

Waste Not Project Curriculum

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Dear Educators,

Thank you for participating in The Waste Not Project!

We hope that this set of information and activities will aid you in educating your students about waste. We encourage you to use these activities as a jumping point, to get your creativity flowing, and to give your students an introduction to waste, source reduction, composting, and the 3Rs: reduce, reuse, and recycle. Some activities are more involved than others, ranging from a 30 minute discussion activity about landfills to a multi-week classroom composting project. Suggested age ranges and subjects of study are listed but are not exclusive, and we hope that you will adjust and change the activities to meet your needs.

There are hundreds of resources, curriculums, fact sheets, and books on waste and related topics. We have a few that are listed under the 'Additional Resources' section at the end of this packet which are available for your use.

We look forward to seeing you in your classroom or at the landfill. It is always effective to get students out to see what they are learning about and get their hands dirty. (Literally: hands-on & in the dirt for this project!) We are glad that we can provide this opportunity.

If you will be attending the Landfill Tour, before you come, please at least have your students generate a list of questions about the things they will be seeing and doing. Depending on what you have chosen as your hands-on activity this may include questions about: landfills, hazardous waste, recycling, composting, worm composting, and other related topics. A list of questions is helpful for us, as the field trip guides, in knowing what your students are most interested in and what knowledge they bring to the experience.

If you have any questions, comments, or concerns about this curriculum, the field trip, or anything else about The Waste Not Project, please contact staff at 756-8993.

Thank you again for your participation.

Happy Waste Educating!

Waste Not Project Staff

Background Information

Waste:

The need for conserving our resources is an increasing concern. Our present and future generations are being faced with a growing waste issue. According to - U.S. PIRG Solid Waste Fact Sheet #1, "Americans produce more garbage than any other people on the planet: 7.6 billion tons of industrial waste and 160-180 million tons of municipal solid waste annually" and our municipal solid waste stream continues to grow at a rate of between 3% and 4% every year. Although we are only 5 percent of the world's population, we produce 50 percent of the world's waste.

Montana's priorities for 'Integrated Waste Management' according to the 1991 Montana Legislature are, in order:

1. Waste Reduction
2. Reuse
3. Recycling
4. Composting
5. Landfilling or Incineration

Implementing the 'State Solid Waste Plan' requires attention to many aspects of waste management including: incorporating federal regulations; technology assessment; education and public information; attention to rural community needs; landfill operator training; special and household hazardous wastes; scheduling and strategy; input from local government, industry and citizens; and revision and updating every 5 years. Municipal Solid Waste Management requires comprehensive and holistic effort to be effective and sustainable.

As we explore these waste issues with students, it is important to understand the many issues taken under consideration in waste management systems. It is also important to understand the ways in which we: educators, students, and citizens, contribute to and take part in these systems. The more informed, better educated, and more involved we are the better our waste systems will become and the better our quality of life and the quality of the environment will be.

Reduce:

A significant step individuals can take towards reducing garbage is to reduce the amount of waste we generate. Reducing personal waste is even better than recycling since reduction uses less energy and resources than reusing or recycling. Packaging comprises 33% (by weight) of Municipal Solid Waste. Using products with no packaging, no paper (trees) or plastic (oil), requires no energy for recycling and no landfill for disposal.

By paying attention to our consumption and buying products that create little or no waste, individuals at any age can take responsible environmental action, and greatly reduce our waste stream. The packaging of plastic and paper for products ranging from TV dinners to disposable razors, while alluring for the perceived convenience it provides, is a detriment to our environment. The less we use, the less we will need to throw away.

Reuse:

While 'reduce' may be the most important and most neglected of the 3 R's (Reduce, Reuse, Recycle) the other 2 R's are also important and effective means for reducing our waste stream. While it is difficult to estimate how much of municipal solid waste currently gets reused before being thrown away it is easy to see what an effect reuse could have on our waste stream.

Plastic ball-point pens, Styrofoam cafeteria trays and plastic utensils, disposable diapers, all of these are examples of the single-use, throw-away, mentality our society has come to believe in. There are many alternative products that can be used many times before being thrown away. Consider the difference in the effect on the waste stream between using a new paper cup each time you take a drink of water and using the same glass every time you take a drink. There are pens that have cartridge refills and sturdy lunch boxes instead of 'disposable' paper bags.

Using a product again and again before it is recycled or thrown away is easy to do, cost effective, and much better for the environment. How many times could you use the same plastic bag before throwing it away? Products can also be reused as something other than what they were originally created as. In this way an old t-shirt becomes a dust rag and a cardboard box becomes a child's play fort.

Recycle:

Recycle means 'to treat or process in order to use again.' In this way it is different from reusing which requires no treatment or processing for reuse. When aluminum cans are melted down and remolded into new cans they have been recycled. When paper is shredded and water is added, much like in the original paper making process, the paper has been recycled. The original aluminum and paper are 'recyclable materials.' The products that are created (new aluminum can, new paper) through the use of recyclable materials are called 'recycled products.'

Approximately 6% of Montana's garbage is recycled but only 26% of the materials that could be recycled in Montana are, which means that 74% of recyclable materials are ending up in landfills. While the U.S. recycling rate is 17.1%, an experimental recycling program in an East Hampton, New York neighborhood achieved an overall recycling rate of 84%!

Here is how much Montanans are currently recycling:

- Aluminum Cans 65.1%
- Lead-acid Batteries 62%
- Newspapers 40.5%
- Glass Bottles 27%
- Corrugated Containers 18.1%
- Rubber Tires 9%
- White Goods 8.1%
- Office Paper 4.7%
- Yard Waste 0.1%

Recyclable materials are not always easy to recycle and often can not be turned into as high quality products as the original materials were made into. For example, when paper is recycled it is often made into products such as paper-board or tissue paper rather than white office paper. Paper may need to be de-inked and approximately 10% of the fibers become too short for use and must be composted, incinerated, or sent to a landfill. These are a couple of the added processes that make paper recycling not entirely efficient. Even with these inefficiencies recycling paper uses fewer resources and can be cost-effective.

Plastic is also difficult to recycle. The many different kinds, due to the many different plastic products that go into manufacturing them, must be recycled separately. The process of sorting plastics is inefficient and expensive. Plastics also lose strength every time they are recycled as the chains of molecules are broken into shorter and shorter pieces through the chopping, melting, and remolding process. Improvements in manufacturing of plastic products, such as thought being given to how they may be efficiently recycled, has contributed to increased recycling of plastic products and will hopefully play a larger role in plastic manufacturing in the future.

The processes for recycling aluminum and glass are somewhat less complicated with more outstanding benefits. It takes less than 1/20th of the energy to produce recycled aluminum as it takes to produce unused aluminum and the process generates less air, water, and solid pollution than manufacturing with original aluminum. Recycling glass requires relatively little water, creates no mining wastes and produces very little air pollution, which is in difference to the process of creating new glass.

It is important to understand that recycling has its down falls, as landfills and incineration have theirs. While recycling does make a great contribution to reducing the volume of waste in our landfills, while there may be new technologies that make recycling more efficient, and while through consumer education there may be greater demand for recycled products to 'close the loop' and add support to the whole recycling process, it is clear from these difficulties why recycling is only 4th on the list of priorities for the Montana solid waste management plan. However, the benefits of recycling still outweigh the costs!

Compost:

Decomposition is nature's way of recycling organic matter. When a dead tree falls, when leaves come to the ground in the falls, and when animals die they all begin to decompose, and eventually turn into soil. Composting is a way to mimic and speed up that process in our own backyards, classrooms, and municipal solid waste systems. Food and yard and garden wastes can be composted, producing rich compost for plants, shrubs and trees.

Currently less than 1% of Montana's waste is composted. If composting was used to its potential we could reduce the waste going into our landfill by up to 33%! In the activities "The Chef" and "As the Worm Churns" two methods for composting are clearly laid out. No matter what you do compost happens! It is a natural process and given a little bit of help it can happen a lot faster. It is inexpensive, efficient, environmentally sound, and effective on a small scale. In these ways, it is an improvement over our current method of landfilling the bulk of our organic wastes.

