BUILDING A VERMICOMPOSTER

ELEMENTARY/MIDDLE YEARS

Learning for a Sustainable Future

LSF

ACTION TOOLKIT

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OVERVIEW

Are you interested in becoming master builders of a novel, garbage-guzzling machine that eats, breathes and wriggles? Vermicomposters use Red Wiggler worms to transform organic waste that is usually sent to the dump into a natural fertilizer for our gardens. Vermicomposting can be done all year round because it is done indoors. Worms allow a greater range of waste to be broken down more rapidly than in a regular composter and require very little maintenance because the worms mix the compost themselves. The end product is a rich organic fertilizer that contains beneficial bacteria, fungi and micro-organisms that normally coexist in a healthy, balanced ecosystem.

SUSTAINABLE DEVELOPMENT GOALS: *Building a Vermicomposter connects to the following UN SDGs*

To have your class reflect on this action toolkit and their connections to the SDGs, read Part A: SDG Connections

LEARNING OBJECTIVES:

- Create an alternative method of disposing of organic waste.
- Consider our waste disposal process from a systems perspective. Assess the personal, social, economic, and environmental impacts of the system.
- Identify biotic and abiotic elements of a vermicomposter ecosystem, describe the interactions between them, and analyze the composter from a systems perspective.

AGE GROUP: Elementary/Middle School

CURRICULUM CONNECTIONS: Mathematics, Science and Language Arts.
For specific province/territory/region and grade links, visit the Building a Vermicomposting resource review on R4R.

** Please help reduce the amount of paper we use by only printing off double-sided and necessary pages. Model sustainable behaviour for your students; remember, your actions speak louder than words! If you wish to access the student worksheets from this action toolkit, you can access them here. **

WHY IS THIS PROJECT IMPORTANT?

- Helps to conserve space and extend the time that a landfill can be used. This helps with the garbage crisis as landfills are full, and new sites are rare and expensive.
- Reduces the amount of waste that needs to be trucked either to a landfill or to a composting site. This means less air pollution from trucks, which is good news for all of us. An estimated 15,300 people die prematurely each year in Canada as a result of air pollution, resulting in tremendous social and economic costs.
- Reduces the amount of leachate produced in landfills. Leachate is the polluted liquid that drains from a landfill, often created by rainwater runoff. Leachate can contaminate both soil and our ground and surface water. This is bad for humans, animals and plants because we all drink and use this water daily.
- Reduces the amount of carbon dioxide and methane produced in a landfill, which is caused when a landfill contains large amounts of organic material. Methane is a potent greenhouse gas.
- Creates fewer pathogens and less odour than the anaerobic decomposition process used in landfills.
- Returns badly needed organic matter to the soil. Worm castings are very rich in nutrients. This provides food for micro-organisms.
- Produces one of nature's best mulches and soil amendments that can be used instead of commercial fertilizers. Using compost improves soil structure, texture, aeration, and it increases the soil's water-holding capacity. Compost loosens clay soils and helps sandy soils retain water. Adding compost improves soil fertility and stimulates healthy root development in plants.
- Creates cheaper, high-quality compost than the fertilizers at your local garden store!

PART A: SDG CONNECTIONS

Connecting the SDGs to Learning

The United Nations 17 Sustainable Development Goals (SDGs), which were adopted by all United Nations Member States in 2015, provide a holistic understanding of the world's most pressing challenges, linking the social, environmental, and economic dimensions of sustainable development. They act as an urgent call to action for all countries and provide a shared framework using indicators and targets through which we can measure action and progress.

For this reason, it is key for students to understand the 17 SDGs and how their actions and climate initiatives can connect to these Goals. This activity will give students an opportunity to apply the knowledge they gained throughout this action toolkit and think critically about the SDGs.

1. As a class or in small groups, have the students explore the SDGs through the UN's SDG website and the Global Goals webpage. Students type out or write on a piece of GOOS paper which SDGs they think could be connected to vermicomposting and why. Alternatively, if your class has an SDG poster or if you would like to create one, students can write down their vermicomposting connections on sticky notes and map them across the poster.

2. Using an active learning strategy, such as a Talking Circle or Two Stray, One Stay, have the students engage with one another and explore the answers that they wrote down during the second step of this activity. You can find more active learning strategies that might come in handy in Appendix G: Assessment Opportunities or LSF's Active Learning Strategy Bank!

SDG Connections: Examples

As you go through this action toolkit, your students may find many connections with the SDGs. Some possible vermicomposting connections that your students could make:

By turning organics into nutrient-filled fertilizer, vermicomposting offers a sustainable form of agriculture that maintains ecosystems and improves soil quality which can lead to possible solutions for sustainable food production.

Cities can implement vermicomposting as a part of their waste management process to help create more sustainable and clean places to live.

Like other forms of composting, vermicomposting is widely regarded as a clean, responsible, and sustainable method to manage organic waste, as opposed to methane-producing landfills.

Unlike other forms of waste removal, vermicomposting is clean and sustainable. Using this method as your daily strategy for personal organic waste removal is a much better option than other non-sustainable methods.

By creating fertile and nutrient-rich soil, vermicomposting promotes a strong ecosystem within the compost combating loss of biodiversity and land degradation.

While these examples act as a starting point, give your students time to ask questions and discover the SDG connections for themselves.

If your students are not yet familiar with the UN Sustainable Development Goals, as a Minds On activity, allow some time for them to get acquainted by watching the video The World's Largest Lesson.

PART B: GETTING READY – ASKING WHY

Activity B1: Where Does it Go?

Time	Description	Materials
1 - 2 hours	Students will draw a map to examine where their waste goes when it leaves their home and the economic, social, and environmental consequences of their waste along the way	☐ Large Good on one Side (GOOS) pieces of paper or bristol board ☐ Markers ☐ Copies of student worksheet for each group

In groups or individually, ask students to choose one of the following items from the materials below. Each group should select an item that no other group has selected.

Materials	
Orange peel	Tin can
Plastic bottle	Aluminum can
Leather shoes	Diaper
Nylon sport shirt	Plastic shopping bag
AA battery	

Have students draw a 'Linear flowchart' to show what happens to this item (or any materials related to the breakdown of this item) when it ***leaves*** their home/school.

Students should draw an arrow from home to the next step. Then, a new arrow from that step to the next step, etc. Encourage the students to draw as many arrows as possible (i.e. to keep the chain going). Some students may see a cycle.

For example, the waste goes to the curb, then to a truck, then to a big trucking depot and then to a landfill. The dirty water that leaves the landfill goes to a stream.

The students' drawings may start as a conventional map and evolve into a mindmap. Check out this link for some Mind Mapping Resources!

Consider asking one group to do this assignment on a large piece of mural paper to post and use to consolidate all groups' ideas at the end. If the technology is available, creating a slide deck on Google Slides can be helpful so students can work independently or share a laptop to create a digital mind map using their own slide.

