A ZERO WASTE CURRICULUM

created by

Seven Generations Ahead

Introduction

An essential part of teaching children how to become good stewards of the environment is to help them learn about the current waste system, its implications, and how it can improve. In nature there is no garbage. Every byproduct from a natural cycle is used to fuel another. Nothing is wasted; there is zero waste. **Zero waste** is a goal of many communities and businesses that includes reducing what we consume, maximizing recycling, minimizing waste, and ensuring that products are made to be reused, repaired, recycled, or returned to nature.

In the world humans have constructed, the life cycles of things we use work a little differently. We take resources from nature to create billions of ton of things which we use once, then throw away. Each time we use raw material from the earth without replenishing it (such as cutting down a tree without planting a new tree), we are depleting a natural resource. To be environmentally sustainable, we have to change the way we handle our resources. We need to use fewer resources by reducing. And much of what we dispose of as waste is actually a valuable resource that can be captured and used again by reusing, recycling, or composting.

Traditional waste disposal methods, landfilling and incineration can cause environmental problems such as air and water pollution. If the amount of trash generated by our society continues to rise, future generations will be faced with greater environmental and health problems as a result. Children today need to be given the knowledge and skills to be able to make good environmental decisions to conserve and recover valuable resources.

Zero Waste Ambassadors (ZWA) are students who are putting their zero waste knowledge into action by making a difference in the way their school, home, and community handle waste and recovers resources. These environmental stewards will translate what they've learned in *Don't Throw Me Away!* into solutions for their school, individual households, local community, and global society.

Education for Sustainability

Don't Throw Me Away! addresses the challenges of waste, how it is handled in our communities, and solutions for recovering resources through a lens of sustainability. The curriculum helps students begin to see that their choices as consumers have an impact on the world around them. The choices that consumers and communities make today, with regards to how they dispose of material, will affect the lives of those living seven generations from now. Students learn different options for conserving and recovering resources such as reusing, recycling, and composting. Students learn that the way we handle waste affects the health and sustainability of plants, animals, insects, people, and communities.

Don't Throw Me Away! is a zero waste curriculum of Seven Generations Ahead's Zero Waste Schools Program and aligns with Common Core State Standards and Next Generation Science Standards.

Place-Based Education

Don't Throw Me Away! uses the local environment as a focal point for learning. Place-based education creates a meaningful and culturally relevant framework for learning. By connecting core concept areas and units of study to their classrooms, local communities and regional environments, students have a real-world context for learning. Place-based education opportunities are plentiful in the *Don't Throw Me Away!* curriculum. Students can facilitate a waste audit in their school, research and visit community recycling and composting facilities, explore how their communities handle waste, and set up zero waste plans and events. Through this approach, students will understand that they can impact the health of local and global communities and environments.

Lesson Objectives

Lesson 1: When is Garbage not Really Garbage?

- Students will compare and contrast natural waste systems with human waste systems.
- Students will identify and measure the types of materials in the waste stream and be able to determine the portion (percent or fraction) that are resources and should not be sent to the landfill.
- Students will compare and contrast natural waste systems with human waste systems.
- Students will identify the types of materials in the waste stream and which of these materials could be reused or recycled rather than discarded.
- Students will calculate the types of materials in the waste stream and be able to determine the portion (percent or fraction) that are resources and should not be sent to the landfill.

Lesson 2: Where Does Our Garbage Go?

- Students will identify possible destinations of the waste they generate at home and school.
- Students will analyze the pros and cons of current systems that are in place to handle waste items including waste-to-energy incinerators and disposal landfills.
- Students will evaluate the impact of current waste disposal systems on land, water, air, and climate.
- Students will create a small-scale landfill and then observe and evaluate the rate of decomposition.
- Students will develop and demonstrate new uses for items that are usually thrown away.
- Students will explore and critique various energy sources.
- Students will calculate the different energy values of waste.

Lesson 3: The Many Lives of a Plastic Bottle/Aluminum Can

- Students will observe how plastic and aluminum are extracted, produced, distributed, and disposed.
- Students will have an understanding of why the production and disposal of these resources can be harmful to the environment and our health.
- Students will assess how much their local community (school or neighborhood) wastes and recycles resources.
- Students will imagine the life story of a recyclable resource.

Lesson 4: Make Less Garbage: Reducing and Reusing

- Students will discover ways in which they can reduce their daily impact through different systems of resource recovery
- Students will create solutions to reduce waste.
- Students will identify objects in the waste stream which could be reused creatively rather than discarded.
- Students will design solutions to address the issue of excessive resource use.
- Students will design and organize a campaign to persuade their fellow students to change a current wasteful behavior.

Lesson 5: Make Something Old Into Something New: Recycle It!

- Students will observe ways materials are separated and sorted at recycling centers.
- Students will create solutions to decrease waste.
- Students will imitate the paper recycling process and produce their own recycled paper.
- Students will evaluate their current waste practices, investigate possible systems for reducing, reusing and recycling, then develop and implement a classroom recycling plan.
- Students will differentiate between the words and symbols for recycled and recyclable.
- Students will investigate and summarize how to recycle in his/her own community.

Lesson 6: Nature's Recycling: Compost

- Students will observe benefits of composting.
- Students will differentiate between carbon and nitrogen materials in the composting process.
- Students will assess different methods of composting (vermicomposting, backyard composting, and commercial composting).
- Students will simulate a compost heap and a landfill and will compare the differences between them.
- Students will observe how composting reuses yard, garden, and kitchen waste.
- Students will observe how vermicomposting reuses yard, garden, and kitchen waste.
- Students will build and maintain a worm bin.

Lesson 7: School Waste Audit Guide

- Students will evaluate the type and quantity of waste generated at the school.
- Students will collaborate with school faculty, staff, other students, parents and community members to conduct the audit and to come up with potential solutions.
- Students will develop methods for reducing waste, increasing recycling, and introducing food scrap composting based on available data.
- Students will use the data collected for real-world math lessons on weight, volume, graphs, and charts.
- Students will implement a waste audit that will measure the kinds and amounts of waste being produced.
- Students will evaluate the waste audit data and imagine a new plan for waste disposal.

Lesson 8: Become a Zero Waste Ambassador

- Students will apply the knowledge gained in previous lessons for real-world activities.
- Students will design and implement activities, crafts, and events that illustrate a zero waste lifestyle.

A ZERO WASTE CURRICULUM

Lesson 1

When is Garbage Not Really Garbage?

What is a Resource and What is Waste?

Objectives

- Students will compare and contrast natural waste systems with human waste systems.
- Students will identify and measure the types of materials in the waste stream and be able to determine the portion (percent or fraction) that are resources and should not be sent to the landfill.
- Students will compare and contrast natural waste systems with human waste systems.
- Students will identify the types of materials in the waste stream and which of these materials could be reused or recycled rather than discarded.
- Students will calculate the types of materials in the waste stream and be able to determine the portion (percent or fraction) that are resources and should not be sent to the landfill

Summary

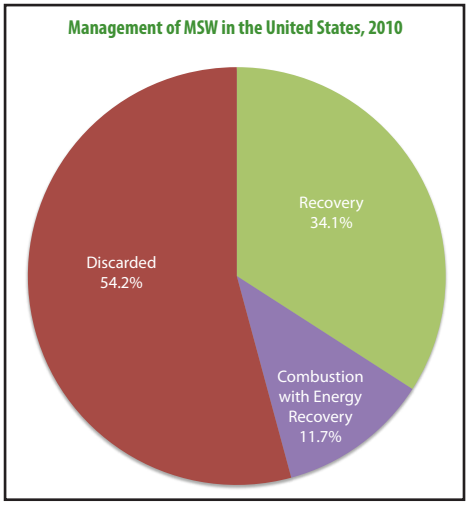
In this lesson, students will begin to understand that much of what we throw away is really a resource and should not be thought of as waste. They will understand how the daily items we use and toss are creating problems. Help students change the way they think about garbage. Change the image from that of a big smelly black bag to a challenge in resource recovery and diversion from the landfill.

Background

In nature there is no garbage. Another word for garbage is waste. In the natural world, life cycles are loops with every step fueling the next step, meaning zero waste. **Waste** occurs when we take a product or resource out of the system and don't allow the cycle to continue. Waste is all of the unwanted materials and substances left over when we are finished using things.

One way to introduce the concept that there is no garbage in nature is with the plant or tree life cycle. From seed to tree to decomposing plant matter nourishing the soil, the plant in its natural environment wastes nothing and uses the output from one step as a resource to power the next step. The cycle has no beginning and no end. A **resource** is a part of the Earth that helps animals, plants, and people live and grow, such as air and water. From a human perspective, a resource is anything obtained from the environment to satisfy human needs and wants.

Like a tree, the **products** we use have life cycles. Manufacturers turn natural resources, like wood or oil, into products like books and plastic toys. People buy, use, and discard these products, which are made from raw or reycled materials. The life cycle is broken when an item that could be reused or recycled ends up in the landfill. In our culture, the resource system has become fairly linear, with creation, distribution, use, and disposal being the four main steps.



Source: US EPA 2010 Facts & Figures Report

Resource Recovery involves using materials that would have been thrown away for a specifc next use. Much of what we dispose of as waste is actually a valuable resource that can be captured and used again by reusing, recycling, or composting. Part of this waste is called **MSW**, or **municipal solid waste**. MSW is all the items we use and throw away from households, businesses (restaurants, stores, offices, etc.), and institutions (hospitals, schools, museums, etc.).

Reuse: Rather than throwing items like clothing or food jars into the garbage, people can find new uses for them -- and thereby reduce their consumption of new resources. Using jars to store beverages or leftover food, and trading or selling used DVDs rather than throwing them out are examples of ways people can reuse.

Recycle: Collect already used materials and make them into another product. Large amounts of plastic, metal, glass and **organic matter** (material that has come from something that was alive at one point and nutrients from decomposed plants and animals such as leaves) are discarded as waste every year. Recycling is a resource recovery practice that refers to the collection of these materials so that they can be reprocessed into new products. Used plastic bottles can be recycled to make clothing, carpeting, detergent, bottles, and more. Metals like aluminum and steel can be recovered and recycled to make new cans, cars, and more. Communities have a variety of recycling programs, such as curbside pickup of recyclables, drop-off centers, buy-back centers that pay you for valuable items and deposit-refund programs. When you buy things, you can also help recycling by purchasing products made from recycled material, such as toilet paper made from recycled pulp.

Compost: Compost is a mixture of decaying organic matter, such as leaves and manure, used to improve soil structure and provide nutrients. In the United States, over a pound of food per person per day is thrown away, generating tens of millions of tons of food waste per year. According to the EPA, the average student generates approximately 1/2 pound of waste per school day. Much of that is food waste and makes its way to landfills where it releases methane as it rots, contributing to greenhouse gas emissions. These gases build up in our atmosphere and contribute to poor air quality and global warming. Every bit of food waste that can be kept out of the landfill is important and composting is a great way to do this.

Reduce: In addition to methods for recovering resources, it is important to find ways to create less waste in the first place. The most effective way to reduce waste is to not make it. Making a new product requires a lot of materials and energy.

Discussion/Verbal Explanation

Write "waste" on large paper. Discuss noun and verb versions of the word and then ask students:

What do you think of when you hear the word 'waste'?

Continue the discussion by creating a Waste KWL Chart.

K	W	L
•- - - -		

In the Knows colum, ask students to brainstorm what they know about waste. Continue filling in the KWL chart by asking students what they would like to know about waste. After working through ***Lesson 1 - When is Garbage Not Really Garbage?***, complete the chart by having the students identify what they have learned about waste.

Explore the following questions and allow the students to share knowledge they already have about the topic, what they want to explore further, and what they have learned through this lesson. Prompt students to discuss what they know about alternatives to simply discarding what they no longer need, such as recycling, reusing, and repurposing.

What is waste?
What are synonyms for the word waste?
Where does garbage go?
When we throw something "away", where exactly is "away"?
Why might landfills be harmful to the environment?
How is garbage processed?
Who takes out the school's garbage?
What will we do if we run out of room for garbage?
What can we do to avoid throwing things away?
What are some things that we throw into the garbage that are actually not waste?
What are some ways that we can recover these resources?

Read *I Can Save the Earth*, by Alison Inches.
Grades K-3

I Can Save the Earth

by Allison Inches

Meet Max the Little Monster. He is a cute, furry green monster who is an environmental nightmare. Among other things, he leaves on all the lights, keeps his computer plugged in, blasts the TV, hoards his old toys and uses so much toilet paper it clogs the toilet until finally, his excessive ways cause a power outage. With no TV to watch, computer to play on, video games to play with, Max finds there is a whole big world outside that he can make a difference in.

Ask students:

What does Max do that is unhealthy for his family/household?

Answer: Max litters and wastes water and electricity.

Why is it unhealthy?

Answer: The litter piles up and hides the beautiful environment. It can also hurt animals, plants, and air quality. Wasting water and electricity means there won't be enough left for everybody else. Those resources should be used only when needed so we don't waste them.

After the blackout, what does Max learn to appreciate?

Answer: Max, as the little green monster, learns to appreciate nature and its beauty and keeping the Earth clean.

Read *The Adventures of Garbage Gremlin*, a fun comic book from the US EPA.
http://www.epa.gov/osw/education/kids/gremlin/gremlin.pdf
Grades 2-5

The Garbage Gremlin lives off things that people throw away. Find out what happens to him when a school group visits a recycling center and learns how to recover resources in their community and school.

Ask:

Why does the Garbage Gremlin move to the town in the story?

Answer: He sees garbage all around the front of the school and thinks there is a lot for him to eat.

What are the 5 steps to recycling?

Answer: Collect, separate, remake, market, reuse.

What material is recycled most?

Answer: Paper.

What do the students do to help their school and community?

Answer: The students have a paper recycling campaign and then clean the trash up outside.

Optional: Guest Speaker

Invite an expert to your classroom to speak with students about where garbage goes. Contact your local garbage or recycling hauler or recycling center to see if a representative can speak to your class. Explain that he or she will be describing the process of bringing waste/recycling from your classroom to a landfill or recycling center. Ask him or her to bring photos and other hands-on materials for students.

Have students prepare two or three questions to ask the expert. Sample questions could include:

Where does garbage/recycling go after it leaves our classroom?

How much garbage/recycling is produced on an average day of school?

What is a landfill?

What is a MRF?

What can and cannot be recycled?

Is garbage/recycling sorted into categories, or is everything put into one pile?

Is garbage/recycling compacted into smaller amounts?

In My Neighborhood

Show students the online video *A Day in the Life of Your Garbage and Recyclables*. See next page for URL. Explain that, while this is not set in your community, garbage is dealt with similarly across the country.

Optional Activity: Have students identify a garbage item that they could reuse rather than throw away. Example: use a plastic two liter bottle to make a planter for a classroom seedling.

Field Trip

Visit a school in your area that is already working on zero waste initiatives. Call ahead to set up a visit. Meet their green team, green club, or zero waste ambassadors. Students should develop interview questions in advance. Ask for a tour of their school to see their reuse, recycling and/or composting systems. Help conduct a waste audit if they have one scheduled or learn about a waste audit that they recently did. While on-site, collect photos and take notes. After the visit, share lessons learned and discuss which ideas could be carried out at your school.

Resources

A Day in the Life of Your Garbage and Recyclables

http://www.youtube.com/watch?v = Prigs6dLLCQ

A video about how garbage and recyclables move through the Sunnyvale Materials Recovery and Transfer Station (aka the SMaRT Station) in Sunnyvale, CA.

Time: 7.5 min

Quaid McQueen, Trash Machine, by Amanda Medress

Rosy the skunk helps a mischievous boy discover how his wasteful ways are harming natural habitats.

Grades K-3.

Waste Management (Environment in Focus), by Cheryl Jakab

Cheryl Jakab's 'Environment In Focus' series each provide some 32 pages of detail with each book in the series providing readers with information about major environmental problems.

Grades 4 +

ACTIVITY

Time Allotted
90 minutes

Target Audience
Grades K-5

Objectives
- Students will compare and contrast natural waste systems with human waste systems.
- Students will identify and measure the types of materials in the waste stream and be able to determine the portion (percent or fraction) that are resources and should not be sent to the landfill.

Materials
- Paper
- Markers, crayons, and/or colored pencils

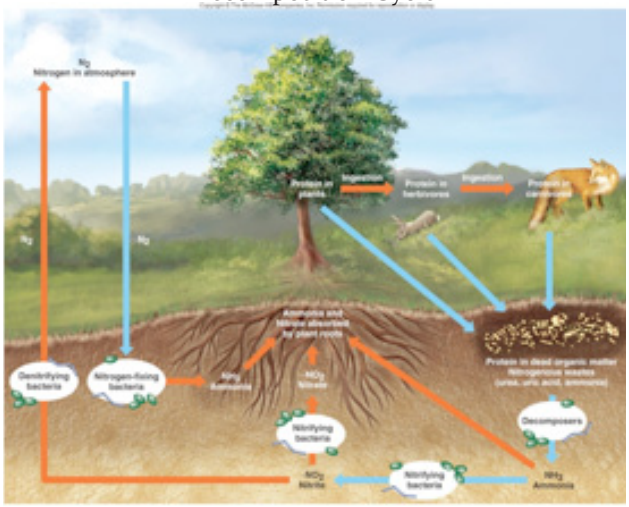
There is No Garbage in Nature

Summary

In this activity, students will explore nature's natural cycles versus those that exist in our society. In nature, there is no garbage. Every output from one stage in a natural life cycle is an input for the next stage. When a plant or animal dies, it decomposes into another material that starts another step of a cycle.

Background

Decomposition Cycle



www.bio.utexas.edu

Decomposition (or rotting) is the process by which organic substances are broken down into simpler forms of matter. When a leaf dies on a tree, it falls off and onto the ground. It dries out, breaks into smaller pieces and then is eaten by small microorganisms and invertebrates (worms, fungi, mold). When that leaf is done being decomposed, it has been transformed into nutrients in the soil. (You can learn more about this in Lesson 5 on composting.) These nutrients then feed a small seed on the ground. The seed grows roots, a stem and then eventually turns into a sapling (a young tree). That sapling grows into a tree. That tree grows new leaves which help to feed the tree (by catching the sunlight and making chlorophyll, a nutrient the tree needs). In the Fall the leaves die, fall to the ground and the cycle starts over again.

Method

1. **Ask:** *Is there garbage in nature?*

   List on the board student suggestions of waste in nature. Encourage other students to think how that waste is actually used.

2. **Ask:** *What do you think would happen if things didn't decompose?*

   Discuss what the world would like like if leaves fell but never decomposed. Now add to that image and think about dead branches, logs, animals, and more - all piled up. The world

would be piled high with things that died but didn't decompose. And we wouldn't have the nutrients in the soil to grow new things, including much of the food we eat.

3. **Draw:** Have students draw the cycle of natural decomposition. For younger students, this may mean coloring, cutting, and pasting the elements into the correct order. Older students can probably sketch. Their drawing should include the following parts: seed laying on rich soil, sprouted seed, sapling, tree with leaves, tree with colored leaves on the ground, decomposing leaves which leads to rich soil.
4. **Identify:** Review with students that glass, metal and plastic do not decompose. Have students work in pairs to explore the classroom to find anything that does not decompose. Students should record items they find and what they are made of on a sheet of paper. Students who work really fast could work on expanding their list to items outside the classroom.

For example:

- plastic bottles/metal cans
- garbage can (made of metal or plastic)
- windows (glass and a metal or wood frame)
- desks (made of wood and metal - the wood might be able to decompose if it could be separated from the metal and put in nature)
- tape dispenser(plastic and metal)
- carpet or floor tiles (plastics)
- chalkboard (porcelain enameled steel or slate, if older)
- computer (made of metal, plastic, rubber in wirings and more)

You can also ask students to think of items outside the classroom that do not decompose. For example:

- cars/trains/buses (cars are made of metal, plastic and glass - none of these decompose easily)
- houses/buildings (walls may be made of bricks, wood, etc....windows are made of glass...etc.)
- cups, plates, bowls (plastic, ceramic, glass, etc.)
- silverware (metal)

Extension

For students who are done quickly with an activity, need extra credit, or learn kinesthetically, offer the option of working in pairs or groups of three to create simple props and a storyline to act out the life cycle of a tree.

ACTIVITY

Time Allotted
30 minutes

Target Audience
Grades K-5

Objectives
- Students will identify the types of materials in the waste stream and which of these materials could be reused or recycled rather than discarded.

Materials
- Voting cards: 1 set for each student
- Paper or white/chalkboard
- Writing utensil or dry erase markers/chalk
- Tarp/newspaper
- Sorting game items (see right)

Resource vs. Waste Sorting Game

Summary

In this activity, students will determine which common household items should end up in the landfill as waste, and which are actually resources that should be recovered by reusing or recycling.

Background

Waste occurs when we take a product or resource out of a system and don't allow the cycle to continue. **Waste** is all of the unwanted materials and substances left over when we are finished using things. A **resource** is a part of the Earth that helps animals, plants, and people live and grow, such as air and water. From a human perspective, a resource is anything obtained from the environment to satisfy human needs and wants. Much of what we throw into the garbage is actually a valuable resource that should be recovered before it ends up in a landfill.

Method

1. Bring in a bag of common household items. These items could include:

Item	Category
Large paper bag (to hold items)	Reuse and recycle
Plastic water bottle	Reuse and recycle
Lid of plastic water bottle	Recycle
Aluminum soda can	Recycle
Paper towel roll	Reuse and recycle
Aluminum foil (clean but crumpled)	Recycle (if clean)
Newspaper	Recycle
Gogurt wrapper	Landfill
Yogurt container	Recycle
White paper	Use both sides, recycle
Glass bottle	Recycle
Wire hanger	Reuse, return to dry cleaner
Plastic 2 liter bottle	Reuse and recycle
Rock	Reuse
Milk carton	Recycle
Reusable bottle	Reuse, reuse, reuse
Coffee cup	Landfill
Lightbulb	Special recycling program
Battery	Special recycling program
Cardboard box	Reuse and recycle
Plastic grocery bag	Special recycle program
Plastic film (saran wrap, ziplock bags)	Landfill

2. **Explain:** The goal of this activity is for the students to identify which items are a **Resource (recyclable), Resource (compostable),** or **Waste (garbage/landfill)**.
3. Arrange the items on a desk or table and allow the students to come up and look at/touch items.
4. Pass out a set of voting cards to each student.
5. Select one person (student or teacher) to hold up each item one by one in front of the class and let the students vote.
6. Select one student to be the record keeper for the audit. Have them tally responses on a chart.

