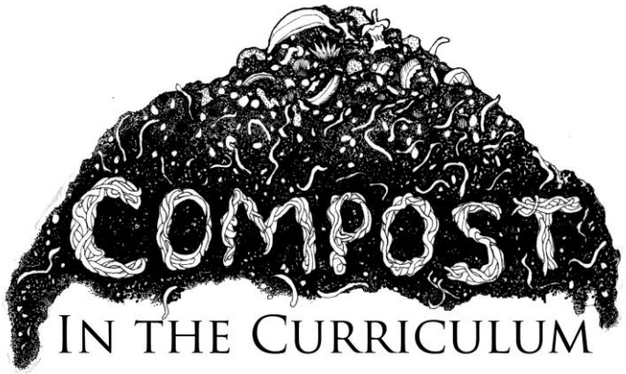
green thumbs growing kids

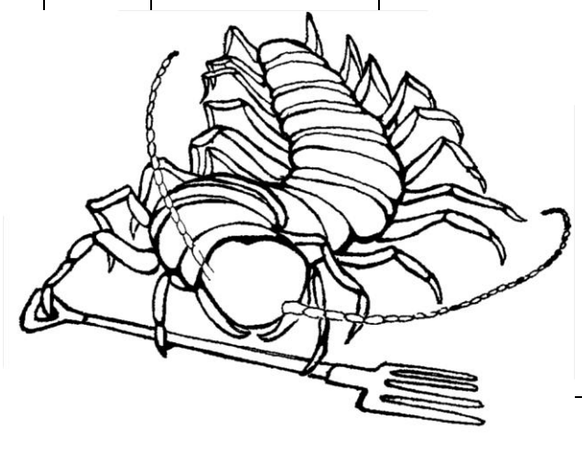


INTRODUCTION: Green Thumbs Growing Kids uses composting as much as possible in garden and food programs with children, and supports the schools we work in to have successful composting programs. Schools often do not have the resources to keep up with compost maintenance, and unless they are using the finished product in gardens, it is much easier to look for other solutions to the waste issue. However, since composting teaches both waste reduction and nutrient cycling, it is an excellent tool for starting to understand larger issues in environmental science and agriculture. We are happy to see the introduction of strong new elements in the 2007 Science and Technology curriculum that support composting, and hope that this guide will increase teachers' willingness to embark on composting projects in the classroom and schoolyard.

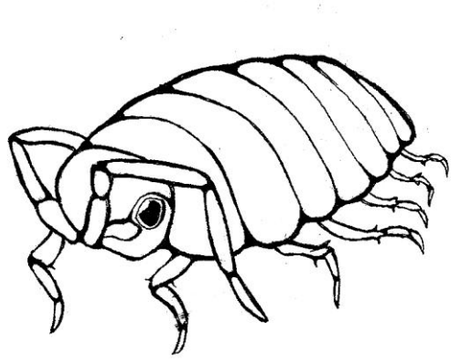
2007 Ontario Elementary Science and Technology Curriculum

Grade	Topic	Strand	Expectations	Curriculum-Specific examples/Digging Deeper
K	**Science and Technology**	**Exploration and Experimentation**	**1.** describe some natural occurrences, using their own observations and representations **8.** demonstrate an awareness of local natural habitats through exploration and observation **9.** participate in environmentally friendly activities in the classroom and the school yard	**1.** Students at Rose Ave. PS made a book and wall display about compost and worms, using a variety of textural/sculptural materials to represent their observations of how compost is made. **8**. The outdoor compost bin and indoor vermicompost bins are intriguing to all students as they contain a variety of species of different living things. **9.** Students bring the classroom compost bin (that contains compostable waste from their snacks) and add it to the outdoor compost bin.
1	**Understanding Life Systems**	**Needs and Characteristics of Living Things**	**1.1** identify personal action that they themselves can take to help maintain a healthy environment for living things, including humans **1.2** describe changes or problems that could result from the loss of some kinds of living things that are part of everyday life **2.1** follow established safety procedures and humane practices during science and technology investigations **2.2** investigate and compare the basic needs of humans and other living things, including the need for air, water, food, warmth, and space, using a variety of methods and resources	**1.1** Composting classroom and lunchroom waste is a prime example, and can be undertaken at home, even in apartments. Start a classroom bin and breed worms for students to take home. **1.2** Investigate: what would happen to our school garden if there were no worms? What would happen to farms and farming if there was no soil life? **2.1** Understanding how to safely investigate the worm bin, how to hold a worm, the importance of washing your hands after handling worms and compost is knowledge acquired by all students who have the chance to work hands-on with compost. **2.2** An indoor vermicompost bin can be used as a living demonstration of the fact that worms need all of the same things as humans do. Worm bins need to be regularly monitored to make sure that there is proper air circulation, moisture level, temperature and appropriate types and amount of food. In a healthy bin, seeds will sprout from food waste such as tomatoes, potatoes, cucumbers, etc. The presence of plants indicates that the soil (worm castings) is now good for growing.

