**DEP Environmental Education Curricula**

**Lesson Plan**

**GRADE/LEVEL: Middle School**

**LESSON TITLE: Composting and Food Sustainability**

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| **Next Generation Science Standards** |  |  | | | |
| **MS-ESS3-4** | **MS-ESS3-4** | Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. | | | |
|  | **Science and Engineering Practices** | [Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.](http://www.nap.edu/openbook.php?record_id=13165&page=71) | | | |
|  | **Disciplinary Core Ideas** | [Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.](http://www.nap.edu/openbook.php?record_id=13165&page=194) | | | |
|  | **Crosscutting Concepts** | [All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.](http://www.nap.edu/openbook.php?record_id=13165&page=212)  Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. | | | |
| **Objectives** | | | | | |
|  |  | **Objective 1:** Students will learn the basic actions needed for composting.  **Objective 2:** Students will learn the benefits provided by composting.  **Objective 3:** Students will discuss food sustainability in their school. | | | |
| **Vocabulary** |  |  | | | |
|  | **Nematode** | any unsegmented worm of the phylum Nematoda, having an elongated, cylindrical body; a roundworm. | | | |
|  | **Methane** | a colorless, odorless, flammable gas, CH 4, the main constituent of marsh gas and the firedamp of coal mines, obtained commercially from natural gas | | | |
|  | **Organic** | characteristic of, pertaining to, or derived from living [organisms](http://www.dictionary.com/browse/organism) : | | | |
|  | **Sow Bugs** | any of several small, terrestrial isopods, especially of the genus *Oniscus;* wood louse. | | | |
| **Background** |  |  | | | |
| **Teacher Version**  Selected Materials from …  Composting At Home | | **Sources:** <https://www.epa.gov/recycle/composting-home> or as designated. | | | |
| **Compost**  Compost looks and feels like fertile garden soil. This dark, crumbly, earthy-smelling stuff works wonders on all kinds of soil and provides vital nutrients to help plants grow and look better.  Decomposing organisms consist of bacteria, fungi, and larger organisms such as worms, sow bugs, nematodes, and numerous others. Decomposing organisms need four key elements to thrive: nitrogen, carbon, moisture, and oxygen. (Source: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/features/?&cid=nrcs143\_023537)  All composting requires three basic ingredients:   * + Browns - This includes materials such as dead leaves, branches, and twigs.   + Greens - This includes materials such as grass clippings, vegetable waste, fruit scraps, and coffee grounds.   + Water   Having the right amount of water, greens, and browns is important for compost development.  Your compost pile should have an equal amount of browns to greens. You should also alternate layers of organic materials of different-sized particles. The brown materials provide carbon for your compost, the green materials provide nitrogen, and the water provides moisture to help break down the organic matter. (Source: https://www.epa.gov/recycle/composting-home)  **What to Compost**   * Fruits and vegetables, Eggshells, Coffee grounds and filters * Tea bags, Nut shells, Shredded newspaper, Cardboard * Paper, Yard trimmings, Grass clippings, Houseplants * Hay and straw, Leaves, Sawdust, Wood chips, Cotton and Wool Rags * Dryer and vacuum cleaner lint, Hair and fur, Fireplace ashes (Source: https://www.epa.gov/recycle/composting-home)   **What Not to Compost**   * Black walnut tree leaves or twigs - Releases substances that might be harmful to plants * Coal or charcoal ash - - Might contain substances harmful to plants * Dairy products - - Create odor problems and attract pests such as rodents and flies * Diseased or insect-ridden plants - - Diseases or insects might survive and be transferred back to other plants * Fats, grease, lard, or oils - - Create odor problems and attract pests such as rodents and flies * Meat or fish bones and scraps - - Create odor problems and attract pests such as rodents and flies * Pet wastes - - Might contain parasites, bacteria, germs, pathogens, and viruses harmful to humans * Yard trimmings treated with chemical pesticides - - Might kill beneficial composting organisms (Source: https://www.epa.gov/recycle/composting-home)   **Benefits of Composting**   * Enriches soil, helping retain moisture and suppress plant diseases and pests. * Reduces the need for chemical fertilizers. * Encourages the production of beneficial bacteria and fungi that break down organic matter to create humus, a rich nutrient-filled material. * Reduces methane emissions from landfills and lowers your carbon footprint. (Source: <https://www.epa.gov/recycle/composting-home>)   **Backyard Composting**   * Select a dry, shady spot near a water source for your compost pile or bin. * Add brown and green materials as they are collected, making sure larger pieces are chopped or shredded. * Moisten dry materials as they are added. * Once your compost pile is established, mix grass clippings and green waste into the pile and bury fruit and vegetable waste under 10 inches of compost material. * Optional: Cover top of compost with a tarp to keep it moist. When the material at the bottom is dark and rich in color, your compost is ready to use. This usually takes anywhere between two months to two years. (Source: https://www.epa.gov/recycle/composting-home)   **Indoor Composting**   * If you do not have space for an outdoor compost pile, you can compost materials indoors using a special type of bin, which you can buy at a local hardware store, gardening supplies store, or make yourself. * Remember to tend your pile and keep track of what you throw in.   + A properly managed compost bin will not attract pests or rodents and will not smell bad.   + Your compost should be ready in two to five weeks. (Source: https://www.epa.gov/recycle/composting-home)   **Food Sustainability**  **Consider Reducing Food Waste**   * *Wasted food is a social problem*: In 2013, 14.3 percent of U.S. households were food insecure at some time during the year. That is 48 million Americans, of which 16 million are children, living in food insecure households. Wholesome, nutritious food should feed people, not landfills. * *Wasted food is an environmental problem*: Food is the largest stream of materials in American trash. Once wasted food reaches landfills, it produces methane, a powerful greenhouse gas. * *Wasted food is an economic issue*: It is estimated that at the retail and consumer levels in the United States, food loss and waste totals $161 billion dollars. (Source: https://www.epa.gov/sustainable-management-food/food-too-good-waste-implementation-guide-and-toolkit#whyis)       Source: Maine DEP  **Food Loss Prevention Options for Your School**  Below is a list of ideas and activities that grade schools may consider implementing to help prevent food loss and waste.  □ **Perform a food waste audit**. See what’s being thrown out and why.  o Get the students involved. Be there at the dish return line with a few volunteers, buckets, a log sheet and a weight scale. Record what and how much is being thrown out and why. Be sure to ask students for reasons why they didn’t finish their food.  o In the kitchen, have only one food waste trash can and provide each staff member a small container to fill with food waste at their station. Before they empty their container, have staff weigh it and record the amount, type and reason the waste is being discarded on a log sheet located near the trash can.  o Audit Tip: Volunteering can be part of the core curriculum or count toward community service hours for many student organizations.  □ **Set up a share table**. Check with your local health department and school board to find out if donating and sharing is allowed. If so, set up a share table, a place students can return whole items that they choose not to eat so that they are available for others who may want additional helpings.  □ **Employ “Offer versus Serve.”** Offer versus Serve is a provision in the U.S. Department of Agriculture’s (USDA) National School Lunch Program and their School Breakfast Program that allows students to decline some of the food offered that they do not intend to eat to help reduce food waste.  □ **Schedule recess before lunch**. This strategy shows a reduction of plate waste and an increase in food and nutrient consumption.  □ **Provide children another choice of beverage** in the food service line that is low cost for the school (e.g., water).  □ **Extend lunch periods** from 20 to 30 minutes to reduce plate waste by nearly one-third.  **□ Minimize waste from mandatory fruit and vegetable servings**. Many schools are required to offer or serve a fruit/vegetable serving to students.  Below are tips to reduce waste associated with this requirement:  o Slice the fruit: Cutting fruit into bite-sized pieces is easier to eat and encourages students to eat what is on their trays.  o Give fruits and vegetables catchy names that appeal to children: Younger kids like fun names like “Xray Vision Carrots” and “Super Strength Spinach” while older children prefer more descriptive names like “Succulent Summer Corn” and “Crisp Celery and Carrots.”  o Put healthy foods within reach: Moving salad bars and fruit closer to students' reach increases both sales and consumption. (Source: https://www.epa.gov/sustainable-management-food/food-loss-prevention-options-grade-schools-manufacturers-restaurants) | | | | | |
| **Cross Cutting Idea** | | [All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.](http://www.nap.edu/openbook.php?record_id=13165&page=212)  What negative consequences can occur when composting does not occur? Where will the waste go?  Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.  What is food sustainability? If we know that some people go without the necessary food, why do we as a society throw so much away? What could you do to encourage food sustainability in your community? | | | |
| **Questions for Discussion** | | Source Material taken from https://aggie-horticulture.tamu.edu/earthkind/landscape/dont-bag-it/chapter-6-composting-questions-and-answers/ | | | |