   An example is below, in orange:

Resource (recyclable)	Resource (compostable food waste)	Waste (garbage/ landfill)	TOTAL
𝍸 𝍸 ||	|	𝍸	𝍸 𝍸 𝍸 |||

7. As the items are held up for the class to see, have students vote on whether they think the item is a **Resource (recyclable), Resource (compostable),** or **Waste (garbage/landfill)** by holding up the corresponding card from their set.
8. Once every student has voted on an item, give the correct answer. Use the correct answer for the tally sheet.

   Option: Students tally on their own personal chart and then discuss as a class.
9. Have students write 2 paragraphs about their findings. Ask:

   What items did you see that you were surprised to find out are a resource and not waste?
   What are ways you can help decrease the amount of garbage in your home?
   Are any of the items we saw today things that you have in your home?
   Do you recycle them at home? Could you?
   Could any of the items we have seen today be reused?
   Which item and how would you reuse that item?

See full size voting cards on page xx

ACTIVITY

Time Allotted
60-120 minutes

Target Audience
Grades K-5

Objectives
- Students will calculate the types of materials in the waste stream and be able to determine the portion (percent or fraction) that are resources and should not be sent to the landfill.

Materials
Option 1
- Garbage sample
- Paper or white/ chalkboard
- Writing utensil or dry erase markers/chalk
- Gloves: 1 pair for each student sorting garbage
- Tarp/garbage bags
- Scale

Option 2
- Garbage sample
- Paper or white/ chalkboard
- Writing utensil or dry erase markers/chalk
- Gloves: 1 pair for each student sorting garbage
- Tarp/garbage bags
- Voting cards: 1 set for each student

Classroom Waste Audit

Summary
In this activity, students will conduct a waste audit in their classroom. They will collect, sort, weigh, measure, and calculate waste to determine a snapshot of what their classroom or school produces in a given amount of time. Note that Lesson 7 gives details on doing a whole-school waste audit.

Background
A **waste audit** is when you collect all of the waste and resources from your garbage (and recycling and compost if you have them), separate the material into categories, weigh each category, and document the findings. Findings can be useful for determining what resources that are currently sent to the landfill that can be diverted into resource recovery streams to move toward zero waste.

There are two options for this waste audit activity. Option 1: students will audit classroom waste by sorting and measuring what is found in the garbage cans at the end of the day (or week). Option 2: Do a random spot check of the garbage cans by having a volunteer (or the teacher) hold up each item for the students to identify what should be done with each: reuse, recycle, compost or waste to go to the landfill. Both methods are explained in this activity.

For sorting classroom waste and resources, here is a guide to commonly found classroom items:

Recycling	Compost*	Landfill
paper	apple core	plastic wrap
aluminum cans	banana peel	squeezable yogurt
sleeve	food soiled paper	
plastic bottles		
cardboard		

* Note that an onsite school based compost system only takes fruit and vegetable scraps (with no oils or dressings). If you just want to know what could be saved from the landfill if your school had access to a commercial compost facility, include fruit, vegetable, meat, dairy, bones, bread and food soiled-paper.

Sorting Tarp

Seven Generations Ahead

Method (Option 1)

1. **Ask:** *How much waste do we produce?*

   Have students predict which products are thrown away most frequently in their school community. To answer this question, tell students that they will be sorting the trash their classroom has collected that day (or week). Consider conducting this audit with another classroom. Make a chart with three categories: Waste (garbage), Recycling (paper, some plastic, metal), and Composting (food waste).

2. **Sort waste:** Give students gloves and place a tarp or garbage bags on the floor. Carefully pour the garbage into the middle of the tarp, and ask students to sort the waste into the three categories labeled on the chart. Ask one volunteer to record the items on the chart, using tallies for repeat items.

   Note: Your scale may measure using pounds and ounces instead of pounds with decimal points. Make sure that the students use consistent units of measurement and note the unit of measurement on the worksheet.

Sample Data Collection Table

Amount of Recycling	Amount of Compost	Amount of Waste	TOTAL

3. **Discuss** the data collected from the classroom waste audit. **Ask:** *Which product was thrown away the most?*

   Were there more recyclable items than garbage items?

   What percentage of the trash was food waste?

   Are there items that could be reused before being recycled or sent to the landfill?

4. **Math Activity:** The following are some options for having students manipulate the data collected into more illuminating and meaningful formats. Choose any or all of the options that might work for your students.

   Option A: Create a pie chart that represents the entire weight of the garbage audited with wedges representing compostables, recycling and waste. Students will need to have knowledge of fractions and creating common denominators.

   Option B: Gather additional facts like the number of classrooms in the school, and number of school days in the year. Use this information to estimate the following:

   - How much waste is each student creating each day?
   - How much waste is the whole school creating each day?
   - How much waste does each student create in the school year?
   - How much waste does the whole school create during the school year?

   Students will need knowledge of 2 and 3 digit multiplication.

   Option C: Depending on what kind of scale you use to do the audit, students can convert pounds (measured in decimal points) to pounds and ounces or vice versa. Students will need to know that there are 16oz in a pound, and how to multiply with decimal points.

Option D: Students can practice rounding numbers to the nearest hundredth, tenth, etc. Students will need knowledge of place value.

Option E: Students can practice writing decimals as mixed numbers and reducing them. Students need knowledge of place value and simple division.

5. **Write:** Have students write 2 paragraphs about their findings. Ask:

   What items took up the most space in the garbage?

   Was that surprising? If so, why?

   What are ways you can help decrease the amount of garbage in your classroom?

Method (Option 2)

1. **Ask:** *Are we managing our waste well?*

   Explain to the students that together you are going to examine the garbage containers in the classroom to find out if the class is recycling everything that can be recycled.

2. **Examine waste:** Select one person (student or teacher) to put on gloves and hold up items found in the classroom waste containers.

3. **Record findings:** Select one student to be the record keeper for the audit. Have them tally responses on a chart, noting the number of items that are in the garbage can that are a resource (recyclable or compostable) or waste.

   An example is below, in orange:

Resource (recyclable)	Resource (compostable food waste)	Waste (garbage/ landfill)	TOTAL
𝍸 𝍸 ||	|	𝍸	𝍸 𝍸 𝍸 |||

4. **Voting:** Pass out voting cards to each student. Each student should have a set of cards stating ***Resource (recyclable), Resource (compostable), Waste (landfill)***. Have students vote on which category they think each item belongs to. Explain to students that as each item from the garbage can is held up, they should think about whether it really is garbage. Could it be a resource to be recycled? Or a resource to be composted? Once they have decided, they should hold up the voting card with their selection. Once every student has voted on an item, give the correct answer. Use the correct answer for the tally sheet.

Seven Generations Ahead

5. **Discuss the data:** After all items from the garbage have been examined and "sorted", have the students discuss the data collected from the classroom waste audit. Ask students:

   Which product was thrown away the most?

   Which category had the most items?

   What percentage of the trash was food waste?

6. **Analyze the data:** After the class discussion, have students create a pie chart to represent how much garbage, recyclables, and compostables (food waste) was in the classroom waste can.

   Calculate the percentage of each category compared to total garbage.

   Create a pie chart to show garbage, recyclables, and compostables (food waste) from the classroom audit.

7. **Write:** Have students write 2 paragraphs about their findings. Ask:

   What items took up the most space in the garbage?

   Was that surprising? If so, why?

   What are ways you can help decrease the amount of garbage in your classroom?

A ZERO WASTE CURRICULUM

Lesson 2

Where Does Our Garbage Go?

Why is Waste a Problem?

Objectives

- Students will identify possible destinations of the waste they generate at home and school.
- Students will analyze the pros and cons of current systems that are in place to handle waste items including waste-to-energy incinerators and disposal landfills.
- Students will evaluate the impact of current waste disposal systems on land, water, air, and climate.
- Students will create a small-scale landfill and then observe and evaluate the rate of decomposition.
- Students will develop and demonstrate new uses for items that are usually thrown away.
- Students will explore and critique various energy sources.
- Students will calculate the different energy values of waste.

Summary

In this lesson, students will begin to better understand why the waste we create is a problem and that waste creates costs for our society and the environment. They will learn about incinerators, landfills and how we can create energy from garbage.

Background

Everything comes from somewhere...and everything goes somewhere. People produce lots of garbage, almost a billion tons of it every year! Another word for garbage is **waste**. Waste is all the unwanted materials and substances left over when we are finished using things. Waste occurs when we take a product or resource out of its life cycle system and don't allow the cycle to continue. As the population has grown in the United States, so has the variety and amount of products we use as well as the amount of garbage we generate each year. On average, each person in the United States generates about 4.5 pounds of garbage per day! As we discussed in Lesson 1, much of what we think of as waste can actually be a valuable resource through reusing, recycling, or composting. Even if we do a good job of recovering these resources, we will still need to dispose of the remaining waste in a way that is **sustainable** and does not cause problems for the environment, people, and animals. Sustainable refers to conserving an ecological balance by avoiding depletion of natural resources. It not cause problems for the environment, people and animals.

Large amounts of plastic, metal, glass and organic matter are discarded as waste every year. Each type of waste causes different problems; many plastics do not break down easily, electronic waste can release pollutants, biological waste can release harmful gases and sometimes cause disease, and space for landfills has

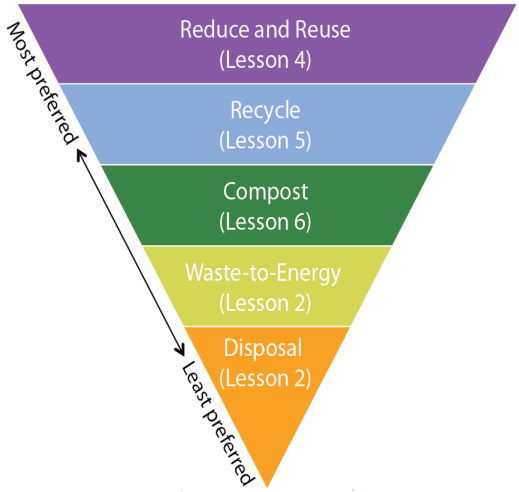
Waste at a Landfill

stlouiscountymn.gov

become hard to find. **Non-biodegradable garbage** is composed of wasted resources that won't decompose or break down easily (eg: plastics and metals). These materials are useful when you are building things that need to last a long time. The problem is what to do with them when they are no longer needed.

The Environmental Protection Agency (EPA) has ranked a hierarchy of waste management options. **Source reduction** (using less) is the most preferred method, followed by recycling and composting, then energy recovery (including incinerators), and, lastly, treatment and disposal (including landfills). The image of the upside down pyramid shows the hierarchy with the best option on the top, funneling down to the less preferred methods. In this lesson we will look more closely at the final two options: incineration (energy recovery and treatment) and landfills (disposal).

Waste Management Hierarchy



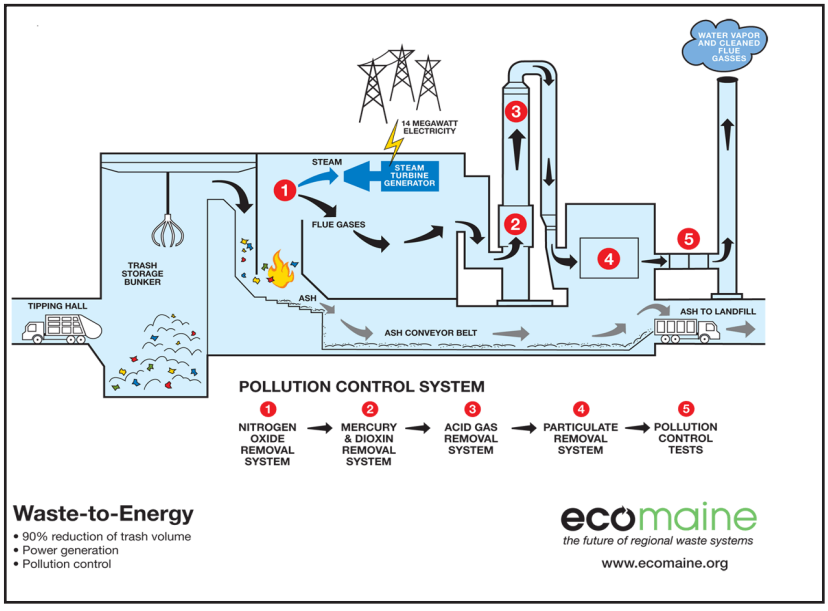
Seven Generations Ahead

Incinerators (Waste-to-Energy Plants)

What does an incinerator do?

Incineration means to burn something up completely. An **incinerator** is a facility designed for the controlled burning of waste to reduce the volume of waste by turning it into gas and ash. Incinerators can burn garbage to create steam or electricity. This is controlled burning of solid waste at extremely high temperatures -- often as high as 2000° F. Garbage is considered a very energy-rich fuel because of the energy it can release that can then be recaptured. When an incinerator is properly equipped, it can convert water into steam for energy production. Some incinerators are also set up to remove recyclable materials before burning the rest of the waste. (Students may be familiar with the incinerator scene in Toy Story 2. All the metal is recovered using magnets and then the rest is burned.)

Waste to Energy



How does a waste-to-energy incinerator work?

Burning garbage for energy involves the following steps:

1. The garbage is burned, releasing heat.
2. The heat then turns water into steam.
3. The high-pressure steam is able to turn the blades of a large generator, which produces electricity that can be captured.
4. Utility companies can then send that electricity through power lines to homes, schools, and other facilities.

What is left after waste goes through an incinerator?
Incinerators reduce the solid mass of the waste by 80–85% and the volume (already compressed in garbage trucks) by 95-96%, depending on the materials being burned. Burning waste reduces the total amount of waste that needs to go to landfills.

Quick Fact: In 2010, over 29 million tons of materials (11.7%) were combusted for energy recovery.
- US EPA 2010 Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010

Incineration produces solid residues called **fly ash** and **bottom ash**. The fly ash is more of a potential health hazard than the bottom ash because the fly ash often contain high concentrations of heavy metals such as cadmium, copper, lead and zinc. The bottom ash seldom contain significant levels of heavy metals. Some, but not all, incinerators have scrubbers and filters that are used to reduce the environmental impact of gases and ash. Scrubbers use liquid to lessen the acidity of gases while filters prevent ash particles from being released into the atmosphere.

How does an incinerator affect the environment?
In many countries, there are experts and local communities worried about environmental impact of incinerators. Incineration involves the controlled burning of waste which releases gases that affect air quality. According to GAIA (The Global Alliance for Incinerator Alternatives), waste incinerators:

a) discharge **toxic**, or harmful, substances to the air, water and ground that are sources of pollutants, including dioxin and other chlorinated organic compounds that are known for their toxic impacts on human health and the environment. Many of these toxins enter the food supply and concentrate up through the food chain. Toxic substances should be disposed of properly.

b) create toxic ash or slag that must then be landfilled. This ash contains heavy metals, dioxins, and other pollutants, making it too toxic to reuse.

c) emit significant quantities of direct greenhouse gases, including carbon dioxide and nitrous oxide, that contribute to global climate change. They are also large sources of indirect greenhouse gases, including carbon monoxide, nitrogen oxide, non-methane volatile organic compounds, and sulfur dioxide.

How do incinerators fit into a resource recovery cycle?
Incineration is the fourth aspect of the EPA's approach to solid waste management. As evidence by the the EPA waste hierarchy, it is better to reuse and recycle before using incineration as a method of waste management. Incinerators are part of a system in which resources are pulled out of the Earth, processed in factories, transported around the world, and then burned. Burning resources that could be reused, recycled, or composted, destroys the energy-saving potential of putting those resources to better use. Recycling saves more energy (3 to 5 times more) than waste incinerator power plants generate.

Landfills

What does a Landfill do?
In a perfect world, we wouldn't throw anything away. We would reuse or recycle everything. In the real world, we do throw things away and most of those things end up in a **landfill**. A landfill isn't just a pile of garbage buried in the ground. It is a large, outdoor site designed for the disposal of waste. There are different kinds of landfills that accept different material including construction and demolition (C&D) debris landfills and industrial, hazardous waste landfills. Usually the garbage that we throw away every day is disposed of in a **municipal solid waste (MSW)** landfill. Municipal Solid Waste is all the garbage generated by households, commercial businesses (restaurants, stores, offices, etc.) and institutions (hospitals, schools, museums, etc.).

Nobody knows who invented the modern landfill that led to the MSW landfills we have today. Some experts say the British did in the 1920s. Others say there were "sanitary" landfills (landfills where the new garbage is covered daily by some material) in the U.S. earlier than that, for example, in Champaign, Illinois in 1904 (www.scdhec.gov/recycle). People realized that open dumps were causing sickness in the community. The first modern landfill was built and all those built afterwards, to improve public health. By 1945, about 100 American cities had "sanitary" landfills. Within 15 years, that number had increased to about 1,400. According to the EPA, there are now approximately 7,000 landfills in the United States.

How does a landfill work?
Most of us assume that when we throw something away, it will eventually break down or decompose in the landfill. This is not actually the case for many things. It depends on what was thrown away and other factors.

Decomposition: To **decompose** or **biodegrade** is to break down into basic elements, given the right conditions of light, air, and moisture. One very well recognized research effort on **decomposition** has been the work done as part of the Garbage Project at the University of Arizona. Researchers mined local landfills to learn about modern civilization. What did they find? Garbage does not break down in landfills. The Garbage Project discovered that biodegradation in a landfill takes a lot longer than previously thought. Air and water are needed for biodegradation. Under normal landfill conditions when the garbage is covered by dirt and the landfill is relatively dry, the only garbage that really decomposes are certain types of food scraps and yard trimmings (banned from most MSW landfills) and even those take a long time. Hot dogs and pastries, buried as long as 15 years ago, were still recognizable. Grass clippings were still green. Newspapers, long thought to be easily biodegradable, were found in landfills virtually intact after being buried for decades.

Leachate (*lee-cheyt*): Rain, snow and the liquids that come from compacted and decomposing waste can seep through a landfill. This liquid is called **leachate** and is a potential source of pollution for surface and groundwater (the source of most drinking water). Landfills are carefully designed to prevent waste from mixing with groundwater. They are designed to have a thick plastic liner and at least 2 feet of other materials, like compacted clay soil, between the ground and the garbage to prevent groundwater contamination. A leachate collection and removal system, installed on top of the membrane, collects any liquids that may leach out of materials in the landfill so that it can be treated at a waste water recovery site.

Cells and Cover Material: Most landfills are divided into a series of sections called cells. All the waste arriving in a particular day will be loaded into the active cell. At the end of each day the waste is compacted (crushed) and covered with several inches of soil or other cover material to reduce odor, litter and control rodents and pests. After the cell fills, waste will be dumped in a new cell. This will continue until all of the cells and the landfill have filled up, or reached their capacity.

Landfill Cells

ashemountaintimes.com

Closing a Landfill: Closed landfills must have a final cover that includes a synthetic cap and a soil layer. Cells that are closed off also have venting systems installed to prevent methane gas from spreading into the ground. The venting systems can be used to collect methane to burn it off.

What is left after waste goes to a landfill?
When waste goes into a landfill, it begins to pile up and squash down and air has a difficult time entering the system. This causes the formation of a byproduct of gas made of 50% methane and 50% carbon dioxide with small amounts of nitrogen and oxygen. **Methane** is a greenhouse gas and is highly flammable and must be removed in order to prevent dangerous fires and explosions. Landfill cells that are closed off have venting systems installed to prevent methane gas from spreading into the ground. The venting systems can be used to collect methane to burn it off. The most efficient and environmentally responsible landfills turn this methane into energy. These landfills extract the methane gas through pipes, then burn it in order to power the facility. **Nitrogen** is a non metallic element found in green material that allows protein production. The **nitrogen cycle** is a cyclical 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.

As was already mentioned, materials deposited in a landfill do not decompose quickly. One problem with dumping into a landfill is that, at some point, we will run out of space. As of 2012, Cook County, Illinois had only one open landfill (in Dolton) and it had seven years of capacity left. Once that landfill closes, waste will have to be hauled to landfills farther away both adding to greenhouse gas emissions (as trucks use more gas to drive longer distances) and increasing the cost to all of us as we pay to have our waste hauled farther away.

Quick Fact: Disposal of waste to a landfill has decreased from 89% of the amount generated in 1980 to about 54% of MSW in 2010. - US EPA 2010 Fact Sheet

How does a landfill affect the environment?
The accumulation of waste in the environment may have a negative effect on the quality of the land, the water, and the air of the community. Landfills emit methane gas from fermenting waste and can be quite stinky. This smell can affect the quality of life of the people who live, work, or play nearby. Biological waste gives off greenhouse gases, including methane, as it rots. Gases escaping from landfills may have toxic pollutants that can cause cancer, asthma, and other serious health conditions. Studies link living near landfills with cancer, where escaping gases will typically carry toxic chemicals such as paint thinner, solvents, and pesticides. Landfills are also a contributor to climate change. They are the largest global source of human-created methane emissions, a toxic climate-changing gas that is 25 to 72 times more potent than carbon dioxide. Landfills can also leak polluting liquids into rivers and groundwater. Even "state-of-the-art" landfills will eventually leak and pollute nearby groundwater.

How do landfills fit into a resource recovery cycle?
As is evidenced by the EPA waste hierarchy, it is better to reuse and recycle before burying our waste in a landfill. Waste disposal in landfills are part of a system in which resources are pulled out of the Earth, processed in factories, transported around the world, and then buried. For every ton of municipal discards wasted, more than 70 tons of manufacturing, mining, oil and gas exploration, agricultural, coal combustion, and other discards are produced. Burying resources that could be reused, recycled, or composted, destroys the energy-saving potential of putting those resources to better use.

Discussion/Verbal Exploration

Using the background information provided in this lesson, divide the paragraphs or sections among small groups of students. Have them spend a few minutes reading the information and discussing what it means. If any information is unclear they may need access to the internet, books or other resources to clarify the information. They should then pick out the most important pieces of information that

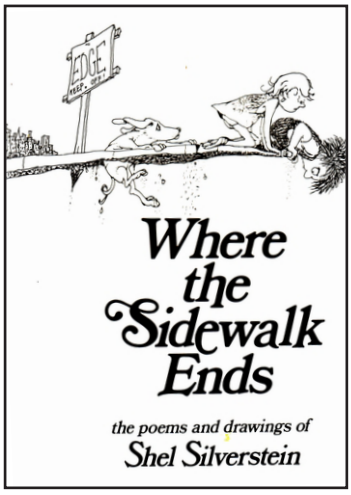
they will then share with the class. Students will then be the experts in their area and a summary can be created as a group and students can take notes. Then have the students discuss the pros and cons of landfills vs. incinerators.

