CSWD- Worms in Your Classroom

Objective:
Create a healthy habitat for worms in the classroom

Grade Level:
K-12

Background:
Read the *CSWD Composting with Worms Guide* provided to you in the confirmation email

Activity:
Introduce the topic as a class then circle around a space, preferably a table, that can get dirty

Materials Included:
- Red wiggler worms
- Ventilated plastic bin
- Samples of compost and sandy soil (display on plate or cookie sheet for class observation)
- Black kitchen food scrap bucket

Materials to Gather at School:
- Wet leaves from outside (enough to cover the bottom of the bin 3" deep)
- 2 wet towels, for students to use for wiping the salt off their hands *before* handling worms
- Small pieces of food scraps for worm food
- Newspaper (to shred into strips point "teeth" or rough edge of paper towards ceiling and tear down for best results)

Visual tools:
10 year-old carrots
FBIs & Rot Cycle

Time Allotment:
45 minutes

I. Introduction

Why are you here?
Focus the audience on the reason for your presentation: to introduce worm composting as a tool we can use to (1) reduce the amount of trash we create and (2) create healthy, rich soil amendment

II. Body

Who knows what the three R's are? For a visual, draw an inverted pyramid, with Reduce as the top and most important step, and Recycling/Rot as the last. As you move down the pyramid, energy use goes up.

Preventing waste from entering into your life uses no energy or fossil fuels, it just requires a good decision and perhaps a little planning. Reuse requires creativity, or coordination between the first and second user. Recycling and composting/ rot require energy and fuel to transport the used items, process them into new things, and to distribute them to stores where people can buy them.

Reduce- to make less of something. Examples: Buying things with less packaging *or* reducing the amount of bags you use when you shop by taking along your own cloth bag. Or eating everything on your plate, so you don't have to compost it.

ReUse- to use things over and over. Examples: Using both sides of a sheet of paper before recycling it *or* sharing used clothing with siblings or friends

Recycle and Rot- to convert materials that would have been garbage into new products; giving a new life to what once was trash. Ex: turning food scraps into compost for your garden

Where does your garbage go when you throw it away?
Trash can → curb → trash truck→ transfer station→ landfill

Fact: The average Vermonter generates between 4 and 5 lbs of trash per day, and about 30% of that is organic and could be composted!

Landfill- is different from a dump; it's a big hole in the ground that's lined with thick plastic to prevent toxic water from entering streams, and rivers. Things do NOT rot in a landfill because the decomposers (like worms) chose not to live there (they have no air to breathe because we compact all the garbage).

Show visual: 10 year-old carrots

How might land in Vermont be used for a different purpose, other than holding all of our trash?

Ask students what they might do with a piece of land. List your preferences, for instance: planting an apple orchard, creating a skate park, or conserving the space for wildlife.

One way to produce less trash is to compost.
What is compost? Compost is nature's way of recycling. It is the process of converting leftover food scraps and other *organic* materials into healthy soils that can be used to grow new crops.

We hear the word *organic* all the time these days. It's used in the grocery store to describe products grown or raised without synthetic chemicals, pesticides or fertilizers. This definition of *organic* simply means anything that was alive or part of something living. Anything *organic* can decompose into soil under the right conditions. Compost uses all 3 R's because it has the ability to :

Reduce the amount of stuff that goes in the garbage.
Reuse food scraps as fertilizer.
Recycle nutrients back into the earth.

Why is compost important? We need healthy soils to grow healthy food, pasture for livestock, prevent erosion, and for hearty green spaces like parks and gardens.

What did you have for breakfast? Could your leftovers be composted? How about leaves and grass from your backyard? How is your leftover breakfast and yard waste alike? All of these things are related because they're *organic*. Could a plastic fork be composted? How about a soup can? Why not?

The average American wastes over 1/2 lb of food per day! How can you waste less food? Do you take only what you can eat for lunch? When you can't avoid leftovers, like an apple core or an orange peel, you can helping feed the rot cycle when you chose to compost.

How does food waste change into compost? It's not magic: there are real organisms that make compost happen, it takes time, and requires water and air.

Show visual: The FBIs & Rot Cycle

Have a student volunteer describe what is occurring in the rot cycle. There is no waste in a cycle; one person's leftovers becomes fuel for the compost process. Discuss the secret, decomposing agents that often go undetected underground: the FBIs. *Not* the Federal Bureau of Investigation, but...

Fungus – examples are mushrooms, molds, mildews, yeast. Fungus live by decomposing and absorbing the organic material they live on. They provide moisture for the compost process.

Bacteria –not all bacteria are bad. Some essential to life, including bacteria in our stomachs that help us digest food. This group is made up of very tiny microbes, but BIG decomposers. You cannot see them, but you know they're present because they produce heat and *steam*. This steam accelerates the thermaphillic, or heat-loving, composting process.