Landfills:

Land disposal is the oldest and most common form of waste management in the United States. 93% of Montana garbage is landfilled. When wastes are taken to a landfill they are dumped, compacted, and covered with soil. While decomposition does take place, due to the volume and limited exposure to air and water, it occurs over a long period of time. Newspapers may be completely legible after 20 years and apples and other food wastes still in tact.

Originally land disposal consisted of dumping waste in open pits with little environmental precaution taken and no regulation, which caused air, soil and water to be contaminated. Rain water would carry toxins, leachate, such as heavy metals, into the soil and groundwater where it could then spread to other areas contaminating drinking water sources and lakes and streams. Modern, 'secure,' landfills are designed to reduce their environmental impact by using a 'composite liner' made of clay or plastic which is impermeable to leachate. Any leachate that does form in the landfill must be collected and treated.

Another potential environmental hazard created by landfills is methane gas. As waste decomposes it puts off methane which is an air pollutant, is potentially explosive, and can starve plants of oxygen. As it is currently regulated, methane production is monitored to ensure that it is being properly vented. Some landfills burn it off as a waste product and a few landfills burn it for electricity production.

Landfilling was once valued for its cost efficiency. However, as land becomes scarcer, environmental standards elevated, and technology more advanced, landfills have become much more expensive. These expenses are paid for through taxes and also through tipping fees which are charged when waste is disposed of at the landfill. While landfills have long provided a place for our waste they are a limited resource.

As shown above, and throughout the following activities, there are many ways to deal with our waste. It will take an integrated approach, including education and action on the individual level, to make our waste systems sustainable and environmentally sound.

How Much Waste Do We Produce?

(Adapted from Activity 1: "How much trash do you throw away in a week?" From Trash Conflicts)

Background: Often when throwing away our trash we are not aware of the actual volume of garbage we as individuals create. Becoming aware of this volume allows students to become aware of the impact they can make on the waste stream and the importance of recycling and reusing items.

Subjects: math, social studies, science

MW Montana Curriculum Coop:

Grade 5: 1.3, 3.4, 5.3

Grade 6: 1.1, 1.3, 1.6, 5.2, 5.3, 5.4

Grade 7: 1.3, 3.4, 5.3

Grade 8: 1.3, 5.1, 5.3

Grades: 5-8

Teaching Time: 20 min. to introduce activity, 1 week of homework assignment waste record, 45 min. follow-up discussion

Focus: waste production, waste stream

Objective: Students will become aware of the volume and content of trash generated by individuals daily through observing and recording how much trash their families produce and exactly what is thrown away. Students will begin to see how waste disposal has become a problem and their own role in trash production.

Note to teachers: Some families may have difficulty cooperating with students collecting trash from home due to issues such as privacy/inconvenience. We hope that you can solicit parent cooperation with this project. There is a sample letter included in the 'supplements' section at the end of this packet. If it is not acceptable for students to keep track of their family's trash, perhaps they could keep track of their own waste, or waste generated at school. Being aware of student's sensitivities about their own trash is essential to making this activity a positive learning experience for all.

Vocabulary: garbage, trash, non-renewable resource, renewable resource, waste stream, landfill

Materials:

- 1 copy of "waste record" for each student
- 1 copy of "analyzing waste record" for each student
- Scales (in lbs.)
- Calculators

Lesson:

Gathering Information

1. Explain to students that they will be asked to document what their family throws away for the next week. Ideally students will weigh their trash, not all families have access to a scale so perhaps these students can estimate weight or list size of waste produced.
2. Distribute "waste record" handout to each student. Explain that on the handout they will list everything that is thrown away according to category.
3. Have students bring in completed sheets at the end of the week.

Compiling Data

1. Talk about the difference between renewable and non-renewable resources with students.
2. Have students complete "analyzing waste record" individually or in pairs.
3. After students are finished hold a discussion where students report their findings.
 - What types of trash did they throw away?
 - How much garbage do you think your family produces in a week?
 - How much garbage do you think you produce in a week?
 - How much of what you throw away is biodegradable?
 - How much of what you throw away is recyclable?
 - Where does all your trash go when you throw it away?
 - Do you think you could decrease the amount of trash you produce? How?
4. Talk about why one family's trash is different from another's and why it might be different from national or state averages. i.e. One student may have a baby in his or her home that uses disposable diapers. Yard waste varies from one season to another and may impact waste collected during one week.

Waste Record

Food Items	Amount	Metal Items	Amount	Yard Waste (list kinds)	Amount
Paper Items	Amount	Plastic Items	Amount	Glass Items	Amount
Other Items	Amount	Other Items	Amount	Other Items	Amount

Waste Record – Recycled

Food Items Recycled	Amount	Metal Items Recycled	Amount	Yard Waste Recycled	Amount
Paper Items Recycled	Amount	Plastic Items Recycled	Amount	Glass Items Recycled	Amount

Analyzing Waste Record

1. What three things were most frequently thrown away?
2. What three things were least frequently thrown away?
3. What was recycled?
4. After each item you listed indicate whether it is renewable (R) or non-renewable (NR).
5. Write the total amount of waste thrown away and recycled in each category:

	<u>Thrown Away</u>	<u>Recycled</u>
Food	_____	_____
Metal	_____	_____
Yard Waste	_____	_____
Paper	_____	_____
Plastic	_____	_____
Glass	_____	_____
Other	_____	_____
Total	_____	_____

6. It is estimated that the average family of four in the U.S. produces 150 pounds of trash each week.

$150 \text{ lbs.} \times 52 \text{ weeks/year} = 7,800 \text{ lbs. of trash per year for a family of four}$

$7,800 \text{ lbs.} / 4 \text{ people} = 1,950 \text{ lbs. per person (1 ton} = 2,000 \text{ lbs.)}$

If you can't imagine what one ton weights think of how much 65 fourteen-inch TV's would weigh, that's about a ton, and that's the average amount each person in the U.S. throws away each year.

- a. How many pounds of trash does your family throw away each week?
- b. How much trash does your family throw away each year?
(Total in part a X 52 weeks)
- c. What is the average amount of trash each member of your family throws away in a year? (Total in part b divided by the number of people in your family)

- d. Does your family throw away the same, less than, or more than the national average?
7. What is the percent of each category in the total trash? (for each category, divide the number of pounds by the total weight of the week's trash)

	Thrown Away	Recycled
Food	_____ %	_____ %
Metal	_____ %	_____ %
Yard Waste	_____ %	_____ %
Paper	_____ %	_____ %
Plastic	_____ %	_____ %
Glass	_____ %	_____ %
Other	_____ %	_____ %

Total = 100%

8. How did the amount of trash in each category compare with what you expected to find?

Is it Waste or is it Soil?

Background: The average family garbage can has varying items of waste. Much of this waste is compostable. In Montana 33% of the waste stream is made up of potentially compostable items. The National municipal waste stream is approximately 7% food waste and 20% yard and garden waste, for a total of 25% compostable waste. Think of the change that would be made in our waste stream if every household took care of their own compostable waste!

Subjects: social studies, science, math

NW Montana Curriculum Coop:

Grade 3: 1.1, 1.3, 1.5, 1.6, 5.3

Grade 4: 1.1, 1.3, 1.5, 1.6, 5.3

Grade 5: 1.1, 1.3, 1.5, 3.4, 5.3

Grade 6: 1.2, 1.3, 1.5, 3.4, 5.3, 5.4

Grades: 3-6

Teaching Time: 45 minutes

Focus: composting, waste reduction, energy saving

Objective: Students will learn, through a simple and fun in class activity, what the average American family throws away daily and will come up with steps, such as reusing and recycling, for reducing the amount of garbage their family generates.