Read: ***Sarah Cynthia Sylvia Stout,* by Shel Silverstein.**

Sarah Cynthia Sylvia Stout
Would not take the garbage out!
She'd scour the pots and scrape the pans,
Candy the yams and spice the hams,
And though her daddy would scream and shout
She simply would not take the garbage out.
And so it piled up to the ceilings:
Coffee grounds, potato peelings,
Brown bananas, rotten peas,
Chunks of sour cottage cheese.
It filled the can, it covered the floor,
It cracked the window and blocked the door
With bacon rinds and chicken bones,
Drippy ends of ice cream cones,
Prune pits, peach pits, orange peel,
Gloopy glumps of cold oatmeal,
Pizza crusts and withered greens,
Soggy beans and tangerines,
Crusts of black burned buttered toast,
Gristly bits of beefy roasts...
The garbage rolled on down the hall,
It raised the roof, it broke the wall...
Greasy napkins, cookie crumbs,
Globs of gooey bubble gum,
Cellophane from green baloney,
Rubbery blubbery macaroni,
Peanut butter, caked and dry,
Curdled milk and crusts of pie,
Moldy melons, dried-up mustard,
Eggshells mixed with lemon custard,
Cold French fries and rancid meat,
Yellow lumps of Cream of Wheat.
At last the garbage reached so high
That finally it touched the sky.
And all the neighbors moved away,
And none of her friends would come to play.
And finally Sarah Cynthia Stout said,
"OK, I'll take the garbage out!"
But then, of course, it was too late...
The garbage reached across the state,

Poem reduced. Full poem available in Where the Sidewalk Ends *by Shel Silverstein.*

Where the Sidewalk Ends



by Shel Silverstein

Go through the garbage listed in the poem and highlight the items that can be recycled or composted instead of contributing to the landfills.

Ask:

What do you think happened to Sarah Cynthia Sylvia Stout?

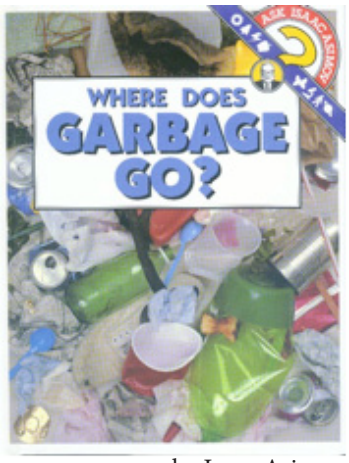
Why is it important to take the garbage out?

Once it is out, where does it go?

What do you think will happen if we don't find better ways to deal with our garbage?

Read: ***Where Does Garbage Go?*, by Isaac Asimov.**

Where Does Garbage Go?



by Isaac Asimov

Ask:

Where do we send our garbage or refuse?

What is a landfill?

What is an incinerator?

Why is waste harmful to your community?

Compared to your classroom's waste, how much waste do you think your school sends to the landfill?

Why is waste harmful to the environment and your health?

Describe what makes modern waste-to-energy incineration different from burning garbage in a pile outside.

What are some of the reasons given in favor of building waste-to-energy incinerators?

What are some of the reasons given against building waste-to-energy incinerators?

The point of the discussion is to help the students understand that the problem of waste is a far-reaching one that impacts many different aspects of our life. At this point the students may naturally start discussing the relative benefits of reuse and recycling in comparison to disposal.

In My Neighborhood

Hold a Charity Drive

Charities often need things that you might be ready to throw away. Find out what your local charity collects and have a charity drive at your school or home. Instead of going to the landfill, your waste could end up with someone who can use it again or for a different purpose. Some items charities might use include used CDs, used books, knitting needles, used stamps, greeting cards, used clothing, and much more.

Field Trip

Visit a landfill. Use the following questions to guide a discussion about the landfill process.

Ask:

Describe the landfill using all five of your senses.

What does a landfill look like? Is it attractive?

What does it sound like? Is it quiet? Are there loud trucks?

What does it smell like? Does it stink?

What does it feel like? When you close your eyes does it feel peaceful? Alive? Dead?

What would it feel like? Are you allowed to touch it? Do you want to touch it?

Can you play there?

Considering the area around the landfill, ask students:

Do people live there?

Would you like to live nearby?

How close do people live to the landfill?

Are the houses nice or not so nice?

Are there stores or parks nearby?

Are there animals nearby?

Is there a lake or river or streams?

Resources

Books to read

The Lorax, by Dr. Seuss

Long before saving the earth became a global concern, Dr. Seuss, speaking through his character the Lorax, warned against mindless progress and the danger it posed to the earth's natural beauty.

Grades K-4

Garbage and Recycling, by Sally Morgan and Rosie Harlow

Explaining the difference between biodegradable and non-biodegradable garbage, this book shows how glass, metal, and wool can be easily recycled. How Can I Help? boxes give suggestions for the young environmentalist who wants to recycle at home.

Grades K-3

Earth Day, by Linda Lowery

Lowery addresses the concerns that eventually brought about Earth Day and the laws and programs that have come about due to its establishment in 1970..

Grades K-3

Waste Management (Environment in Focus), by Cheryl Jakab

Cheryl Jakob's 'Environment in Focus' series each provide some 32 pages of detail with each book in the series providing readers with information about major envrionmental problems.

Grades 4 +

Where Does Garbage Go?, by Isaac Asimov

Briefly examines how we get ride of the things we throw away, describing some of the problems of waste disposal and some of the solutions..

Grades K-3

I Can Save the Earth, by Alison Inches

Meet Max the Little Monster. He is a cute, furry green monster who is an environmental nightmare... Max finds there is a whole big world outside that he can make a difference in.

Grades K-3

Quaid McQueen, Trash Machine, by Amanda Medress

Rosy the skunk helps a mischievous boy discover how his wasteful ways are harming natural habitats.

Grades K-3

The Adventures of an Aluminum Can: A Story about Recycling, by Alison Inches

The storybook is told from the point of view of an enthusiastic aluminum can. The dairy entries are fun and humorous, yet point out the ecological significant behind each product and the resources used to make it.

Grades K-3

Energy for the Future, by Helen Orme

Following brief definitions of renewable and nonrenewable energy sources, the spreads introduce various methods of producing Earth-riendly power... Orme presents concepts in clear, simplified language that may leave students with questions, such as how fossil fuels form or what, exactly, are the "dangerous wastes" that a nuclear plant produces.

Grades 2 +

In My Neighborhood: Garbage Collectors, by Paulette Bourgeois and Kim LaFave

This book in the In My Neighborhood series is a fun and informative behind-the-scenes look at garbage collectors.

Grades K-3

Michael Recycle Meets Litterbug Doug, by Ellie Bethel and Alexandra Colombo

Litterbug Doug is lazy. He is wasteful. he is messy. But worst of all, he hates reccyling! it's up to Michael Recycle, planet Earth's green-caped crusader, to show dastardly Doug the error of his ways... before it's too late!

Grades K-3

Videos to watch

Great Pacific Garbage Patch

http://www.schooltube.com/video/bfb7d59e02cb49f79c7d/Great%20Pacific%20Garbage%20Patch-Johnston,Khalife

Time: 1.58 min.

Story of Stuff

http://www.storyofstuff.org/movies-all/story-of-stuff/

The Story of Stuff is a short polemical animated documentary about the lifecycle of material goods. The documentary is critical of excessive consumerism and promotes sustainability.

Time: 21.25 min.

Converting Trash into Electricity- Eliminating the Unwanted, While Creating the Needed

https://www.youtube.com/watch?v=UjZgtmd1kko

Video about clean energy solutions.

Time: 5:49 min.

Plastic Island

http://www.mightybook.com/MightyBook_free/new_month/april_fun/plastic_island/plastic_island.html

Powerpoint and song about the island of trash that exists in our Pacific ocean. Complete with solutions on how to reduce waste.

Video Field Trip- Landfill

https://www.youtube.com/watch?v=iPz5bJa9eOI

Inside look at a landfill in Florida. Guided tour with commentary.

Time: 6:56 min.

Where Does Our Garbage Go

https://www.youtube.com/watch?v=iPz5bJa9eOI

A fun but informative look at household waste disposal geared toward elementary age children. This short takes kids from garbage generated to recycling, waste to energy disposal, and landfilling in Layton, Utah.

Time: 10 min 42 sec.

ACTIVITY

Time Allotted
60 minutes

Target Audience
Grades K-5

Objectives
- Students will create a small-scale landfill, observe leachate production and evaluate methods of landfill construction.

Materials
- 3 transparent 2-liter bottles cut in half with cap
- 1 bag each of sand, gravel, topsoil, clay dirt
- Plastic wrap
- Food coloring (red, blue or green)
- Liquid measuring cups
- Rulers
- Water
- Large poster board
- Writing utensil/marker
- Build a Landfill Worksheet

Build a Landfill

Summary

In this activity, students will conduct an experiment to assess the effectiveness of landfill construction methods on preventing leachate production. They will simulate a landfill in plastic bottles, set up a controlled experiment to test three different lining materials, and measure the production of leachate over time.

Background

As garbage breaks down in a landfill, a dangerous byproduct called leachate is produced. **Leachate** is the resulting solution of liquid containments from a landfill after liquid has passed through a landfill's contents. Leachate can be dangerous to our health and the environment if it seeps into ground water or soil surrounding a landfill. To prevent pollution, landfills must be constructed in a way that prevents leachate from leaking out.

Method

This experiment will be built in one class and can be observed over two days. Using three 2-liter plastic bottles, the class will create separate landfills to study the construction of landfill linings and their effectiveness on preventing leachate from leaking into surrounding soil and ground water.

Build

1. Have student decide which materials to use and write their hypotheses for each bottle on their Build a Landfill Worksheet.
2. Make 3 holes in each bottle cap, then replace the caps on the bottles.
3. After cutting each bottle in half, place the top half of each bottle cap-side-down into each bottom half.
4. Place your liners (three different ones) at the bottom of each bottle (inverted top half). If plastic, lay it down and press flat. If clay, pack it down with your fingers.
5. Randomly select any of all three of the soils - sand, gravel, topsoil, and begin layering the soils. Be sure to pack them with your fingers. You can layer your soil as thick as you want with as few or as many layers as you want, doing it differently in each bottle.
6. Add 3 drops of food coloring to your water. The colored water represents leachate.
7. Pour the colored water into your landfills and watch how fast the water drains. Make sure to pour the same amount of liquid into each landfill so you are able to compare results.

Analyze

1. Measure the amount leachate collected at the bottom of the bottle. Using a ruler, write down the height of the liquid in centimeters in the bottom of each bottle.
2. Lead a discussion about students' initial thoughts, including the materials used, hypothesis/predictions, observations, and actual outcome with analysis.
3. On a large poster that can be displayed to the whole class, the students should record the following: date, time, and amount of leachate collected for each landfill.
3. In small groups of 3 or 4, have students create a bar graph with the bottles on the x (horizontal) axis and amount of leachate on the y (vertical) axis.

Sample Landfills

http://urban-science.blogspot.com/2008/05/make-your-own-model-landfill.html

Discuss

After all data collection is complete and in graph form, lead students in a group analysis asking the following questions.

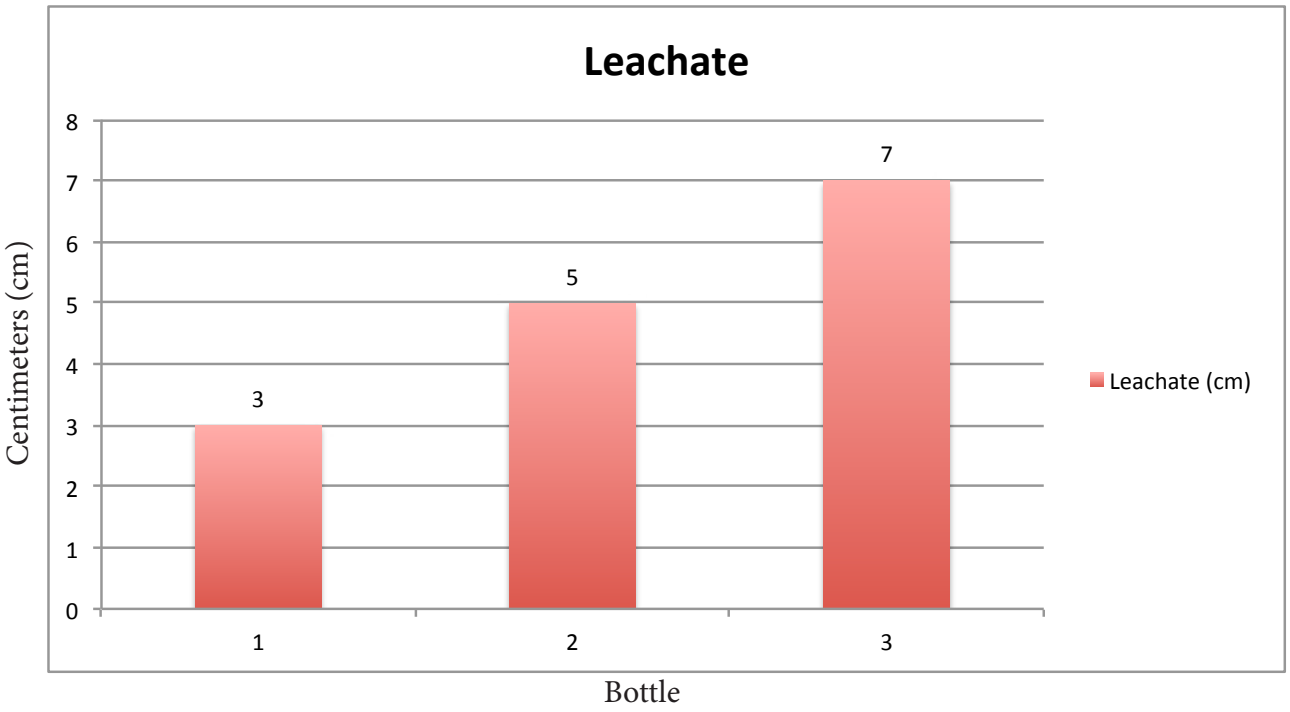
What does the data show us?

Did the leachate leak through?

Which materials were most effective at preventing leachate from leaking? Which were least effective?

How does layering or not layering soil affect leachate pollution?

What can we predict about a real life-size landfill?



Source

Urban Science Blog: http://urban-science.blogspot.com/2008/05/make-your-own-model-landfill.html

Build a Landfill Worksheet

Hypothesis: _____

_____

_____

_____

_____

_____

Bottle 1	**Bottle 2**	**Bottle 3**
Materials:	Materials:	Materials:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Observations:

Bottle 1	**Bottle 2**	**Bottle 3**
Date: _____	Date: _____	Date: _____
Time: _____	Time: _____	Time: _____
Leachate: _____	Leachate: _____	Leachate: _____
Description:	Description:	Description:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Conclusion & Analysis: _____

_____

_____

_____

_____

_____

ACTIVITY

Time Allotted
45 minutes

Target Audience
Grades K-5

Objectives
- Students will develop and demonstrate new uses for items that are usually thrown away.

Materials
- Poster board
- Magazines
- Drawing utensils: markers, crayons, colored pencil, etc.
- Scissors
- Glue
- Optional: reuse items from home

Create a Poster

Summary

In this activity, students will discover ways to reuse objects that we generally throw into the landfill. They will showcase their creativity on posters.

Background

Much of what we throw into the landfill can be recovered and reused as material for something else. There are many practical and creative ways to reuse regular household items. The more we reuse, the less raw materials must be pulled from the earth to create new material. **Raw materials** are unprocessed materials used in the manufacture of products. These unprocessed materials can be either natural substances such as wood or metals or recovered materials such as crushed glass from residential recycling. We can also save money by reusing more and buying less.

Method

Now that students have discussed with their classmates why waste is a problem and how much we throw away on a daily basis, divide the class up into small groups (4-5 students per group).

1. Tell the groups that they will work together to create a poster showing different items we throw away every day and ways that we can reuse these items. Explain that they will have time to brainstorm together (5-10 minutes), to agree on the design of their poster (5-10 minutes), to prepare their materials (5 minutes), to create the actual poster (15 minutes) and then to present their poster to the rest of the class.
2. Have the students brainstorm a list of items and then work together to think of ways that these items can be reused. For example, an egg carton can be used as a planter for seedlings. Each list should have 5-6 items and each item should include at least one way in which it can be reused.
3. Each group should then discuss how they want their poster to be designed and agree on a plan for creating their poster.

   Option A: Students can draw, paint or write phrases to create a message about keeping items out of the garbage.

   Option B: Students can cut images from magazines. Use these images to create a collage with a message about keeping items out of the garbage.

   Option C: Students can bring in items from home to be attached to their poster. Use these items to create a 3-D collage with a message about keeping items out of the garbage.

4. Create posters.
5. Allow each group to present their poster to the class.
6. Display posters around the classroom, school or neighborhood.

NOTE: Get creative and identify other related themes for the posters. Some examples might include: landfills, what is garbage, and more.

Posters for Lunchroom Sorting Stations

www.zerowastetrips.com

mradrianhartanto.wordpress.com

www.incredibleart.org

craftulate.blogspot.com

ACTIVITY

Time Allotted
60 minutes (may be allotted over a few days)

Target Audience
Grades 3-5

Objectives
- Students will explore and critique various energy sources.
- Students will calculate the different energy values of waste.

Materials
- Journal/notebook
- Writing utensil
- Access to research library and/or internet

Turning Garbage Into Energy

Summary

This activity teaches how our garbage can help us generate power and electricity.

Background

What is energy?
Energy is the ability to do work. Energy gets you out of bed in the morning, makes the wind blow, the sun, moon and stars shine, lets dogs run, birds fly, plants grow and so much more. Energy is also what you get when you burn fuel to move something like a car. People have learned to store energy to do useful work for them. By burning coal, you can use the chemical energy stored in the coal to heat up water until it becomes steam which then drives large machines to generate electricity. Electricity is another form of energy.

You use energy every day. Every time you turn on a light, use hot water, or ride in cars, busses, some trains, or airplanes, you are using energy. It takes energy to make things like toys, furniture, clothes, and the food you eat. Without energy, there would be nothing: no light, no movement, no heat, no life.

Where does energy come from?
The light that comes to the Earth from the sun is pure energy. Nearly all other sources of energy originally got their energy from the sun. There are many different sources of energy on Earth and there are many different ways that we can tap into those sources and make the energy work for us - creating power, electricity, and heat. One source of energy we use a lot of is **fossil fuel**. These fuels were formed millions of years ago: ancient plants took in energy from the sun and stored that energy. Ancient animals, like dinosaurs, ate the plants and converted the plant's energy into body mass. They used this energy to move and grow, to repair injuries, and to keep warm. When the animals and dinosaurs died, their remains collected in the ground, and, over millions of years, decomposed into a source of fuel. These fossil fuels include coal, oil, and natural gas and are the stored energy of organic remains.

How is energy connected to garbage?
While we still use fossil fuels for energy today, they are **nonrenewable resources** that will eventually be all used up. Once we use all of our supplies, we will have to depend on new sources of energy. We are looking for new energy sources so that we can **conserve**, or use wisely to avoid waste, those that come from within the Earth. Did you know that you can get energy from garbage? There are two ways that we can use our garbage to make energy.

In one method, garbage is taken to a waste-to-energy incinerator. These burn the garbage and this process generates heat that can be converted to fuel and electricity.

A second method involves the garbage that we dispose of in landfills. As this garbage decomposes, it produces **methane gas**. Landfills are using the gas, captured by a special pipe system set up in the landfill, to generate electricity; provide fuel for factories, schools, and other facilities; and to produce natural gas.

Method

Part 1
Have students keep an energy diary for one week. Ask them to record every time they use energy in a day (for example, turning on lights, using a car or bus). Where could they have saved energy (for example, riding a bike instead of using a car)?

Part 2
Divide the class into groups and assign each group an energy source to research. Ask each group to conduct research on their topic and prepare a presentation to teach the class about their findings. Some topics might include: fossil fuels, solar energy, incinerators, landfill methane capture, or hydroelectric energy.

Part 3
Have students complete the worksheet for this activity (next page). Have students work individually to rank the energy sources that were explored from best to worst. Students should support their choices using facts from their research and the worksheet.

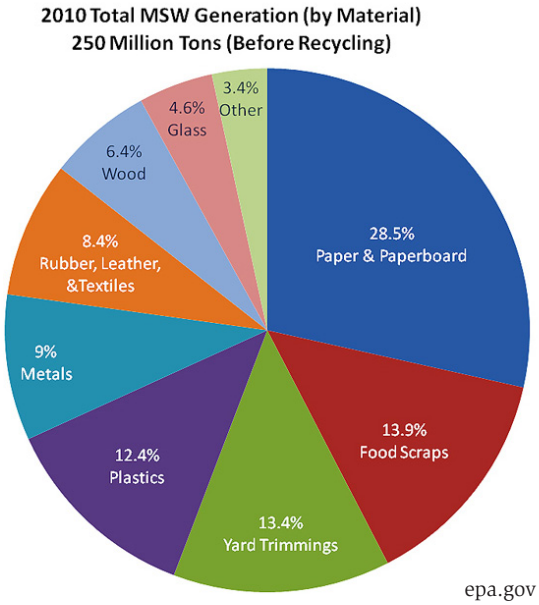
Turning Garbage Into Energy Worksheet

Assuming that you have 100 tons (200,000 pounds) of MSW, use the pie chart to determine the relative weights of each kind of material: paper, food waste, yard trimmings, plastic, metals, rubber, wood and glass. (For example, there will be 12 tons--or 24,000 pounds of plastic) Follow the steps and write your answers below.

a. Use the pie chart on the right to determine the percent (%) of total MSW (municipal solid waste or household waste) of each material in the table below.

b. Use the percent (%) of MSW to determine the tons of each material in your sample. Note that one (1) ton = 2,000 pounds. Round this to the nearest whole number.

c. Convert tons to pounds. Round this to the nearest whole number.



epa.gov

MATERIAL	Percent (%) of MSW	Tons in Sample	Pounds in Sample
Paper (newspaper, cardboard boxes, etc.)			
Food waste			
Yard trimmings			
Plastics			
Rubber, leather, textiles			

Let's take a closer look at these categories. Using the weights you calculated and the chart below, calculate the total energy that would be produced by the 100 tons of MSW in terms of BTUs (British Thermal Units). Show your calculations below.

The Energy Values Of Different Materials When Incinerated*

Material	BTU** per pound
Paper (newspaper, corrugated boxes, etc.)	7,500
Food Wastes	2,600
Yard Trimmings	3,000
Plastics	15,000 (11,000 – 20,000)
Rubber	10,900

*Source: Council on Plastics and Packaging in the Environment

**BTU (British Thermal Unit) is defined as the amount of heat required to raise the temperature of one pound of water one degree (Fahrenheit)

MATERIAL	Pounds in Sample	BTU per pound	Total energy
Paper (newspaper, corrugated boxes, etc.)			
Food waste			
Yard trimmings			
Plastics			
Rubber, textiles, leather			
TOTAL			

Calculate the approximate amount of energy produced by each material:
_____ pounds of material sample x BTU/pound = _____ BTUs produced

3. A "kilowatt-hour" is a method of measuring amounts of electricity. Assuming that 3,142 BTUs will generate 1 kilowatt-hour, how many kilowatt-hours of electricity would be generated from 100 tons of MSW? Show your calculations.