1. At each different place on the map, ask students to draw and/or describe the following in three different colours:
    - Ecological impacts (positive and negative)
    - Social [health, justice, beauty, etc.] impacts (positive and negative)
    - Economic impacts (positive and negative)
2. Students should consider humans and non-humans, nearby and far away, now and in the future.
3. Provide a copy of the information on the Where Does it Go? worksheet to each group. Ask the students to read the information and then reflect on what they have learned from their map.
4. Ask each group to share one important concept captured on their map. Have one group compile this information on the large format map (see step 1).
5. Individually, ask students to write and/or draw reflections to the following questions:
    a) We discussed a number of the negative consequences related to sending garbage to landfills. Which consequence (if any) concerns you the most? Why? If none of the consequences concern you, why not?
    b) Do you think you personally put a lot or a little bit into the landfill in your community?
    c) Do you want to reduce the amount of stuff you put into the landfill? Why or why not?
    d) What could people your age do if they wanted to reduce the amount of garbage they send to landfills? List as many ideas as possible.

💡 Student Information Sheet 💡

Where Does it Go?

- Landfills are smelly.
- Purchasing land for a landfill is expensive.
- It is becoming increasingly difficult to find a place for a landfill (no matter how much we are willing to pay). Many people oppose having them in their communities.
- Landfill owners charge fees to dump garbage in a landfill. Generally, these fees are paid for by the taxes homeowners pay.
- If you live in a city or suburb, garbage often needs to be trucked long distances to the closest landfill. An estimated 15,300 people die each year in Canada as a result of air pollution. Not only is this sad, but it also costs a lot of money to look after sick people. In Canada, we all pay for health care through our taxes.
- When it rains, the rainwater runs over the garbage in a landfill and becomes polluted by all of the garbage in the landfill. When it drains out of the bottom of the landfill, the water is called leachate. The leachate is acidic and contains dissolved metals and other toxins. It runs into streams and rivers—the water system that all of us share (and drink from).
- Landfills give off methane and carbon dioxide. Methane is 25 times more powerful at contributing to global climate change than carbon dioxide is. Methane emissions from Canadian landfills currently account for 20% of national methane emissions.
- Climate change is a concern for many reasons. For example:
    - It causes more extreme weather events for all of us. This includes: more severe droughts, more severe ice storms, wind storms, etc
    - It causes habitat changes that are difficult and sometimes impossible for other species to survive in. For example, reductions in the amount of ice in the Arctic will make it difficult for polar bears to hunt seals. Many polar bears are going hungry. Many people are concerned that polar bears could become extinct.

- New diseases and pests are moving into Canada. For example, the incidence of Mountain Pine Beetle infestations, West Nile virus, Zika, and Lyme Disease are all made worse by climate change.

Activity B2: Designing Mini Composters

Time	Description	Materials
2 hours	Students will design their own controlled experiment to understand and study what factors affect decomposition	☐ 2 two-litre bottles ☐ potting soil ☐ soil from outside ☐ carrot and apple peels (not citrus) ☐ packing tape

1. As a group, guide the class into coming up with a definition for 'decompose'. Discuss what causes things to decompose (see Appendix A for help).
2. Ask students to guess how long it would take each of the following items to decompose in a landfill site. After each guess, reveal the estimate written below.

- Banana peel, 2 – 10 days
- Cotton rags, 1 – 5 months
- Sugarcane Pulp Products, 30 - 60 days
- Paper, 2 – 5 months
- Rope, 3 – 14 months
- Orange peels, 6 months
- Wool socks, 1 – 5 years
- Cigarette filters, 1 – 12 years
- Tetra packs (plastic composite milk cartons), 5 years
- Plastic bags, 10 – 20 years
- Leather shoes, 25 – 40 years
- Nylon fabric, 30 – 40 years
- Plastic six-pack holder rings, 450 years
- Diapers and sanitary napkins, 500 – 800 years
- Tin cans, 50 - 100 years

- Aluminum cans, 80 - 100 years
- Plastic Bottles, 450 years
- Styrofoam cup, 500 years

3. Review basic parameters of science experiment design, like asking testable questions.

4. Tell students that they will be building basic composters out of the materials listed above. In groups, ask students to create an experiment in which they can find out: "What conditions make a compost bin most efficient?"

   If your students need more direction, before the class, check out these resources on 'pop bottle composters': Experiment with Composting and Learn About Food Waste and Pop Bottle Composter

   Tell students that one of the variables that must be kept constant is the size, shape, or type of material that they will try to decompose. All the other factors must remain the same in order to conduct a proper test. Be sure to address the difference between dependent and independent variables.

5. Some example experiments are provided below:

   - Poking drain holes in one container and no drain holes in another.
   - Fitting a lid on one container and no lid on the other.
   - Putting more soil than organic trash in one container and less soil than organic trash in the other.
   - Placing soil and organic trash in one container and no soil and organic trash in the other.
   - Mixing the soil and organic trash daily (or every two or three days) in one container and not mixing the trash in the other.
   - Using one green beverage bottle and one clear one.
   - Placing soil from the garden in one container and sterilized potting soil in the other.
   - Using very wet material in one container and damp material in the other.
   - Using very dry material in one container and damp material in the other.

6. Have groups share the problem or question that they will be investigating with the class. Duplication of experiments should be allowed for verification and inspiration.

7. Before they begin, ask students to generate a list of all the variables that must be held constant (control variables) in their particular experiment and all of the variables that can change (independent variable). These should be verified by the teacher before the students begin.
8. Observations should be made once a week for at least 3 weeks. Check out steps 8 and 9 of this bottle composting experiment for a sample observation chart!
9. Ask students to analyze and share their results with each other.
10. After sharing results as a class, have students respond to the following reflection questions individually:
    - What factors seemed to affect the rate of decomposition?
    - What do you think the conditions are like in a landfill?
    - What things do you think would decompose well in a landfill?
    - What things do you think would not decompose well in a landfill?
    - What things do you think would decompose well in a compost bin?
    - What things do you think would not decompose well in a compost bin?
    - What implications do our findings have for how we deal with our waste?

PART C: BUILDING COMPOSTERS DAY

TO DO LIST FOR TEACHERS (BEFORE BUILDING DAY)

- Tell teachers in your school that your class will be building vermicomposters. Other teachers may wish to choose 1-2 students who will take part in the activities and share the knowledge with their own class.
- Research and create a clear poster of what waste can be recycled and composted in your school and what goes into the garbage stream.
- Divide students into teams (ideally 4 students per team) based on the number of vermicomposters your school would like to build. Maintaining 1-2 vermicomposters is ideal for one classroom.
- Please stress the importance of the commitment to take care of the worms long after the building day. Have a class discussion on what it means to care for the worms.

***EACH vermicomposter will require:**

Materials	
1 Rubbermaid bin & lid (other brands that we have tried tend to crack) - minimum size 61 x 48 x 22cm (24 x 18.5 x 14 inches)	Newspapers (at least 4) - Coloured is okay but not glossy
500 ml of garden soil - Not indoor potting soil as it has been sterilized	Red Wiggler worms - the most economical place to buy these are online, you can check out Mother Worms or Northern Rockies Vermicompost you might find them at your local garden store or Canadian Tire)
A tray - as long and wide as the bin	2 wooden splints
4 - 6 eggshells	1-2 litres of water
Ideally: power drill or old fashioned	Good on one Side (G.O.O.S) paper and

hand drill (a hammer, nails and a wood block may work but it is sometimes frustrating)	markers
String	Re-used yogurt/sour cream container - for excess water & handing out soil
Gloves	Wood splints
Tray	Wood block
Sensitive scales [not bathroom scales]	Clean up materials
A copy of Appendix B	
Notebooks/journals for sketching/reflection	

- Collect clean up materials (mops, rags, broom, newspapers, large recycling bin, large garbage bins, soapy water) & all other materials (see list above)
- Ensure that students have notebooks/journals available for sketching and reflection.