Vocabulary: waste, compost, reduce, reuse, recycle, worm bin, hot pile compost

Materials:

- Heavy cardboard or construction paper
- Garbage can poster/silhouette
- Masking tape or scotch tape
- Colored marking pens
- Scissors
- Tape measure (if you build a life size model)

Lesson:

1. Construct a cardboard/construction paper garbage can
2. Ask students what kind of waste they produce on a daily or weekly basis.
3. Discuss the different kinds of waste i.e. paper, plastic, kitchen and yard waste, toxic/hazardous waste, etc.
4. Distribute, or have students make, 10 strips of paper per student (or per group if you prefer to do this activity in groups).
5. Have students write or draw a compostable item (food or yard waste) on 3 of their strips, a recyclable paper item on 2 of their strips, other recyclable items (aluminum, #1 and #2 plastics, etc.) on 2 of their strips, a reusable item on 1 of their strips, a reducible item on 1 of their strips, and a non-recyclable/reusable/compostable item on 1 of their

strips. (This will approximately mimic the actual waste stream with a little shifting to make room for reducible and reusable items which are not easily calculated in solid waste assessments.)

6. Tape students' strips to the garbage can and discuss the statistics (as listed in the background info above) and the results. What makes up the largest percentage of our waste? (compostable material)

7. Try taking away different types of materials to see how it changes the waste stream. Take away all the compostable items and note the difference.

8. Some possible questions: What causes a variation in yard and garden wastes or recyclable waste between states? Towns? Families?

9. Discuss reduction of compostable wastes: How can food waste be reduced? Can yard and garden waste be reduced? How? How can compostables be recycled? (compostables can be recycled by using a worm bin or a hot pile compost; see the Background Information on composting and activities "The Chef" and "As the Worm Churns" for more information on composting).

Extended Learning:

1. Combine information from this activity with the activity "Take a Look in Your Garbage Can!" Discuss the composite results of the garbage can.

2. Discuss recycling, focus on the amount of recyclable products in our waste stream and how decrease the waste stream through recycling.

3. Discuss ways to reduce the waste stream through source reduction (see activity...as a reference).

4. Set up a school worm bin or compost pile (there are activities in this book to help you do that!)

Decomposing Garbage

What happens to our garbage in the Landfill?

Background: Packaging in which we buy things in and receive mail order items in have not been created with decomposition in mind. Packaging is typically made with materials which are sturdy and non-biodegradable which means it takes more than 500 years for them to biodegrade. About 15 generations ahead of us will still be seeing traces of our packaging waste. Purchasing items that use less packaging or that have been packaged with recyclable materials can greatly reduce our waste production and improve environmental quality.

Subjects: science, biology

Grades: K-12

NW Montana Curriculum Coop:

- Grade K: 1.1, 1.3
- Grade 1: 1.3, 1.6, 3.0
- Grade 2: 1.3, 1.6, 3.0
- Grade 3: 1.1, 1.6, 3.1
- Grade 4: 1.3, 1.6, 3.1, 3.2
- Grade 5: 1.3, 1.6, 3.1, 3.2
- Grade 6: 1.3, 1.5, 1.6, 3.0
- Grade 7: 1.1, 1.6, 3.0
- Grade 8: 1.1, 1.6, 3.0, 5.1
- Grade 9: 1.6, 3.1, 5.1, 5.2
- Grade 10: 1.1, 1.2, 3.1, 5.2
- Grade 11: 1.1, 1.6, 3.0, 5.1, 5.2
- Grade 12: 1.3, 1.6, 3.1, 5.1

Teaching Time: approximately 3 hours over a 1-2 month period

Focus: decomposition of waste, composting

Objective: Students will learn about the basics of decomposition and the life expectancy of waste in landfills. Through understanding how decomposition happens and what happens to trash in the ground they will learn the importance of reducing waste and will discuss ways to reduce their own waste.

Vocabulary: decompose, compost, recycle, landfill

Materials:

- Soil
- small containers with lids i.e. peanut butter jars, yogurt containers, pint milk cartons (or Ziploc bags if more convenient), enough for 4-7 for each group
- items chosen by students i.e. orange peel, plastic pen, Styrofoam, cardboard, paper, etc., enough for one item per container for each group

- Water
- Decomposition record handout for each student

Lesson:

1. Ask students to gather materials from their lunches which they would like to use in an experiment.
2. Have students get into groups and pass out the containers.
3. Have students fill containers with soil and bury one object in each container.
4. Students should take detailed notes on what they bury and in what condition the items are in.
5. Label and date containers. Moisten soil.
6. Have a discussion about decomposition. Asks students questions such as:
 - What is decomposition?
 - What causes decomposition and what factors affect decomposition?
 - What items do you think will decompose first? Last?
 - Where can you see decomposition in nature?
7. Weekly or biweekly have students check on objects, moisten soil in their containers and record their observations. Ask students to think about decomposition – what is decomposing quickly, what is slow to decompose, what factors are at work, how long do they think certain items will take to decompose.
8. At the end of the experiment period (1-2 months) have a wrap-up discussion:
 - What did you find? What has decomposed? What has not?
 - What does this tell you about what you can expect to find in a 1 year old landfill? 50 year old landfill? 100 year old landfill?
 - Why is decomposition important?
 - Talk about composting as a way to speed up decomposition of food waste. (see activities “The Chef” and “As the Worm Churns” for background information on composting).

Extended Learning:

1. Have students present their groups’ findings through graphs.
2. Have students make a presentation on why or why not decomposition was happening quickly.
3. Have students use different types of soils, levels of moisture, or amounts of aeration with the same object. Have them find out how these factors contribute to decomposition.

What do you think you will find next time you check on your pots?

Zero Waste Lunch

(Adapted from Activity 13 Brown Bag Lunch from Trash Conflicts and Zero Waste Lunch from Blueprint for a Green School)

Subjects: math, social studies

Grades: 5-8

Teaching Time: 5 minutes to introduce activity, 20 minutes the following day to examine lunch trash, 30 minutes the next day to compare trash and discuss homework assignment (bag lunches on 2 consecutive days)

Focus: Waste Reduction, Reuse

Objective: Make students aware of what kind of materials go into their lunch, the amount of waste that they produce each day, and how they could reduce their lunch waste. Students will learn how to pack a lunch which creates less waste by examining their current lunch waste, discussing waste source reduction, and then creating a lunch with waste reduction as the goal. Students will also look at waste that they can not eliminate and will talk about reusing, recycling, and composting options.

Note: Some students will not be able to bring lunch from home. In communities where most students eat cafeteria lunches, this activity might not be appropriate or teachers may have to adjust the activity procedure to fit such conditions.

Vocabulary: trash, source reduction, reuse, recycle, compost, consumption

Materials:

- Paper and pencils
- 1 copy of handout "brown bag lunch" for each student
- "waste free" school lunch example (small cooler w/ Tupperware containers)
- waste from students' lunch on two consecutive days
- 1 '5 gallon' bucket for food wastes
- 1 measuring tape
- 1 scale

Lesson:

Day 1 - 1. Explain to students that they should bring in a bagged lunch (if they don't do so already) for two consecutive days. Ask each student to save the trash from their lunch for a classroom activity. Talk about the definition of trash.

Day 2. - 2. On the first day that the students bring their lunches, ask each student to answer question 1. on the handout "brown bag lunch" (list below all the items in your lunch trash from the first day). Remind students to include the bag itself if it is not reused.

3. Put students in groups of 3 or 4. Ask students to take turns recording the answers to the following questions:

- Identify the most common item thrown away.

- What is "source reduction"?
- How could you use less packaging for this food? (use a reusable lunch bag or box and use smaller reusable containers, such as Tupperware, to transport food; replace juice box with thermos; etc.)
- What food waste did you have? Did you have paper products? Did you have #1 or #2 plastic products?
- What could you do with the lunch waste you produce besides throwing it away?
- Why is it important to reduce our waste?

4. Have one spokesperson from each group share the group answers with the class. The class as a whole should come up with one definition of source reduction.

5. Ask students to put their trash in a separate box, bucket or bag to compare with the next day's lunch trash. If you will be visiting the compost garden soon, place food wastes in a bucket to bring with you.

6. Homework Assignment: Ask students to come up with, and bring, lunches for the next day which use the least amount of trash.

Day 3 – 7. Ask students to bring trash from the second day's lunch to class.

8. Have students fill out remaining questions on the "Brown Bag Lunch" handout.

9. Have students get into the same small groups and discuss answers to handout questions.

10. Collect the trash from all students and compare with trash from previous day. Note difference in weight and volume.

11. Have one student from each group (a different student than the previous day) report the group's findings to the class.