3. Ask your parents about your family's electrical usage:

How many kilowatt-hours per month do you use?

How many months would your house be able to run on the electricity generated by 100 tons of MSW?

A ZERO WASTE CURRICULUM

Lesson 3

The Many Lives of a Plastic Bottle/Aluminum Can

Resource Life Cycle

Objectives

- Students will observe how plastic and aluminum are extracted, produced, distributed, and disposed.
- Students will have an understanding of why the production and disposal of these resources can be harmful to the environment and our health.
- Students will assess how much their local community (school or neighborhood) wastes and recycles resources.
- Students will imagine the life story of a recyclable resource.
- Students will imagine the life story of a recyclable resource.

Summary

In this lesson, students will understand the resource life cycle of aluminum and plastic, and the many steps required to produce, distribute, and ultimately dispose of each resource. Students will also learn the benefits of recycling, or giving new life, to these resources rather than disposing of them as waste.

Background

Aluminum and plastics are helpful in places like hospitals, schools, stores and homes. They make things convenient and add safety to everyday tasks and supplies. Aluminum is used in transportation, packaging (the materials used to wrap, contain, and protect products) and construction. It is lightweight and strong and has many uses both in building things and packaging things. Plastics are used to make many products we use every day, including beverage and food containers, grocery bags, trash bags, plastic cups and utensils, diapers, children's toys, and bottles for everything from window cleaner to shampoo and dishwashing liquid. Furniture, appliances, computers and cars all contain plastic too.

Aluminum Cans

Plastic Bottles

This lesson will look at two specific products made from these resources: the aluminum can and the plastic water bottle. As we use and discard more and more aluminum cans and plastic water bottles we have learned a couple of important lessons:

1. If you throw an aluminum can or plastic water bottle away and it is sent to a landfill, it will still be there in 500 years. These items do not disappear, decompose or go away.
2. Both aluminum and plastic are resources that can be easily recovered and given a new use through recycling.
3. It is better (cheaper, more energy efficient, and conserves resources) to make products from recycled plastic and aluminum than it is to use new plastic and aluminum.

In order to understand the role that plastics and aluminum play in our lives and our environment, it is important to learn about the life cycle of each resource. A **resource life cycle** is defined as the complete succession of changes undergone by an organism during its life. A resource life cycle includes all of the steps a resource goes through from the moment it is formed to the last moment it is used. A new cycle occurs when an identical set of changes is begun.

ALUMINUM

Aluminum is a hard, yet lightweight metal we get from a mineral called bauxite found in the Earth's crust. Bauxite is found in about 8% of the earth's crust. It is rust resistant and very strong. The equivalent of 24 aluminum cans can hold up a 4,000 lb vehicle. Infinitely recyclable, aluminum can be used again and again without losing its main properties. Recycled aluminum cans can be made into furniture, car parts, appliances, airplanes, and more. About 75% of all the aluminum ever made is still in circulation today.

Aluminum beverage cans are the most widely used form of beverage packaging for many reasons:

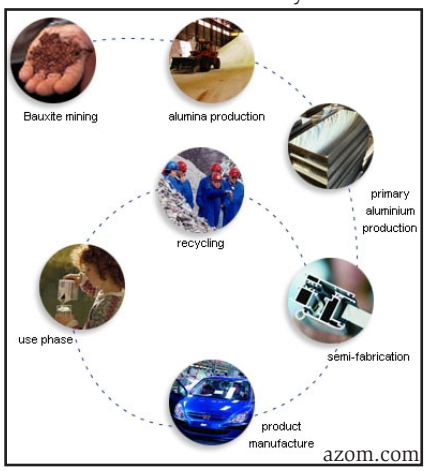
1. Drinks stay chilled longer and cool down faster than in any other beverage container.
2. Aluminum cans are lightweight, easy to stack, and are 100% recyclable.
3. They preserve taste and deliver a fizz that no other container can match.

The Life Cycle of an Aluminum Can

Step 1 - Bauxite Mining
Bauxite makes up 8% of the earth's crust. The ore from which aluminum is produced is bauxite. More than 130 million tons of bauxite are mined each year.

Step 2 - Alumina Production
Bauxite has to be processed into pure aluminum oxide (alumina) before it can be converted to aluminum by electrolysis. Four tons of bauxite are required to produce two tons of alumina. Two tons of alumina then produce one ton of aluminum at the primary smelter.

Aluminum Life Cycle



Step 3 - Production
Primary aluminium is produced in reduction plants (or "smelters"), where pure aluminium is extracted from alumina. The reduction of alumina into liquid aluminium happens at about 950 degrees Celsius in a fluorinated bath under high intensity electrical current. Smelting is one of the most destructive processes to our climate. For every ton of aluminum produced, three tons of toxic red sludge are produced. This sludge is slightly radioactive, contains heavy metals and pollutants, can contaminate our air, ground water, and soil, and is bad for the environment and people.

Quick Fact: Recycling just one soda can saves enough electricity to run a laptop computer for over 10 hours.

Step 4 - Fabrication
Fabrication includes several industrial processes: rolling, casting and extrusion. After aluminum is made into the right shape, it is then formed into products. For example, aluminum may be shaped into the engine cylinder head for a car and then that engine cylinder head is installed in a car.

Step 5 - Consumption and Collection
The major outlets for aluminium products are in transport, building and construction, packaging and engineering. After being emptied, they can be recycled. Most cities collect recyclables along with garbage. The aluminum is sorted out for recycling.

Aluminum Car Parts

Step 6 - Recycling
Used aluminium is valuable - it is easily recycled and can be recycled over and over without losing quality. Because the refining of aluminum metal is so energy intensive, aluminum manufactured from recycled

material saves 95 percent of the energy required to produce aluminum from ore which avoids greenhouse gas emissions used in the process. According to the Aluminum Association, aluminum recycling annually saves the energy equivalent of 15 million barrels of crude oil – nearly America's entire gas consumption for one day.

Quick Fact: If not properly recycled, an aluminum can will still be in a landfill in 500 years. Americans could save $3 billion worth of energy every year just by recycling cans. Throwing out a single aluminum can is like pouring out six ounces of gasoline. Would you still throw that can in the garbage?
Source: http://www.aluminum.org

The life cycle of an aluminum can from mining to recycling is 60 days. Think of how many beverage and food cans you will use during the next 60 days. The impact on the environment (carbon footprint or greenhouse gas emissions) can only be judged from the life cycle perspective. If you interrupt the life cycle of the aluminum can and do not recycle it, you not only lose a valuable resource, but you are forced to use even more resources and energy to produce new aluminum. You can make a big difference by making sure that every aluminum can gets recycled.

PLASTIC

Plastic is a hotly debated material: it's cheap to produce and easy to work with, but it can cause damage to the environment. Beginning in the 1950s with the population boom in the U.S. and the rise of the pre-packaged products, plastics became much more widely used in everything from packaged vegetables to plastic ballpoint pens to contact lenses. Plastics prevent waste by keeping foods fresh longer and by keeping products from breaking or spoiling. There are many reasons why plastics are a valuable resource, but there are many reasons they are harmful to the planet's health.

Above your washing machine, under your kitchen sink or in your refrigerator, plastic bottles are all around us. Americans buy an estimated 28.3 billion plastic water bottles every year, and nearly eight out of every ten of those bottles will end up in a landfill. In 2010, 31 million pounds of plastic waste was generated in the United States (http://www.epa.gov/osw/conserve/materials/plastics.htm#facts). When not recycled, this plastic continues to be a problem. Although some aspects of our lives became easier because of the use of plastic, the quality of other aspects decreased, such as wildlife health and air quality.

The Life Cycle of a Plastic Bottle

Step 1 - Polymerization

Plastic is made from oil found underground. This oil has been forming since the time that dinosaurs roamed the Earth and it cannot be replaced. Once humans use all of the oil, it will be gone forever. Plastic begins its life as a semi-liquid, as a mixture of crude oil and natural gas. They are easily molded into shape while soft and then set into a rigid form.

The science of polymers: A **polymer** is a chemical compound formed from long chains of the same molecule group. These chains repeat over and over. Plastics are polymers. Polymers can be flexible, pliable and stretchy. Polymers tend to be dense, strong, and flexible. Some examples are plastic bottles, styrofoam, latex paints and chewing gum. Some examples of things that are not polymers include brick, glass, and metals. Polymerization is a chemical reaction in which two or more small molecules combine to form larger molecules. See below for the steps involved in polymerization of plastics:

1. Petroleum is drilled and transported to a refinery.
2. Crude oil and natural gas are refined into ethane, propane, hundreds of other petrochemical productsand, of course, fuel for your car.
3. Ethane and propane are "cracked" into ethylene and propylene, using high-temperature furnaces.
4. Catalyst is combined with ethylene or propylene in a reactor, resulting in "fluff," a powdered material (polymer) resembling laundry detergent.
5. Fluff is combined with additives in a continuous blender.
6. Polymer is fed to an extruder where it is melted.

If a bottle is made from recycled plastic, it is made largely from melted down older bottles, in addition to some fresh materials.

Plastic Bottle Life Cycle

Step 2 - Molding
There are a number of different ways that plastic is molded. In most processes, the plastic has already been cooled and worked into granules. Plastic granules or pellets are usually fed into a heating hopper, which melts them down and then pushes the melted plastic into a press used to create a bottle.

Step 3 - Packaging
The bottle is filled with the product it's made to contain, and a paper label is glued to the front. The bottles are then grouped, boxed, and shipped to vendors and consumers.

Step 4 - Consumption and Collection
The bottles are sold through vendors or directly from the factory and the contents are consumed. After being emptied, they can be recycled. Most cities collect recyclables along with trash. The plastics are sorted by type and sent to be recycled. That is assuming that the bottles are actually recycled. When they are thrown in with garbage, they will simply sit in a landfill and the story ends there.

Quick Fact: Empty plastic bottles will be around for more than 500 years if they are put into a landfill.

Step 5 - Recycling
Used plastic bottles are shredded, washed, rinsed, melted and extruded to end up as plastic flakes used to make many recycled plastic products. The different types of plastics can be used in different ways, for everything from more bottles to plastic bags to carpeting and clothing. Most of the plastics recycled end up in fabrics and clothing. Plastic products are melted into the plastics mixture when a company begins production of the next set of plastic products.

Recycling plastics conserves energy and natural resources (materials derived from the earth, such as water, petroleum and natural gas, which are used for energy or in the manufacture of goods) that are needed to create new plastic. Recycling plastic products also keeps them out of landfills and allows the plastics to be reused in **manufacturing**, the process of turning raw materials into a product or good by hand or machinery, new products.

Discussion/Verbal Exploration

Ask students to think about what containers hold the milk they drink, the soup they eat, or the yogurt or peanut butter they like? The containers much of our food and drinks come in are made from natural resources which are mined, transported, and then made into metal, plastic, or glass at a factory. The manufacturing process releases greenhouse gases which cause climate change. By reusing or recycling these containers, you can reduce the need to mine, transport, and manufacture natural resources to make new products. In other words, you reduce the amount of greenhouse gas released and help prevent climate change.

Ask:

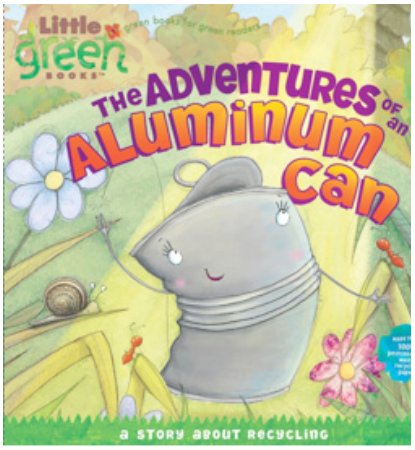
How often do you use aluminum cans?
What kind of food is stored in an aluminum can?
At home, do you toss aluminum cans in the garbage or recycle them?

At school, do we toss aluminum cans in the garbage or recycle them?
If an aluminum can is recycled, into what can it be made?
How often do you use plastic bottles?
What is stored in a plastic bottles?
At home, do you toss plastic bottles in the garbage or recycle them?
At school, do we toss plastic bottles in the garbage or recycle them?
If a plastic bottle is recycled, into what can it be made?

Read: *The Adventures of an Aluminum Can*, by Alison Inches (Grades K-3).

Peek into the diary of an aluminum can as it goes on a journey from inside a bauxite rock to the manufacturing line to the store shelf to a garbage can and finally to a recycling plant, where it emerges into its new life . . . as a baseball bat!

The Adventures of an Aluminum Can



By Alison Inches

Ask:

Where did the little speck of alumina originally live?

How do the workers get the alumina out of the earth?

Why is the alumina taken to a processing plant first?

After the aluminum was processed, what shape does it come out of the machine? (hint: like a sleeping bag)

What are a few uses for aluminum?

What was the second use of the aluminum can?

How was it remade into the bat?

How many times was the aluminum used? Is this good or bad, and why?

Read: *The Adventures of a Plastic Bottle*, by Alison Inches.
(Grades K-3)

The Adventures of a Plastic Bottle

By Alison Inches

Peek into this diary of a plastic bottle as it goes on a journey from the refinery plant, to the manufacturing line, to the store shelf, to a garbage can, and finally to a recycling plant where it emerges into it's new life... as a fleece jacket!

The diary entries are fun and humorous yet point out the ecological significance behind each product and the resources used to make it.

Ask:

Where did the oozing blob of crude oil originally live?
How did the crude oil get to the oil refinery?
What materials can crude oil be turned into at the oil refinery?
Why was it sent to a manufacturing plant?
What did the manufacturing plant melt and shape the crude oil into?
What else can you think of that also comes in a plastic container?
How did the family use the flower after it wilted in the bottle?
How can you tell what kind of plastic a container is?
What happened to the bottle at the recycling center?
What could the fleece sweatshirt be recycled into next?

In My Neighborhood

At home with an adult, count the number of food items that use plastic containers in your kitchen.

How many containers does your family have?

Are there some things your family could purchase that could reduce how much you purchase plastic?
(eg: Buying yogurt in a large container with multiple servings instead of individual serving portions)

Are there ways your family could reuse the containers you currently have?
(eg: Using empty butter tubs for leftover food containers)

Make a list of ways your family can reuse plastic containers and hang the list on the refrigerator.

Field Trip

Whole Foods Market offers educational field trips focusing on packaging of products. These field trips can be tailored to the age of the students.

Resources

How it's Made, The Life of a Plastic Bottle

http://www.youtube.com/watch?v = ZfyPCujUPms

Discovery/Science Channel's "How It's Made" Plastic Bottles & Jars episode.

Time: 4.51 min.

Story of Bottled Water

http://www.storyofstuff.org/movies-all/story-of-bottled-water/

The Story of Bottled Water, released on March 22, 2010 (World Water Day) employs the Story of Stuff style to tell the story of manufactured demand—how you get Americans to buy more than half a billion bottles of water every week when it already flows from the tap.

Time: 8.05 min.

Story of Stuff

http://www.storyofstuff.org/movies-all/story-of-stuff/

The Story of Stuff is a short polemical animated documentary about the lifecycle of material goods. The documentary is critical of excessive consumerism and promotes sustainability.

Time: 21.25 min.

The Aluminum Association Website

http://www.aluminum.org/AM/Template.cfm?Section = News_Statistics

There is a link to a PowerPoint presentation called Aluminum 101. This is an overview of the history of aluminum, how it is produced, used and recycled.

ACTIVITY

Time Allotted
60 minutes

Target Audience
Grades K-5

Objectives
- Students will assess how much their local community (school or neighborhood) wastes and recycles resources.

Materials
- Recycling containers
- Recycling signs, printed or hand-made, to assist students with sorting
- Writing utensils/markers
- Paper or a chalk/whiteboard to create lists and charts
- Plastic gloves

Bottle Bonanza

Summary

This activity will help students gain an understanding of how many plastic bottles are being used in their school and whether or not they are currently being recycled.

Background

Plastic is a hotly debated material: it is cheap to produce and easy to work with, but it can cause damage to the environment. There are many reasons why plastics are a valuable resource, but there are many reasons they are harmful to the planet's health. Above your washing machine, under your kitchen sink or in your refrigerator, plastic bottles are all around us.

Method

Follow the steps on the worksheet to evaluate how well your school recovers plastic for recycling.

Plastic Bottles

http://urbanresearch.wordpress.com/2008/11/11/costco-japan-yokohama/

Optional Research on Other Resources

Have students investigate the life cycles of other materials such as glass, wood, paper, and copper. From what does this material originate? How is it extracted from its natural environment? What do we use this material for? Explain the steps it goes through in order to become what we use it for today. Students can examine these resources in their school. Follow the steps for Bottle Bonanza but look at paper or other resources found in your school.

Bottle Bonanza Worksheet

[sample - see appendix for full worksheet]

1. Where do students and staff get the water bottles they drink from in school?

Break up into small groups and brainstorm a list of where students and staff get the plastic bottles they drink at school. Come back together as a whole class and develop a complete list of locations. This list might include: brought from home, lunchroom, vending machine, etc.

Location 1 home
Location 2 PTO Lunch
Location 3 _____
Location 4 _____
Location 5 _____

2. Identify all of the places where students and staff do dispose of (recycle or put in the garbage) a plastic bottle. Indicate in each location if plastic bottles will be in the garbage, recycling or both.

Location 1	classroom	☐ recycling	☐ garbage	☒ both
Location 2	_____	☐ recycling	☐ garbage	☐ both
Location 3	_____	☐ recycling	☐ garbage	☐ both
Location 4	_____	☐ recycling	☐ garbage	☐ both
Location 5	_____	☐ recycling	☐ garbage	☐ both

3. Design a plan for collecting all of the plastic bottles used in school during one school day.

This may include having students with recycling containers standing in the lunchrooms, making signs to let students and staff know to put their bottles in a specified collection container, collecting plastic bottles from classroom garbage or recycling containers, etc. Write out the steps in your plan and who will complete each step.

STEP	LOCATION	WHAT IS NEEDED	PERSON RESPONSIBLE
Make signs	Lunchroom, classrooms, office	Cardboard, markers	
Collect bottles at lunchtime	Door on north side of lunchroom	Box with sign saying "Recycle plastic bottles here"	

4. Create a chart to keep track of how many plastic bottles were collected in each location.

If there is recycling available at the school, you might want to include how many bottles were being recycled and how many were going into the garbage.

LOCATION	# OF BOTTLES BEING THROWN AWAY	# OF BOTTLES BEING RECYCLED	# OF TOTAL BOTTLES
Lunchroom - 1st period	17	8	25

5. Analyze your data. Use the data collected to answer/complete the following questions:

What percent of all the bottles collected were going to be recycled?

What percent of all the bottles collected were going to be thrown away?

Create a pie chart showing the difference between the bottles begin recycled and the bottles being thrown away.

6. Use the number of plastic bottles collected in one day to extrapolate.

How many plastic bottles are being disposed of in the school in one school year?

_____ x _____ = _____

bottles collected # days in school year # bottles used for the whole year

About how many plastic bottles are recycled during the school year?

_____ X _____ = _____

bottles recycled # days in school year # recycled for school year

Use ratios to figure the percentage of bottles recycled during the school year.

recycled : X

_____ ____

# of bottles 100

7. Design a plan to decrease the number of plastic water bottles used and then start or improve recycling of plastic bottles. Write a list of the steps you will take to achieve your plan.

To decrease the quantity of plastic bottles that are being used at school, ask the following questions:

a) Can students and staff bring reusable water bottles?

b) Does the school have water fountains?

c) Do the school water fountains work for refilling reusable water bottles?

d) Are there other drinks available to students and staff?

To start or improve recycling of plastic bottles, ask the following questions:

a) Does the school have recycling?

b) Will the recycling company accept plastic bottles?

c) Are there recycling containers where they need to be in the school (classrooms, lunchrooms)?

d) How can we teach students and staff to recycle their plastic bottles?

ACTIVITY

Time Allotted
2 hours

Target Audience
Grades K-5

Objectives
- Students will observe how plastic is extracted, produced, distributed, and disposed.
- Students will imagine the life story of a recyclable resource.

Materials
- A variety of recyclable materials (plastic water bottles, milk cartons, plastic and glass jars, yogurt cups, greeting cards, etc.)
- Drop cloths (to use as a backdrop for the performance)
- Paint
- Tape, glue, string (to affix recyclables to cloth)

Recycle Theater

Summary

In this activity students will explore the concepts behind the resource life cycle of a plastic bottle. They will examine the process of recycling plastics and discuss the role students can play in reducing and recycling. They will then write and perform a skit and create a stage set using recycled materials.

Background

Plastic bottles are made from oil found underground. Plastic begins its life as a semi-liquid, as a mixture of crude oil and natural gas. Plastic is molded by a variety of processes. In most, the plastic has already been cooled and worked into granules. Plastic granules or pellets are usually fed into a heating hopper, which melts them down and then pushes the melted plastic into a press used to create a bottle. During packaging, the bottle is filled with the product it's made to contain, and a paper label is glued to the front. The bottles are then grouped, boxed, and shipped to vendors and consumers. A **consumer** is a person who buys products or services that they will use. They make the decision whether or not to purchase an item at the store. After consumption, bottles should be recycled. Recycling plastics conserves energy and natural resources. It reduces the amount of energy and natural resources (such as water, petroleum and natural gas) needed to create new plastic. Recycling plastic products also keeps them out of landfills and allows the plastics to be reused in manufacturing new products.

Method

1. Watch a video about The Life of a Plastic Bottle. Tell students that they are going to learn about plastic bottles and the importance of recycling. As they view the video they should record interesting facts in a journal. How it's Made, The Life of a Plastic Bottle--http://www.youtube.com/watch?v = ZfyPCujUPms

2. Read The Adventures of a Plastic Bottle, by Alison Inches.

3. Discuss the video and/or book. Use the following questions as prompts:
   What natural resource is used to make plastic?
   What can be made from recycled plastic?
   What can students do to help make sure plastic water bottles get recycled?
   What is the message of the video/book?
   Discuss students' answers and clarify and explain any concepts that the students do not understand.

Break the students up into smaller groups.

4. Brainstorm ways to reuse or reduce plastic bottles. Ask the

groups to think of ways plastic bottles can be reused or reduced. For example, a plastic bottle could be reused as a flower vase or you can use a reusable water bottle instead of a plastic single use one. Groups may then share their ideas with the class.

5. Ask students to think of ways they can reduce, reuse and recycle plastic bottles in their lives. Students should write one paragraph or create a poster describing how they can use fewer water bottles (reduce), use bottles in a different way (reuse), or improve recycling of water bottles.