| **What is compost?**  Compost is the partially decomposed remains of plants. In its final state of decomposition, it is referred to as humus.  **Is it necessary to shred materials for the compost pile?**  The finer the material is that goes into the compost pile the quicker and more thorough the decomposition.  **Do compost piles have offensive odors?**  Not if composting is done properly (i.e. provided good aeration and moisture for rapid decomposition).  **How do you know when compost is finished?**  When is has become dark, loose and crumbly; and if in a hot pile, when it doesn’t re-heat upon turning. Sifting out unfinished materials is helpful if the aesthetics are a problem  **Should the compost pile/bin be placed in the shade or sun?**  A sunny spot is best because the heat of the sun speeds decomposition. However, the pile also dries out faster and requires more frequent watering than a pile in the shade. | | | | | |
| **Project 1**  **Can everything be turned into compost?** | | | **Materials taken from Source:**  **https://compostingcouncil.org/wp-content/uploads/2015/06/CompostingHandbook.pdf** | | |
| **Activity**  1. Find four or five widemouthed glass jars. You’ll want to be able to see through the sides of them.  2. Collect a banana skin or apple core, a scrap of newspaper, a leaf (green or brown), and a piece of plastic. There may be other things you want to test as well.  3. Place each of these items in a separate jar. Hold them close to the side, where you can see them, and fill the jars with ordinary soil.  4. Don’t cover the jars, but make sure the soil covers your samples. Label each jar for contents.  5. Water every day, just enough to keep the soil damp. Don’t let it dry out or freeze.  6. Watch what happens, or doesn’t happen, in each jar. You’ll soon notice changes in some of your samples as they start to decompose. Some change faster than others, and the piece of plastic won’t change at all! Anything that once came from a living thing is called “organic” and will break down. You can use these to make compost.  What do you think happens to all these things when they’re taken away by the garbage collector and buried in a landfill? | | | | | |
| **Project 2**  **Food Sustainability Action Plan for your School** | | | |  | |
| Choose one or more of the following topics for students and their teacher to consider implementing at their school.  For each topic chosen provide the following information to your school leadership for their consideration.   * List at least two reasons why minimizing food waste is a benefit for your school and community. * Determine if there will be a cost associated with the food sustainability task you might like to adopt. * Determine if there is a time constraint that may make the sustainability task you might like to adopt. * Determine if there are any legal constraints that may make the sustainability task you might like to adopt un-doable.   Prepare and write up your thoughts and action plan suggestions for your school leadership.  Present your suggestions and findings to your school leadership for their consideration and/or implementation. | | | | | |
| **Teacher Prep** |  |  | | | |
|  | **Advanced Preparation Steps &**  **Duration** | 1. Read and consider associated background material, projects, and questions for discussion. (1 hour) 2. View How to Make Compost <https://www.youtube.com/watch?v=q7LnBpJkuhs>  (~5:50 minutes) 3. Review Composting and Food Sustainability PowerPoint (15 minutes) 4. Assemble Project Materials & Practice Project (1hour) | | | |
| **Needed Materials** |  |  | | | |
|  |  | 1. View How to Make Compost <https://www.youtube.com/watch?v=q7LnBpJkuhs> (~5:50 minutes) 2. Compost and Food Sustainability PowerPoint 3. Compost and Food Sustainability Lesson Plan 4. Internet connection   **Composting Project Materials:**   * Four or five widemouthed glass jars. * Banana skin or apple core, a scrap of newspaper, a leaf (green or brown), and a piece of plastic. * Soil, enough to cover the materials you will place in the widemouthed glass jars. * Four or five labels to describe materials in each jar. * Record sheet, to keep a daily record of changes in each jar. * Water, enough to moisturize your soil and composting materials.   **Food Sustainability Action Plan Materials:**   * This project requires student brainstorming and planning of recommendations for the school leadership for your action plan. Students can either make a poster to present their materials, or write a letter to present to their school leadership. | | | |
|  | **Duration of activities** | 60 minutes | | | |
|  | **Safety notes** | Always handle materials with care. Do not drink or ingest materials. | | | |
| **Procedures for instruction** |  |  | | | |
|  |  | Introduce the class to the idea of composting and food sustainability. | | | ~2 minutes |
|  |  | Discuss composting and food sustainability. Review composting with embedded video How To Make Compost - Easy Composting Tips (~ 5:49) | | | ~30 minutes  (PowerPoint and embedded video) |
|  |  | Composting Activity **OR** Food Sustainability Plan | | | ~25 minutes |
|  |  | Discussion | | | ~5 minutes |
| **Student Materials** |  |  | | | |
|  | Background Informational Sheet | Reading assignment prior to the project day. | | | |
|  | Vocabulary List | Available for clarification of terminology as students read their Background Informational Sheet and Project. | | | |