12. Conduct class discussion:

- Was there a reduction in the class's trash? By how much?
- Was there source reduction from one day to the next?
- Is source reduction a good way to reduce waste? Why or why not?
- What are problems with source reduction? Can we resolve any of those problems?
- What was the most common way we reduced our trash? What did we use less of? What was easy to reduce? What was hard to reduce?
- Hand out "Simple Ways to Reduce Waste in your Lunch." Are there any things on this list that we did not think of a class? (this hand out can be a reference for student for future use in continuing to reduce their lunch waste)

Extended Learning:

Discussion - In what other areas of our lives can we use source reduction, besides in our lunches? Do you consume a lot? How could you reduce your consumption? What is difficult about reducing consumption? Is it important to reduce our consumption?

- Activities -
1. Have students collect lunch non-food items for one week and weigh how much waste is disposed each week just from their lunches.
 2. Have a contest between classes to see which classroom can generate the least amount of lunch or classroom waste.
 3. Have students address cafeteria waste. This could include educating

other students about waste, working with cafeteria and administration to address source reduction in cafeteria purchasing, and any number of other actions. (see Cafeteria Facilities information)

Handout

Name: _____

Brown Bag Lunch

List below all the items in your lunch trash from the first day. Categorize them according to paper, plastic, food waste, etc.

List below all the items in your lunch trash from the second day.

What methods did you use to reduce the amount of trash you produce?

What trash was easy to reduce? What was difficult to reduce?

What changes in habit were required to reduce the amount of trash in your lunch?

Is source reduction, such as you did in this experiment, something that you could continue? How?

Write a short statement summarizing your findings about source reduction from this activity.

Simple Ways to Reduce Waste in Your Bag Lunch

1. Don't use disposable lunch bags – Buy or make a reusable canvas, nylon, or cotton bag. Plastic lunch boxes and coolers are okay but think about what you will do with it when it does wear out and how long it will take to decompose. You can use these types of bags and boxes for many years!
2. Don't use pre-packaged singles- Buy bulk foods and treats which can be put in reusable containers.
3. Use reusable containers- Use durable plastic containers. Reuse margarine, yogurt, and drink containers over and over.
4. Reuse plastic bags as much as possible- If bags which food is wrapped in are reused instead of using new bags for each meal, buying new bags may not be necessary. Bread bags make great sandwich bags which can be used for months. Simply turn inside out, wipe with soapy sponge, rinse and leave out to dry.
5. Use recyclable products - Aluminum is commonly accepted at recycling centers. Currently, containers such as glass and certain types of plastics are not recycled in most places in Montana. In Flathead County #1 and #2 plastics with necks, such as milk cartons and juice bottles, can be recycled. Read the number which is on the bottom of plastic containers to find out if they are recycled in your area or not.
6. Take leftovers home- Leftovers don't have to be garbage. Take leftovers home to be eaten later or to be composted.
7. Bring containers home- You are responsible for your own waste. Bring your used containers home to be washed and reused. Materials are not "finished" just because we are done using them for the moment.
8. Have you thought of other ways to reduce your lunch waste? List them here:

Cafeteria Facilities – background information for extended learning

An ideal environmentally oriented school cafeteria is one that serves food on permanent-ware (reusable silverware, trays, cups, and dishes) and uses energy-grade and water-efficient industrial dishwashers.

Many schools' food services have been sold into the notion that disposable lunch ware are cheap, clean, convenient, and labor efficient. Within the last 20 years this notion has become more popular. Disposables may be more cost efficient to schools in the short term but are more costly to the environment in the long term. Using disposables also teaches students that using large amounts of disposable products for meals is okay any time, not just during school lunch.

Here are some of the costs and benefits of creating a less wasteful cafeteria:

Benefits	Costs
<ul style="list-style-type: none">- Less trash going to the landfill- Less consumption of natural resources- Reduced pollution associated with resource replacement extraction, manufacturing, and transportation- Opportunity to educate students about the value of resources and about the consequences of the throw-away culture- Opportunity of students to learn by example and through action	<ul style="list-style-type: none">- Initial monetary cost of buying dishes, utensils, and dishwasher- Ongoing dish and utensil

Polystyrene vs. Styrofoam

Polystyrene is a new material popularly used in food-service facilities and is often mistaken for Styrofoam. It is cheap, lightweight, sanitary, and considered to be recyclable. However, Polystyrene also has many negative environmental impacts: Using polystyrene trays gives students a message that using a material for a few minutes only to discard it is acceptable. This type of message reinforces the throw-away mentality, increases the size of landfills, and adds to the waste problem

Polystyrene is a petrochemical base; it is made out of non-renewable resources. Materials such as polystyrene cannot be made into the same material again, which is different from recyclable materials such as glass and aluminum. Once recycled new resources will always be needed to create the same product.

Polystyrene is a possible carcinogen and can leach from cups and plates into food, causing nerve damage in humans.

Polystyrene can pose a hazard to workers during production. After 5 years of plants being in service a significant percentage of workers developed liver cancer though to be related to their work.

If your school uses polystyrene it is worth looking into the costs and benefits of this product and considering recyclable or reusable alternatives.

Purchasing and installing industrial-grade, energy grade and water-efficient dishwashers and purchasing reusable trays, plates, cups, and utensils are a couple of the steps your school can take toward creating a waste free cafeteria. These measures will also require some education of cafeteria staff as well as faculty and students to be successful. There are many innovative actions schools are taking in their cafeterias, classrooms, and buildings that positively impact the environment and the school community. Reducing waste does not have to be a costly undertaking. Some schools send their food waste to a local pig farm for slop or to commercial composting operations; other schools have clean plate club education to get students to only take as much lunch as they can eat. With a bit of research, creativity, and energy your school can make a difference too!

Why Bury Waste?

(Adapted from A-Way With Waste activity "Why Bury Waste")

Subjects: language arts, social studies

Grades: 3-6

Teaching Time: 30 minutes

Focus: waste reduction, solid waste disposal, landfilling

Objective: While there is much that can be done to reduce our waste stream there will most likely always be materials that can not be reduced, reused, or recycled and must be disposed of as trash. In this activity students will learn about landfills, how they work, and the role that they play. If students will be touring the landfill this can get them thinking about it and give them some background information.

Vocabulary: landfill, methane, leach/leachate, reduce, reuse, recycle, compost, decomposition, tipping fee

Materials:

- pictures of appliances or worn out furniture
- magazine or newspaper ads showing items that may end up in a landfill
- picture of 'a modern landfill' (in the 'supplements' section of this curriculum)

Lesson:

1. Divide students into groups.
2. Give each group an item or a picture of an item which can no longer be used as it was intended to be used, and has no more useful life.
3. Ask students to speculate about the "life" – the history and experience – of their items. Ask them to select a spokesperson to then present their discussion to the class.
4. Ask groups to think of other items which, despite repair and reuse, will someday be disposed of. Ask "what can be done with these."
5. Talk about landfills, their cost, and their use.
6. Talk about the local landfill, where it is, how the services work, and what the cost is.
7. Have a class discussion about the positive role a landfill plays and also about the negative impacts it can have, particularly if not properly managed.
8. If students will be visiting the landfill have them generate a list of questions to be given to The Waste Not Project coordinators to be answered during the tour.

What's Hazardous At Home?

(Adapted from A-Way With Waste "What's Hazardous At Home")

Background: People have become concerned about the health effects of hazardous materials stored, used, or disposed of in their houses and communities. Consumers generally have little information about the long-term effects of chemicals contained in common home and garden products. Many products and chemicals that were once considered "harmless" have now been linked to health problems, due to exposures over long periods. A substance that is classified as hazardous is required to be labeled with warning statements and safety information. Even with labeling it can still be difficult to determine how to use, store, and dispose of a product safely.

Subjects: science, social studies, health

NW Montana Curriculum Coop:

Grade 2: 1.2, 3.0

Grade 3: 1.2, 3.1

Grade 4: 1.1, 3.0, 3.1

Grade 5: 1.1, 3.0

Grade 6: 1.1, 3.0, 3.1

Grades:2-6

Teaching Time: one class period

Focus: household hazardous wastes, storage and disposal

Objective: Some household products may be harmful to people, pets, and/or the environment if handled improperly. Students will learn about some common household products that may be hazardous, identify where these products may be found, learn how to protect themselves, and learn how to educate their parents and siblings about these products.