Timing consideration: Students need to save and use the waste from their lunches for *Activity C2*.

SUGGESTED TIMETABLE FOR VERMICOMPOSTER BUILDING DAY:

- Introduction: (10 min.)
- Activity C1: Trivia Game (45 min.)
- Activity C2: Waste Audit - What's in Your Waste? (120 min.)
- Activity C3: Build Vermicomposters (45 min.)
- Activity C4: Get to Know Your Worms Lab (20 min.)
- Activity C5: "So What?" Activity (40 min.) **Save the charts from this activity** for a few months, as they will be needed for follow-up Activity D6.
- Clean-up
- Wrap-Up (10 min.)

Activity C1: Trivia Game (with whole class)

45 minutes - Play the trivia game to find out how much students know or need to learn about vermicomposting.

INSTRUCTIONS:

Decide how groups will answer, either by raising their hands or creating a “buzz-in”. Each group will be asked a question in turn. They have the first chance to answer.

Group A will be asked the first question. If Group A confers with all team members, the team will score 100 points regardless of whether or not the response is correct.

Teams will be allowed 30 seconds to confer. If Group A gets the correct answer, the team scores 100 points (in addition to their collaboration points). If Group A answers incorrectly, any other group can answer (students must hit their buzzers—no yelling!) to receive 100 points for a correct answer (not eligible for collaboration points).

Question 2 will be asked to Group B, and so forth.

After a team responds correctly, if necessary, READ THE FULL ANSWER TO THE GROUP SO THAT THEY BENEFIT FROM ALL OF THE TRIVIA.

NOTE: Use your judgment as to how close an answer needs to be to be right, given students’ age, level, language ability, etc. However, be careful not to let an incorrect answer be accepted as true.

TRIVIA QUESTIONS

Bank of Questions

Ask each team at least 1 question (more if time permits). By the end of the game, each team should have been asked the same number of questions. Make sure you ask a balance of questions by selecting questions from each category. To create engaging and interactive trivia, consider using an online platform like Kahoot.

Worm Facts

Q1. Do worms have eyes & ears?	A1. No.
Q2. Do worms have bones?	A2. Worms have no bones. Their bodies are made up of hundreds of small rings called 'segments'. They move by manipulating each segment with tiny circular muscles beneath their skin. They secrete a slippery fluid that lets them move easily through the earth.
Q3. How many hearts does a worm have?	A3. Worms have 5 hearts.
Q4. How much of its body weight can a worm eat each day?	A4. A worm can eat ½ its body weight in food each day. 1 pound of these busy little invertebrates can convert three to four pounds of food waste per week into quality vermicompost.
Q5. What sex are worms?	A5. Each worm is both male and female (hermaphrodite).
Q6. Does cutting an earthworm into two make two worms?	A6. No. If an earthworm is cut in two, it never makes two worms. If a tail is cut off it grows a new one, but if it is cut anywhere between its head and clitellum, it dies.
Q7. Do worms like the light?	A7. No. They are very sensitive to light. They can sense light and darkness through their skin. They avoid direct light.
Q8. How do worms breathe?	A8. They breathe through their skin. They have no lungs to breathe through, and their skin needs to be moist for the worms to breathe.
Q9. What can worms eat?	A9. They can eat any organic waste. However, you only want to feed bread, grains, fruits and veggies. Stay away from meat, oils & dairy as they attract critters. Stay away from citrus fruits as they make the bin very acidic.
Q10. Name 5 things worms need to live.	A10. Worms need: food, darkness, warmth, moisture, air and bedding.

Composting Basics

Q11. What is composting?	A11. Composting is Nature's way of recycling and the end result of the natural process of decomposition. Any plant material, if left long enough, will decompose into compost with the help of worms, fungi, bacteria and other soil microorganisms. The compost then provides nutrients to help new things grow.
Q12. How do worms make compost?	A12. Red wigglers eat your organic waste and leave behind fertile compost when they poop.
Q13. Name 1 advantage and 1 disadvantage of composting.	A13. Advantages: ● It's good for the soil and can be used instead of store-bought fertilizers. ● It's cheap. It can be made without spending much money. ● It reduces the amount of waste we send to landfills. Disadvantages: ● It might smell if not taken care of properly. ● Some people are scared of worms.
Q14. Why add compost to your soil?	A14. Using compost: ● The organic matter in compost provides food for microorganisms, which keeps the soil in a healthy, balanced condition. ● Produces nitrogen, potassium and phosphorus naturally, by feeding microorganisms; therefore, no other soil amendments (like store-bought fertilizer) are needed. ● Provides nutrients that plants need to live.
Q15. Where does all the waste you throw into the garbage go?	A15. It goes to a landfill. ● Humans are the only known species to produce things (e.g., plastics) that cannot be reabsorbed by natural cycles.
Q16. Why are we doing this project?	A16. We are doing this: ● To recycle our organic waste, and turn it into something useful, instead of throwing it out and sending it to the landfill. ● To reduce the amount of air and water pollution our class creates. ● To practice our science skills (e.g. designing an experiment, making observations, etc.) ● Because it's fun!

Environmental Perspectives

Q17. What is waste? Give a few examples.	A17. Waste is something that is left over or that is no longer needed. Examples: • Food wrappers • Banana peel • Materials when a building is demolished
Q18. Name 3 types of waste.	A18. Types of waste: (many answers are possible) • Biodegradable or organic • Recyclable • Garbage • Solid, Liquid, gaseous, radioactive • Industrial and commercial
Q19. List 2 ways waste affects plants.	A 19. • Waste can smother plants, removing their ability to get air and/or light. • Waste pollutes water, which plants need to live. • Organic waste is essential for plants as it provides them with the nutrients they need.
Q20. List 2 ways waste affects animals.	A 20. • Some waste creates a "buffet" for scavengers (e.g. bears and seagulls eat at landfills). • Animals can ingest, choke or become entangled in different types of waste. • Waste pollutes water, making it harmful for animals to drink, swim and live in or near. • Waste can damage other things that animals need to survive (e.g. other animals or plants).
Q21. What are 3 consequences of sending garbage to landfills?	A 21. Landfills: • Take waste away from our communities. • Emit methane, a potent greenhouse gas, into the atmosphere. • Pollute, as harmful chemicals are released into soil and water around the landfill. • Smell and look dirty. • Change the ecosystem for the plants and animals that live there. • Devalue the land for property nearby. • Create a mentality of "out of sight, out of mind," which gets some people 'off the hook' from thinking about their waste.