			2.3 investigate and compare the physical characteristics of a variety of plants and animals, including humans **3.1** identify *environment* as the area in which something or someone exists or lives **3.2** identify the physical characteristics *(e.g., size, shape, colour, common parts)* of a variety of plants and animals	**2.3** Worms have five hearts! How many hearts do humans have? Worms don't have lungs, but they need air, so they breathe through their skin. Earthworms in the garden (nightcrawlers) and red wiggler worms in the compost are different species of worms. Nightcrawlers can survive winter by burrowing and they are solitary and territorial, while red wigglers are social and surface-dwelling species that cannot survive freezing temperatures. **3.1** Both indoor and outdoor composts are living demonstrations of this. **3.2** Worms, sow bugs, pill bugs and other compost critters make for fascinating observation.
1	**Understanding Structures and Mechanisms**	**Materials, Objects, and Everyday Structures**	**1.1** identify the kinds of waste produced in the classroom, and plan and carry out a classroom course of action for minimizing waste, explaining why each action is important	**1.1** Classroom composting is a way to minimize both organic waste and paper waste. Shredded paper from the office may be used in both indoor and outdoor composting.* Other carbon-rich materials may also be used, that would otherwise go into the waste stream, such as dried leaves, straw or wood shavings.
1	**Understanding Earth and Space Systems**	**Daily and Seasonal Changes**	**1.2** assess ways in which daily and seasonal changes have an impact on society and the environment	**1.2** Red wiggler worms cannot survive freezing temperatures outside unless the compost is kept active and warm. Worms can also be brought inside in vermicompost bins in order to survive the winter. Outdoor composting slows down in winter, but some bacteria are still active below the freezing point of water.
2	**Understanding Life Systems**	**Growth and Changes in Animals**	**1.1** identify positive and negative impacts that animals have on humans (society) and the environment, form an opinion about one of them, and suggest ways in which the impact can be minimized or enhanced **1.2** identify positive and negative impacts that different kinds of human activity have on animals and where they live **2.1** follow established safety procedures and humane practices specific to the care and handling of live animals, where appropriate, during science and technology investigations **2.2** observe and compare the physical characteristics and the behavioural characteristics of a variety of animals, including insects, using student-generated questions and a variety of methods and resources **2.3** investigate the life cycle of a variety of animals using a variety of methods and resources **2.5** investigate the ways in which a variety of animals adapt to their environment and/or to changes in their environment, using various methods	**1.1, 1.2** Earthworms improve soil quality and enable us to grow more food. Earthworms transform our waste into compost. Thus, worm farming is a way to enhance the soil's ability to grow food for us. However, nightcrawlers used for fishing bait and left behind in forests will start to colonize the forest soils, decomposing them too fast and disrupting the balance of nature. **2.1** Worms and other compost critters may be handled if proper care is taken. Worms will emit a yellowish liquid, a bitter fluid that is their self-defence mechanism, if they are stressed. To reduce the stress, children's hands can be moistened with water in order to make sure worms can breathe, (as they breathe through their skin). They should not be dropped, instead gently placed back into the bin. **2.2** Use the outdoor compost cell that is mostly finished to observe sow bugs, centipedes, millipedes, spiders, ants and worms. While screening** compost to use in the garden, students can retrieve the worms and return them to the active compost cell to continue their work. **2.3** Students can often find worm eggs in a healthy vermicompost bin and also see the differences between juvenile and adult worms. Worm "eggs" are actually cocoons and hatch 2-3 worms each. Worms are hermaphrodites so any two adults can mate. Worm life cycles vary between 3-10 years and the cocoons hatch in about 3 weeks. **2.5** Red wiggler worms will reproduce in accordance with their current environment, i.e. the size of the vermicompost bin. If there are too many, they will revert to their juvenile form and stop breeding. Experiment with different sizes of bins started with the same amount of worms.