Vocabulary: hazardous waste, corrosive, toxic, flammable, reactive, irritant

Materials:

- 1 copy of "what's in your house" handout for each student (found in the 'supplements' section of this curriculum)
- Packages and labels of hazardous waste
- Other handouts about substance warnings, hazardous characteristics, and hazardous substance substitutes (found in the 'supplements' section of this curriculum)

Lesson:

1. Talk with students about hazardous wastes. Define various terms: hazardous, harmful, corrosive (rapidly eat into or dissolve away what they touch), toxic (poisonous), flammable (quickly burnable), reactive (explosive), irritant. Ask where these types of products might be found in their home.

2. Have each student draw a floor plan of his or her house, garage, and any other buildings or areas where they live.
3. Hand out "what's in your house." Go over the list with students, identify and describe the less familiar products such as antifreeze, paint strippers, varnishes, and drain cleaners.
4. Have students mark on their floor plans where in their houses the listed products might be found.
5. Show students packages and labels from a number of products on the list. Ask questions such as: Where on a label or package can you look to find out if the product might be harmful? What will the package or label say? (Package or label may say "Danger/Poison," "Warning," "Caution," or "Keep out of reach of children," and then will list the possible harmful effects of the product.)
6. Have a discussion about how and where these products should be stored. Have students draw arrows on their floor plans to show where hazardous materials should be moved from and to.
7. Talk with students about possible disposal methods. How can we get rid of these products without hurting ourselves, others, or the environment? (There is household hazardous waste disposal available at the Flathead County Landfill 758-5910 on the third Saturday of every month. Products should not be mixed together. Automobile oil can be recycled at local gas stations. For disposal information on other products there are many resources such as Montana Pollution Prevention Program at (888) 678-6872 and on the web at www.montana.edu/wwwated/business.html and the Montana Department of Environmental Quality at (406) 444-1435.)
8. Ask students if they know of ways to reduce their hazardous waste. What could they use as alternatives to products that are hazardous? (refer to handout 'safer subs')
9. Have students take home their floor plans and handout to share with their family.

The Chef

Setting-up a Classroom Composting System

Background: Composting is an easy method of taking backyard, garden, and food waste and turning it into healthy, nutrient rich soil. Composting is also a traditional means of reduction and recycling organic wastes which now fill our growing landfills. In Montana 33% of residential solid waste is lawn and garden waste. When community-scale composting takes place it can greatly reduce the volume of waste going into landfills or incinerators.

Subjects: science, biology, horticulture, vocational agriculture

NW Montana Curriculum Coop:

Grade 3: 1.3, 5.0

Grade 4: 1.3, 5.0

Grade 5: 1.3, 5.1, 5.2

Grade 6: 1.3, 5.1, 5.2

Grade 7: 1.1, 1.2, 1.3, 5.0

Grade 8: 1.1, 1.2, 5.1, 5.2

Grade 9: 1.2, 1.3, 5.0

Grade 10: 1.1, 1.2, 5.0

Grade 11: 1.2, 5.0, 5.3

Grade 12: 1.2, 5.0, 5.3

Grades: 3-12

Teaching Time: one class period

Focus: composting, organic gardening

Objective: Students will: 1. learn the basics of composting, 2. understand how composting reduces yard, garden, and kitchen waste, 3. learn the basics of soil construction, and 4. learn the difference between carbon and nitrogen materials in the composting process.

Vocabulary: compost, organic, nitrogen vs. carbon, brown and green materials, nitrogen cycle, recycle

Materials:

- Organic materials that contain high carbon, e.g. dead leaves, saw dust, tea leaves, coffee grounds, etc. (brown materials).
- Organic materials that contain high nitrogen, e.g. fresh grass clippings, food scraps, etc. (green materials)
- Soil
- 5 gallon bucket or compost bin 3 cu. ft.
- soil thermometer

Lesson:

Option 1 – Building a hot compost pile. Hot compost piles are useful for composting food and yard wastes together. The advantages of hot compost piles, properly constructed, are that they: are free of pests, kill soil diseases and weed seeds, and produce compost quickly.

1. Gather all the materials needed to make a pile at least three cubic feet. Use both green (nitrogen rich) materials such as fresh grass clippings, yard trimmings and food waste, and brown (carbon rich) materials such as dead leaves, straw, and saw dust. (Alternating layers of brown and green materials of the same thickness produces a 30 to 1 carbon to nitrogen ratio which is ideal for fast decomposition).
2. Shred or chop materials which are larger than 3 square inches.
3. Start your pile with a 4-6 inch layer of brown (carbon) materials. If no food wastes are included and the pile is going to sit for more than a few weeks, use coarse material such as corn stalks or small tree branches for this base layer to let air into the pile.
4. Moisten materials.
5. Layer 4-6 inches of green (nitrogen) materials on top of the brown materials. If the greens are not fresh sprinkle them with a small amount of cottonseed, poultry manure, or other high nitrogen source. Food wastes should not include meat, fats, or oils because they are difficult to decompose and they attract animals.
6. If you choose to build a bin to hold the compost, fill the bin until the pile is three or four feet high. Continue alternating 4-6 inch layers of carbon and nitrogen materials.
7. Cover the pile or close the bin to aid in maintaining the proper amount of moisture (not too much or too little). Regularly monitor the temperature in the pile's interior. It should peak between 120-160° F.
8. When the pile begins to shrink in size, turn it. Take materials from the outer edges and the top of the pile and put them at the base and in the middle of the pile and materials from the middle to the outside.
9. The temperature should peak about a week later. Turn the pile again. In another week it should be finished.

(Option 2) – build many compost piles to experiment with different variables and see the effect on the composting process.

1. Using the layering and turning method described in Option 1, start five (or more) experimental compost piles in bins or five-gallon buckets. Here are ideas of variables to adjust:

- a. Nitrogen – use only brown, high carbon, materials
- b. Carbon – use only green, high nitrogen, materials
- c. Aeration – do not poke holes or have air circulation in one bucket
- d. Moisture – do not water it and do not add wet materials
- e. Control - recommended pile, as described in Option 1, with 30:1 nitrogen:carbon, aeration, and moisture

Students may want to come up with their own variables as well.

2. Keep a daily record of the temperature of each pile, and any other observations (size, weight, smell, mold/fungus, organisms present, etc.)

3. After three or four weeks discuss the results. Some questions you may ask:

- What are the necessary components of a good compost pile?
- Does one pile decompose more quickly than the others? Why?
- How do the components of a compost pile work together to decompose materials?
- How is recycling within the compost pile like the nitrogen cycle and other natural cycles in our biosphere?

- Where does composting occur naturally?
- What are the environmental impacts of dumping compostable materials into landfills?

Extended Learning:

1. Use the finished compost as soil for classroom plants or a school garden.
2. Visit other composting sites, such as local farms, or families who compost.
3. Look at other types of composting, such as worm composting.

As the Worm Churns

Setting-up a Classroom Worm Bin Composting System

(Adapted from Activity *As the Worm Churns* from [A-way with Waste](#))

Background: When food scraps are thrown into the garbage, we are throwing away a valuable resource. Redworms, *Eisenia foetida*, are used to process kitchen waste into high quality garden compost. Properly constructed and maintained, the bins do not give off an offensive odor and can handle all of a household's, or even a classroom's, food waste. Worm bins produce the following benefits: reduce household waste, save garbage disposal costs, produce an excellent soil nutrient enhancer, provide worms for fishing, and demonstrate the important natural processes of biodegradation and soil production.