Tell the students that their task is to write and perform a one-minute skit about the life of a plastic bottle and why it is important to reduce and recycle. They will also design a backdrop for their skit that uses recyclable materials.

6. Brainstorm ideas for the skit. Each group should write down their ideas for their skit, and then agree on 1) a main message, 2) characters, and 3) setting/action.
If students have not had exposure to role playing, it may be a good idea to demonstrate dialogue through a quick role play. Remind the students that their skit should be only one minute long.

7. Write skit. Have students write dialogue for their characters. This means that they should write down the exact words that they want their characters to say in the skit.

8. Brainstorm ideas for the backdrop. Provide each group with a project display board for their backdrop. Tell students that their backdrop should reflect the setting they chose. Students should also be aware of the art supplies and recyclable materials they will have to create their backdrop. Give groups time to discuss and sketch on drawing paper what their backdrop will be and how they will create it. Check in with each group before they start their backdrop.

9. Create backdrop. Once groups have approval from the teacher, they may start to construct their backdrop. Students should sketch or outline their design on the project display board before they begin painting or attaching objects. Students may also decide at this time if they want to include basic props or costumes.

10. Rehearse skit. Allow students time to practice and time their skits. Students may either memorize their lines or read from a script.

11. Present skit. Have each group present their skit.

12. Discussion. After the skits have all been presented, discuss the following questions with the class:
    What was the main message of each skit?
    Did the backdrop work to help communicate the setting?
    What parts of the dialogue helped you to understand the main message?
    Did the skits present different main messages or were they all the same message?

13. Reflection. Give students another opportunity to journal. After watching all of the skits, have they identified other interesting facts about the life of a plastic bottle? Have students journal about why it is important to reduce and recycle plastic bottles. Ask them to consider what they can do personally and what they can do in their community (either school or neighborhood). Have them reflect on whether their skit did a good job of communicating the importance of recycling.

14. Wrap up. Invite students to share their thoughts and ideas with the entire class.

A ZERO WASTE CURRICULUM

Lesson 4

Make Less Garbage

Resource Recovery Systems: Reducing and Reusing

Objectives

- Students will discover ways in which they can reduce their daily impact through different systems of resource recovery
- Students will create solutions to reduce waste.
- Students will identify objects in the waste stream which could be reused creatively rather than discarded.
- Students will design solutions to address the issue of excessive resource use.
- Students will design and organize a campaign to persuade their fellow students to change a current wasteful behavior.

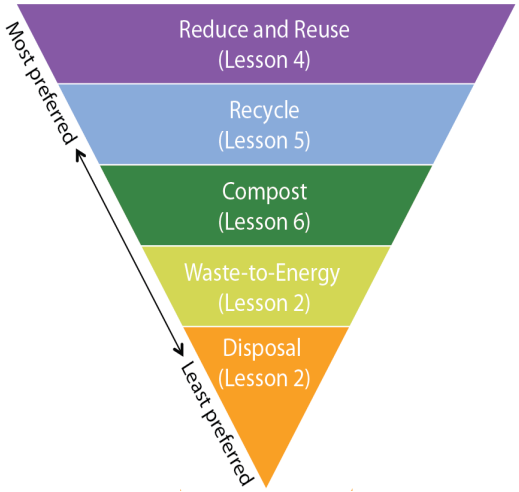
Summary

In this lesson students will learn about source reduction and reuse, two ways to reduce waste, and the amount of waste that goes to the landfill

Background

The most effective way to reduce waste is to not create it in the first place. Making a new product requires a lot of materials and energy: raw materials must be extracted from the earth, and the product must be fabricated and then transported to where it will be sold. As a result, source reduction and reuse are the most effective ways to save natural resources, protect the environment, and save money. According to the Environmental Protection Agency (EPA), source reduction is the highest goal in the hierarchy of waste management options.

Waste Management Hierarchy



Seven Generations Ahead

Source reduction means creating less waste. Reusable trays in a lunchroom reduce the watse of disposable bags being used and thrown away each day. **Disposable items** are made to be used only one time and then thrown away. A hand dryer in the bathroom reduces the waste of all paper towels used and thrown away. Reducing waste can be accomplished in a variety of ways including reusing items so that you do not need to purchase another. **Reuse** means thinking of a new use for an item that has already been used. A **durable product** is a product that is designed to have an extended life span and to last in spite of hard wear or frequent use. When you reuse products or packaging, you can either delay or avoid their entrance into the waste stream. Even if you cannot reuse something, there may be someone else in your community who can. Some ways to reuse include refilling, repairing, donating and reselling products. Rather than throwing out items like clothing or food jars, find new uses for them. Use jars to store beverages or leftover food. Trade or sell your used CDs or DVDs instead of throwing them in the garbage.

Reusing a Plastic Bottle

prudentmoms.blogspot.com

In addition to reusing items, there are a number of other methods of source reduction:

Use less/Buy less: A consumer can reduce what they buy and create less waste. A consumer is a person who buys products or services that they will use. They make the decision whether or not to purchase an item at the store. They can use less if they only buy what they need.

Buy used: Purchase used, rebuilt, or refurbished products. Many things can be found used including clothing, furniture, building materials, and more.

Buy reusable or returnable products or rent them: One example might be to buy a reusable water bottle instead of buying plastic bottles of water. Borrow or rent a tool instead of buying one. Consider reusable plates, forks and cups instead of paper or plastic disposable ones.

Buy products made to last a long time: Some products are designed to be used once and thrown away. Avoid these products when possible. Make sure to buy things that are able to last a long time and are strong enough to be reused many times.

Use less packaging: Many products are **over packaged**, having more packaging material than is needed to wrap and protect the product. By decreasing the amount of items purchased that have excessive packaging to help reduce packaging waste. When manufacturers make products with less packaging, they use less raw material. **Bulk products** are sold unpackaged or in large volumes to reduce packaging waste. Reuse any packaging that you do get.

Source reduction also takes place at a manufacturing level by using less material to create a product or packing. For example, using less plastic in plastic bottles to decrease plastic use. The weight of aluminum and steel cans, plastic bottles and glass have all been reduced by up to 30% or more since the 1970s.

	1972	**1992**	**1999**
100 15oz glass bottles	75.7 pounds	48.1 pounds	37.5 pounds
100 12oz steel cans	10.5 pounds	7.2 pounds	7.2 pounds
100 12oz aluminum cans	4.5 pounds	3.5 pounds	3.1 pounds
100 2l PET bottles	14.6 pounds	12 pounds	10.6 pounds

Source reduction and reuse help the environment by reducing the need for more raw materials, reducing the pollution and greenhouse gasses caused by harvesting new materials and manufacturing products, saving energy, and reducing the amount of waste that needs to be recycled or sent to incinerators and landfills.

Discussion/Verbal Exploration

DISCUSSION A - Word Cloud on Being a Smart Consumer
Where do you fit into all of this? Create a word cloud as a class. Draw a cloud or circle on the board, or use a large sheet of paper and hang it on the wall. At the center write "consumer/ you," then draw lines out from the center to words/ideas, developed around the topic of how to make the most responsible and environmentally friendly choices as far as reducing and reusing. Guide students to suggest environmentally conscious ideas focused around packaging, food, clothing, or transportation choices. Examples include: donating clothing to younger family members or friends, using a reusable water bottle, or using both sides of paper when printing.

DISCUSSION B - Packaging and Reuse Options
There are many ways you can reuse products and materials. Reuse can start at home by reusing clothes,

glass containers, or buying products that are reusable instead of single-use, such as food containers. It can also happen when you decide to buy things in bulk to avoid extra packaging. Examples to stay away from include single serving yogurt containers, plastic pens that can't be refilled, single use ziploc bags, and paper napkins. The convenience of using these single-use convenience items sometimes overshadows their environmental impacts, one of which is creating more garbage. Learning how to change your purchasing habits takes education and awareness of the benefits of sending less waste to the landfill.

Tell the students that you are going to learn about what it means to reduce waste. Explain that you can reduce waste by avoiding making garbage in the first place. That way you don't have to deal with disposing of waste or recycling it later.

Items needed:

- Bulk bag/jar of a food item (big bag of popcorn, large yogurt container, big jar of applesauce, etc.)
- Single servings of same food item as above (popcorn in single serve bag, individual yogurt cups, single serve apple sauce containers). Try to have the same volume of the food as in the bulk item
- Gallon jug of juice in a glass jar
- Juice boxes (same juice and volume as above)
- Optional: Frozen juice concentrate (same juice volume as above when prepared)

Food packaging: Show the students the large bag of food and individual bags of food and ask them which they think makes more waste. Consider both material and energy waste. Show the students how more wrapping is used in the individual bags and tell them that if more paper and packaging is used to make something, it makes more waste and uses more enegy to make it. Explain how packing food in reusable containers will reduce waste because it makes less garbage.

Beverage packaging: Show the students the gallon jug of juice in a glass jar, and a six-pack of juice boxes. Ask the students to predict which of these items makes more waste. Tell the students that it takes more paper, plastic, and energy to make the juice boxes.

Applesauce Packaging

www.youngatheartmommy.com

Ask:

If you use a reusable lunch box or bag instead of paper, how does this reduce waste?
If you use dishes instead of paper plates, how does this reduce waste?
If you write on both sides of paper, how does this reduce waste?
If you use a reusable mug instead of a paper or plastic cup, how does this reduce waste?
If you buy one big bottle of detergent instead of three small ones, how does this reduce waste?
If you bring your own bags to the store instead of using their plastic or paper ones, how does this reduce waste?

Encourage the students to think of other examples of how to reduce waste.

DISCUSSION C - Creative Reuse Video

Show video of the Landfill Harmonic, an orchestra in Paraguay where the musicians play on instruments created from trash in the landfill.

Landfill Harmonic

Trailer. A heartfelt and moving story of how instruments made from recycled trash bring hope to children whose future is otherwise spiritless. In Spanish with English subtitles.

http://www.youtube.com/watch?v = ZfyPCujUPms

Time: 3.28 min.

Discuss other creative ways that the students can think to reuse trash.

In My Neighborhood

Discover reuse places in the community around the school. Ask students to list any places that they know will take donations of items including clothing or furniture. Some common places might include: Salvation Army, Goodwill, churches, shelters, food banks, thrift stores, used book store, and more. Create a list of neighborhood reuse locations and which items they will accept.

Field Trip

Visit a Reuse Business: Field Trip to the Rebuilding Exchange

The mission of Rebuilding Exchange is to create a market for reclaimed building materials. They do this by diverting materials from landfills and making them accessible for reuse through a retail warehouse, by promoting sustainable deconstruction practices, by providing education and job training programs, and by creating innovative models for sustainable reuse. Since their inception in 2009, Rebuilding Exchange has diverted thousands of tons of building materials from the landfill, and simultaneously created over $2 million worth of quality reuse materials available to the public.

Creative Resuse

profeblog.es

Rebuilding Exchange
1740 W Webster Ave
Chicago, IL 60614
www.rebuildingexchange.org

Ask: *What does the Rebuilding Exchange do?*
Why is this helpful to our community?
Why is this helpful to the environment?
How can you reuse items at your home and school?

Resources

City Green, by DyAnne DiSalvo-Ryan

Right in the middle of Marcy's city block is a littered vacant lot. Then one day she has a wonderful idea that not only improves the useless lot but her entire neighborhood as well.

Grades K-3

Landfill Harmonic

Trailer. A heartfelt and moving story of how instruments made from recycled trash bring hope to children whose future is otherwise spiritless. In Spanish with English subtitles.

http://www.youtube.com/watch?v = ZfyPCujUPms

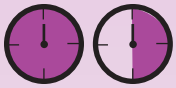
Time: 3.28 min.

Waste Management (Environment in Focus), by Cheryl Jakab

Cheryl Jakob's 'Environment in Focus' series each provide some 32 pages of detail with each book in the series providing readers with information about major envrionmental problems.

Grades 4 +

ACTIVITY



Time Allotted
1.5 hours (over 2 days)

Target Audience
Grades K-5

Objectives
- Students will identify objects in the waste stream which could be reused creatively rather than discarded.

Materials
- Garbage/recycling samples to make artwork (students should bring these from home)
- Scissors
- Glue
- Tape
- Pieces of cardboard
- String
- Twist ties
- Hole punchers

Making Art from Garbage

Summary

In this activity, students will determine which common household items should end up in the landfill as waste and which are actually resources that could be recovered and reused for an art project. Students will create an illustration of their ideas using things that might be found in the garbage. This piece of art can be used to help other students or community members become aware of what they throw away that could be reused or kept from the landfill.

Background

A sub-genre of art is known as trash art or junk art. These works use materials that have been discarded. Often they come literally from the garbage. One example of trash art is Trashion - using trash to create fashion. Many organizations sponsor junk art competitions. Trash art may also have a social purpose, of raising awareness of trash.

Method

Day 1

1. Tell students that artists (both professional and amateur) make art out of garbage. This art can be 2-dimensional or 3-dimensional. Show them photos or examples of recycled art. Explain that they will be creating their own work of art from garbage they have at their own homes.
2. Have students bring in items from home that they think could be turned into art. You can give suggestions including: bottles, cans, bottle caps, rubber bands, used paper towel and toilet paper rolls, old greeting cards, pictures from magazines, ribbon, yarn, pieces of wood, board game pieces (if no longer needed), nuts, bolts, photos, buttons, and more.

   Note: It might be a good idea to have extra items available either for students who couldn't bring in ones from home or who need a bit more variety.
3. Send a note home to explain the activity and to ask for help from parents.
4. Remind students to take only items that their family no longer needs.

Day 2

Have other construction materials available (ie: twist ties, glue, scissors, hole punchers, tape, etc.). Allow students to spread out to work. Consider having an area where unwanted materials can be shared.

Day 3

Have students write a brief artist's statement.

1) Explain if their art creation has a purpose, if it can do anything, and what the inspiration was.

2) Point out 1-2 pieces of original material in their art and say what its original purpose was.

Optional: Photograph the artwork and create an online gallery to share with parents or other families in the school.

OR

Display art in a public area and invite other classes to come and see.

OR

Present to the class.

ACTIVITY

Time Allotted
60 minutes (additional time for classroom presentations)

Target Audience
Grades 3-5

Objectives
- Students will design solutions to address the issue of excessive resource use.

Materials
- Large blank paper
- Pencils
- Colored pencils or markers

Ecological Designers

Summary

Students will observe what items are frequently thrown away and will design a solution(s) to reduce the waste they see.

Method

The night before, student homework should include taking a peek at the household garbage and recycling and making notes on what creates a large part of what the household is using up.

Reusable Sandwich Bags

www.reusablebagstore.com

In class, use an example to model this activity for the large group (ie: tiny yogurt containers).

> *What are some other options for carrying yogurt?*
> *Why are these tiny containers so popular?*
> *Is there a way to keep the convenience, but eliminate some resource use?*

Students must:

1. Create a visual representation of their new idea(s)
2. Create a brief written explanation that includes
   - The problem with the current design
   - The good aspects of the current design
   - How thir idea deals with the problem while keeping at least some of the good aspects.

Optional: Students can create their product!

ACTIVITY

Time Allotted
45 minutes

Target Audience
Grades 3-5

Objectives
- Students will design and organize a campaign to persuade their fellow students to change a current wasteful behavior.

Materials
- Materials will depend on which activities students decide to pursue.

Waste Reduction Campaign

Summary

Create a campaign to advertise to the school about how to reduce your waste impact. Options might include reducing paper, plastic bottles, or plastic bags at lunch.

Method

1. Review as a class the items in the trash or recycling that are frequently seen. Discuss the possibility of reducing one of those items through a school campaign. Set a goal for your campaign.

   Example: We will reduce the use of plastic water bottles by encouraging students to bring reusable water bottles to school.

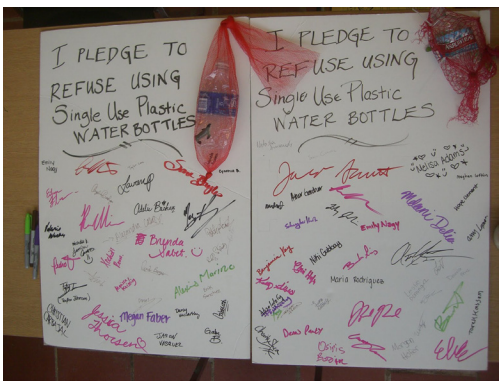
   Example: We will reduce the amount of paper that is recycled and thrown away by encouraging students to use the blank sides of used paper for scratch paper or work that does not need to be turned in.

Be sure you are aware of any reliance on the sale of water bottles (for example) for funding by the school. Reusable water bottles would be an appropriate alternative fundraiser.

2. Brainstorm a list of actions that will need to be taken to inform and convince others to participate.

- Students should consider whether any supplies or containers will need to be provided.
- Students might want to put together a short presentation that can be given in each classroom.
- Posters addressing common concerns and questions would be helpful as well as posters convincing students of the need for this change in behavior.
- A pledge could be written on large paper and placed in the lunchroom or other public space for students to sign.

Sample Poster



thedailyocean.blogspot.com

3. Divide students into groups to work on creating and implementing these ideas.

A ZERO WASTE CURRICULUM

Lesson 5

Make Something Old Into Something New - Recycle It!

Resource Recovery: Recycling

Objectives

- Students will observe ways materials are separated and sorted at recycling centers.
- Students will create solutions to decrease waste.
- Students will imitate the paper recycling process and produce their own recycled paper.
- Students will evaluate their current waste practices, investigate possible systems for reducing, reusing and recycling, then develop and implement a classroom recycling plan.
- Students will differentiate between the words and symbols for recycled and recyclable.
- Students will investigate and summarize how to recycle in his/her own community.

Summary

In this lesson students will learn about the resource recovery process called recycling and how recycling works to recover resources from the waste stream and make them into new products.

Background

Much of what we call waste today is actually a valuable resource that should not be thrown in the garbage. Another word for garbage is waste. **Waste** is all the unwanted materials and substances left over when we are finished using things. A **resource** is a part of the Earth that helps animals, plants, and people live and grow, such as air and water. From a human perspective, a resource is anything obtained from the environment to satisfy human needs and wants. The **environment** refers to all the conditions, circumstances, and influences surrounding and affecting an organism.

Large amounts of plastic, metal, and glass are discarded as waste every year. **Resource recovery** is when we are able to use some of these disposed materials for a next use. One way to recover some resources is to **recycle**. Recycling involves collecting already used materials that would otherwise be thrown away as garbage and making them into new products. All of the following products can and should be recycled:

Recyclable Products

www.mesacc.edu

GLASS can be recycled into new food jars, beverage bottles, insulation and other construction materials. Making products from recycled glass uses less energy than starting from scratch.

PAPER PRODUCTS can be recycled and made into other paper or paperboard products. Recycling paper saves valuable space in landfills and reduces the number of trees that need to be cut down to make new paper.

Office paper can be recycled into other writing paper, tissue and towel products.

Newspapers are usually recycled into paperboard, new newsprint, insulation and animal bedding products. Failing to recycle a daily edition of one newspaper wastes as much energy as pouring out a can half-filled with gasoline.

Cardboard (also known as corrugated cardboard) is used to make new paperboard and corrugated boxes.

ALUMINUM is the most valuable of household recyclables. Aluminum cans are recycled to produce new aluminum cans. Recycling aluminum cans saves energy as it takes a lot of energy to mine for bauxite and make new aluminum. Recycling aluminum saves 96% of the energy it would take to make a new aluminum can. Other sources of household aluminum such as clean aluminum foil, clean pie tins, aluminum siding, and the metal frames of aluminum lawn furniture also can be recycled. These items, however, may not be accepted by local recycling programs and may require special handling.

STEEL CANS are a good source of steel scrap and their tin coating also can be recovered and recycled. Many recycling programs also collect empty steel aerosol cans and paint cans. Steel can be recovered and recycled to make car parts, new cans, and more. Recycling steel saves 62% of the energy it would take to make new steel.

PLASTIC collected for recycling is sorted into different types or colors. It is then either shredded or melted down and recycled to create a variety of products. Two examples include:

Plastic Soda Bottles: The material used to make plastic soda bottles (polythylene terephthalate or PET) is recyclable. These bottles are coded with the number 1 and the letters PETE. Recycled plastic bottles could end up as clothing, carpet backing, sleeping bag insulation, containers for non-food items and more.

Plastic Milk Jugs: The plastic used in one-gallon milk and water jugs (high density polyethylene or HDPE) is recycled to make products such as trash cans, flower pots and plastic pipe. These containers are coded with the number 2 and the letters HDPE.

Quick Facts:

- The average American creates 56 tons of garbage every year.
- Americans throw away 2.5 million plastic bottles every hour.
- Americans throw away about 40 billion soft drink cans and bottles every year. Placed end to end, they would reach to the moon and back nearly 20 times.
- Only about one-tenth of all solid garbage in the United States gets recycled.
- Recycling an aluminum soda can saves 96% of the energy used to make a can from ore, and produces 95% less air pollution and 97% less water pollution.
- Every glass bottle recycled saves enough energy for a 100 watt light bulb to be lit for 4 hours.

The US Environmental Protection Agency (EPA) views recycling as a loop involving
a) collection and processing,
b) manufacturing, and
c) buying recycled products

The EPA is a 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

How are recyclables collected?

Communities have a variety of recycling programs, such as curbside pickup of recyclables, drop-off centers, buy-back centers that pay you for valuable items, and deposit-refund programs. Each of these

programs involves having people sort their recyclable materials from their waste and put it in a different container.

Single Stream Recycling means that recyclable resources must be separated from waste, but all glass, plastic, metal, cardboard and paper can go into the recycling container together. Waste goes in the garbage can. In single stream, both the collection and processing systems are designed to handle this mixture of recyclables, with materials being separated at a materials recovery facility.

Multi Stream Recycling is when recyclables need to be sorted a bit more as there may be separate containers for newspaper, cardboard, metal, plastic, etc. Different trucks (or trucks with different compartments) come to take the recyclables for processing.

After collection, recyclables are sent to a recovery facility to be cleaned and processed into materials that can be used in manufacturing.

MRF in Action - Machine and Manpower

www.machinexrecycling.com

dorsetcpre.wordpress.com

Where and how are recyclables processed and sorted?

A **Materials Recovery Facility** (MRF - pronounced "murf") is used to sort and recover recyclables. Haulers bring recyclables to this facility. Most MRFs use Single Stream Recycling, which means there is no pre-sorting and all recyclables go to the MRF mixed together (paper, glass, plastic, etc). They are dumped onto a conveyer belt and separated by both manpower and machinery.

