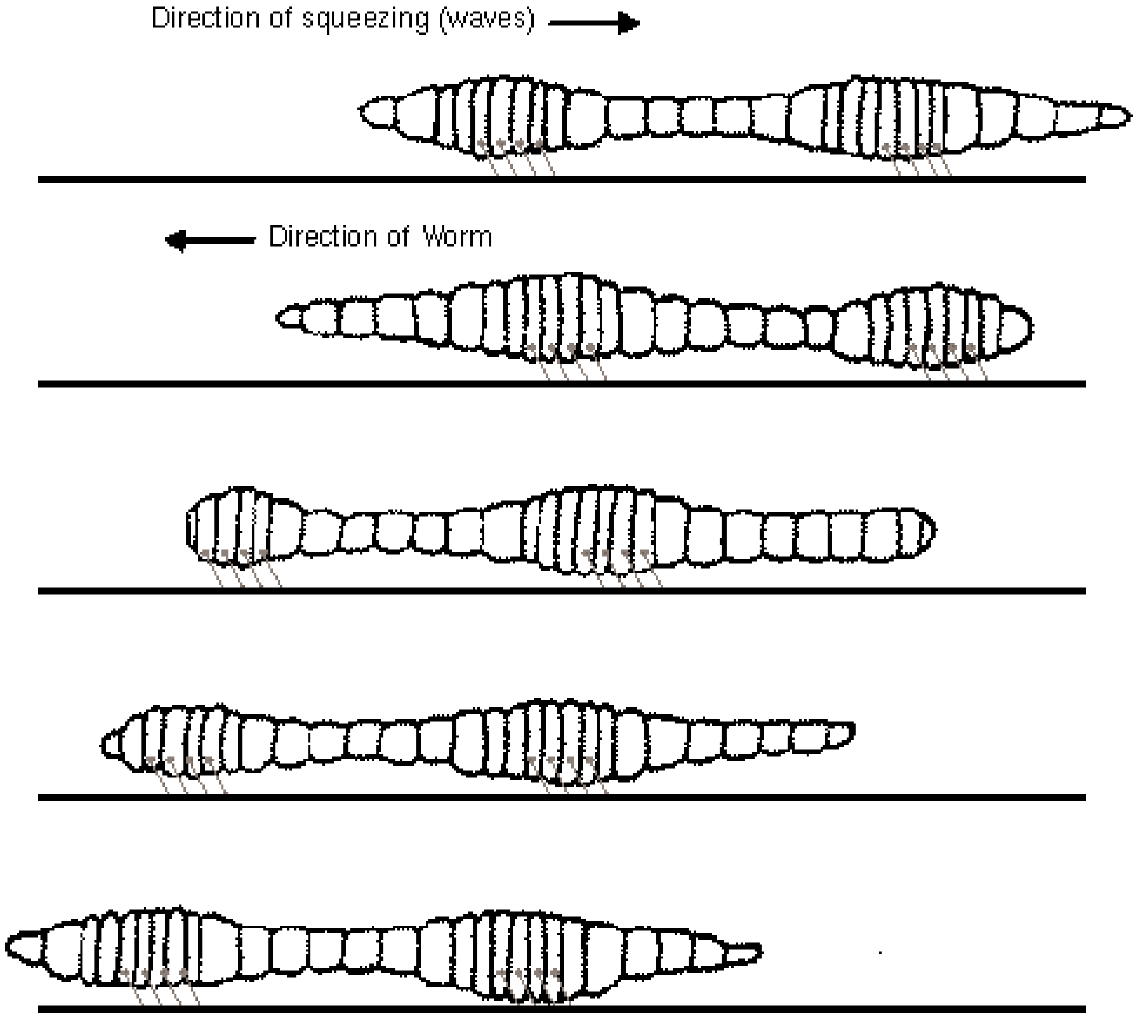
____

____

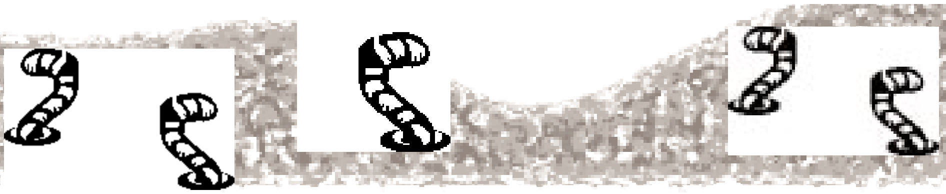
Worm Walk

When a worm wants to move forward, its powerful muscles contract and it squeezes itself around the middle (sort of like when you squeeze a tube of toothpaste). The worm's front gets long and thin and burrows ahead. Then another set of muscles squeezes and makes the worm fat. It pushes its setae (bristles) down and grips the burrow while the rear section catches up with the front section.

Worms can force their way through soft earth; they must eat their way through harder soil. Eaten earth passes through their intestines and is deposited on the ground's surface as castings.



Adapted from *The Reasons for Seasons,* by Linda Allison. Yolla Bolly Press/Little, Brown, and Co. Boston,1975.



Name ____________________

Red Worm Observation

Draw a picture of a red worm. Can you label the parts?
(head, tail, mouth, segments, band)

Draw lines pointing to the parts and write the names on the lines.

Write three observations about the worm.

1. ____

2. ____

3. ____

Collector Name ______________________

Recorder Name ______________________

Reporter Name ______________________

What Does Your Worm Prefer?

1. Light or dark?______________________________________

2. Wet or dry?______________________________________

3. On top of soil or underground?__________________________

Developed by Betsy Weiss

Lab Activities

The following lab activities provide an engaging opportunity for students to learn about the important role worms play in nature. The primary goal of the activities is for students to perform the experiments and draw their own conclusions. As an extension, you may want to have students design their own experiments using the scientific method—posing an idea, forming a hypothesis, constructing an experiment, analyzing results, and presenting conclusions.

To address the negative attitudes towards worms, present the lab activities as an opportunity to learn more about a creature that is vital to recycling nutrients in the soil and helping us to grow nutritious food. You may want to pair squeamish students with others who are less concerned about working with the worms.

Tell students that while working with the worms they should keep them moist by placing them on a moist paper towel or in a petri dish with water. Explain to students that the worms breathe through their wet skin, and therefore must be kept moist.