Invertebrates – animals without backbones. We are vertebrates. Worms are especially good invertebrate decomposers. They can eat half of their own weight in food daily.

Scavengers – raccoons, seagulls, rats, etc. Not desirable in compost bins. Keep out by having an enclosed bin, not composting meat, dairy, fats, and by covering food with leaves or shredded newspaper.

Show **soil vs. compost** samples: What do you notice? Color, texture. Soil made from rocks weathered into sand, silt, and clay. Compost comes from organic stuff (used to be alive) such as food scraps, leaves, manure, etc.- it's called humus (pronounced hew-mus). This is the way nature recycles.

Show samples of soil vs. compost & discuss benefits.
Finished compost is great for use in gardens, potted plants, lawn. It's like fertilizer, but better because it's alive!

1) Adds nutrients to the soil, like a vitamin tablet
2) Makes soil texture nice and loose for roots to grow in
3) Increases soil's ability to hold water

Build worm bin for your classroom

Use an aerated container no more than 16" deep. If you were a worm, would you want to live in here? What do you need to make this a good habitat (home)?

- Damp soil and leaves create a healthy environment by providing surfaces for fungus and bacteria to live
- Water should make the top layer of shredded newspaper damp but not create standing water in bottom
- Dry, shredded newspaper helps absorb water and prevents soil from getting muddy. It also acts as a bedding material that the worms will eat through. You'll need to add a layer each time food scraps are added.
- Food: remember only half a black bucket of cut up fruit and vegetable scraps per week, and always cover w/ newspaper to prevent odors and fruit flies.
- Air (holes drilled in top to allow aeration)
- Worms: these are warm weather worms; they are different from earth worms and cannot survive in Vermont's cold weather. Before handling the worms gently wipe the salt from the palm of your hands because worms breathe through their skin; they don't have lungs like us. The salt from your hands can hurt their skin and ability to breathe.

Assembly:

Add 3" wet leaves and a handful of starter soil- use enough water to make the soil wet without turning it into mud. Worms use the soil to chew the food because they don't have teeth. *Give each student a wet paper towel and have them wipe their hands off. The salt on their hands can hurt the skin of the worms.* Students have the choice to handle the worms or not. Like all living creatures, worms deserve respect. Students should not throw, drop or pinch the worms. When they are finished observing, they can add the worms to the bin and welcome them to their new home.

Once all the worms are in the bin, cut up some food and add that to the surface. Add the shredded newspaper and a single sheet of damp newspaper on top. The paper will act as moisture control; if you see that it's dry then add water with a spray bottle. If it's wet, remove the cover of the bin for the day and let it dry out. If the bin is under the lights, the worms will not crawl out.

Feed the worms one cup of food every week… no more! If the worms haven't eaten all of it, feed them less the next week. Remove any food that molds. When you feed the worms, bury the food completely in an area of the bin where the worms seem to be congregating. Spray the shredded paper with water if necessary to keep the worms moist. Remember: worms breathe through their skin and they a damp environment or they will dry out and suffocate.

Reminders: If it gets too wet, add newspaper. Too dry, add water.
1 cup of cut fruit and veggie scraps per week to start. Adjust as needed.
Always cover food scraps with newspaper.

Under what conditions do redworms* **T- H - R - I - V - E** ?

T - ***Temperature*** – optimum is between 68° - 77°F
At 40° F the worms are less active, they can survive in the mid 30's for short periods. Worms become stressed at 85° F.

Feeding too much can cause bin to heat up and kill worms or cause them to escape!

H - ***H_20 - Moisture*** – 75%-85% moisture
Bedding should have the same moisture as a wrung out sponge.
Squeeze a handful of bedding, 1 or 2 drops should be released.
Drainage is extremely important in any vermicomposting system.

R - ***Recycle organic material only*** (anything that was once alive and is now dead)

Fruits	Cereals	Pastas
Egg shells	Coffee & Filters	Tea bags
Paper – shredded	Limited citrus	Beans
Breads	Aged manures	Vegetables

No dairy, fish or meat products.
Worms will eat it but these items can smell bad and attract pests.

Oily or salty foods can harm worms.

Recycle pet waste in a separate system.

➔ ***Add more food only when you see that the worms are completely involved in the food that is already there.*** ←

Feed in layers no thicker than 1 ¼ inch to avoid heating up. DO NOT OVERFEED!!

I - ***Invertebrates & Microbes*** found in a healthy system

Beneficial creatures that are harmless to you, your worms, and your plants:

Enchytraeids or pot worms	Flies and their larvae	Fungi
Bacteria (Aerobic)	Spiders & Mites	Springtails
Gnats and their larvae	Millipedes	Protozoa
Molds (beware of allergies to spores)		Beneficial Nematodes

Invertebrates and Microorganisms to avoid:
Anaerobic Bacteria – characterized by a bad smell, caused by too much moisture & or overfeeding (lack of oxygen) - aerate bedding ASAP

Ants - bedding too dry	Centipedes - carefully remove
Beetles – remove	Planarians or flat worms - remove & destroy

V - **Ventilation** – All the creatures in the system need AIR and lots of it!