Q22. What are 3 advantages of composting organic waste?	A 22. Composting: • Decreases the amount of space needed in landfills. • Decreases the amount of waste transported to landfills, which decreases the amount of fuel spent on transportation. • Creates natural fertilizer.
Q23. Name 1 advantage and 1 disadvantage of using commercial fertilizer (chemicals added to soil to feed plants)	A 23. Advantages: • In the short-term, it can help plants grow. • It's easy to purchase (readily available). Disadvantages: • It doesn't provide all the nutrients plants need (it will return nitrogen, potassium and phosphorous but rarely other nutrients). • It's expensive. • It's not natural (it is adding chemicals that aren't in the soil). • Its production requires the burning of fossil fuels. • The chemicals in the fertilizers end up in our lakes and rivers and pollute the water we drink.

Social/Economic Perspectives

Q24. Who generates/ creates waste?	A24. Waste is generated by consumers, industries and businesses. Most of it is created by humans.
Q25. Name a few examples of how waste is generated.	A25. Waste is generated when (many answers are possible): • Someone eats chocolate and throws out the wrapper • A building is renovated
Q26. List 2 ways you could create less waste at school or at home.	A26. At school: (many answers are possible) • Bringing lunch to school in reusable containers and water in a reusable bottle. • Use only "good on one side" (G.O.O.S) paper At home: • Bring your own reusable bags when shopping. • Buy food in bulk, with less packaging. • Drink tap water instead of water from water bottles.
Q27. Who deals with waste?	A27. • In most communities in Canada, the municipal government deals with waste (i.e. garbage collection, recycling). The service is usually paid for through property taxes. • The government makes laws on how industries must deal with waste • Innovative companies/industries find ways to reduce and reuse waste • Individuals find other ways to deal with waste (i.e. reusing things, using second-hand stores, building their own composters, etc)

Q28. List 3 ways that your vermicomposter may affect your school.	A28. • People may become more aware of the waste they create. • People may develop a better understanding of worms. • People in the wider community may be inspired to reduce their waste (other classes, other schools, parents, friends, etc). • If people don't like it, they may tell others not to use it.
Q29. List 2 ways waste affects people.	A29. Waste • People have to deal with waste. People work to dispose of waste, manage landfills & other waste facilities, transport & collect waste. • People often don't want to live near a landfill, or waste disposal facility, as they are concerned about the smell and devaluation of property. • People are involved in finding ways to manage waste: re-use clothing stores, innovative packaging, zero-waste products...etc

Information for the worm facts is taken from Cathy's Crawly Composters

Activity C2: Waste Audit – What's in Your Waste?

Before Lunch

- Explain to students that you will be taking a look at the waste their group creates during the lunch hour.
- Students will be asked to collect their lunch waste and bring it back to class after lunch. "Waste" = anything & everything left over after they have finished eating, including items that can be composted, re-used and/or recycled.

After Lunch

- Have students go to their group and drop off their waste on a table covered with newspaper.
- Ask the group for their reactions to the amount of waste collected. What do they think? How do they feel?
- Before students get started, as a class, discuss:
    - What types of compostable items are probably good for worms to eat? (see Appendix C)
    - What types of food are probably not good for worms to eat (meat, dairy, highly processed foods, eg. Cheese Whiz).
- Have students work through the Waste Record Sheet.
- When finished, ask students what they think they can do to reduce their garbage from their lunch. Discuss creative lifestyle changes that can reduce the amount of garbage sent to landfills. Some examples include:
    - Bringing in a waste-free lunch to school, i.e. lunch packed in reusable containers rather than disposable packaging.
    - Using a refillable bottle instead of buying bottled water.
    - Bringing their own reusable grocery bag when shopping.
    - Shopping at stores that encourage less packaging, such as cooperatives, environmentally-friendly stores…etc.
    - When shopping, choose items in stores with less packaging.
    - Not buying take-out food from restaurants in disposable containers or bringing your own

💡 Student Information Sheet 💡
WASTE AUDIT LAB SHEET

1. Dump your group's lunch waste on your work area and create a list of all the waste on the Waste Record sheet under "item"

2. Discuss and record which items can be composted [C], recycled [R], Reused [RE] or those that have to go to the landfill as garbage [G]. Separate compost into: good for worms [CW] and not good for worms [CN].

Item	Where does it go?*
Chip Bag	**G**
Banana Peel	**CW**

3. Discuss: Are there any other options for the waste [G], i.e. could it have been given to someone else? Could it be reused in a meaningful/practical way?

4. Sort your waste into five separate piles: compostable and good for worms, compostable but not good for worms, recyclable, reusable, and garbage.




5. Weigh each pile and record the mass.

6. Calculate and record how much waste your group would collect in:
   - one week
   - one year

7. Discuss with your group:
   - What type of material/item did you throw out the most? Paper, plastic water bottles, plastic bags? Were there any surprises?

8. Clean-up: Dispose of each pile appropriately. If you don't have appropriate disposal (i.e. you don't have a green bin for compostable things that the worms cannot eat or you don't have a recycling bin) discuss solutions.

💡 Student Information Sheet 💡

WASTE RECORD SHEET

GROUP MEMBERS: _____

Item	Where does it go?*

* R = Recyclable, CW = Compostable and good for worms, CN=Compostable, but not good for worms, G = Garbage/Landfill, O=Other (eg. reuse)

💡 Student Information Sheet 💡

WASTE RECORD SHEET

Type of Waste	Total Mass in grams (for one day)	Estimate of amount for one week	Estimate of amount for one year
Recyclable			
Compostable and good for worms [CW]			
Compostable and not good for worms [CN]			
Garbage			
Total Waste			

Activity C3: Build a Vermicomposter

45 minutes

Student roles (you can have students rotate between roles):

- 1 hole maker
- 1 reader
- 2-3 newspaper shredders
- 2-3 soil and water adders

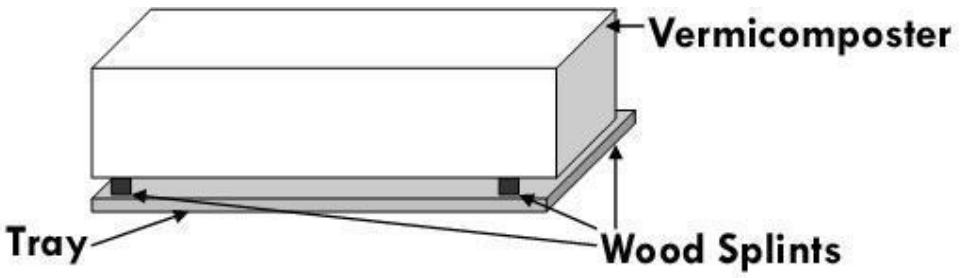
You may wish to model this process at the front of the room before students begin to make their own bins.

Read instructions below out loud as you proceed through the steps.

- **STEP 1**: Poke holes evenly in the bottom of the bin and on the lid of the bin. The holes should be at least 1-1.5cm in diameter (3 on each side, 2 on each end and 12 in lid). **CAUTION:** A drill is best for this activity. If it is not possible to do this, holes can be made with a hammer, nail and wood block. Place the wood block under the surface you plan to hammer on to protect the table.

- **STEP 2**: Tear newspaper into roughly even strips. Both black and white and coloured newspapers are fine, but do not use glossy sections. Fill the bin with the shredded newspaper; this is your dry bedding material.