Following the lab descriptions are sample station cards. You might want to set these labs up at stations and have students rotate through. Allow students ample time to observe and record their findings for each lab activity.

1. Tell the students they are going to observe the red worms living in the compost bin. Ask, "What do you know about redworms?" "What do they do?" "Where do they live?" "What do they eat?"

While many students are familiar with worms, most have not taken the opportunity to observe them closely. List students' responses and refer back to them as they learn more about the worms. Redworms (Eisenia foetida), also called manure worms or red wigglers, are the type of worm used in worm composting systems because they are litter dwellers requiring organic material to live, they tolerate a wide range of temperatures, and they do not require large amounts of soil for burrowing.

Have students use a hand lens to observe the worms. To find out which is the front end, students should observe how the worm moves and which end leads the body. When the worm moves the front (head) end usually goes first. Another distinguishing feature is the clitellum, the swelling or band which is usually distinguished by its lighter color, is nearer to the front end.

2. Are worms sensitive to light? Do worms have eyes?

Darken the room and ask a student to shine a beam from a flashlight covered with red cellophane on a worm. Since worms, like many nocturnal animals, are not sensitive to light from the red end of the spectrum, the worm will probably not react to the light. When the cellophane is removed, the worm will react to the light by turning away. Have students repeat the experiment with a number of worms and record their findings in their Learning Journals. As a variation, set up the experiment with the worm in a dish that is partially covered so the worm has a dark place to retreat to.

3. Do worms have favorite colors?

To test a worm's response to lights of various colors, shine a flashlight through a prism so it casts a spectrum on a white sheet. Place a worm in the spectrum. The worm should crawl away from the blue light and through the red. Remind students about the red cellophane on the flashlight. Are the two responses consistent with each other? How do they fit in with the environment in which worms live?