Often the material is placed on a conveyor belt and magnets are used to pull out metals, blowers and vacuums pull out plastic, electrical currents force out aluminum, and paper is separated with a screen. Glass usually falls off the end of the conveyor belt. Workers watch over and help the whole process, making sure that everything is being sorted correctly.

Once everything is separated, the materials are usually baled and loaded onto trucks for transport around the world to be recycled. **Recycling balers** are used to compact recyclables such as aluminum, cardboard, paper, and plastic into blocks that can easily be stacked and transported. The blocks of recyclables that come out of balers vary in size and weight depending on the size of the baler.

Watch this youtube video for an example of a MRF in action sorting recycling:
http://www.youtube.com/watch?v = 2g2OHGSNBfs

Recyclables get shipped out to wherever there is a market for that particular resource. Recyclables are bought and sold just like raw materials would be (raw materials are unprocessed material used to make products - for example, aluminum). Recycling prices go up and down depending on supply and demand in the United States and around the world.

How does recycling work?

Different materials are recycled in different ways. Plastic bottles are recycled as follows:

1. After bottles are collected, they are taken to a materials recovery facility (MRF) where they are condensed into large bales for shipping. Each bale weighs from 800 to 1,200 pounds and can contain anywhere from 6,400 to 9,600 bottles.
2. Bales are shipped to a plastic reclaimer where a machine called a bale breaker rips apart the bales.
3. The pieces go through a machine where they are shredded into tiny flakes.
4. The flakes are washed, dried and melted.
5. The melted plastic is extruded into pellets which are sold and can be made into various plastic products.
6. In many cases the plastic is spun into a very fine thread-like material. This can be used to make carpets, clothing or filling for jackets and quilts. This thin plastic has good insulation properties.

For other types of plastics, the pellets are melted and extruded into plastic lumber or pipe, and can be further blow-molded into plastic bottles, or injection molded or thermoformed into plastic containers, garden products, sheet and packaging. For additional information, see Lesson 3 - The Many Lives of a Plastic Bottle/Aluminum Can.

How does recycling affect the environment?

According to the EPA, the following are the benefits of recycling:

- Reduces the amount of waste sent to landfills and incinerators
- Conserves natural resources such as timber, water, and minerals
- Prevents pollution caused by reducing the need to collect new raw materials
- Saves energy
- Reduces greenhouse gas emissions that contribute to global climate change
- Helps sustain the environment for future generations
- Helps create new well-paying jobs in the recycling and manufacturing industries in the United States

How does recycling fit into a resource recovery cycle?

In Lesson 3 you learned about the resource life cycle of an aluminum can and a plastic bottle. A **life cycle** is defined as the complete succession of changes undergone by an organism during its life. A new cycle occurs when an identical set of changes is begun. In each of those examples, recycling is a vital part of the resource recovery cycle. Without recycling, valuable resources would not only be wasted but additional resources and energy would be needed to create products from new aluminum and plastic. For example, recycling one ton (2,000 pounds) of steel conserves 2,500 pounds of iron ore (metal that comes from a particular mineral or rock in the ground), 1,400 pounds of coal and 120 pounds of limestone. Recycling one ton (2,000 pounds) of aluminum conserves up to 8 tons (16,000 pounds) of bauxite ore and 14 megawatt hours of electricity.

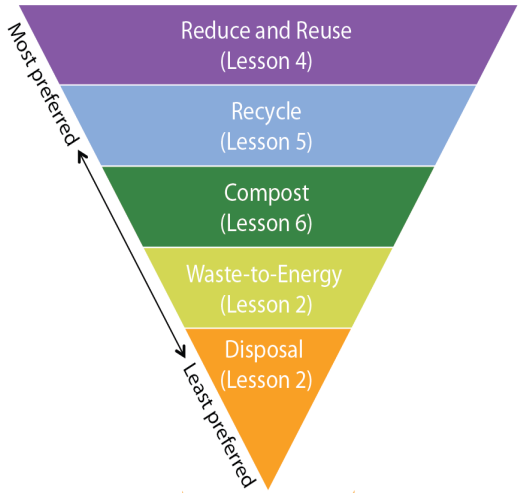
The lifecycle of a product includes raw materials, manufacturing, distribution, use, and disposal. All of these stages produce carbon dioxide (CO^2). **Carbon dioxide** is a naturally occuring gas in the atmosphere, released by oceans, decaying vegetation, and the respiration of living creatues and plants. It's also a greenhouse gas created by human activities such as fossil fuel combustion. Greenhouse gases trap heat inside the earth's atmosphere. In addition, when organic waste decomposes in landfills, it produces a greenhouse gas called methane, which is 20 times more powerful at trapping in heat than CO^2. Goods made from recycled material mean less energy needed to extract, transport, and process raw materials and fewer greenhouse gases emitted into the atmosphere. Recycling diverts waste from landfills and makes use of materials by turning them into valuable resources. According to the EPA, recycling is one of the highest goals in the hierarchy of waste management options, after source reduction and reuse.

What is the difference between "recyclable" and "recycled"?

Many products have symbols on them to help determine if they are **recyclable** (able to be recycled) or **recycled** (made from recycled materials).

Even if a product has the symbol that it can be recycled, it is important to know if it can be recycled in your community. Different communities can recycle different resources. Check with the local solid waste and recycling office to see if a specific item can be recycled in a specific community. Plastics that can be recycled will often have the "can be recycled" symbol with a number in the middle of the arrows. These numbers are a code to let you know what kind of plastic was used to make that specific product. This number becomes important because some recycling programs can only recycle some of the kinds of plastic.

Waste Management Hierarchy

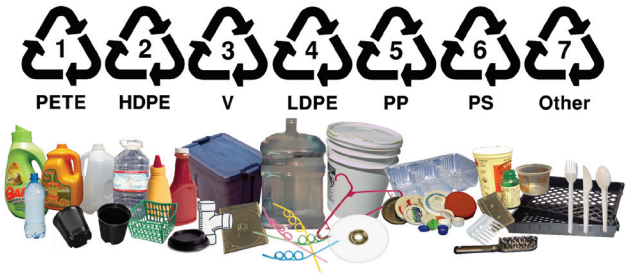


Seven Generations Ahead

A consumer, someone who buys products or services to use, can help recycling by purchasing products made from recycled material, such as toilet paper made from recycled pulp. The more of these recycled content products that are purchased, the more companies will make. When people buy products made from recycled materials, they close the loop and their choices can make a difference in terms of costs to the environment. **Environmental cost** is 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

Recyclable

Recycled



cityofdavis.org

Discussion/Verbal Exploration

Items needed:

Recycled items (from the classroom or have students bring them in from home)
A list of which materials are recyclable in your community.

Recycling in the Community!

Discuss recycling options students have seen around the community. Do certain stores have recycling on-site (ie: WalMart, Target, Jewel, etc.)? Where would students like to see recycling bins in their community and school?

Depending on which activity you choose, any of the following books can be read.

Recycling: *Recycle!* A Handbook for Kids, by Gail Gibbons
Here Comes the Recycling Truck, by Meyer Seltzer
Michael Recycles, by Ellie Bethel

In My Neighborhood

A) Recycling at Home

Do you already recycle at home? If you do, are you recycling everything that can be recycled?

1. Ask your local community for recycling guidelines to find out what can and cannot be recycled.
2. Find out if you need a certain kind of bin to put outside for recycling pickup. Determine if you already have the right bin or if you need to get one from the local community.
3. Set up a place in your home for a recycling bin or bins. The garage or big roll–out kitchen drawers are good places.
4. Make a label for each bin clearly listing what items belong in it.
5. Bring your recycling to the curb on recycling day.

B) Celebrate America Recycles Day in Your Neighborhood

How does your community celebrate? America Recycles Day, held each year on November 15, is the only nationally recognized day and community-driven awareness event dedicated to promoting and celebrating recycling in the United States. Nationally, thousands of organizations hold events to educate people about recycling resources in their community. Through recycling collection drives, demonstrations, competitions, tours, displays and other awareness-raising events, citizens are encouraged to increase their recycling at home, at school, in the office and in the community at-large. Find out how you can participate! http://en.wikipedia.org/wiki/Keep_America_Beautiful

Field Trip

Contact your local materials recovery facility (MRF), recycling center, or recycling drop off station to see if your class can visit to see recycling in action. Schedule a tour if possible and have your students come prepared with questions.

Resources

Charlie and Lola: We are Extremely Very Good Recyclers, by Lauren Child

This adventure is printed on FSC-approved paper and includes recycling tips as well as a tree poster... so kids can keep track of their recycling projects and help to save the planet all on their own.

Grades Pre K-2

Garbage and Recycling, by Sally Morgan and Rosie Harlow

Explaining the difference between biodegradable and non-biodegradable garbage, this book shows how glass, metal, and wool can be easily recycled. How Can I Help? boxes give suggestions for the young environmentalist who wants to recycle at home.

Grades K-3

Here Comes the Recycling Truck, by Meyer Seltzer

Elisa stresses the importance of recycling and shows readers how she drives through the city, collecting glass, cardboard, newspapers, and cans in her recycling truck named "Uncle Bud".

Grades Pre K-3

Michael Recycle, by Ellie Bethel

Just in time for Earth Day on April 22, "Michael Recycle" tells the adventures of a young superhero whose power allows him to teach people about recycling.

Grades 1 +

Recycle!: A Handbook for Kids, by Gail Gibbons

This lively and informative handbook explains the process of recycling from start to finish.

Grades 3-6

Recycled Crafts Box, by Laura C. Martin

Master crafter Laura C. Martin shows kids how to make art out of the paper, plastic, metal, and cloth we usually consign to the recycling bin or the garbage can.

Grades 3 +

Waste Management (Environment in Focus), by Cheryl Jakab

Cheryl Jakab's 'Environment In Focus' series each provide some 32 pages of detail with each book in the series providing readers with information about major environmental problems.

Grades 4 +

Kids and Recycling (part 4) - How are recyclables sorted at a MRF?

http://www.youtube.com/watch?v = 2g2OHGSNBfs

In this segment of Curiosity Quest Goes Green, kids get curious about a MRF (Materials Recovery Facility). This episode will discuss the reasons why the MRF needs to separate out all the various commodities and how they get separated

Times: 3.57 min

Website:

The National Association for PET Container Resources

http://www.napcor.com/PET/kcorner.html

A website with links for kids to learn more about PET plastic and what kids can do to make sure more PET containers get recycled in their community.

For a fun activity on how a MRF works, see Keep America Beautiful's Waste in Place curriculum. Activity #25 MRF in Action (p85). http://recycle-bowl.org/wp-content/uploads/14-MRF-in-Action-Numberless-done.pdf

ACTIVITY

Time Allotted
30 minutes

Target Audience
Grades K-5

Objectives
- Students will imitate the paper recycling process and produce their own recycled paper.

Materials
- Blender or egg beater
- Mixing bowl
- Flat dish or pan (9x13")
- Round jar or rolling pin
- Newsprint, scrap paper or wrapping paper
- 4 pieces of cloth to use for blotting the paper (or towels)
- 10 pieces of newspaper for blotting
- screen (can cut to fit ideal size and shape of paper)
- 2 cups of hot water
- 2 teaspoons of instant starch (optional)

Recycled Paper

Summary

In this activity students make their own recycled paper. They gain an understanding of each part of the paper recycling process through a fun, hands-on activity.

Background

Paper isn't found ready to write upon in the natural world. It is made from raw material and goes through a process to become the flat sheet that we use for books, newspapers, and all sorts of things. Used paper can be recycled and turned into fresh pages that can be written upon again to reduce the number of trees we need to cut down to make new paper. Recycling paper involves mixing used paper with water and chemicals to break it down. It is then chopped up and heated to break it down even more into strands of cellulose, a type of organic plant material; this mixture is called pulp, or slurry. The pulp is strained through screens to remove any glue or plastic that may still be in the mixture. It is then cleaned, de-inked, bleached, and mixed with water. After all of this, the pulp s ready to be made into new paper.

Recycling paper is a creative project that benefits the environment. You can use a variety of waste paper, from colored tissue to white copy paper, to remix and reinvent without adding harmful emissions to the air or water. Experiment by sprinkling in dried leaves, petals or herbs, and make sheets of different sizes for use in various projects.

Method

1. Tear scrap paper or wrapping paper into very small bits (approximately 1 inch across)
2. Put the pieces of paper in a blender, filling it loosely to the halfway mark. You can also do this by hand or with an egg beater.
3. Add water to the top fill mark.
4. Put on the lid, and blend the mixture at low speed to start, and then at medium until all the paper is reduced to pulp.
5 Pour the pulp into a large bowl or tub; repeat the entire process twice
6. Mix in starch (optional). Completed pulp should be the consistency of split pea soup.
7. Pour the pulp into a flat pan.
8. Slide the screen into the bottom of the pan and move it around until it is evenly covered with pulp.

9. Lift the screen out of the pan carefully. Hold it level and let it drain for a minute.
10. Put the screen, pulp-side up, on a blotter (rags or towels) that is placed on top of newspaper. Put another blotter over the pulp, and more newspaper over that.
11. Roll a jar or rolling pin over the "sandwich" of blotter and paper to squeeze out the rest of the water.
12. Take off the top newspaper. Flip the blotter and the screen very carefully. Do not move the pulp, it will take at least 12 to 24 hours to dry depending on how thick and wet the paper is.

You now have your own handmade paper! (If you have leftover pulp, don't pour it down the drain--you might clog things up. Put it in the garbage.). Try this again and use some decorative elements such as colored thread, glitter, dried flowers and leaves to add some flair. Make cards or note paper out of the newly created paper.

View demo here: https://www.youtube.com/watch?v = aQoz1pkKmdA

Optional: For younger children, pulp can be pressed into cookie cutters and allowed to dry or molded around an upside-down cup and dried to
produce a bowl.

Making Recycled Paper

public.merlin.swgfl.org.uk

designloft.blogspot.com

ACTIVITY

Time Allotted
60 minutes

Target Audience
Grades 3-5

Objectives
- Students will evaluate their current waste practices, investigate possible systems for reducing, reusing and recycling, then develop and implement a classroom recycling plan.

Materials
- Waste audit data (from Lesson 1)
- Writing utensil
- Large paper

Classroom Recycling Plan

Summary

In this activity students will evaluate their classroom's baseline recycling rate and use it to design a classroom recycling program. Students will present their ideas and choose one program to implement and measure over time.

Background

Many classroom materials that get thrown in the garbage can be recovered as resources. This activity will help students evaluate possible systems for reducing, reusing, and recycling. A good place to start is with a simple classroom waste audit. See activity 1.C from Lesson 1 for details. Audit data can be used to determine how to structure a recycling program for a school or classroom.

Method

1. Students should be split into 3 groups to investigate the three options for dealing with classroom waste: reducing, reusing and recycling. Using data from the audit, students should brainstorm solutions for their area of waste management. Students should be required to make the processes and solutions they come up with easy and student driven. If any adult help is required, students should write up a written request of what assistance is needed.
2. One student in each group should record all of the ideas generated. Another student should be chosen to present to the class.
3. Each group should present to the class and then a class discussion/vote should take place for each area of the recycling plan. Final plan ideas should be recorded on large paper for reference.
4. Back in groups, jobs should be divided up and a list of responsibilities created. Signs might need to be created, containers for sorting or storing one-sided paper might be needed. Allow students to work briefly and collect the job resopnsibilities list.
5. Set a deadline for the plan to be implemented.
6. Set a date to review and evaluate how the plan is going. Adjustments might be needed.

ACTIVITY

Time Allotted
60 minutes

Target Audience
Grades 3-5

Objectives
- Students will differentiate between the words and symbols for recycled and recyclable.
- Students will investigate and summarize how to recycle in his/her own community.

Materials
- Phone Book or access to a computer

Community Recycling

Summary

In this activity, students will explore how to recycle in their community. Practicing research skills, they will identify community leaders who can give them answers to what material their community's recycling facilities can and cannot accept. Based on their findings, students will determine which items they can and cannot recycle from home and whether or not they use items created with recycled content.

Background

Many products have symbols on them to help you to determine if they are **recyclable** (able to be recycled) or **recycled** (made from recycled materials). Plastics that can be recycled will often have the "can be recycled" symbol with a number in the middle of the arrows. These numbers are a code to let you know what kind of plastic was used to make that specific product. This number becomes important because some recycling programs can only recycle some kinds of plastic. Even if a product has the symbol that it can be recycled, you need to know if it can be recycled in your community.

Communities have a variety of recycling programs, such as curbside pickup of recyclables, drop-off centers, buy-back centers that pay you for valuable items, and deposit-refund programs. Each community's system can differ. It is important to understand what recyclables your community's recycling system can accommodate to help you make environmentally friendly choices.

Method

Have students research their community's recycling program:

1. Find out the solid waste or recycling provider for your community. Example: In the City of Chicago, students can find infomation online at http://www.cityofchicago.org/city/en/depts/streets/supp_info/recycling1/blue_cart_residentialrecyclingacceptedmaterials.html
2. Inquire about what materials can be recycled in the community.
3. Ask students to create a poster on what can be collected for recycling in their community and how it should be collected.

OR

1. Have students research their homes to determine if there are any items made of recycled content (notebooks, printer paper, some plastic bottles, fleece clothing, etc.).
2. Ask students to write a paragraph on what items they recycle at home and if they use any items made with recycled content.

A ZERO WASTE CURRICULUM

Lesson 6

Nature's Recycling - Compost

Resource Recovery: Composting

Objectives

- Students will observe benefits of composting.
- Students will differentiate between carbon and nitrogen materials in the composting process.
- Students will assess different methods of composting (vermicomposting, backyard composting, and commercial composting).
- Students will simulate a compost heap and a landfill and will compare the differences between them.
- Students will observe how composting reuses yard, garden, and kitchen waste.
- Students will observe how vermicomposting reuses yard, garden, and kitchen waste.
- Students will build and maintain a worm bin.

Summary

In this lesson students will analyze resource recovery through composting and understand how composting converts organic waste into nutrients for soil.

Background

Although we cannot help but create some garbage living in modern society, we have choices in what we purchase and how we dispose of this garbage. Most people have no idea how much food they throw away each day and over 97 percent of the food thrown away ends up in a landfill. This includes uneaten leftovers, spoiled produce, and more. In the United States, we send approximately 33 million tons of food waste to landfill every year. Over a pound of food per person per day is thrown away, generating tens of millions of tons of food waste per year. According to the EPA, the average student generates approximately 1/2 pound of waste per school day.

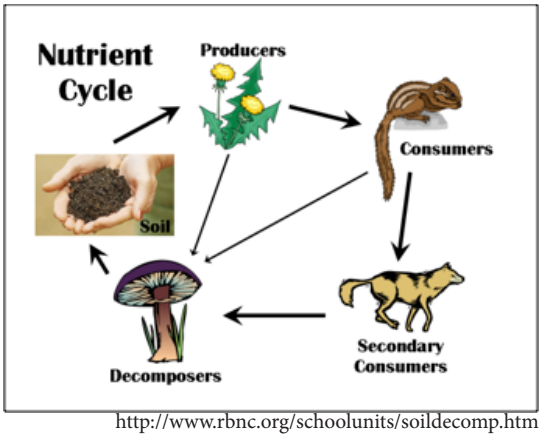
Composting is a way of recycling organic wastes which now fill our growing landfills. Composting, or decomposition, is part of the nutrient cycle of life and is often described as nature's way of recycling and returning needed nutrients to the soil.

Composting is the biological process during which microorganisms, bacteria, insects, and worms break down organic matter such as food waste, manure, leaves, grass trimmings, paper, coffee grounds, etc., into extremely useful humus.

For more information: http://www.epa.gov/wastes/conserve/composting/index.htm

Why should you compost?

Nutrient Cycle



http://www.rbnc.org/schoolunits/soildecomp.htm

Compost returns nutrients to the soil. When we grow food, plants take nutrients from the soil so that they can grow. A **nutrient** is something that provides nourishment requred for growth and the maintenance of life. Animals (and humans) eat food and use those nutrients for energy for our bodies. Yard waste (parts of plants from our yards) and food scraps (the parts of food that we do not eat) still have nutrients. If you compost those scraps, the nutrients cycle back into the soil so that the soil can grow more plants. Air, sunlight,water, and decomposed matter in the soil is changed by plants into food. Compost helps your soil retain moisture, returns beneficial nutrients to the soil, and is so nutrient rich that there is no need to supplement soil with chemical fertilizers.

If you put those same yard and food scraps in a landfill they do not turn into compost. Those nutrients get buried instead of being given back to the soil.

Anaerobic decomposition is decomposition without oxygen. Food scraps in the landfill break down and produce methane, a potent greenhouse gas which contributes to climate change. Landfill methane is a gas that is made because things in a landfill undergo anaerobic decomposition. When waste buried in a landfill does not receive oxygen, it will produce methane. **Aerobic decomposition** is decomposition with oxygen. A compost pile undergoes aerobic decomposition. Because it is exposed to oxygen, either by turning it or through the use of worms and other living organisms, it produces CO2 (carbon dioxide) instead of methane. If a compost pile is being taken care of properly, it will produce far less methane than a landfill.

Biodegradable waste is material that can decompose, usually by bacteria or sunlight into basic components. Vegetable and fruit skins, peels, and many food scraps are biodegradable and can all be composted. When you compost, you allow these scraps to decompose without harming the earth. You don't need a big vegetable garden to be able to use compost. Lawns and flowerbeds appreciate it too. Compost helps soil retain moisture and returns beneficial nutrients to the soil.
Compost is a mixture of decaying organic matter from leaves, yard waste, and food scraps that can be used to improve soil structure and provide nutrients. There are many ways to compost: vermicompost, backyard compost, and commercial compost.

Compost

commons.wikimedia.org

Vermicomposting is a composting method that uses worms to recycle food waste into a healthy, rich soil conditioner. The advantage of worm composting is that it can be done indoors and outdoors, so you can compost year-round no matter the climate in which you live. It also provides people who live in apartments with a way to compost. Worm compost is made in a container filled with moistened bedding, a handful of soil, and red worms. Food waste is added and the worms and microorganisms will convert the contents into rich compost. Household items that can be vermicomposted include newspaper, tea bags, coffee grounds and some food scraps (fruits and vegetables as long as they do not have sauce or dressing on them).

Quick Facts:

The two types of worms best suited for worm composting are the red worms Eisenia foetida (commonly known as red wiggler, brandling, or manure worm) and Lumbricus rubellus.

Red wiggler worms:
- consume their weight each day in raw organic matter.
- lay 2-4 light colored cocoons per week, which will hatch 2-3 baby worms after 3 weeks.
- live for about 1 year.
- take only 6 weeks to grow from hatchling to mature adult.
- do NOT turn into 2 worms when cut in half and could die if this happens.

Worm Bin

www.wormguys.com

Red Worms

downtowngreen.org

Background composting is easy and convenient.