- **STEP 3**: Place the vermicomposter on a tray just in case there is excess water. Place wood splints around the perimeter of the tray between the bin and tray to raise the bin and allow excess water to escape onto the tray. This also allows air to enter the bin from the holes on the bottom.



- **STEP 4**: Slowly add water to the bin until the newspaper bedding is the consistency of a wet sponge (approx. 1-2 litres). ADD WATER SLOWLY AND USE YOUR JUDGMENT. Mix contents. The worm bin should be ½ full of wet material. Add more dry material or water as required.
- **STEP 5**: Add 4 - 6 crushed eggshells and approximately 500mL of soil to the bin. The total amount of dry bedding and soil should be no more than 30cm deep.
- **STEP 6**: If liquid is dripping out of the bottom, this is an indication that the worm bin is too wet. Add dry bedding to absorb the excess liquid.
- **STEP 7:** Make holes along the bin and weave string to make 6 quadrants across the top of the bin. This will help you to determine where in the bin to place the food scraps. See Appendix B for instructions about feeding the worms.

WHEN YOU GET YOUR WORMS:

- **STEP 8**: Place your 250g of worms on top of the bedding under direct light. Their natural photophobic (avoiding light) tendencies will force the worms into the bedding to a darker, more comfortable environment.
- **STEP 9:** Allow the worms to settle into bedding for a day before feeding for the first time. See Appendix B to learn how to properly feed the worms. **DO NOT FEED WORMS ON BUILDING DAY!**
- **STEP 10**: Store the worm bin in a cool, preferably dark place. Worms can live in a 5 °C to 30 °C temperature range, but the ideal temperature would be between 15 °C and 21 °C. Do not allow the worm bin to freeze.
- **STEP 11**: Clean up!
- **MAKE SURE EVERYONE WASHES THEIR HANDS WELL AFTER THE BINS ARE FINISHED.**
- If time permits, begin discussing what the other classes adopting your vermicomposters need to know. What information should go in a "worm care" sheet? Start planning a presentation about worm care as well as feeding and harvesting instructions for the class that will be adopting your vermicomposter.

See the following Appendices for further information and instructions:

- Appendix B: Feeding The Worms
- Appendix D: Harvesting The Compost
- Appendix E: Maintenance Strategy Tips
- Appendix F: Troubleshooting Tips
- Appendix G: Assessment Opportunities

Activity C4: Getting To Know Your Worms

1. Dim the lights.
2. Discuss the humane treatment of worms. This should include:

- ***Ask*** students ***whether or not they think we*** should treat the worms humanely. Once they have had an opportunity to give their opinion, state that today their opportunity to handle the worms is dependent on their ability to handle them humanely. Brainstorm things to consider:
    - ***Keep worms close to the table so that if you drop them they will not have far to fall.***
- Don't tug them, shake them around or yank them. Explain that if a worm is cut in half, depending on where the cut is, it may not survive. Handle the worms very gently.
- Avoid dropping the worms.
- Keep the worms moist by placing them on a damp newspaper. Why? Explain to students that worms "breathe" through their wet skin, which must be kept moist.
- Keep the worms away from bright lights. Why? Explain that worms have sensory cells that are concentrated on their skin at the front end of their bodies. These sensory cells detect light. Red worms prefer darkness.
- Some students may have an aversion to touching worms. Explain that worms are very timid creatures and cannot bite since they have no teeth. They cannot hurt anyone in any way. Also, stress that worms are very important to us because they break down organic waste and convert it to rich compost. STUDENTS SHOULD BE ENCOURAGED BUT NOT FORCED TO TOUCH THE WORMS.

3. Each student should take 1-2 worms each and put them on the dampened piece of newspaper or paper towel.
4. Ask students if they know what kind of worms they are. Do they look similar to worms they've seen? Explain that these worms are Red Wigglers which are from the same family as the common earthworm, the ones you see on your driveway after it rains outside. However, Red Wigglers are suited for vermicomposting because they are accustomed to living in rich organic soils, reproduce the fastest and can eat 1/2 their own weight in a day.
5. Have the reader read the steps of the **Getting to Know Your Worms Lab Sheet**. Have a notetaker note students' observations and questions about worms. If students have their own journals/notebooks, have everyone answer questions and

sketch in their own notebooks. If you have access to computers, to save paper make copies of this form and have the students fill it out digitally

6. Collect the **Getting to Know Your Worms Lab Sheet** or **individual journals**.
7. Clean up!
8. Ask students for questions they have about worms and note them on the flipchart paper. Share the appendices in this guide with the students. For questions that are not answered in the appendices, check out Cathy's Composters or Worms at Work.

💡 Student Information Sheet 💡

GETTING TO KNOW YOUR WORMS LAB

Student Name(s):

Date:

Getting Ready

1. How should you handle/care for the worms?

2. Do you think you should care for the worms responsibly? Why or why not?

Worm Observations

1. What does it look like (colour, shape, length)?

2. How does it move?

3. Touch your worm and note your observations.

4. Estimate and record the length of each worm. (If you don't have a ruler, use your thumb width to measure).

5. Select 1 worm. Please draw your worm and label the following parts: Head, tail, prostomium (mouth), segments and clitellum (band).

ACTIVITY C5: "SO WHAT?" ACTIVITY

Time	Description	Materials
40 minutes	Students create a "So What" chart about their vermicomposters. The central picture of the chart depicts all the waste the class created at lunch time. Each line away from the central picture and each subsequent picture asks the question, "So what?"	• Good on one Side (G.O.O.S) chart paper • Crayons • Pencil Crayons • Old Magazines • Clip art • Glue sticks • Scissors

NOTE: Before students try the activity below, do an example together on the board using a different issue than the one the students will be using. For example, "People use a lot of plastic bags …" or "We purchase food that has been grown in far off places…". Try to include:

- positive and negative consequences
- health, justice, environmental, economical consequences
- consequences for all humans, other animals, and plants
- consequences for all of us near and far
- consequences that affect us now and in the future
- sketches as well as words

1. Creating a "So What?" Chart:

   a) In the center of a piece of chart paper, draw a square, circle and a squiggly shape. Inside that shape, draw a picture or use pictures from a magazine that represents the issue that bugs you. For example, draw a picture to represent: "We purchase food that has been grown in far-off places." NOTE: Trying to use pictures rather than words can help students to think about the issue in a more holistic way.

   b) Draw a line away from the picture. On top of the line, write the question, "So what?"