4. Do worms like water?

On a piece of paper place a drop of water. Place a worm near the water drop. The worm should crawl to the water. Students could also do the experiment in a box to block out the light.

5. When two worms are placed in the same area, will they move together or stay apart?

Place two worms in a container with a cover to block out the light. The worms should move towards each other. Have students discuss reasons the worms might move towards each other. Possible ideas might include that the worms are seeking moisture or they are looking for companionship, etc.

6. What is the average length of a worm?

Place a worm on a damp paper towel, straighten out the worm, and measure it with a ruler. Have students measure a number of worms and calculate the average length. Students should note the accuracy of measurement should increase by measuring a larger number of worms versus only a few.

For younger students, have them measure "gummy" worms to gain experience with measuring and recording data. Variables affecting the length of a worm include how old it is, how well fed it is and if its body has enough moisture.

7. Does a worm move forwards or backwards or both?

Place a worm on a moist paper towel. Using something soft such as a paint brush or leaf touch the end of the worm. The worm will move both forwards and backwards. Worms move through contracting and relaxing their muscles in waves, alternating between circular and long muscles. Contraction of the circular muscles forces the worm's body forward. Then, the long muscles contract, drawing the tail end of the worm towards the skinny front end. When the long muscles contract, the circular muscles relax, causing the worm to become thick. To keep from skidding during movement, tiny bristles called setae act as brakes to hold part of the worm's body against the surface. The worm moves forward and backward in similar ways.

8. Can a worm feel?

Place a worm on a moist paper towel. Using a feather and then a leaf, touch the worm and observe its reaction. The worm will respond to touch. This experiment demonstrates that worms have senses. Students may garner respect for these creatures rather than squishing them on the playground or tossing them in the air.

9. How do worms find food?

This is a physical education activity. In a large area set up a maze or obstacle track. Explain to students they are now redworms, therefore they have no eyes, legs or arms. They must make their way through the maze to get to their destination or food source. At the conclusion of the activity have students discuss their observations.

Station

Does a worm sense light?
Do worms have eyes?

Station

Do worms have favorite colors?

Station

Does a worm like water?

Station

What happens when two worms are placed in the same area?

Will they move together or stay apart?

77

Station

What is the average length of a red worm?