Backyard composting is the practice of collecting leftover kitchen scraps (excluding meats and fats) and yard trimmings for decomposition in a private compost pile, typically in a bin or a pile. Backyard composters can use their compost as a soil enhancement for their gardens.

1. Get a bin or choose an area in your yard that is approximately 3'x3'x3' (one cubic yard) . Size is important for the right temperature. Piles that are too large (more than 5 feet cubed) do not allow enough air to reach microbes in the middle of the pile. Piles that are too small cannot hold enough heat for good composting.
2. Mix two parts brown (dry leaves, small twigs, straw, etc.) with one part green (grass clippings, kitchen scraps, etc.). This 2:1 ratio gives the best mix of **carbon** (brown materials) to **nitrogen** (green materials).

   Carbon/brown: A non metallic element found in all organic compounds. Carbon provides energy. The brown material used in composting provides carbon.

   Nitrogen/green: A non metallic element found in all organic compounds. Nitrogen allows protein production. The green material used in composting provides nitrogen.
3. Chop up any twigs and large pieces of fruits and vegetables. Materials will break down more quickly with increased surface area.
4. Keep the compost pile moist like a wrung-out sponge.
5. Keep it turning. Compost needs air. Turning the compost will help it break down and will prevent it from smelling bad.
6. When it is ready, compost should look and smell like rich soil. Use finished compost in a garden, flowers, potted plants and lawn.

Compost Bins

Many household items such as newspaper, some food scraps, and broken down yard waste can be composted in a backyard compost bin. Anything you eat (except meat and dairy products) can go into the compost pile including leftover pasta, veggie trimmings, fruit peels or cores, coffee grounds, and even an unfinished PB&J sandwich. Animal products (meat and dairy) are not typically part of backyard composting as they take much more energy and heat to break down and they attract pests.

To create optimal compost, there needs a good mix of green and brown materials, which each serve important needs of the microbes breaking down the material. Green materials are nitrogen-rich and offer protein to the microbes and brown material is carbon-rich and is the source of energy for microbes.

The optimal mix varies depending on what material is used, but a general rule of thumb is to have a little more brown material than green.

The Science of Compost - Balancing Carbon and Nitrogen

All organic matter is made up of substantial amounts of carbon (C) combined with lesser amounts of nitrogen (N). The balance of these two elements in an organism is called the **carbon-to-nitrogen ratio** (C:N ratio). For best performance, the compost pile, or more to the point the composting microorganisms, require the correct proportion of carbon for energy and nitrogen for protein production. Scientists (yes, there are compost scientists) have determined that the fastest way to produce fertile, sweet-smelling compost is to maintain a C:N ratio somewhere around 25 to 30 parts carbon to 1 part nitrogen, or 25-30:1. If the C:N ratio is too high (excess carbon), decomposition slows down. If the C:N ratio is too low (excess nitrogen) you will end up with a stinky pile.

http://www.organicgardeningguru.com/composting-101/carbon-nitrogen-ratio/

Commercial composting refers to composting at an industrial processing facility where yard and food scraps will be turned back into nutrients for soil. This usually involves hiring a hauling service to transport organic waste and all food scraps including meat and dairy to the facility. The collection system is similar to that of recycling and garbage with weekly pick-ups. Unlike backyard compost bins or worm composting, commercial composting can handle the large daily volume of food & paper waste that comes out of a restaurant, school, hospital or other business/institution and can also accept meat, dairy, cardboard, bones, wood, etc.

Quick Fact:

Composting in Chicago: In December 2009, Land and Lakes Company was granted the City of Chicago's first permit to operate food waste recycling. Land and Lakes compost has been used for beautification of city parks and highway vegetation projects, as well as in gardens for potting.

Watch this video of commercial composting at the Land and Lakes facility in Chicago, Illinois: http://www.youtube.com/watch?v = 8Q6Fl34mWGw

Compost Windrow Being Turned and Watered

organic.tfrec.wsu.edu

Recycling the organic waste of a household into compost allows us to return badly needed organic matter to the soil. In this way, we participate in nature's cycle and cut down on garbage going into landfills while improving the quality of our soil.

Discussion/Verbal Exploration

DISCUSSION A - The Magic School Bus

Read: The Magic School Bus Meets the Rot Squad, by Joanna Cole

(Grades K-2)

Everybody agrees that mold is just disgusting until the class goes on a field trip inside a rotting log. They discover that all the dead-looking stuff is actually alive... and it's pretty neat after all. Join the class on their "rotten" adventure and learn about how nature recycles through decomposition.

Ask:

What was the result of Wanda's rotten subject?

What caused Ms. Frizzle's class to get on the bus?

What effect do mushrooms have on a log?

What rotting things did the kids see?

What effect did the students have on Larry?

What do they call plants and animals that recycle once living things?

The Magic School Bus Meets the Rot Squad

by Joanna Cole

In the book, the students decide to leave the vacant lot as it is. Talk about the fact that in many communities empty lots are used for many different purposes including building sites, parks, community gardens, and parking lots. Ask students to identify vacant lots in their neighborhood and have them predict what these lots will eventually become.

DISCUSSION B - Brown vs. Green

Discussion on brown v. green material

(Grades 2-5)

To create the optimal or best quality of compost that contains lots of rich nutrients to feed plants, we need a good mix of both grown and green materials. Brown material refers to material with high concentrations of carbon. Brown materials are typically rough and coarse such as dried leaves, paper and wood products, twigs, and bark. Green material refers to nitrogen-rich organic material, such as food scraps, green leaves, coffee grounds, grass clippings, and manure.

Ask:

Why is carbon-rich material important for composting?

Answer: Important energy source for microbes

Why is nitrogen-rich material important for composting?

Answer:Important protein source for microbes

OPTIONAL Guest Speaker:

Master Composters have been taught the art and science of urban home composting and techniques for teaching others. They can teach about the essentials of indoor/outdoor composting, science of composting, anatomy of a landfill, and more. Invite a Master Composter in to teach the students about compost. In Illinois, contact the University of Illinois Extension Program.

In My Neighborhood

Investigate to find out if there is composting going on in your neighborhood. Do any neighbors have backyard composting bins? Do any of the businesses use commercial composting?

Field Trip

Visit a local commercial compost facility to find out how they compost large amounts of food scraps. For example, Land and Lakes Food Waste Recycling Program serves Chicago.

If you are interested or would like more information on Food Waste Recycling, please contact them at 847.825.5000.

http://www.land-and-lakes.com/#!food-waste-recycling/c1e4w

Resources

Composting: Nature's Recyclers, by Robin Koontz

Learn more about compost and how you can use it in your garden or yard.

Grades K +

Compost Kids

http://www.youtube.com/watch?v = Njbn34JrKnE

Hamilton County Recycles provides a guide on how to start backyard composting.

Time: 4.05 min.

Environmental Protection Agency: Recycle City

http://www.epa.gov/recyclecity/

Hamilton County Recycles provides a guide on how to start backyard composting.

Explore Recycle City to see how the people of the town reduce waste, use less energy, and even save money by doing simple things at home, at work, and in their neighborhoods.

Herman the Worm

http://urbanext.illinois.edu/worms/

Learn about worm history, anatomy, feeding, and care from Squirmin' Herman.

Idaho Public Television: Garbage Facts-Dialogue for Kids

http://idahoptv.org/dialogue4kids/season6/garbage/facts.cfm

Learn about worm history, anatomy, feeding, and care from Squirmin' Herman.

Kids Recycle: Composting Websites by State

http://www.kidsrecycle.org/composting.php

Learn about worm history, anatomy, feeding, and care from Squirmin' Herman.

Land and Lakes Commercial Composting - Virtual Tour

http://www.youtube.com/watch?v = 8Q6Fl34mWGw

Land and Lakes is one of the largest commercial composting operations in the Midwest. Land and Lakes

operates from several locations; the site profiled here is located at Romeoville, Illinois. Using both heavy machinery and manual labor to process and manage yard waste (branches, brush, leaves and grass clippings), each year, Land and Lakes processes hundreds of thousands of cubic yards of natural waste into a premium finished compost product. This video was funded through a grant from the Illinois Department of Commerce and Economic Opportunity (DCEO).

Time: 2:14 min.

Organic Gardening Guru

http://www.organicgardeningguru.com/composting-101/carbon-nitrogen-ratio/

Website on composting and the carbon-nitrogen ratio

Worms Eat My Garbage: How to Set Up and Maintain a Worm Composting System, by Mary Appelhof

A new edition of the definitive guide to vermicomposting--a process using redworms to recycle human food waste into nutrient-rich fertilizer for plants. Internationally recognized as an authority on vermicomposting, Appelhof has worked with worms for over three decades.

Target Audience: adults.

ACTIVITY

Time Allotted

60 minutes +

1 month observation

Target Audience

Grades 2-5

Objectives

- Students will simulate a compost heap and a landfill and will compare the differences between them.
- Students will observe how composting reuses yard, garden, and kitchen waste.

Materials

- This activity can be done in groups of 4-6 students.
- Materials listed cover one group, not an entire class
- 2 2-liter soda bottles
- Spray bottle
- 1 apple
- Black trash bag
- Twist-tie
- 2 coffee filters
- Rubber gloves
- Knife/scissors
- Soil (from ground, garden, compost, not potting soil).
- Leaves/grass clippings
- Gravel
- Cardboard, paper, plastic from reycling bin
- Camera (optional)

Decomposition Race

Summary

This experiment compares how long it takes a biodegradable item (an apple) to decompose in a compost pile compared to a garbage bag in a landfill. The goals are to introduce the idea of nutrient cycling, the inherent issues of waste management, and the choices available for disposing of garbage.

Background

When we can't recycle or reuse items they ultimately end up in a landfill. One of the main concerns of landfill use is keeping groundwater supplies clean. When it rains, water leaches through the layers of garbage picking up toxins. This runoff from the landfill is called leachate. Another cause for concern in landfill use is the buildup of methane gas. Over 97 percent of the food thrown away ends up in a landfill. This includes uneaten leftovers, spoiled produce, and more. Once in landfills, food breaks down to produce methane, a potent greenhouse gas which contributes to climate change.

Method

RESEARCH

Have students research the following questions (using internet or reference books):

- What conditions need to exist for biodegradable material to decompose?
- How does a compost pile work?
- How is a landfill constructed? What are the different layers of a modern landfill?
- What effect does runoff or leachate from landfills have on groundwater?
- What can be done to prevent leachate from contaminating groundwater?
- How do we prevent the buildup of methane gas in landfills?

BUILD YOUR MODELS

You will need the 2-liter bottle and the knife or scissors to start.

Building the compost model.

1. Cut the top half off of both of the bottles and invert the top inside the bottom half.
2. Take one coffee filter and cut about an inch off the perimeter of the filter.
3. Place the filter down in the neck of the bottle so that it will filter any liquids that might come out of your model.

Building the landfill model:

4. Repeat steps 1-3 to build the landfill model.
5. Pour an equal amount of gravel into both models to make a shallow first layer (approximately ½ inch).
6. Pour an equal amount of soil into both models to make a deeper second layer (approximately 1 inch).
7. BOTH: Cut the apple in half. You will use one half in the compost model, and one half in the landfill model Measure the apple and write down observations of how it looks. You may wish to photograph it at this time.
8. COMPOST: Add leaves and grass clippings into the compost model.
9. COMPOST: Put the ½ apple into the compost model. Place it somewhere where you will be able to see it from the outside of the bottle.
10. LANDFILL: Layer cut up pieces of paper, plastic, etc. from the recycling bin in the landfill model.
11. LANDFILL: Cut the corner off of the black trash bag to make a mini trash bag. Put the second half of the apple inside the bag and close the bag with a twist tie.
12. LANDFILL: Put the mini trash bag into the landfill model. Layer soil on top of the layer of "trash".

Model Landfill Construction

organized31.blogspot.com

urban-science.blogspot.com

The remaining steps will be done to both models:

13. Fill the spray bottle with water and give each model the same number of sprays of water. Spray them with water on a regular basis.
14. Put the models on a windowsill where they will get equal light.
15. Throughout the month, observe the models on a regular basis. Do not move the models or take anything out of them. Take photographs if you have access to a camera. Keep track of your observations and watering schedule in a science notebook.
16. (Optional) You may wish to take a photo of each of your models on a regular basis. You can use the pictures to illustrate the changes in your project.
17. When your models have been decomposing for one month, take them apart. Find the apple in each. Carefully write down what the apple looks like. Measure the apple. If you have been taking photographs, take a picture of each apple.
18. Also look at any liquid that has come out of the landfill or compost. This is the leachate. Write down some observations of the leachate and take a picture. Does it look clean or dirty? Does it smell?

Discussion

- Compare the two models. What was realistic or not realistic about your models?
- Which is a better method for decomposing the apple?
- Why do you think this is important?
- How are your landfill model and compost model like real-life landfills and compost piles?
- What variables did you have to consider or measure in your experiment?

ACTIVITY

Time Allotted

60 minutes +

continued care

Target Audience

Grades K-5

Objectives

- Students will observe how vermicomposting reuses yard, garden, and kitchen waste.
- Students will build and maintain a worm bin.

Materials

- Plastic bin, small (16" x 24") or medium (20" x 30")
- Drill
- Soil (a few handfuls)
- Food scraps (a few cups)
- Newspapers (~ 1-2 Sunday papers for an medium-size bin)
- Large poster paper
- Marker
- Gloves
- Trowel
- Water jug
- Worms

Make a Classroom Worm Bin

Summary

In this activity students will build a vermicomposting bin for their classroom. They will design an optimal habitat for worms, incorporating the right amount of bedding, moisture, grit, and food. Once the bin is ready, students can begin composting food scraps and other green and brown material.

Background

Vermicomposting is a composting method that uses worms to recycle food waste into a healthy, rich soil conditioner. The advantage of worm composting is that it can be done indoors and outdoors, so you can compost year-round. It also provides people who live in apartments with a way to compost.

Refer to earlier in Lesson 6 for more details on worm composting and red wriggler worms.

Method

Pre-classroom construction

1. Order worms from online or a local retailer. The number of pounds of worms you order will depend on the size of your worm bin and the volume of food scraps. Make sure to ask the retailer before you purchase.
2. Drill holes in a plastic bin about 4 inches apart in the top and on the sides for ventilation.
3. Gather newspaper, food scraps, soil, and worms.

Classroom construction

Note: With large classes, you can either construct one bin up front using a few student volunteers, or you can work with groups of 6-7 students at a time to construct a bin (all steps except the final step of adding worms), deconstruct it, and then reconstruct it for each group. It is recommended to work with smaller groups whenever possible.

1. Bedding: Have students rip newspaper into long strips about an inch wide. Rip enough strips to fill your bin about half way. Avoid using newspaper pages with lots of color.
2. Moisture: Students should place newspaper strips on the bottom of the bin and then sprinkle the newspaper with enough to make them damp.
3. Grit: Add a few handfuls of soil, sprinkling it across the bedding. Worms do not have teeth. Soil provides grit for the worms to help them to digest the food scraps.

4. Food: Add a small amount of food scraps and cover the food scraps with more damp newspaper. The food scraps must be covered in order to prevent fruit flies.
5. Worms: Slowly dump worms into the bin after all other items are in the bin. Make sure worms are able to wiggle deep into bin materials as they don't like light and will want to start eating immediately.
6. Make a list of responsibilities for caring for the worm bin. As a class, consider what the worms need and how students can provide for them.

Making a Worm Bin

healthywaltham.wordpress.com

Ask:

Do the worms need water?

Answer: Yes, they need it damp to be able to move and tunnel through the bin.

Do the worms need light or dark?

Answer: Dark.

Why do the worms need dirt?

Answer: Worms do not have teeth so the grit helps them to digest the food.

How can we help the worms be comfortable?

Answer: Make sure they are not too hot or too cold, and that the bin stays moist.

What do we feed the worms?

Answer: Food scraps (mostly fruit, vegetables and grains)

How often do we feed the worms?

Answer: This depends on the size of the bin and the number of worms. If the bin is smelling and attracting flies, you need to stop adding food scraps, keep a dry cover layer of bedding on top and let the worms have a chance to eat what is already in the bin.

Worm Bin

7. Hang poster next to worm bin as a reminder of how to care for the worm bin, making sure the teacher and student helper checks on the worms every few days.

A
ZERO
WASTE
CURRICULUM

Lesson 7

Exploring Waste at School

Objectives

- Students will evaluate the type and quantity of waste generated at the school.
- Students will collaborate with school faculty, staff, other students, parents and community members to conduct the audit and to come up with potential solutions.
- Students will develop methods for reducing waste, increasing recycling, and introducing food scrap composting based on available data.
- Students will use the data collected for real-world math lessons on weight, volume, graphs, and charts.

Summary

A **waste audit** involves collecting all the garbage and recycling within the school for one day, separating it into categories, measuring each category, and documenting the findings.

Background

Zero Waste Ambassadors Guiding a Waste Audit

www.sevengenerationsahead.org

In a perfect world we would not throw anything away. We would use less and then reuse or recycle everything. For students to understand why waste reduction is important, they need to understand that waste is a big problem. Their one milk carton or plastic water bottle may not seem to make a big difference but when they see the cumulative impact of all the waste at their school over time, they begin to see why things need to change. Conducting a school waste audit provides the students and school with information on what is in the school waste stream and where it is going. This information can also identify resources that could be reduced or recovered through reusing, recycling and composting. If you know what is being thrown out and from where it is coming, you can design and implement solutions to reduce waste.

From the ground up: Stories of ZWAs in action

District 97 Beye Elementary School Lunchroom Waste Audit in Oak Park, IL

www.sevengenerationsahead.org

District 97 Oak Park elementary schools have all conducted waste audits with the guidance of Seven Generations Ahead, an environmental nonprofit. The audit was conducted by students with the support of parents, school administration, teachers, lunchroom staff and custodians. The data obtained during the audits was used to identify a variety of ways to reduce school waste including: 5 schools converted to reusable lunch rooms (no more Styrofoam trays or spork packets), 6 schools set up composting programs, a district policy was implemented for double-sided copies, schools implemented digital backpacks to share information with parents online, zero waste lunches and more. One school is now diverting over 97% of waste from their lunchroom.

A waste audit sounds like a messy smelly job. The surprising thing is how much fun both adults and students can have sorting, measuring, extrapolating, reporting and coming up with a plan for change! To see a waste audit in action, check out this video from D97 Holmes Elementary School: http://vimeo.com/17296019

Quick Fact: Reducing the amount of waste that is sent to landfills is important for many reasons. According to the Illinois EPA, as of January 2012:

- 12 years of landfill capacity remained for Region Two (Metropolitan Chicago) based upon current waste disposal rates. The counties of Cook, DuPage, Grundy, Kane, Kankakee, Kendall, Lake, McHenry and Will are located within Region Two.
- There was only 1 active landfill site left in Cook County.
- Approximately 20 years of capacity remained for landfills in the state of Illinois based on current waste disposal rates.

According to the EPA, the average American generates about 5 pounds of waste per day and each student produces about ½ a pound of waste per school day. Reducing school waste will save natural resources, reduce air, water and land pollution, reduce greenhouse gas emissions, save the school and community money and ensure a healthy future for the next generation.

Discussion/Verbal Exploration

Show the short video (Bill Nye The Science Guy - Garbage) that discusses the problems of waste generation, landfills, and litter as well as the solutions of reducing, reusing, recycling and composting. It isvaluable in setting the stage for the waste audit and lasts about 23 minutes.

http://www.youtube.com/watch?v = SEjc0AY6ur0

While watching the video, have students think about the following questions and take notes.

1. List 2 facts that surprised you in this video.
2. What is one or two differences between human waste and waste in nature?
3. Why do you think humans make so much garbage?
4. Find an example of each in the movie...
   - Reusing
   - Recycling
   - Reducing
5. Predict what we will observe in our waste audit.

Prompt students to discuss what they know about alternatives to simply discarding what they no longer need, such as recycling, reusing, and repurposing.

In My Neighborhood

Identify local businesses that do a good job recovering resources. Is there a restaurant or grocery store with recycling bins? Composting? Ask to talk to a manager and find out if they know how much they are recycling each week/month/year. Do they measure this or get data from their hauler to know how much is getting thrown away and how much is being recovered? Have they ever conducted a waste audit?

Field Trip

Visit a school that has conducted a waste audit. Set up a trip to meet their Zero Waste Ambassadors or the parents or teachers who coordinated the audit. Learn about how they did their waste audit and what they have done with the information they got from the audit.

From the ground up: Stories of ZWAs in action

Chicago Public Schools (CPS) has a number of schools that have conducted waste audits. CPS Peterson Elementary School worked with Seven Generations Ahead (www.sevengenerationsahead.org) to conduct a waste audit planned by teachers and conducted by students with the support of parents, school administration, lunchroom staff and custodians. The data obtained during the audits was used to identify a variety of ways to reduce school waste. This school is now a LEED silver certified school and serves as a model for other schools working to reduce waste.

CPS Peterson Elementary School Lunchroom Waste Audit

www.sevengenerationsahead.org

Objectives

- Students will implement a waste audit that will measure the kinds and amounts of waste being produced.
- Students will evaluate the waste audit data and imagine a new plan for waste disposal.

Summary

The **waste audit** can take two to three hours and will provide valuable information for planning waste reduction strategies. Take the time to plan a thorough audit and gather detailed information. Begin by having students complete the worksheet Exploring Our School Waste Stream (Worksheet 7.A). You will use a Waste Audit Form (Worksheet 7.B.1, 7.B.2, or 7.C) to document all of the data collected during the audit.

Planning

Conducting an audit is a valuable opportunity for educating students, staff, faculty, administration, parents and the community about waste, resource conservation, and why it is important to reduce how much waste the school generates.

www.sevengenerationsahead.org

Planning involves considering **who** needs to be involved, **when** to conduct the audit, **why** you are doing this, **what** materials you will need, and **how** your audit will be structured.

Who: Your Zero Waste Team

Begin your audit with good communication with all stakeholders.

Administration: It is important to discuss this activity with the principal of the school and receive permission before proceeding. The principal or assistant principal can also give you a list of key people to involve in the audit.

Custodial and Lunchroom Staff: Introduce yourself to the custodial staff and lunchroom staff/volunteers. Discuss the audit with them, explain what is involved, why the school is doing this, and learn what the schedule is for collecting waste/recycling throughout the school. Invite their input on organizing the pre-sorting station, table dismissal, and lunchroom communication.

Teachers and Students: Scheduling the audit to occur when students are learning about concepts related to waste and recycling (e.g. natural resources, nature's decomposers, or climate change) provides a hands-on experience to complement their classroom learning. It is recommended that the attached questionnaire, Exploring Our School Waste Stream (Worksheet 7.A), is completed prior to the audit by students with the assistance of adults.