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| **Student Background Information Sheet – Composting and Food Sustainability** | | |
| **Compost**  Compost looks and feels like fertile garden soil. This dark, crumbly, earthy-smelling stuff works wonders on all kinds of soil and provides vital nutrients to help plants grow and look better.  Decomposing organisms consist of bacteria, fungi, and larger organisms such as worms, sow bugs, nematodes, and numerous others. Decomposing organisms need four key elements to thrive: nitrogen, carbon, moisture, and oxygen. (Source: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/features/?&cid=nrcs143\_023537)  All composting requires three basic ingredients:   * + Browns - This includes materials such as dead leaves, branches, and twigs.   + Greens - This includes materials such as grass clippings, vegetable waste, fruit scraps, and coffee grounds.   + Water   Having the right amount of water, greens, and browns is important for compost development.  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| **Student Vocabulary List– Composting and Food Sustainability** | | |
| **Vocabulary** | **Nematode** | any unsegmented worm of the phylum Nematoda, having an elongated, cylindrical body; a roundworm. |
|  | **Methane** | a colorless, odorless, flammable gas, CH 4, the main constituent of marsh gas and the firedamp of coal mines, obtained commercially from natural gas |
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**Project Assessment**

**Project Title:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Instructor/School/Grade: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Instructor Contact Information: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date assigned: \_\_\_\_\_\_\_\_\_\_\_\_\_ Number of Students Participating \_\_\_\_\_\_\_\_\_\_\_\_**

The following questions are intended to help us understand your feelings regarding the presentation and materials. Your sincerity in answering these questions is appreciated. Please feel free to use the space at the end of the form for any additional comments that you may have. *This form has been left in Microsoft Word format so that you may fill it in electronically. Please fill out the form completely and email your assessment to* [david.madore@maine.gov](mailto:david.madore@maine.gov).

**Ranking System**

1 ~ Excellent / Strongly agree

2 ~ Good – Above average / Moderately agree

3 ~ Average – ok / Neutral in agree or disagree

4 ~ Poor – below average / Moderately disagree

4 ~ Very poor – not acceptable / Strongly disagree

NA / not applicable

*Please continue on the second page…*

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| --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **NA** | **Questions** |
|  |  |  |  |  |  | **Course Content** |
|  |  |  |  |  |  | 1. Value of course content to you. |
|  |  |  |  |  |  | 1. Importance of course content given your teaching topic. |
|  |  |  |  |  |  | 1. Overall rating of course content. |
|  |  |  |  |  |  | 1. Ease of implementing materials into daily lessons. |
|  |  |  |  |  |  | **Materials/Project** |
|  |  |  |  |  |  | 1. Movie (if applicable) was easy to present. |
|  |  |  |  |  |  | 1. Student worksheet was useful and easy to follow. |
|  |  |  |  |  |  | 1. Student project stimulated thinking & conversation. |
|  |  |  |  |  |  | 1. The project put ideas across effectively. |
|  |  |  |  |  |  | 1. Teacher materials were useful and easy to follow. |
|  |  |  |  |  |  | 1. The method of material presentation encouraged students feel free to ask questions, disagree, express ideas, etc. |
|  |  |  |  |  |  | **Self-Evaluation (Instructor)** |
|  |  |  |  |  |  | 1. What was your level of knowledge concerning this topic prior to this presentation? |
| **Please share any recommendations you feel would be helpful.** | | | | | | |

**Thank you for providing your feedback!**

Please email your assessment to david.madore@maine.gov.