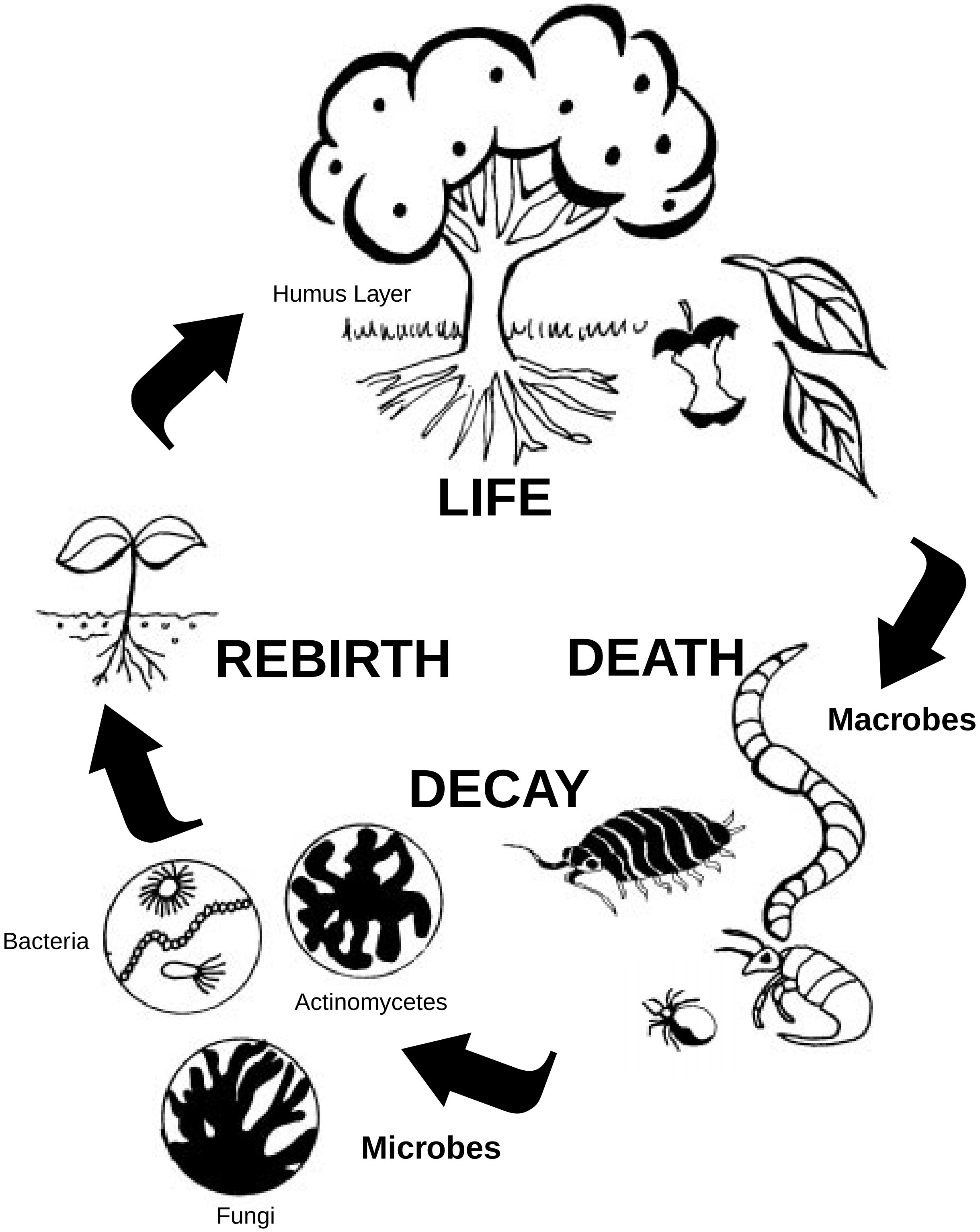
Station

Does a worm move forwards, backwards, or both?

Station

Can a worm feel?

Soil and Decomposition



Fungi and Bacteria

Description

Students compare the growth of fungi and bacteria in different environments.

Objective

Students observe growth of fungi (yeast) and the effect of bacteria as organic matter is decomposed.

Grade

2-6

Time

One 30-minute period, one 15-minute period and observation periods over two weeks.

Materials

Two slices of bread for each group of students

Two lemons or oranges for each group

Several bananas

A knife for you to cut the bananas

Six plastic bags for each group

Twist ties for each bag

One-half teaspoon of yeast for each group

Cotton balls

Masking tape

Water

A warm dark place to store things for two weeks

A refrigerator or cool place to store things for two weeks

Background Information

Fungi and bacteria are essential to the decay of plant material. Fungi and bacteria are decomposers working at the microscopic level to help plants break down into their basic elements.

Moisture and darkness encourage rapid growth of fungi and some bacteria. Both of these factors help fungi and bacteria thrive.

Preparation

Decide on a warm, dark place for bags to be kept during the experiment.

Procedure

Day One

1. Ask the students how they think plants decompose and what factors effect decomposition. What conditions do they think are the best to help plants decompose?
2. Explain that they are going to test how environmental conditions effect decomposition. Provide each group with six plastic bags and enough ties to secure them, two slices of bread, two oranges or lemons, and two pieces of banana.
3. In each of the two bags have the students place a slice of bread. One slice should be wet but not soggy.

Nothing should be done to the other slice. Ask the students to seal both bags with ties. Place the bag with the moistened slice in a dark warm place and the other bag in the refrigerator, or a cool place.

4. In each of the other two bags, place a piece of banana. In one bag pour half a teaspoon of yeast on the banana and mark this bag with a "Y." Place both of these bags in a warm, dark place.