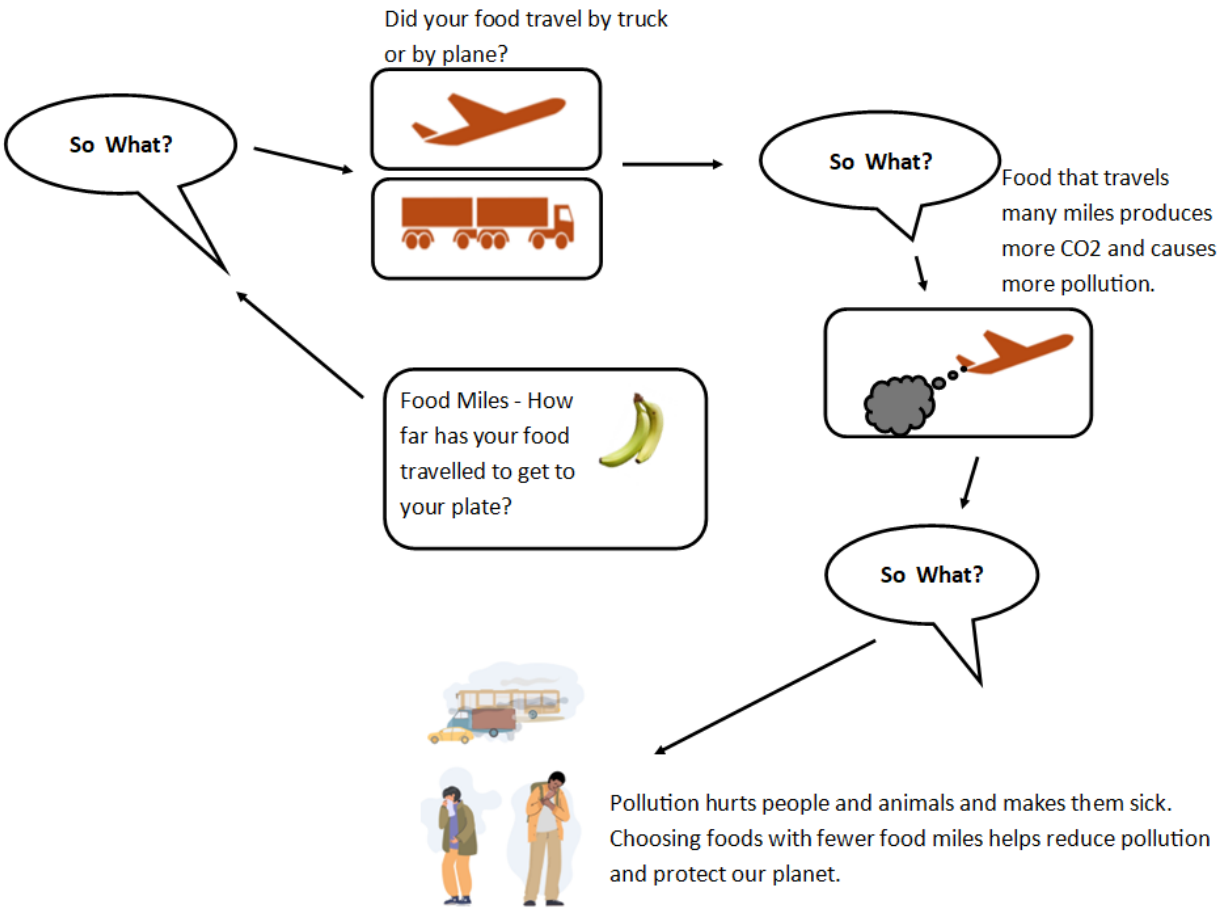
c) Connect the line to a new shape.

d) Inside the new shape, draw a picture of one of the consequences. For example, you could draw an airplane with a big gas tank since shipping food from far-off places takes a lot of fuel.

e) Draw a line away from the previous picture (e.g. of the airplane). On top of the line, write "So what?"

f) Connect the line to a new shape. In the shape, draw a picture of the consequences of the situation in the previous picture. For example, using a lot of fuel creates air pollution—draw a picture of exhaust coming out of planes and polluting the sky.

g) Continue with this one line of thinking until you no longer have an answer to the question "so what?", e.g. "air pollution hurts people and animals that I love."



h) Start a new spoke from the central picture with a new line of thinking, e.g. "Buying food from far away could mean that there are fewer farms in Canada." So what? "Farmers in Canada may not be able to do farm work." So what? "Some farmers may be sad that they cannot work at the type of job they love." OR "Buying food from far away may help to provide an income for people in financially poor countries"…

2. Have the students create their own "So What?" diagrams with the phrase, "Today we created _____grams of waste at lunch time".

3. Have the students post their diagrams around the room and invite everyone to look at everyone else's. Students should be given the opportunity to not post their diagrams.

4. Review all of the "So What?" posters with the whole class. Double check to ensure that all of the ideas from the Student Information sheet from Activity B1 have been captured.

NOTE: Save the "So what?" diagrams from this activity for a few months as they will be needed for Activity D6.

This activity was copied with permission from Teri Burgess' *Engaging Students in Sustainable Action Projects* Participant Guide

Activity C6: Compiling The Data

TIME: 10 minutes

As a large group:

1. Collect your group's Waste Record sheet and combine the weight results with those of other groups to form a class record of each type of waste. The students will need this data for Activity D5.
2. Compile any questions that students had about the activities and make a plan to pursue the answers.
3. Have students reflect on their journals as a self-assessment of the activities performed in this action toolkit.

PART D: ESSENTIAL FOLLOW-UP ACTIVITIES

Activity D1: Reflection Journals

Ask students to reflect on the following questions individually:

- Do you care about any of the consequences outlined in the "So What?" diagrams? If so, which ones do you care about? If not, why not?
- Will you collect the waste from your lunch that is appropriate for the worms? Why or why not?
- Is there anything else that you will do to reduce the amount of waste your lunch creates? If yes, what will it be? If not, why not?

Activity D2: Feed the Worms and Create A How To Feed Poster

Have each group that built a vermicomposter create an easy-to-read poster or a digital slides presentation highlighting the steps for feeding the worms (see Appendix B for detailed information about how to feed the worms).

Activity D3: Plan Your Maintenance Strategy

Discuss how your class will share the responsibilities for feeding, monitoring and caring for the worms. Make a plan and assign responsibilities. See Appendix E: Maintenance Strategy Tips and Appendix F: Troubleshooting Tips.

Activity D4: Teach Others How to Use the Vermicomposter

Divide students into as many groups as composters that you will be giving away. Have each group of students prepare a short educational presentation for each class that will receive a composter.

Activity D5: Graph the Results

As a graphing activity, have students individually create a pie or bar graph that shows the distribution of waste (recyclable, organic waste appropriate for worms, organic waste not appropriate for worms, and garbage) based on the class data from the Waste Audit in Activity B2.

Activity D6: Log the Distribution of Waste

Ask students to create a log that can be used to track the distribution of waste in your class. First, measure the mass of each type of waste every day for one week. Then, conduct the audit once a month for 4 months. At the end of the audit period, have students:

- Analyze the trend.
- Revisit their "So What?" charts from the Vermicomposter Building Day.
- Comment on the social, environmental and economic consequences of the trend.
- Estimate what the distribution of waste will look like in 3 months, in 1 year, in 5 years, etc.

PART E: EXTENDING THE LEARNING

E1: Examine The Composter's Ecosystem

The vermicomposter can be studied from a system perspective. Students can create a diagram to illustrate the inputs, outputs (biotic and abiotic) and activities of all of the elements of the system. Students can begin with what they know and then investigate the not-so-obvious living things in the vermicomposter. For each element of the system, students should indicate the role the element plays in the system.