			2.6 use scientific inquiry/research skills and knowledge acquired from previous investigations, to investigate the basic needs, characteristics, behaviour, and adaptations of an animal of their choice **3.1** identify and describe major physical characteristics of different types of animals **3.2** describe an adaptation as a characteristic body part, shape, or behaviour that helps a plant or animal survive in its environment **3.3** identify ways in which animals are helpful to, and ways in which they meet the needs of living things, including humans, to explain why humans should protect animals and the places where they live **3.4** identify ways in which animals can be harmful to humans	**2.6** Red wiggler worms have food "preferences", which could be investigated in a controlled group of indoor bins. Bacteria grow prolifically on sweet foods such as banana peels and apple cores, providing more food for worms. **3.1** Worms are a great example of an animal which students are able to observe closely and more frequently if there is a classroom worm bin on hand. **3.2** Once familiar with worms and other compost critters, students can describe numerous ways in which they are suited to their environment. **3.3** Worms improve soil quality. Worms also reduce toxins found in soils. The biodiversity in soil and compost is necessary for healthy, living soil that sustains food production. **3.4** The types of worms that help in the garden or compost are not harmful; however there are species of worms that are parasites.
2	**Understanding Earth and Space Systems**	**Air and Water in the Environment**	**1.1** assess the impact of human activities on air and water in the environment, taking different points of view into consideration, and plan a course of action to help keep the air and water in the local community clean **3.3** describe ways in which living things, including humans, depend on air and water	**1.1** Discuss composting at school as waste reduction; saving fossil fuels and thus reducing air pollution, reducing use of chemicals for agriculture that pollute waterways. Discuss composting as the diversion of waste from landfills that pollute groundwater. **3.3** Worms need water and air, and therefore the environment of the vermicompost bin needs ventilation holes and occasional misting in order to keep the right level of moisture for the worms (it should be moist like a wrung-out sponge). Since worms do not have lungs, they get air from water (oxygen molecules).
3	**Understanding Life Systems**	**Growth and Changes in Plants**	**1.1** assess ways in which plants are important to humans and other living things, taking different points of view into consideration and suggest ways in which humans can protect plants **2.5** use scientific inquiry/experimentation skills and knowledge acquired from previous investigations, to investigate a variety of ways in which plants meet their basic needs *Sample guiding questions:* How do plants meet their need for air, water, light, warmth, and space? What are different ways in which we can help plants meet their needs? **3.6** describe ways in which plants and animals depend on each other **3.8** identify examples of environmental conditions that may threaten plant and animal survival	**1.1** Ask students to name a food that does NOT come from a plant. When they name an animal product, ask them what this animal eats in order to grow. Not only are humans completely dependent on plants for food, we are completely dependent on decomposers to reduce the food waste and animal waste. We protect the plants by protecting soil life. **2.5** The curriculum outlines the basic needs of plants, but neglects to mention that most plants need healthy soil to provide them with nutrients. Composting in the classroom is a way of understanding the nutrient cycle from plant material (apple cores and banana peels, etc) into compost, which then helps new plants grow. Students can experiment with growing seeds in sand, regular soil, and soil with added vermicompost to discover the value of good soil and compost. Note: too much compost will harm young plants. **3.6** Use earthworms (and other compost helpers) and the way they produce compost for the school garden (from garden waste) as an example of interdependence. **3.8** What might threaten the survival of the worms in the indoor bin? What about in the outdoor compost?