5. Rub the oranges or lemons on the floor to pick up bacteria and let them sit out in the air for one day.

Day Two

6. Place each orange or lemon into a bag. Add a cotton ball moistened with water to one of the bags. Tie both bags closed. Place the bag with the cotton ball in a warm, dark place and the other bag in a cool spot.

7. Have the students hypothesize what will happen to each of the items. What will the yeast do? What affect will temperature and light have?

During The Week

8. Twice during the week have students observe each bag and record their observations on the worksheet.

After One Week

9. The bread and banana should be well on their way to decomposing. Allow the students to observe the structures of mold and the decomposition of the bananas with a hand lens. Students can draw what they see on their worksheet, or on separate sheets of paper. What has the yeast done to the banana? What role does moisture play?

Note: The oranges or lemons may take a week or longer to turn into bluish-green fuzz balls. If so, continue the experiment an extra week.

Extension

Bake yeast bread. The yeast are fungi that are alive. The fungi eat the honey or molasses in the dough and give off carbon dioxide as a by-product. The carbon dioxide gets trapped in the net of gluten fibers and causes the dough to rise.

Source: Alameda County Home Compost Education Program, 7977 Capwell Drive, Oakland, CA 94621, (510) 635-6275

Fungi And Bacteria

Name ____________________

Worksheet

Bread		
Date	**Wet/Warm**	**Dry/Cool**

Oranges/Lemons		
Date	**Wet/Warm**	**Dry/Cool**

Bananas		
Date	**Wet/Warm**	**Dry/Cool**

Skin Deep

Description

Students bury fruit cut into different size pieces in either a worm compost or a backyard compost bin and record decomposition rates.

Objective

Students will see that cutting up organic material speeds decomposition by creating more surface area for decomposers to feed on. Students will see how skin acts as a protective covering to keep microorganisms out.

Grade

2-8

Time

Ongoing project

Materials

- Four whole fruits of the same type (e.g., four apples, melons, or tomatoes)
- A cutting knife
- A compost system to bury the food in (if you do not have a compost system, food can be buried 10 inches in fertile soil)
- Popsicle sticks
- Journals

Procedure

1. Use one corner of your compost bin to bury the food.
2. Prepare the four pieces of fruit: leave one intact with the skin unbroken, puncture the skin of one with a knife, cut one in fourths, and chop the last one into many small pieces.
3. Bury each of the fruits in the compost or the ground and mark with a labeled popsicle stick.
4. Dig up and check weekly.
5. Record the rate at which each fruit is decomposing in relation to the amount of surface area available for decomposers to feed off of.
6. Record where the decomposition has started and what part of the fruit it is spreading to.

Extension

Graph the relationship between the number of pieces the fruit was cut into, and how many weeks it took to completely decompose. Repeat the experiment with another type of fruit and compare results. Find examples in nature of the same materials decomposing at different rates due to differences in surface area.

Discussion

Which would decompose faster, a 200-pound log or 200 pounds of small twigs? In what situations would it be reasonable to buy large expensive equipment and use fossil fuels to chop organic materials into smaller pieces? What was the difference between the fruit with the skin intact and the one with a puncture in the skin? How does skin act as a protective covering? When humans get a cut why should they clean it and cover it as soon as possible?

Source: Marin County Office of Waste Management, 3501 Civic Center Drive, Room 403, San Rafael, CA 94903, (415) 499-6647

Dirt for Lunch

Description

Students track the food in their lunches back to the earth.

Objective

To illustrate that all our food comes from the earth and that healthy food depends on healthy soil.

Grade

2-6

Time

One class period

Background Information

Many children do not understand that all of our food including animal products and processed foods originates from the earth's soil. Soil is made up of five components: sand, silt, clay, organic material, and soil organisms. Different soil types have different proportions of these components. In general, soils high in organic material house large numbers of soil organisms and are very fertile. Soil organisms are classified as decomposers since they eat dead organic material. Organic material is anything composed of or derived from living organisms. There are many decomposers. Some we can see like worms, sow bugs, and beetles, but most, like bacteria and fungi, are too small for our eyes. A tablespoon of healthy soil can contain many billions of bacteria and fungi.