Subjects: science, personal and family life science, woodshop

NW Montana Curriculum Coop:

- Grade K: 1.1, 1.3
- Grade 1: 1.3, 1.6, 3.0
- Grade 2: 1.3, 1.6, 3.0
- Grade 3: 1.1, 1.6, 3.1
- Grade 4: 1.3, 1.6, 3.1, 3.2
- Grade 5: 1.3, 1.6, 3.1, 3.2
- Grade 6: 1.3, 1.5, 1.6, 3.0
- Grade 7: 1.1, 1.6, 3.0
- Grade 8: 1.1, 1.6, 3.0, 5.1
- Grade 9: 1.6, 3.1, 5.1, 5.2
- Grade 10: 1.1, 1.2, 3.1, 5.2
- Grade 11: 1.1, 1.6, 3.0, 5.1, 5.2
- Grade 12: 1.3, 1.6, 3.1, 5.1

Grades: K-12

Teaching Time: 30-40 minutes, plus a little time each week to maintain the bin

Focus: household waste, composting, waste reduction

Objective: Students will: discover a beneficial and easy way to reduce household waste, understand the natural process of biodegradation and soil production, learn the benefits of composting, and know how to improve soil fertility through worm composting.

Vocabulary: reduce, composting, worm composting, biodegradation, worm castings

Materials:

- Paper (best to use old newspaper or paper that would otherwise be recycled)
- Water
- Soil
- Red worms
- Food waste
- Worm bin

Vermicomposting Basics and Suggestions:

Some benefits of worm bins

- Reduce household waste going to the landfill
- Save garbage disposal costs
- Produce an excellent soil enhancer
- Provide worms for fishing
- Demonstrates important natural processes: biodegradation and soil production

A worm bin

Worm bins can be built in many shapes and sizes. A few common items that work well include: plastic 10 gallon bin with holes poked in it, a 5 gallon bucket with holes poked in it and a lid, a box constructed out of wood, a commercial worm bin (usually these are made out of plastic and have a few bins stacked on top of each other). Practically any container can be used as a worm bin provided it is large enough, has good ventilation, there is enough food for worms, and the bedding is kept moist.

Size

As a general rule: 1 cu. ft. of space is needed for each pound of food waste generated each week. If your class produces about four pounds of food waste each week you need to have a 4 square foot worm bin. A 5 gallon bucket would be appropriate for approximately 1 lb. of food per week.

Materials needed to start your bin (based on a 4 cu. ft. size – adjust accordingly)

- 1 bin, no deeper than 12 inches (to prevent anaerobic conditions from developing), with a lid or a black plastic sheet to cover it
- A place in your room or elsewhere that has a temperature from 55-77° F.
- 6 lbs. of paper for bedding (black and white newsprint or used paper work great)
- 1-2 handfuls of soil (optional)
- 1 lb. of red worms (usually *Eisenia foetida*)
- 4 lbs. of food waste per week
- Water

The general formula

For each cubic foot of bin you need: 1.5 lbs. of bedding, 4.5 lbs. of water, 1 lb. of garbage per week, 4.5 ounces of red worms, and a bit of soil.

Ventilation

For a 4 cu. ft. box about nine to twelve holes should be drilled into the sides and bottom of the bin. This should be enough to keep air circulating and not too many to dry out the worms.

Getting your bin started

Shred the paper by tearing it into strips about 2 inches wide. Put the paper in a bucket and slowly pour water in while fluffing the paper occasionally. Let the paper segments drip until dripping subsides. Put wet strips of paper in the worm bin. Gently place the worms in the box, leaving the top open until the worms burrow down. Close the

lid or cover with a black plastic sheet. (Since worms do not react to red light, a red Plexiglas side panel or lid would allow direct observation of worm activity). Bury food in the box each week, rotating the burial location.

Food dos and don'ts

Do use:

- fruits and peels
- cheese and cottage cheese (in small amounts)
- oatmeal, cereal
- pizza crust, bread
- vegetables (raw or cooked)
- small amounts of paper products such as napkins, tissues, and paper towels

Do not use:

- meats and fats
- high quantities of dairy products
- non-food products such as aluminum, plastic, and glass

Make sure that all materials are broken into small chunks. Larger pieces will take longer to decompose.

Moisture

Be sure to add water to your worm bin to keep the bedding moist and to keep the worms from drying out. The bedding should be kept about as wet as a wrung out sponge.

Changing the bedding

Bedding should be changed and compost (mostly worm castings) removed every 3-6 months.

Either dump the contents of the bin under a bright light and brush the layers of compost away (the worms will move away from the light and gather at the bottom of the pile) then put in new bedding and replace the worms or pull the compost plus worms to one side of the bin, add new bedding to the vacant side, wait a couple days, and then remove the compost (the worms will move to the new food, leaving your compost worm free and ready to use).

Lesson:

1. Obtain a bin
2. Talk with the class about the impact of food wastes on the solid waste stream. Discuss alternative methods of handling food wastes. Introduce the idea of using red worms. (see background info on...)
3. You will need one pound of earth worms for the bin. Ask the students to look for and collect red worms (not night crawlers). Hints for where to look: barnyards under mulch, in compost piles, under decomposing lumber. You may need to supplement your worm supply from a commercial grower (see composting resources for possible worm sources).
4. Set up your worm bin. For a 4-cu.ft. bin, bury four pounds of food waste in the bin each week, making sure to rotate the location of the burial. It may be helpful to mentally divide the bin into nine squares and rotate through these every nine days. Your worms will do most of the work! You just need to maintain the bin as directed above.

Extended Learning:

1. Study the food preferences of young versus mature worms. Using four worm bins, study the reactions of the worms to the four food groups.
2. Keep records of the temperature of the compost, room temperature, amount and types of food fed to the worms, and total volume/weight of compost. Relate these variables to each other and to the productivity of your worm bin.
3. Study the worm life cycle. How do worms reproduce? Do you see any babies? How long do the worms seem to live? Do you see any dead worms?
4. Study the other organisms present in the worm bin (many of these are microscopic). What is the relationship of these organisms to one another and to the compost process?
5. Study the effects of various mixtures of vermicompost, soil, and perlite on potted plants.

Personal Waste Impact Statement

(Adapted from Connections: Your Guide to a Healthy Environment, "Eco Assignment 6")

Subjects: social studies, English (writing)

Grades: K-12

Teaching Time: 30 min.

Focus: Personal Waste Reduction

Objective: This activity is meant as a wrap up to any previous waste education. It is a way for students to reflect on what they have learned and think about how to apply their learning beyond the individual lessons.

Vocabulary: personal impact, waste, all vocabulary from previous lessons

Materials:

- 1 copy of "impact statement worksheet" for each student
- writing utensils

Lesson:

1. Hold a discussion about the lessons the students have learned. Ask questions such as: What have you learned about waste? Recycling? Source reduction? Landfills? Composting? Would you like to do anything to reduce your waste in the future? What can you do?
2. Have students spend some time filling out the personal waste impact statement. (if students did not do the activity where they measure their family's waste production, have them fill in the blanks with the national or state average: the average U.S. citizen produces 3.58 lbs. per day; the average Montanan produces 4.85 lbs. per day.)
3. If students want to share more about their answers or learning, after filling out their statement, allow time for that.
4. Encourage students to follow their statements, both in and out of the classroom, and use what they have learned.

Extended Learning:

1. Make copies of the impact statements for future use. A few weeks or a month later return the statements to the students and ask them if they have tried to use what they learned and if so in what ways. How do they feel about what they are doing? How do their families feel about it? Why is it important to them?

Date: _____

Name: _____

Personal Waste Impact Statement

Decide how much you want to reduce your impact by reducing your waste stream. Think about what you have learned from the activities on waste, recycling, reducing, and/or composting. Think about what you want to do now that you have learned about waste.

Draw or place a picture of yourself here:

I (print your name)

have learned a lot about the waste I produce. I realize that through the choices I make I affect the environment. I will try to reduce my impact through the actions I write below.

(signature) _____

This is how much waste I produce:

_____ lbs. of non-recyclable garbage produced/year by your family divided by number of family members in your house = _____ lbs./year from each person.

Divide this number by 365 to get your daily waste production: _____ lbs./day.

I produce about _____ lbs. of garbage each day.

This is how I plan to reduce my waste:

I will try to reduce this to about _____ lbs. each day by doing the following things:

1. _____

3. _____

2. _____

4. _____

Describe how the actions you plan to take will affect the environment:

Your Efforts Really Do Make a Difference!!!