E2: Make Personal Commitments To Waste Reduction

Now that your students have a better understanding of the consequences of sending waste to landfills, encourage your students to make a personal commitment to reducing the amount of waste that they send to the landfill. Brainstorm personal commitment options (examples are provided below). Choose a time period (e.g. two weeks) and ask students to try to honour their commitment and to keep a log of how the process goes. Provide students with an option to not make a personal commitment to change. These students could keep a log of all of the opportunities that they had to do something differently during the time period and an explanation of why they chose not to take the waste-reducing option each time. Examples are:

- Refuse plastic bags at stores
- Bring reusable bags (like a knapsack or tote bag) to stores
- Bring your own container when you purchase fast food
- Carefully use rechargeable batteries
- Use the library instead of purchasing books
- Share something with a friend or rent it instead of buying something new
- When you are offered something free/disposable—ask yourself—do you need it?
- When something at home breaks, see if you can have it repaired instead of buying something new.
- Consider purchasing used clothes from your local thrift shop.
- Check your local garage sales and buy used items from your neighbours.
- Create a vermicomposter for your home. When the worms at school have multiplied, you will be able to separate some to take home. Check out Appendix D to see how to do this properly.

Modelling any of these actions will be more powerful than any 'education campaign' you can create. Spread the word!

E3: Donating The Harvest

Harvest your compost using the instructions in Appendix D. Find a suitable location for your compost, i.e. donate your compost to a community garden or start your own garden with the class! If you donate the compost, ask for an opportunity to provide a presentation about vermicomposting.

E4: School-Wide Waste Audit

Conduct a waste audit for your entire school. See the following web links for help:

- *Ecoschool's Best Practices for Waste Management*
- *Ecoschool's Waste Audit Instructions*
- *Waste Reduction Week Canada – Resources*

E5: Reduce More Waste - Create Reusable Bags

Create and share or sell reusable bags.

Create posters for local grocery stores encouraging people to bring their own bags or for local malls encouraging people to reuse bags, or for local takeout restaurants encouraging people to bring their own reusable containers (try to use Good on one side (G.O.O.S) paper for posters).

APPENDIX A: BACKGROUND INFORMATION

The Nutrient Cycle and Decomposition: Decomposition is part of a cycle in which nutrients are recycled from dead to living things. A nutrient is any chemical element or compound that an organism must have in order to live, grow, or reproduce. Nutrients are continuously cycled from nonliving things (i.e.: air, water and soil) to living things (plants and animals) when they consume the nutrients found in the soils, and then back to nonliving things through death and decomposition. These processes are called nutrient cycles.

When any plant or animal dies, decomposers start to use the dead material as food. Decomposers are made up of fungi, bacteria and invertebrates - worms or insects, or "FBI". They break down dead plants and animals, turning them into nutrients for other beings living in the ecosystem. Without this necessary decomposition, the waste would end up piling up and put the natural circle of life of plants and animals at risk.

Organisms do not have to die to be part of the nutrient cycle. Waste excreted by animals is also high in nutrients. Decomposers release these nutrients into the soil.

If nothing decomposed, the soil would not get back the nutrients that plants use to grow. Without nutrients, plants could not live, and therefore, the animals that depend on the plants for food would not survive.

Natural cycles can completely convert organic waste into nutrients for living things. Humans create many items that cannot be reabsorbed by natural cycles, vermicomposting is one way we can preserve the natural decomposition cycle.

What is compost?

Compost is the end result of the natural process of decomposition. If left long enough, any plant materials will decompose into compost with the help of worms, fungi, bacteria and other soil microorganisms.

Why Make Compost? Using compost improves soil structure, texture, aeration and increases the soil's water-holding capacity. Compost loosens clay soils and helps sandy soils retain water. Adding compost returns nutrients to the soil to maintain its fertility and improve plant growth. The organic matter provided in compost provides food for

microorganisms, which keeps the soil in a healthy, balanced condition. Compost also slowly releases the natural fertilizer so it won't burn the plants like chemical fertilizers.

Why Red Wigglers? Red Wigglers (Eisenia foetida) are from the same family as the common earthworm or Night Crawlers (Lumbricus terrestris) you see on your driveway after it rains outside. However, Red Wigglers are better suited for vermicomposting because Red Wigglers prefer to eat on the go, whereas Night Crawlers like to draw food down into burrows (up to 6 feet deep) before ingesting. Therefore, because Red Wigglers feed just 6" - 12" below the surface, they are perfect for composting.

Are Red Wigglers invasive species? Should they be released outside?

Red wigglers are not originally from Canada, though there is some debate about whether or not they settled here several hundreds of years ago.

We recommend that you use your vermicomposter as an ***indoor*** composter. When you harvest the compost, be very careful to remove all of the worms before you put the compost outside.

Worm Facts:

- A worm's body has a simple structure composed of two tubes, one within the other. The inner tube is the digestive system.
- Worms don't have any bones, instead their bodies are built up of hundreds of small rings called 'segments' and manipulate each segment with tiny circular muscles beneath their skin in order to move. To help them slide more easily through the earth, they secrete a slippery fluid that lets them move easily through the earth.
- Worms don't have any eyes or ears but are very sensitive to light and try to avoid bright sunshine at all costs! They can sense light and darkness through special cells on their skin.
- Each worm has 5 hearts so they have so much love to share!
- Worms are sensitive to movement and vibrations. It is hard to play a game of hide and seek with one of our wiggly friends. Red Wrigglers usually know when people are near simply by the vibrations they make by walking.
- Only one pound of these busy little invertebrates can convert three to four pounds of food waste per week into quality vermicompost.
- Similarly to birds, instead of teeth, worms have gizzards that help them grind up their food.
- Worms are cold-blooded, and their surroundings are what determines their body temperature. The perfect temperature for Red Wigglers to be the most active is

between 16° - 28°C (60° - 80°F). When the temperature falls out of this range, they become sluggish and eat less.

- Each worm is a hermaphrodite, meaning they are both a male and a female. This means that each worm has both female and male reproductive organs. You may have noticed a swollen area about 1/3 the way down the length of some worms. This area is called the clitellum. The presence of this section signifies that the worm is sexually mature. The clitellum secretes a cocoon in which fertile eggs are laid.

APPENDIX B: FEEDING THE WORMS

Materials

- laminated sheet (see step 1 below)
- gloves
- knife for cutting food
- food scraps
- dry erase marker
- Egg shells

It is best to feed the worms 1-2 times per week rather than daily as worms don't like to be disturbed.

STEP 1: Each of the six sections you marked out with string represents one week of feeding. You can keep track of the feeding schedule by placing a laminated copy of your quadrant layout (like the diagram below) near the bin, with dates of the weeks written in dry-erase marker. Use a nontoxic, dry-erase marker to cross out each quadrant as you place food in it. When all quadrants are crossed out, erase all of the markings and start over with quadrant 1. See the example below:

1	**2**	**3**
4	**5**	**6**

STEP 2: Always wear gloves and wash your hands. If feeding takes place twice a week, add no more than 500mL each time. If lots of scraps are left over from previous feedings, wait a day or two before adding additional food. Do not overfeed the worms! Place scraps in 1 section every week, for example, in week 2, only feed worms in section 2.

STEP 3: Make sure the scraps are cut up into small pieces. Worms do not have teeth, they have a gizzard and use the soil to process their food. Your worms will be eternally grateful if you chop the organic material into small pieces.

STEP 4: Bury food a couple of centimetres under the bedding. Bury the food in a different section each week. Be sure to cover the food with bedding to avoid fruit flies.