3	**Understanding Earth and Space Systems**	**Soils in the Environment**	**1.1** assess the impact of soils on society and the environment, and suggest ways in which humans can enhance positive effects and/or lessen or prevent harmful effects **1.2** assess the impact of human action on soils, and suggest ways in which humans can affect soils positively and/or lessen or prevent harmful effects on soils **2.1** follow established safety procedures during science and technology investigations **2.4** investigate the process of composting, and explain some advantages and disadvantages of composting **3.3** describe the interdependence between the living and non-living things that make up soil **3.4** describe ways in which the components of various soils enable the soil to provide shelter/homes and/or nutrients for different kinds of living things	**1.1, 1.2** Organic growers use compost and worm castings instead of chemical fertilizers, which have a beneficial effect on the environment (healthy soil life) and prevent harmful effects such as runoff of excess nutrients into waterways. **2.1** Students should wash their hands following compost and soil investigations. Tools used to dig into compost bins should be blunt and ergonomically correct to avoid strain. For outdoor compost a garden fork is indispensible. For indoor compost a large old serving spoon or plastic trowel is best. Students need to be careful not to fling soil upwards during investigations, and to always keep working parts of tools low to the ground or pointed down. **2.4** Composting is decomposition, a process that takes place in nature. Humans can speed it up, by designing special compost bins and putting in the right mix of materials, then turning the compost frequently. The only "disadvantage" to composting is the work needed to maintain the compost bin in good condition, but it is also good exercise. Mice and rats are attracted to compost bins, for the warmth and food – they even eat worms - so it is important to keep them out through proper bin design, site selection and maintenance. **3.3** Living things in the soil like worms and even bacteria need air and water. They also need the minerals in the soil. **3.4** The more organic material is in the soil, the more plant and animal life can depend on that soil. A single spoonful of healthy topsoil contains more than a billion living organisms.
4	**Understanding Life Systems** 	**Habitats and Communities**	**1.1** analyse the positive and negative impacts of human interactions with natural habitats and communities, taking different perspectives into account, and evaluate ways of minimizing the negative impacts **2.2** build food chains consisting of different plants and animals, including humans **2.4** use scientific inquiry/research skills to create a living habitat containing a community, and describe and record changes in the community over time **2.5** use appropriate science and technology vocabulary, including *habitat, population, community, adaptation*, and *food chain*, in oral and written communication **3.1** demonstrate an understanding of habitats as areas that provide plants and animals with the necessities of life *(e.g., food, water, air, space, and light)* **3.2** demonstrate an understanding of food chains as systems in which energy from the sun is transferred to producers (plants) and then to consumers (animals)	**1.1** Have students work in groups to discuss the positive and negative impacts of composting our school food waste, and have them record their ideas on a T-chart. Then students could role-play as different members of a school community (caretakers, principals, neighbourhood gardeners, waste collection workers, etc.) where the compost program has been stopped. **2.2** As a class, create and assemble a food chain that includes you, your classroom compost bin and its inhabitants. Use either modelling clay or drawings, and have each student create one element of the food chain. **2.4** A vermicompost bin would be ideal, starting with a newly set-up bin and observing changes over the length of time until the castings are ready to use (usually 3-4 months). **2.5** All of these words can be used when writing and talking about the classroom vermicompost bin or the outdoor compost bin. **3.1** Investigate outdoor/indoor compost bins to see if they provide all the necessities of life. Compare these two habitats and evaluate different areas of the schoolyard as potential habitat for different compost critters. **3.2** Feeding vegetable and fruit scraps (especially if they are from the school garden or lunchroom) to worms in the vermicompost bin or outdoor bin is an excellent hands-on way of understanding this concept.