E - **Environment** - pH 5.5 is preferred
Worms tolerate a range from pH 4 to pH 9.
The worms are sensitive to light so keep it dark.
Good bedding can be any combination of aged manures, shredded paper products, coir (coconut fiber), decomposing leaves, straw, wood chips, peat moss, a handful of soil to seed bin with microorganisms, etc. Worms can eat about 3 times their weight a week.
Redworms mature in 8 weeks & double in biomass every 3-4 months under ideal conditions
1 mature worm could produce 96 worms in 6 months (2 cocoons X 24 weeks X 2 hatchlings)

The more you know about worms and what they need,
the more you'll enjoy the vermicomposting experience.

Find worms, worm bins, books and lots of information at www.happydranch.com.

Eisenia fetida & E. hortensis* **Courtesy of Happy D Ranch **www.happydranch.com**

Why do redworms* **C - R - A - W - L** off ?

C - ***Change*** *of habitat*

If worms have been raised with a particular feedstock or bedding material and are then transferred to a system that uses completely different material and feed, the worms may crawl away from the new, shockingly different habitat.

A few good questions to ask the grower that you purchase worms from are :
What species of worm they raise, what bedding are they raised in, and what is their primary feedstock? It would be best if a buyer gets worms that are raised in a similar environment that they intend to use.

To keep worms in the bin so they'll adapt to a new environment, keep them in a place where you can leave a light on. Since worms are sensitive to light, they'll stay in the bin to avoid the light. It is imperative that the light stay on at night or you may wake up to a mass vermicide.

If you've had your system in operation for a while and the worms crawl off, perhaps you've changed their habitat by adding too much salty, oily or acidic material. Some people have used lime to adjust the pH and caused more harm than good. Crushed eggshells work very well to help balance your system and provide grit for the worm's digestion.

A word of caution... Be aware that there are some growers that call their worms "redworms" but are actually the "India Blue" (*Perionyx excavatus*), which is a thinner worm that is red but has a translucent blue sheen to it when observed in bright sunlight. The "India Blue" worm is less tolerant of temperature and moisture variations and is prone to migrate out of bins en-masse for no apparent reason. The P.E. is a worm you don't want for lots of reasons!! Stick with the *Eisenia fetida* and you and they will be happy campers.

R - ***Rain***

Just before and during a thunderstorm or any low-pressure system, it is natural for worms to crawl up, down and around a plastic worm bin. Worms are great natural barometers.

A - ***Absence of Air***

Overfeeding, too much moisture, poor bin design, or not enough ventilation can severely reduce the amount of air available to the worms. Anaerobic bacteria live in the absence of oxygen. If there is a foul smell in the bin it may indicate the presence of large numbers of anaerobic bacteria. If this occurs, the environment may lack enough oxygen for the worms to breathe and they may crawl outside of the bin seeking air or die. Be sure there are enough ventilation and drainage holes in your system and aerate the bedding promptly if a bad smell occurs.

W - ***Water*** *- too much or too little*

Too much water can cause the bedding to become so compacted that there aren't enough pockets of air for the worms to breathe. Putting wood chips, strips of cardboard, straw, etc., within the bedding can ensure that there is enough air throughout their environment.

Not enough water can cause your worms to die or try to escape. Lack of water will cause your castings to dry out and harden. The population of important microorganisms is lower when the castings dry out, thus diminishing the castings' effectiveness. In order to produce the most useful castings, be sure to manage your moisture carefully. Bedding should have the moisture of a wrung out sponge.

Don't pour water through your vermicomposting system to make worm tea.
To make worm tea: take a cup of well processed castings, soak overnight in a gallon of water, shake to aerate, and use within 12 to 24 hrs.

L - ***Lack of food***

If you don't feed your worms regularly they may go looking elsewhere for needed sustenance or starve. Feed in thin layers, no thicker than 1¼ inch, to avoid heating up of waste. Bury the food in the bedding or top feed and cover with shredded moist newspaper. Worms can eat 3 times their weight a week.

But please - **DO NOT OVER FEED !!!**

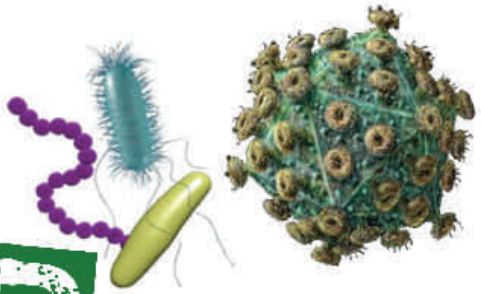
William Laurens Rathje's 10 year-old, landfill carrots

W. Rathje is an American archaeologist with a PhD in anthropology from Harvard University. He was the longtime director of the Garbage Project which studied trends in discards by field research in Tucson, AZ, and in landfills elsewhere.