Waste Not Project Glossary:

actinomycete - bacteria resembling fungi because they usually produce a characteristic, branched mycelium

aerate - expose to air, or cause air to circulate through; in composting: turning the pile to get oxygen into it

aerobic bacteria – bacteria that require oxygen to function; these work on compost faster than anaerobic bacteria and are typically found in compost piles that are well aerated

anaerobic bacteria – bacteria that do not require oxygen to function; these do not work as quickly to decompose materials as aerobic bacteria do and are typically found in compost piles that are not well aerated

animal – any living organism, excluding plants and bacteria

annelid - any of a roundish, wormlike animal having long, segmented bodies, a brain and ventral nerve cord, and a closed circulatory system

bacteria - one-celled microscopic organisms, some are capable of causing disease in humans, others are capable of making pile of decomposing matter hot enough to kill pathogens

biodegradable – can be broken down and decomposed by living organisms

browns - compost materials that are high in carbon such as dead leaves, dried grass clippings, and woody materials like brush

carbon - a nonmetallic chemical element found in all organic compounds

carbon:nitrogen ratio - the ratio of carbon to nitrogen in an organic substance, the ideal carbon:nitrogen ratio for a quick decomposition compost pile is between 20:1 and 30:1

close the loop – complete the recycling process by buying products made from recycled materials

composite liner – a landfill liner made of both plastic and soil components

compost – (noun) the end result of composting; dark, rich decayed organic matter that looks like soil and is used for fertilizing and conditioning soil; (verb) the process of biological reduction of organic waste to humus

composting – the natural decomposition and recycling of organic material by micro-organisms into rich humus known as compost; the speeding up of a natural decomposition process under the semi-controlled conditions of a heap, pile, or bin; a waste management strategy where organic wastes are partially decomposed by aerobic bacteria and fungi, producing a useful soil additive; fourth priority in the waste management hierarchy

consumption – the use of resources (either materials or energy) or services, either by consumers or in the production of other goods

contaminate - to make impure, infected, radioactive, etc. by contact with or addition of something; pollute

contaminant – a substance which causes pollution

corrosive - a substance that eats into or gradually wears away another material

decompose – to decay, to rot; to break down into smaller particles

decomposers – organisms such as fungi and bacteria that break down organic material

decomposition – the natural process of recycling of organic matter by breaking it down into its simpler parts

disposable product – a product designed for single-use or short life span to be thrown away after use, e.g. disposable diapers, ball point pens

dorsal – the top surface of an earthworm

durable product – a product that is designed to have an extended life span and to last in spite of hard wear or frequent use; opposite of disposable

earthworm – a segmented worm of the annelid group which contains some 4000 species; most earthworms are terrestrial, that is they live in the ground, and have bristles known as setae which enable them to burrow in the soil; they help to aerate and enrich the soil

Eisenia fetida – scientific name for one of several redworm species used for vermicomposting; color varies from purple, red, dark red to brownish red, often with alternating bands of yellow in between segments; found in manure, compost heaps, and decaying vegetation where moisture levels are high; frequently raised on earthworm farms

fungi - simple plants, often microscopic, that lack photosynthetic pigment

environment – all the conditions, circumstances, and influences surrounding and affecting an organism; surroundings, habitat

environmental cost – a calculation of the effect that the production of a product has on the environment, usually considers the effect of resource depletion and pollution in extraction, manufacture, transportation, use and disposal

EPA (U.S. Environmental Protection Agency) – the federal agency charged with enforcement of all federal regulations having to do with air and water pollution, radiation and pesticide hazard, ecological research, and solid waste disposal

excrete – to separate and to discharge waste

feces – waste discharged from the intestine through the anus; manure

fertile - producing abundantly; rich in resources

fertilize – to supply nutrients to plants; to make productive

fertilizer - a substance (natural or synthetic) used to enrich the soil

garbage – wet discards and food waste, as contrasted with trash, which refers to discards that are dry

green products (green consumer choices) – items which have a lower environmental cost than traditional products

greens - compost materials that are high in nitrogen such as kitchen food waste, green plants, and green grass clippings

hazardous material – chemical or product that poses a significant threat to human health and/or the environment in use, transportation, or disposal defined as toxic, reactive, ignitable, corrosive, or radioactive

humus – partially decayed organic matter that is the end product of composting

ignitable - able to be set fire to or cause to burn

incineration – burning to ash; waste disposal technique, fifth priority in the waste management hierarchy

incinerator – facility designed for the controlled burning of waste; reduces waste volume by converting waste into gases and relatively small amounts of ash

landfill – a place where wastes are disposed of by burying them in the ground; in sanitary landfills waste is layered with soil and compacted; lined landfills have a barrier to prevent leaking into the surrounding area (secure landfill)

leach – to run water through a medium, causing soluble materials to dissolve and drain off

leachate – the liquid formed when water passes through a landfill picking up a variety of suspended and dissolved materials from the waste; can be toxic and may be carried into the ground water if not contained; pertaining to compost, it is the liquid that drains from organic material, especially when rain water comes in contact with the compost

loam - a soil mixture of sandy soil, clay, and organic matter

Lumbricus rubellus – scientific name for redworm species; color is ruddy-brown or red-violet, iridescent dorsally, and pale yellow ventrally; it has been found in a wide variety of habitats, including under debris, in stream banks, under logs, in woody peat, in places rich in humus, and under dung in pastures; grown by worm growers

macro organism – an organism which can be seen by the naked human eye; in compost, animals such as earthworms, sow bugs, mites, millipedes, and beetles that live in compost at the cool, end stage

mesophilic bacteria – bacteria that thrive in the mid-temperature (70° - 90°F) stage of composting; their consumption generates heat and raises the temperature of the pile to over 100°F

methane – a colorless flammable gas; formed by anaerobic decomposition common in landfills which must be vented or burned to prevent gas buildup and potential explosion; can be used as fuel

micro-organism – organism that is not visible to the human eye without being magnified; in compost: bacteria, fungi

monofill – a special secure landfill which is used only for a single type of waste, e.g. ashfill

MSDS (Material Safety Data Sheets) – information provided by manufacturers of hazardous substances which specify contents, and procedures for handling, storage, and disposal

mulch - organic material placed on top of soil to reduce evaporation and erosion, prevent weed growth, insulate plants from extreme temperature change, and feed the soil; includes materials such as wood chips, leaves, hay, etc.

municipal solid waste (MSW) - solid waste originating from homes, industries, businesses, demolition, land clearing, and construction

natural resources – materials derived from the earth, such as coal, oil, water, etc. which are used for energy or in the manufacture of goods

nitrogen cycle – cyclic progression of chemical reactions in which atmospheric nitrogen is compounded, dissolved in rain, deposited in the soil, assimilated and metabolized by bacteria and plants, and returned to the atmosphere by organic decomposition

non-biodegradable - a material that will not break down and decompose

oligochaeta – name of the class of annelids to which earthworms belong, characterized by having setae

open dump – traditional waste disposal method of open piles of garbage

organic – pertaining to or derived from living organisms

organic matter – anything that is, or once was, living; material which comes from something which was once alive

organism - any individual animal or plant with diverse organs and parts that function together as a whole to maintain life and its activities

over-packaged – term describing goods which have more packaging material than is necessary to simply wrap, contain, or protect the product; overpackaging is a source of waste that can be reduced

packaging – the materials used to wrap, contain, and protect products; may also advertise the product

paperboard – a type of thin cardboard used for products like cereal boxes; often made of recycled fiber

particulates – very small separate particles, in incineration: particles of ash carried in the hot gasses produced in incinerators; usually “scrubbed” before the gasses are released

pathogens - disease-causing organisms

peat moss - organic matter that is slightly decomposed originating under conditions of excessive moisture such as in a bog; used to be commonly used as a starter worm bedding in vermicomposting, its use is no longer recommended by most composters as it is recognized as a non-renewable resource

pest – an organism which someone wants to get rid of; any destructive or troublesome insect, small animal, weed, etc.