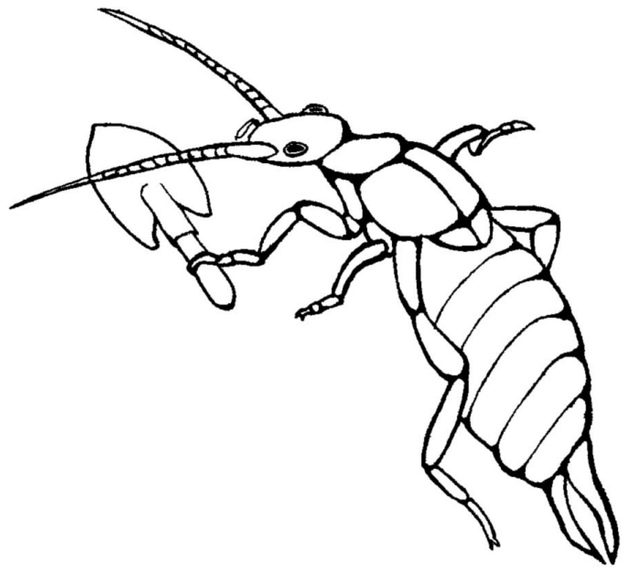
			3.3 identify factors *(e.g., availability of water or food, amount of light, type of weather)* that affect the ability of plants and animals to survive in a specific habitat **3.4** demonstrate an understanding of a community as a group of interacting species sharing a common habitat **3.5** classify organisms, including humans, according to their role in a food chain **3.7** describe structural adaptations that allow plants and animals to survive in specific habitats **3.9** demonstrate an understanding of why all habitats have limits to the number of plants and animals they can support **3.10** describe ways in which humans are dependent on natural habitats and communities	**3.3** What will happen if we forgot to feed our classroom worms? What will happen if we stop putting food waste in the outdoor compost bin? What happens in winter? Why do earthworms come up onto the sidewalk after a rain? **3.4** Refer to "Food Web of the Compost Pile" www.thegreenteam.org/Compostfoodwebposter.pdf *(attached).* **3.5** (e.g., producer, consumer, decomposer): Where do worms and the other compost critters fit? **3.7** For example, the bitter yellowish fluid a worm emits would taste bad to a predator such as a rodent or bird. **3.9** Use the vermicompost bin as an example of a very limited habitat: outside the bin is a wasteland that could not support the animals within the bin. Think about food production for humans as an activity with limits: what kinds of habitats support it? How much food can we grow in the city? **3.10** How does composting help humans? How does soil health impact the health of human communities?
5	**Understanding Earth and Space Systems**	**Conservation of Energy & Resources**	**1.1** analyse the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts	**1.1** All over the planet, the widespread depletion of topsoil required to grow crops is one cause of world food shortages. Industrial agriculture that relies on cheap fossil fuels is causing irreparable damage to topsoil. Soil is one of our most important and endangered natural resources: composting is one way we can help restore precious topsoil as well as conserving the fuel used to transport waste.
6	**Understanding Life Systems**	**Biodiversity**	**1.2** assess the benefits that human societies derive from biodiversity and the problems that occur when biodiversity is diminished **2.2** investigate the organisms found in a specific habitat and classify them according to a classification system **3.2** demonstrate an understanding of biodiversity as the variety of life on earth, including variety within each species of plant and animal, among species of plants and animals in communities, and among communities and the physical landscapes that support them **3.3** describe ways in which biodiversity within species is important for maintaining the resilience of those species **3.4** describe ways in which biodiversity within and among communities is important for maintaining the resilience of these communities	**1.2** Monocultures and chemical farming inputs also eliminate microbial biodiversity in the soil. Monoculture systems on farms reduce diversity, and so more soil and pest problems result. In turn, farmers apply more chemical fertilizers and pesticides, which pollute the land, the water, and the food they are producing**.** With compost, we can address this...One teaspoon of compost can contain a billion microorganisms from possibly millions of species! Organic farmers are learning to apply compost tea, which keeps the biodiversity of the soil healthy. **2.2** Refer to "Food Web of the Compost Pile" *(attached)* **3.2** Students play 'compost bingo': look through a shovel-full of compost and try to identify all the living things. Compare the biodiversity of different soils: compost from the outdoor bin, from the indoor worm bin, garden soil, store-bought potting soil. **3.3** One example is the fact that red wigglers mature and breed at different times as a variation within the species, allowing for a staggered reproductive rate and thus greater survival for the group as a whole. **3.4** Research the many different species of annelids (earthworms), all with a special niche or adaptation. Investigate the biodiversity of the outdoor compost pile and its relationship to the health of the school yard or garden ecosystem.