Materials

Students' lunches

Journals

Procedure

1. In their journals, have students list everything they are having for lunch.
2. Inform students that no matter what they have packed for lunch, ultimately they are eating dirt.
3. Challenge students to name a food in their lunches that did not come from dirt.
4. Help students figure out the ingredients in different foods and, as a class, trace each food's origin back to the earth.
5. Use a tuna fish sandwich for an example.

The bread came from wheat grown in the dirt.

Pickles are preserved cucumbers grown in the dirt.

Lettuce was grown in the dirt.

Mayonnaise came from eggs, that came from chickens, that ate grains grown in the dirt.

Tuna living in the ocean eat smaller fish that eat zooplankton that eat phytoplankton, which need nutrients from the decomposed bodies of dead plants and animals accumulated on the ocean floor and brought to the surface by currents.

Extension

Make posters and pins that say, “I Eat Dirt, Ask Me How.”

Source: Marin County Office of Waste Management, 3501 Civic Center Drive, Room 403, San Rafael, CA 94903

(415) 499-6647

Growing Plants With Compost

Description

An experiment to observe how plants germinate and grow with varying amounts of compost.

Objective

To see if adding compost to the soil has an effect on the sprouting of seeds and the growth of plants.

Grade

2-8

Time

Ongoing project

Background Information

Adding compost to the soil can increase the soil's ability to hold water. In addition, compost can add nutrients to the soil. This helps the plants in your garden to grow. On the other hand, it is difficult for seeds to sprout in pure compost. In fact, sensitive seeds may even be killed by a fungus if you try to sprout them in compost. This problem occurs most often when the organic material is not completely broken down.

Materials

Four flower pots or cups with drainage holes

Gravel for drainage

Compost

Perlite

Seeds (bean, pea, radish, or lettuce seeds work well)

"Growing Plants With Compost Record"

Pencil

Scraps of paper or cardboard

Procedure

1. Put 1 inch (2.5 cm) of gravel in the bottom of each of the flower pots. Label the pots 1 to 4.
2. Fill pot 1 with 100 percent compost.
3. Using a measuring cup or other plastic cup, measure part compost and an equal amount of perlite. Mix

the compost and perlite together thoroughly. Fill pot 2 with this 1 to 1 compost-to-perlite mixture.

4. Using a measuring cup or other plastic cup, measure one part compost and three parts perlite. Mix the compost and perlite together thoroughly. Fill pot 3 with this 1 to 3 compost-to-perlite mixture.
5. Fill pot 4 with 100 percent perlite.
6. Plant three to four seeds of the same species in each pot. Bean seeds are fast growing and easy to observe.
7. Water your seeds following the instructions on the package. Make sure you add the same amount of water to each pot.
8. After four or five days, your seeds should have sprouted. Count the number of seeds that have sprouted in each of the four pots. Record the number of seeds that have sprouted. Thin the extra plants so you have one plant in each pot.
9. Follow the growth of your plants for four to five weeks. Once a week, measure the height of the plant in each pot. Record the height of the plants. Note if any plants die.
10. After five weeks, count the number of surviving plants. Compare the number of surviving plants in the different mixtures of compost and perlite. Then measure the height of the plants.

Note: To be more scientific, you may want to have more than one pot for each of the four compost “treatments.”

Extensions

Repeat the experiment with a different kind of compost (vermicompost or backyard compost) and note any differences.

This experiment can also be done in a garden bed by mixing different measured amounts of compost into the soil and planting the same seeds in each bed.

Source: A Cornell Cooperative Extension Publication, *Composting: Waste to Resources,* Cornell University, Ithaca, NY, 14850, (607) 255-5830

Growing Plants With Compost

Plant species: ____________________

Date planted: ____________________

Sprouting pot number: ____________

Plant: __________________________

Date: __________________________

Number of Seeds Sprouted

1

2

3

4

Growth Pot Number

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Growth Pot Number ____________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Growth Pot Number ____________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Growth Pot Number ____________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Date__________ Height__________

Decomposer Tag

Description

Students play a freeze tag game where death tries to tag and freeze the nutrients in plants and animals. The decomposers unfreeze the nutrients trapped in dead bodies, allowing them to return to the cycle of life.