STEP 5: Sprinkle a handful or so of eggshells on top of the bedding roughly once a week as they counter the acidity in the food scraps.

STEP 6: Add additional bedding, such as leaves, straw, shredded newspaper, etc., when it is difficult to bury food scraps or when the bedding is too moist.

STEP 7: WASH HANDS.

APPENDIX C: WORM FOOD LIST

Fruit/vegetable peels	Coffee grounds/filters	Plant cuttings
Tea bags	Crushed eggshells	Brown paper towels
Cooked pasta & rice (no sauce)	Egg cartons/coffee trays	Breads/cereals/grains
Leaves/grass clippings	Sawdust (from untreated wood)	Beans

DON'T FEED YOUR WORMS MEAT, DAIRY OR OILY FOODS AS THEY ATTRACT UNWANTED CRITTERS SUCH AS RATS, MICE, ETC.

APPENDIX D: HARVESTING THE COMPOST/WORMS

It is time to harvest the compost when the bedding has almost all been consumed (or turned into beautiful black compost – approximately 4-6 months). Do not feed the worms for one to two weeks prior to harvesting. Allow the worms to finish their job. If any bedding or organic material is remaining, simply set it aside and add it to a new bedding. There are several methods for harvesting.

** This is also a good time to harvest some worms to start a new vermicomposter.

1. **Dump and Sort:** Under bright lighting, empty the composter's contents onto a plastic sheet. Separate it into pyramid-shaped piles. Wait 10-15 minutes. Worms are very photosensitive and crawl to the bottom of the piles to avoid the light. Remove the top portion of each pile and repeat this process until only the worms are remaining. Add the worms to a fresh bedding and start the vermicomposting process over again. Double-check that there are no worms in the compost, and then mix the compost (also called "castings") in gardens and houseplant pots.
2. **Side to Side:** Feed the worms on one side of the bin for a number of weeks, thus forcing the worms to migrate to that side of the bin. Once the worms have moved to the food source, remove the compost from the vacated quadrant. Replace the castings with fresh bedding (see bedding preparation above). Wait a week or two, then repeat the process in the opposite direction, herding the worms into the new bedding.
3. **Harvesting the Worms:** You can take some of the worms from your bin to start a new bin at any point – however, a good time to do this is when you're harvesting the compost as you're already disrupting the worms. If you're starting a new composter, prepare the bedding & simply separate some of the worms and place them on top of the bedding of the new composter. If you need to transport the worms to a different location- place them in a box/container with air holes and with old bedding & newspaper. The worms will multiply to adjust to their new, less-crowded home.

NOTE: This information has been adapted from Cathy's Crawly Composters at http://www.cathyscomposters.com

APPENDIX E: MAINTENANCE STRATEGY TIPS

- Your class must collect organic waste EVERY DAY, so have a container set up for daily waste. This waste will be fed to the worms every 3-4 days, so ensure that the container is big enough to hold this much waste.
- The food collection container can be stored in a freezer each evening if odour or fruit flies are a concern (freezing and thawing the food scraps is good for the worms because it breaks down the food).
- Every day, the organic waste needs to be cut up and set aside to be fed to the worms once or twice a week. We recommend having a different student or team of students responsible for the waste every week so that all students will become familiar with the process.
- Don't feed your worms meat, dairy or oily foods as they attract unwanted critters such as rats, mice, etc.
- Feed the worms small pieces of food.
- Adding small bits of eggshell or a handful of gritty soil to your bin will help your worms digest the food.
- You will find springtails and mold in your bin that will assist worms by breaking down the food waste first. See Activity E1 to find out more about the other critters living in your vermicomposter!
- Red worms prefer darkness; therefore, keeping worms in a dark container with a lid is important.
- The least expensive and easiest bedding to get for red worms is shredded newspaper. Coloured newspapers are fine. Avoid glossy advertisements and magazines.
- The temperature of the room in which the vermicomposter is stored must not be below 10 degrees Celsius.

For additional help:

- contact: www.cathyscomposters.com or https://www.nrvermicompost.ca/compost

APPENDIX F: TROUBLESHOOTING TIPS

Symptom	Diagnosis	Remedy
Strong, Bad Smell	Too much food in the bin.	Feed worms less food and/or less often (you may want to start another vermicomposter to deal with extra food waste).
Fruit Flies	Food exposed.	Bury food under bedding completely.
Overly Wet	did not wring newspaper out enough	add strips of dry newspaper
	Too much food with high moisture content.	Add less high water content food (Fruits and veggies)
Overly Dry	Not enough moisture	Add a piece of good with high water content, such as an apple core, watermelon or berries. You could also add newspaper that you've soaked and wrung out excess water.

NOTE: Troubleshooting information is taken from the Indiana Department of Environmental Management

APPENDIX G: ASSESSMENT OPPORTUNITIES

Throughout this action toolkit, there are many opportunities available for assessment. We recommend going beyond the rubric and journal entries to include options for students to showcase their abilities and strengths. Below, we have included some ideas that can be used before, during and after learning! To find more active learning strategies, check out the Active Learning Strategy Bank, a part of our Climate Learning resource.

1) **Graffiti wall**
   - The students are school artists and are invited to explain to their community about their thoughts prior to and what they have learned in the lesson. Offer a space for students to add words or draw up on the wall.
   - A graffiti wall is a tool where you can share ideas and opinions about topics discussed in class.

2) **Choice board**
   - Choice boards are graphic organizers that offer a chance for students to differentiate their learning by offering a choice of assessment type. Choice boards are composed of different squares, each with different options of activities. Students choose to complete one or more of these activities. They can progress from one activity to another in whichever way they wish.
   - For more information on choice boards, check out this website
   - Example of a choice board:

Create a Bumper Sticker	Oral Story about how the "fish/plant/animal" feel being in nature	Make an Announcement
Draw a Picture	**FREE CHOICE**	Create a dance or yoga session
Make Music (any materials)	Sing a Song	Use Recycled Materials to Make a Model

3) **Exit Tickets**
   - At the end of class, have the students explain how their thinking has changed (with a personal example) as a result of the inquiry during the lesson. This can be done through writing or drawing!
   - Checking out this document detailing the I used to think... Now I think model for exit tickets.

4) **Change the School!**
   - This is a fun challenge that can be done often at the end of the inquiry to have the students make a change in their own school! Students come together in partners or small groups and come up with a plan that will make the school "greener" by using ideas from this action toolkit. Have the students present their ideas to the principal/superintendent/custodians or any other stakeholders.

5) **3-2-1 Strategy**
   - Have students summarize their learning by identifying 3 things they have learned, 2 things they would like to learn more about and 1 question they still have.
   - Check out this website for more information on the 3-2-1 strategy.

6) **30 Second - 1 Minute Sound Bite**
   - The students work in partners or small groups to summarize a topic to their peers in 30 seconds
   - Check out this video detailing this activity!

7) **Tableau**
   - This drama activity is a great way to have the students engage in their inquiry in a different and unique way! Students create a still picture without talking with their bodies, which communicates the meaning of a concept that they learned in class. Teachers can effectively use Tableau to see newly gained knowledge from the inquiry.
   - For more information on Tableau, check out this website!