			3.5 describe interrelationships within species, between species, and between species and their environment and explain how these interrelationships sustain biodiversity	**3.5** Refer to "Food Web of the Compost Pile" www.thegreenteam.org/Compostfoodwebposter.pdf *(attached)*
7	**Understanding Life Systems**	**Interactions in the Environment**	**1.2** analyse the costs and benefits of selected strategies for protecting the environment **2.1** follow established safety procedures for investigating ecosystems **2.2** design and construct a model ecosystem and use it to investigate interactions between the biotic and abiotic components in an ecosystem *Sample guiding questions:* What are some biotic components of this ecosystem? What are some abiotic components? How do these components affect each other (abiotic and abiotic; biotic and biotic; abiotic and biotic)? What are some of the interactions that are occurring in the model ecosystem? **3.1** demonstrate an understanding of an ecosystem as a system of interactions between living organisms and their environment **3.2** identify biotic and abiotic elements in an ecosystem, and describe the interactions between them **3.3** describe the roles and interactions of producers, consumers, and decomposers within an ecosystem **3.5** describe how matter is cycled within the environment and explain how it promotes sustainability **3.7** explain why an ecosystem is limited in the number of living things *(e.g., plants and animals, including humans)* that it can support	**1.2** Students could analyse the costs and benefits of a school-wide composting program, with various factors in play e.g. cost of garbage pickup, amount of waste including paper waste that can be composted, transportation of wastes that are not composted vs. using compost created on-site. **2.1** Examples: wash hands after investigating an ecosystem; respect all living creatures; handle worms gently. **2.2** Use the compost and/or the school garden as inspiration for the model ecosystem. Analyze the carbon : nitrogen ratio of various inputs and research the sets of relationships between the decomposers and the elements. This can also be accomplished with a vermicompost bin. Discuss the reason why indoor worm bins are generally made of plastic and not wood, like outdoor compost bins. **3.1** Analyze what happens in the vermicompost bin and/or outdoor compost bin, by having small groups of students pick a specific interaction to illustrate and explain to the class. Have the class create a model to illustrate how these separate interactions constitute a system. **3.2** Composting science is all about the C : N ratio and the relationship of the various micro-organisms to these elements, given fluctuations in temperature and moisture. Analyze compost bins in various stages of decomposition by measuring bacterial activity, heat etc. **3.3** For example: describe compost, animals, plants and humans in an ecosystem. **3.5** How does composting happen in some ecosystems without human intervention? Where could you find an example of this? **3.7** Make two (or more) vermicompost bins of different sizes and/or different food inputs to illustrate this.
8	**Understanding Structures and Mechanisms**	**Systems in Action**	**3.2** identify the purpose, inputs, and outputs of various systems **3.9** identify social factors that influence the evolution of a system	**3.2** Identify the differences between aerobic home- or community-based composting and anaerobic composting carried out in large digesters. Identify the differences between indoor vermicomposting systems and outdoor aerobic systems. **3.9** Analyze the transition from home and community-based composting to curb side pickup of organics such as Toronto's Green Bin program. Which system produces a better finished product, and under what conditions? Which is easier for residents, and how does this impact the policy decisions regarding composting? Which system is better for the environment?

COMPOSTING IN THE SOCIAL STUDIES CURRICULUM

3	**Canada and World Connections**	**Urban and rural communities**	Application – describe ways in which they and their families use the natural environment. – compare the characteristics of their community to those of a different community.	Discuss food production, urban and rural, and waste treatment, urban and rural – relationship between urban and rural as regards food production and waste disposal.

RESOURCES



A Guide to Composting in School http://www.iowadnr.gov/waste/recycling/files/school.pdf

The Complete Compost Gardening Guide. Barbara Pleasant and Deborah L. Martin. Storey Publishing.

The Worm Cafe: Midscale Vermicomposting of Lunchroom Wastes. Binet Payne. Flower Press.

Worms Eat Our Garbage: Classroom Activities for a Better Environment. Mary Applehof, Fenton, Harris. Flower Press.

Healthy Foods from Healthy Soils by Elizabeth Patten and Kathy Lyons, illustrated by Helen Stevens. Tillbury House, Publishers.

NOTES

*Some people have expressed concerns about office paper as a source of dioxins. This would have been the case before the paper industry switched to a different formulation of chlorine for whitening paper. It is now presumed safe for composting.

** Screening compost refers to the operation of putting finished compost through a ½" wire mesh in a frame, in order to catch large particles and return them to the active bin to continue decomposing.

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