post-consumer content – in a recycled product, the amount of material that has been previously used at the consumer level and returned for recycling and remanufacture

pre-consumer content – in a recycled product, the amount of material that has been recovered from the manufacturing process and recycled into a new product; recycled material that has not been used at the consumer level

psychrophilic bacteria - cool temperature bacteria which thrive at low temperatures (14° F), but optimally above 68° F; they enter the compost pile during early stages and begin to burn or oxidize carbon, releasing heat and nutrients, and raising the temperature of the pile

raw materials – substances still in their natural state before processing or manufacturing; the starting materials for a manufacturing process

reactive – a category of hazardous material which tends to react spontaneously with air or water, explode when dropped, or release toxic gasses

recovered materials – those materials which are separated and collected for recycling, removed from the waste stream for sale, use, or reuse

recycle – to treat or process in order to use again; a waste management strategy where materials from waste are recovered, reprocessed, and manufactured into new products; third priority in the waste management hierarchy

recycled – composed of materials which have been processed and used again

reduce – see source reduction; the first priority in the waste management hierarchy

redworm – a common name for *Eisenia fetida* and also *Lumbricus rubellus*; *Eisenia fetida* is a common worm used for vermicomposting, although in some parts of North America, *Lumbricus rubellus* is more common

reuse - to use again

setae – bristles on each segment of a worm, used in locomotion

soil – the surface layer of earth, supporting plant life; soil is made up of mineral particles, organic matter, air, and water; the organic matter acts like a sponge to hold water; the mineral particles are called sand, clay, or silt, depending on their size: sand has large particles and feels gritty. clay has fine particles and feels sticky or slippery when wet, silt particles range between silt and very fine sand, soil types have differing amounts of each of these particles

soil conditioner - something that improves the physical condition of soil and increases its organic content

solid waste – any of a variety of solid materials and liquids that are considered unusable and must be discarded; includes household garbage, food waste, yard trash, white goods, ash, sludge, or other discarded material

source reduction – a waste management strategy which attempts to decrease the amount and toxicity of solid waste before a material enters the waste stream; reducing the amount of waste by design and engineering; first priority in the waste management hierarchy

sow bug – a small crustacean with 10 pairs of legs which breathes with gills and lives in organic litter, common in the final stages of composting

springtail – a small primitive insect with a turned-under projection on its abdomen which causes it to spring about, common in the final stage of composting

subsoil – mineral bearing soil located beneath humus-containing topsoil

sustain - to keep in existence; keep up; maintain

sustainable – able to be continued indefinitely without a significant negative impact on the environment or its inhabitants

sustainable future – the objective of many conservation efforts to minimize the use of resources in the maintenance of a productive lifestyle; an ideal vision of the future where there is no net loss of resources

thermophilic organisms – high-temperature (105° - 158° F) compost bacteria, fungi, and molds that help to complete the compost process

tipping fee – the fee charged a waste hauler to deposit material at a transfer station, incinerator, or landfill (see user fee)

toxic – poisonous or harmful to humans, animals, plants, and/or the environment...poisonous, life-threatening

toxic chemical - a chemical that causes disease or harm to an organism (plant or animal)

toxicity – a relative measure of how poisonous a substance is; an objective o source reduction waste is to reduce the toxicity of waste as well as the amount of waste

trash – term used for the category of wastes that usually do not include food waste, but may include other organic materials such as yard trimmings, refers specifically to discards which are theoretically dry, such as newspapers, boxes, cans, etc.; the term is commonly used to indicate anything we throw away, including organics; broken, discarded, or worthless things; rubbish; refuse

unrecoverable waste – waste which has no reusable or recyclable components and must be disposed of in a landfill or incinerator

user fees – money charged to recipients of a particular service, e.g. fees charged by a trash hauler to collect trash curbside (see tipping fee)

ventral – term for the underneath surface of an earthworm

vermicompost – (noun) mixture of partially decomposed organic waste, bedding, worm castings, cocoons, worms, and associated organisms that is the end result of composting with worms; (verb) to carry out composting with worms

vermicomposting - composting with worms

vermiculture – the raising of earthworms under controlled conditions

waste – any material that is useless, superfluous, or not used and is discarded, such as ashes, garbage, sewage, etc.; a substance or material discarded despite its inherent value or usefulness

waste exchange – a system which allows the waste from one activity to be used as a resource in another activity

waste management hierarchy – the priority order of managing waste developed by the EPA: 1) Reduce, 2) Reuse, 3) Recycle, 4) Compost, 5) Incinerate, 6) Landfill

waste stream – the total waste produced by a community or society, as it moves from origin to disposal; all of the waste generated in the process of production, utilization, and disposal of goods

worm bedding – moisture-retaining medium which provides a suitable base environment for worms; worm beddings are usually cellulose-based, such as newspaper, corrugated cartons, leaf mold, or compost

worm bin – container designed to accommodate a vermicomposting system

worm castings – worm excrement; undigested material, soil, and bacteria deposited through the anus; appear dark and granular like soil, and are rich in soil nutrients

The Waste Not Curriculum Trunk

Please take advantage of our small but useful library. It contains many activities and curricula you and your class can benefit from, including resources on how to set-up your own classroom or school recycling and/or composting programs, great activities for pre landfill field trip preparation and post trip reflection, as well as other ideas for extended learning in the areas of waste, waste reduction, recycling, composting, and worm composting. You are welcome to check out any or all of the below listed resources and we encourage you to do so!

Videos:

- The Complete Home Composting Video Guide
- ComposTwin (a video on this particular compost bin)
- Do the Rot Thing: The Simple Art of Home Composting
- Solid Waste Systems
- Worm Bin Creatures: Alive Through a Microscope

Books:

- Backyard Composting: Your Complete Guide to Recycling Yard Clippings, Harmonious Press, 1992
- Blueprint for a Green School, Jayni Chase, Center For Environmental Education, 1995
- Composting in the Classroom: Scientific Inquiry for High School Students, Nancy M. Trautmann and Marianne E. Krasny, 1998
- Trash Conflicts: A Science and Social Studies Curriculum on the Ethics of Disposal, Amy Ballin, Educators for Social Responsibility, 1993
- The Worm Café: Mid-Scale Vermicomposting of Lunchroom Wastes, Binet Payne, 1999
- Worms Eat My Garbage, Mary Appelhof, Second Edition, 1997
- Worms Eat Our Garbage: Classroom Activities for a Better Environment, Mary Appelhof, 1993

Other Publications:

- “A-way with Waste” – Washington State Department of Ecology curriculum with Montana Supplement, 1992
- “Compost Bins” – binder with information on the compost garden compost bins and other styles of compost bins including ordering/building information
- “Composting” – binder with general information and articles about composting
- “Solid Waste Management – The Garbage Crisis” – teaching packet and plan from the Montana State University Extension Service, 1994

“Waste Not Curriculum” and other activities/curricula – The Waste Not Project’s own set of

activities

collected and adapted from a variety of curricula, last updated 2003

“Woodsy Owl Activity Guide” – environmental education curriculum

“Worms” – binder with articles and information on worm composting including a number of copies of “Worm Digest” newsletter all about vermicomposting

“Worm’s Way Catalogue” – catalogue of composting materials for mail order

Other Items:

Scale

Calculator

Resources Used in Creating This Curriculum:

A-Way With Waste. Michael and Linda Zupan.

Blueprint for a Green School. Leadership Policy Research, New York, NY. 1995.

Connections: Guide to a Healthy Environment. Eco Education, 275 E. Fourth Street, Suite 821, St. Paul, MN 55101. 1994.

Humanure Handbook. Joseph Jenkins. Jenkins Publishing. 1999.

Pathways to a Sustainable Future: A curriculum Guide for Schools Exploring Waste Management Issues. The Chewonki Foundation, Wiscasset, Maine 04578.
www.chewonki.org. 1999.

Project Learning Tree: Environmental Education Activity Guide. American Forest Foundation, 1111 19th Street, NW, Suite 780, Washington, DC 20036, 202-463-2462.
<http://www.plt.org>. Eighth Edition, 2001.

Trash Conflicts: A science and social studies curriculum on the ethics of disposal. Educators for Social Responsibility, Cambridge, MA. 1993.

The Urban/Suburban Composter. Mark Cullen and Lorraine Johnson. St. Martin's Press, New York, NY. 1992.