Rathje's research uncovered some misconceptions about landfills. In particular, it was revealed that *the rate of natural biodegradation is far slower than had been assumed.*

In natural systems, anything organic, or derived from something that was alive, is capable of decomposing. Something as natural as a carrot cannot decompose at a normal rate in a landfill because it is buried by trash. Oxygen, water, sunlight, and organisms are all limited in a landfill. If composted, the carrot will rot and turn into healthy soil between 3 months to a year!

FUNGUS



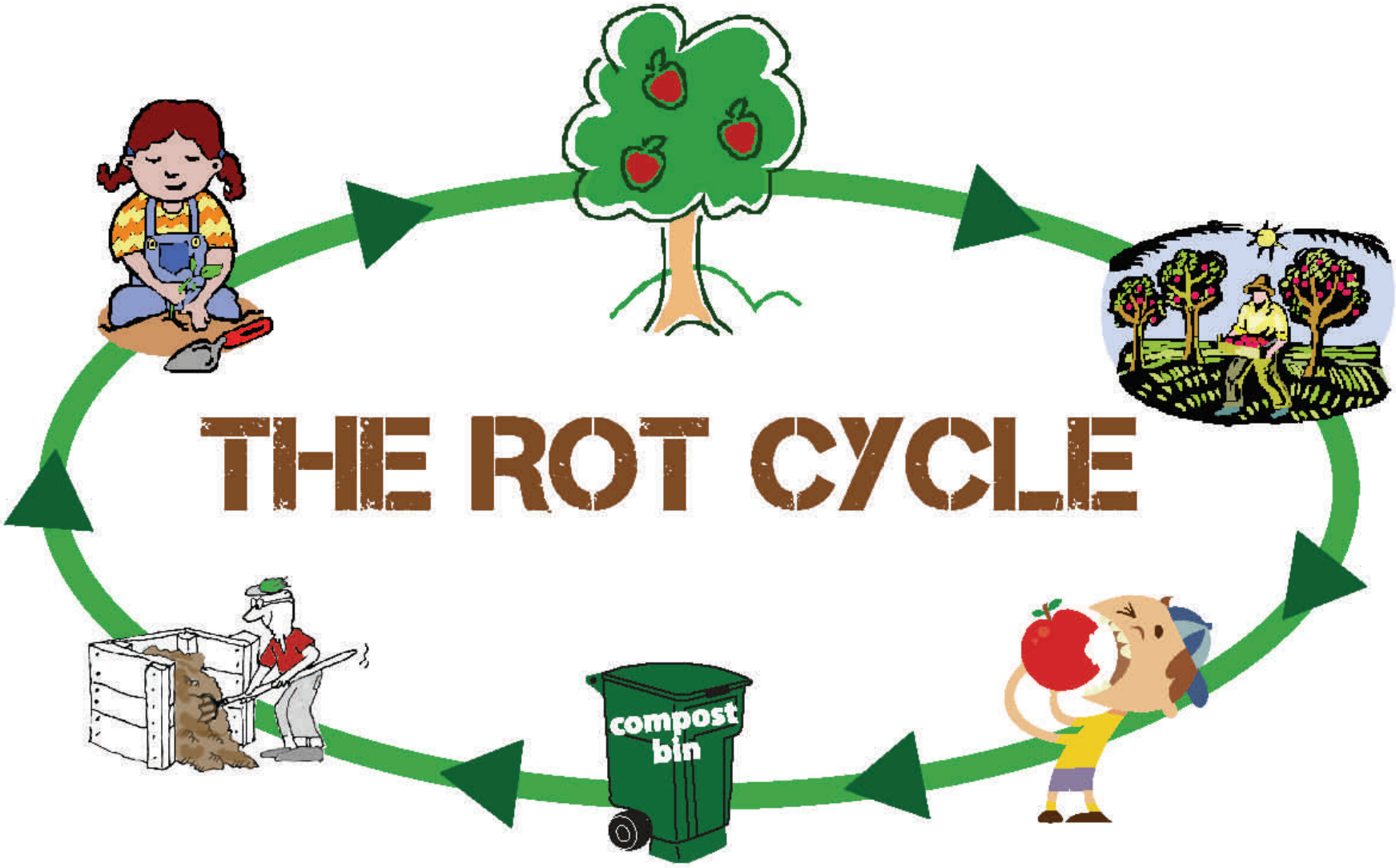
BACTERIA

PSSSSST!

THE FBI'S ARE THE DECOMPOSING AGENTS.

INVERTEBRATES

SCAVENGERS


THE ROT CYCLE
compost bin