Grade: 2-6

Time: 20-30 minutes

Materials: Two light colored and one dark colored bandanas.

Procedure

1. One student is "Death" and wears a dark colored bandana.

2. Two or three students are decomposers and wear light colored bandanas. All other students are plants or animals.

3. Death kills plants and animals by tagging them. If plants or animals are tagged, they are frozen in place until one of the decomposers unfreezes them by running around them three times. The decomposers unfreeze the plants and animals as fast or faster than death freezes them.

4. The game has no natural end. You should let students play long enough to experience the concept, and stop the game well before students get exhausted and/or lose interest.

Variation

To demonstrate that life would stop without decomposers recycling dead things, you can allow "Death" to tag and freeze the "Decomposers" along with the plants and animals. The game, and life on Earth, ends when everyone is frozen except "Death."

Source: Marin County Office of Waste Management, 3501 Civic Center Drive, Room 403, San Rafael, CA 94903
(415) 499-6647

I Can Compost...

Description

In this game students call out something they can compost before the person in the middle tags them. This game can be played indoors or outdoors.

Objective

Students review what they can compost.

Grade

1-8

Time

20 minutes

Materials

A ball or other object to toss.

Procedure

1. On the board or in their journals, students list as many items as possible to compost.

2. To start the game everyone stands or sits (if indoors) in a circle.

3. A person calls out something that can be composted and the person's name who the Koosh ball (or any other appropriate object) is being tossed to.

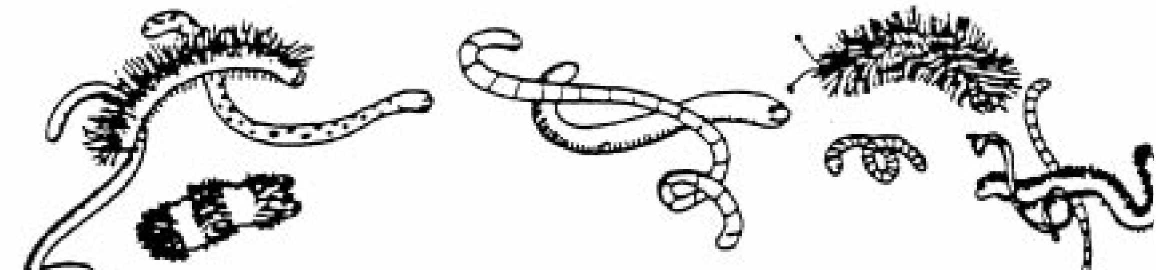
4. Once students get the hang of it, put someone in the middle of the circle, whose goal is to tag the person with the ball before it is tossed. If tagged, that person changes places with the one in the middle.

5. To make sure all the students get a turn, students can sit down after they have named something they can compost and tossed the ball to another student.

Extension

A song, rap, or poem can be created out of the list of what can be composted.

Source: Marin County Office of Waste Management, 3501 Civic Center Drive, Room 403, San Rafael, CA 94903 (415) 499-6647



Nobody Likes Me

Nobody likes me, Evrybody hates me,

Guess I’ll go eat worms, Long, thin, slimy ones,

Short, fat, juic-y ones, Itsy-bitsy, fuzzy-wuzzy worms.

2. Down goes the first one,
   Down goes the second one,
   Oh, how they wiggle and squirm,
   Long, thin, slimy ones,
   Short, fat, juicy ones,
   Itsy-bitsy, fuzzy-wuzzy worms.

3. Up comes the first one,
   Up comes the second one,
   Oh, how they wiggle and squirm,
   Long, thin, slimy ones,
   Short, fat, juicy ones,
   Itsy-bitsy, fuzzy-wuzzy worms.