Everyone Else: Make sure everyone in the school is aware of when the audit will occur.

A waste audit can be conducted with only a few people. Getting more people involved (students, staff, and parents) makes it easier and a better opportunity to engage others in waste reduction. Having students involved in the sorting, weighing, documenting and discussion is an important aspect of conducting a school waste audit. Yes, this process could go much faster if only adults were involved, but a valuable learning opportunity will have been lost and students will not feel invested in the process of reducing waste. The same students who help with the pre-sorting in the lunchroom can help with the final sorting and weighing. Try to involve 10-20 student volunteers and at least 3-5 adult volunteers.

When: Setting the Date

Choose a typical day at school in order to capture a true representation of the waste generated. Avoid holidays, days when special celebrations will occur, or days when many classes will be away on field trips. Do not plan a waste free lunch day on the date of the audit.

The audit can be very messy depending on what is served for hot lunch. Choosing a hot lunch day where a piece of fruit is served instead of fruit salad, pizza instead of spaghetti, a cookie instead of pudding will make sorting easier. Students who bring lunch from home will have a variety of food items that cannot be controlled, but having a less messy hot lunch helps with the process.

Julian Middle School's
Zero Waste Lunchroom

www.sevengenerationsahead.org

Why: Tell People Why You Are Doing This

Communicate why and when your school is performing a waste audit with the entire school and community. Create an electronic flyer, post information on the school website, make announcements in classes or in the lunchroom, and show the Holmes Zero Waste video depicting a school waste audit (www.sevengenerationsahead.org). Generating awareness and excitement about this event will be helpful in garnering cooperation and support on the day of the audit.

What: Materials Needed for Waste Audit

This list of materials is a general guide as to what your school may need to perform a waste audit. When including lunchroom waste in the audit, it can be helpful to have students pre-sort their waste into labeled receptacles after they eat. Additional garbage/recycling receptacles, bags, and signs may be needed for this process.

- Space for sorting waste
- Roll of disposable plastic to be laid on floor or **plastic tarps**
- Trash bags and paper grocery bags
- Disposable plastic **gloves** for every participant
- 5 gallon buckets - 2 to 4 for liquids
- Bins/cans for: recycling, landfill, compost
- Camera
- **Scale** - nurse/doctor type, postage, bathroom
- Provided **Audit Worksheet(s)** to record audit data
- Scissors and tape for cutting and securing plastic to floor and posting signs
- **Signs** for bins and sorting areas on the floor
- White board or chalkboard for recording
- Paper and marker for labeling bins/cans

If you plan on having students involved in the waste audit, then you may choose to have those students coordinate in some way (e.g. wear the same colored bandana or wear a safety vest) so others know who to ask for help.

Consider having a couple photographers (student or adult volunteers) document your waste audit. The photos can really give you an idea of the amount of waste generated in one day at school as well as the volume of resources that are being wasted rather than recovered. For example, students are always surprised to find out how much paper is being thrown away rather than recycled. These photos are also a lot of fun for the students to see as they begin to realize that the choices they make each day are part of a larger collective impact that their entire school has.

Zero Waste Signage

www.sevengenerationsahead.org

How:

Audit Structure

Audits can give an overview or provide detailed information. They can be a simple measure of how much recycling a school generates or they can give a detailed look at what resources can be recovered (metal, glass, paper, etc.) in different parts of the school. They can take an hour or two or they can take a whole day to complete. It is important to understand how the data collected will be utilized when planning how to structure the audit. Discuss and review the waste reduction strategies your school plans on implementing. Think about what type of information needs to be captured in order to best measure waste reduction after the strategy is implemented. If your school will need to conduct follow up audits to submit with a grant report, then review how that information needs to be measured and documented.

Work closely with custodial staff, building engineers, and lunchroom staff. Request that on the day of the audit, no waste or recycling be removed from the school. Establish a location for custodians to deposit and save any waste that must be collected before the scheduled audit so that it can be measured and documented as a part of the audit.

Options for conducting a Waste Audit:

Option A - Lunchroom: The lunchroom waste audit can give you great information on not only opportunities for reduction and recycling, but also composting. Collect, sort, weigh and document the lunchroom waste and recyclables. Use worksheet 7.B.1 or 7.B.2.

Option B – School Overview: Use this option for schools looking at overall recycling and waste reduction, but not composting. Collect and combine 1) waste from all rooms, 2) recycling from all rooms, and 3) only recyclables from lunchroom. Sort, weigh and document. Use worksheet 7.C.

Option C – Room by Room Audit: Use this option to develop area-specific strategies for waste reduction. For all waste and recyclables: collect waste and recycling from throughout the school, but keep it organized by classrooms and office/staff rooms (containers can be temporarily labeled before being brought to a central sorting area). Sort each "room", weigh and document. You can also plan your audit as waste reduction games between rooms, grades, or students and faculty. Have each classroom, office, staff room, etc. sort and weigh their own waste, weigh and document. Use worksheet 7.C.

Pre-Sorting: Setting up Sorting Stations

Imagine the mess as you dump out many large garbage cans filled with smelly garbage and then don your gloves to sort it into your waste audit categories. A little bit of advance planning can not only keep you from having to perform this smelly task, but also provide a perfect opportunity to get the students involved in the waste audit process. Plan to set-up one or more waste sorting stations in the lunchroom. Each station should be the same with receptacles well labeled. Assign a student to each receptacle or sorting station and explain to them that their job is to help the other students sort their lunch waste into the proper receptacles when they are done eating. It is also important to have extra adults on hand to assist the students.

Each audit volunteer should have plastic gloves and have their hair tied back. Spend time explaining their duties and remind them of the important job they have. Announce to the lunchroom that when they are dismissed from their tables, they are to go to a sorting station and will be helped by the student and parent volunteers. Have extra garbage bags handy, as volume will increase rapidly as lunch comes to a close. Usually sorting can be completed in the allotted time for lunch, but a lot depends on the number of volunteers available to help.

Sample Stations

Lunchroom Audit - Simple

Lunchroom Audit - Detailed

School Audit

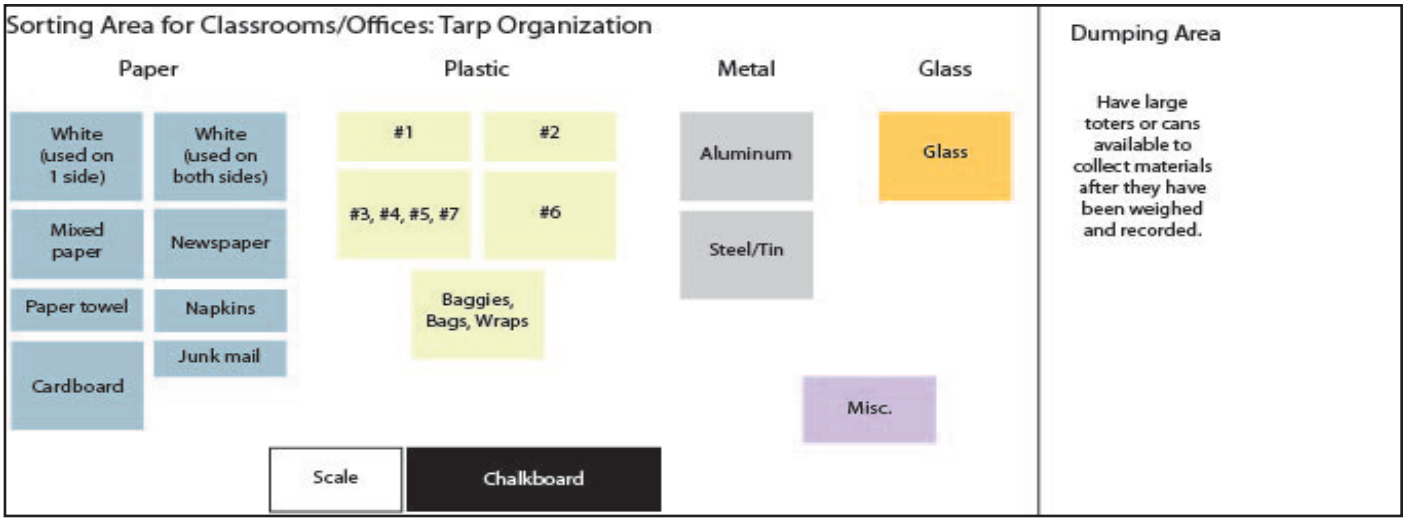
Sorting Area

Set-up the sorting area where 1) you have adequate space and time to conduct the waste audit, and 2) it will require only limited transport of liquids and food scraps. This can be done in the lunchroom after all lunches are over, in a gym, auditorium, unused classroom, or the hallway. If needed, prepare the room by covering the floor with plastic tarps or sheeting. Tape the plastic down to the floor on all sides to prevent slipping and tripping.

Request to borrow a scale from the nurse's office or science classroom. Postal scales and home bathroom scales work as well. A digital readout is preferred. The size and type of scale that you use may determine whether you can weigh items in their container/bin or need to remove the bag and weigh items in a different manner. Have a large chalkboard or whiteboard for charting information and taking notes.

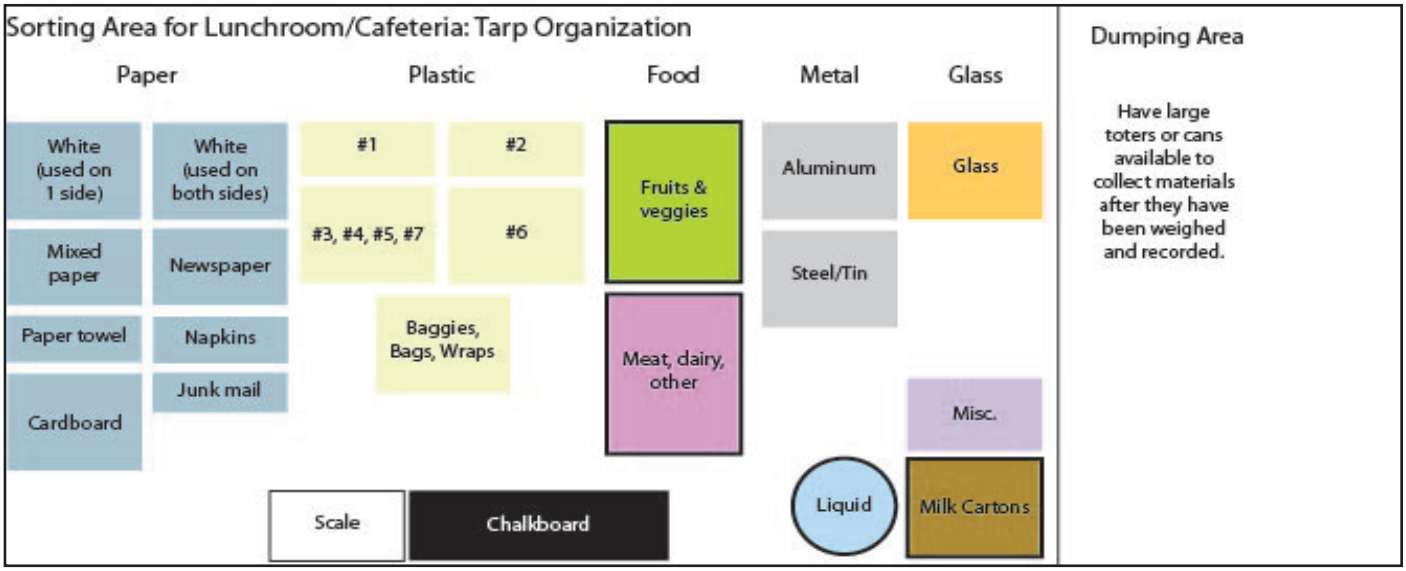
Sorting Area for Classrooms and Offices

This diagram shows how you can organize your sorting piles on a plastic tarp. This diagram is for a more detailed waste audit.



Sorting Area for Lunchroom/Cafeteria Audit

This diagram shows how you can organize your sorting piles on a plastic tarp. This diagram is for a more detailed waste audit and includes all the categories of a classroom audit with added categories for food, liquid and other common lunchroom resources.



Job Assignments

A waste audit can be done by as few as 2-3 people. That being said, getting others involved helps this to become a visible kick off for your waste reduction efforts as well as a way to help engage students and adults. The following chart gives an idea of a variety of ways you might use volunteers during the waste audit. When you have a good number of volunteers, it is important that each be a useful part of the audit and assigning a task or assignment can assure that everyone plays a role.

Task	Description	Volunteers
Recorder	Records all data from audit on the recording sheet. This includes weights and counts for all waste streams that are measured. Recorder will know which streams require counts in addition to weights (see recording sheet) when asked by audit team.	• Sandy
Counter	Counts the items that require that data (see Recorder). Use tarp in designated location. Report final data to Recorder and discard into proper receptacle.	• Bill
Sorter	Receives any contaminated bags and sorts discarded material into its proper waste stream. Use tarp in designated location. Label new bags with its waste stream and and give to Receiver.	• Emily • Jessica • Tim
Weigher	In charge of the scale and making sure that all bags are weighed properly. He/she should report the data to the Recorder. After data is recorded, discard into proper receptacle.	• Liz
Receiver	Receives all bags coming in to be weighed for the audit. Make sure the runner has indicated what waste stream is inside. If the bag is not contaminated, give to the Counter if it must be counted or the Weigher if it does not need a count. If the bag is contaminated, give to Sorter. Help Counters and Sorters during downtime.	• Zachary
Bag Runner	Floats around to each station picking up full bags that are ready to be weighed. As you check each station, also look within each receptacle to make sure streams aren't being contaminated. If you see items that have been discarded improperly, rescue material (with gloves!) and put it in its proper place.	• Benji • Sam • Joey
Educator	Educate students about how to properly discard their items. Each receptacle is designated to collect a particular waste stream (see signage). Make sure whatever item is being discarded is going into its proper receptacle. If it isn't properly discarded, rescue that material (with gloves!) and put it in its proper place.	• Megan • Grant • Rick • Scott

Measuring and Recording Waste

1. Weigh all empty collection containers before you begin including empty recycling bin, bucket, box or other container. Remember to deduct this weight from the final weights you record for your waste audit.
2. Waste from classrooms and offices can be dumped onto the tarp/plastic where volunteers can sort it into general piles of paper, plastic, metal, food, miscellaneous.
3. Once a "room" has been sorted, start to weigh the individual categories of waste, document it on the Waste Audit Form, then move on to the next category.
4. Once all of the waste from a "room" has been sorted, weighed and documented, all of the landfill waste can be set aside to be transferred outside. The recyclables can be dumped into a toter (or the receptacle the custodial staff uses for recyclables) and set aside.
5. The next "room" can now be sorted, weighed and documented.

D97 Hatch Elementary School Lunchroom Waste Audit

www.sevengenerationsahead.org

For lunchroom waste that was pre-sorted, much of it can be weighed as is and documented. The recyclables and miscellaneous waste may require further sorting. For lunchroom waste that was not pre-sorted, dump it out onto a tarp to sort into separate bags/bins for fruit, veggies, meat, bread, and miscellaneous items.

Take note of items that are not on the waste audit form, but are a regular waste item at your school, such as plastic straws, plastic utensils, condiment packets or chip bags. If possible, weigh or count these items, document them on the Waste Audit Form under Miscellaneous and write in the item name, count and/or weight. This information can be used to advocate for less wasteful alternatives.

Learning Opportunities

A teacher or another adult should be assigned to engage the students in educational activities during the waste audit.

Estimate and Measure: When a category is brought to the scale for weighing, ask a few students to lift the bag or bin and estimate how much it weighs. Assign another student to weigh the bag, operate the scale, announce the true weight, and figure out whose estimate was closest. Have students take turns weighing and estimating.

Discuss how you deal with waste in your community: Talk about the waste and discuss why sending it to the landfill is a problem (waste of natural resources, lifespan in a landfill, pollution caused by landfills, shortage of landfills in area). Question the students about solutions for reducing the amount of waste generated and sent to landfills. If some items are recyclable at your school, but are not being recycled, ask them why they think those items are not being recycled and ask them for possible solutions. Take notes of the student responses and keep them involved in the waste reduction strategies.

Extrapolate: Use the data gathered at your audit to extrapolate and determine the total amount of waste generated for your school during one school year (approximately 175 days). How much of that waste should be recycled. Extrapolate to determine how many pounds of recycling can be recovered by your school in one year.

Clean-up

It is important to discuss clean-up of the Waste Audit with the custodial staff. Determine if the custodial staff will still be working at the end of the audit and if they can assist with clean-up. It is important to remember that the custodial staff will play an integral part in the success of any newly implemented waste reduction strategies, so be aware of any extra help that is being requested of them and acknowledge the efforts they make. Know ahead of time what the custodial staff can do and what you need to be prepared to have volunteers do.

Tasks:

- All of the waste and recyclables will need to be transported to the dumpsters outside at the end of the audit.
- The bins and receptacles need to be put away.
- The plastic tarp (if reusable) will need to be cleaned, removed from the floor and stored. If plastic sheeting is used, then carefully remove it from the floor and add it to the landfill waste.
- The liquid buckets will need to be emptied and cleaned.
- The floor will probably need to be mopped or cleaned.
- Return the scale and the chalkboard.

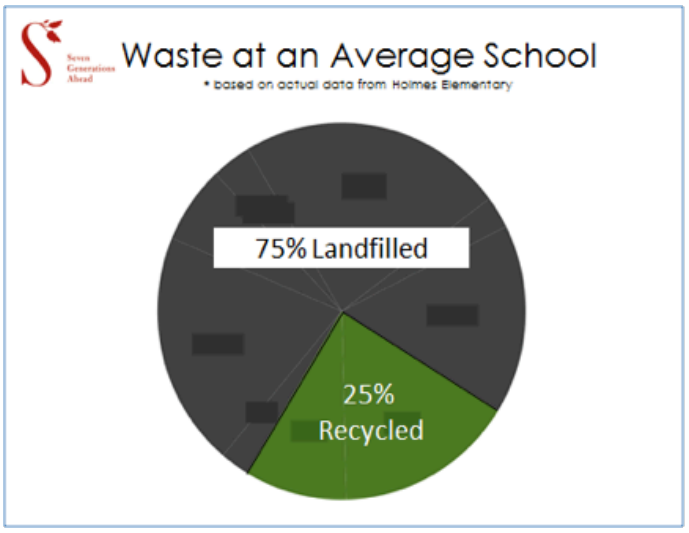
Joseph Sears Elementary Waste Audit

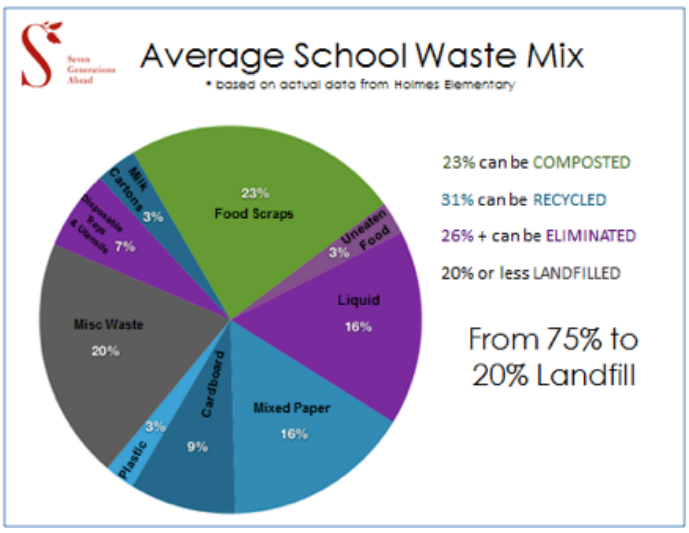
www.sevengenerationsahead.org

Waste Audit Results

Once your waste audit is complete, the data you have gathered needs to be summarized and reported. If students were working on chalkboards or whiteboards, consider taking photos of their calculations. Come up with a summary report that shows what you have learned. This may be a data table or a pie chart – something that can show the total amount of waste generated, what the school is currently recovering (usually through recycling), and what else could be reduced or recovered.

The following are examples from an elementary school, typical for an average school:





Note that your charts or tables do not need to be created on a computer. It is even more powerful to have one of the students create the chart on a large piece of paper (flip chart) or the board.

Waste Extrapolation

School	# Students	Waste per day (lbs/day)	Waste per school year (lbs)
Percy Elementary	900	584.25	102,810
Eden Charter	400	519.4	91,400
Applebury High	1,100	2,144.86	377,495

Audit Data Extrapolation: Hobbes Elementary

Item Collected	Recovered per day (count or lbs/day)	Recovered per year (count or lbs/yr)
Milk Cartons	301 per day	51,113 per year
Liquid	99.6 lbs/day	16,932 lbs per year
Paper Bags	398 per day	67,660 per year

Data from your waste audit can help students, staff, and parents to see the impact of their collective efforts. One deision about where to put a milk carton is part of a big solution.

Exploring Our School Waste System

How many garbage dumpsters does your school have? _____

How much garbage does each dumpster hold? _____

How often does the garbage get picked up? _____

How full are the garbage dumpsters at collection time? _____

What company collects the garbage from your school? _____

Where does the garbage travel to? _____

How much money does it cost for the garbage to be picked up from the school? _____

How is the garbage cost determined (# of dumpsters, weight of garbage, etc)? _____

Does your school recycle? _____

What items does your school recycle? _____

Does your school have a recycling dumpster or container outside? _____

What company collects the recycling from your school? _____

How much money does it cost for the recycling to be picked up from your school? _____

What are all of the items your recycling company will collect?

Does each classroom have a recycling bin? _____

Does the office, library and resource center have recycling bins? _____

Does your school recycle in the lunchroom? _____

What does your school recycle from the lunchroom? _____

LUNCHROOM WASTE AUDIT DATA

School Name: _____ Date: _____

Person in Charge of Audit (Teacher, Administrator, Parent): _____

Have students sort items into collection containers (cans and buckets with signs) as they finish eating lunch. Students will sort their own items with help from Zero Waste Ambassadors and volunteers. All weighing, counting and recording will be done after lunch.

Item(s)	Count	Weight	Currently recycle/ compost/ collect?	List items (if applicable)
RECYCLING				
Milk cartons (count and weight)			☐ Yes ☐ No	
All Other Recycling			☐ Yes ☐ No	
TOTAL RECYCLING (combine weights above)			☐ **Yes** ☐ **No**	
LIQUID				
Liquid (milk, water, juice)			☐ Yes ☐ No	
COMPOST				
Food scraps - see below to determine which food scraps should be measured *			☐ **Yes** ☐ **No**	
LANDFILL				
Landfill - plastic bags, straws, Styrofoam, etc.				
TOTAL WEIGHT (combine green and orange boxes)				

* Determine which type of composting will happen at your school. A school compost program can usually compost only clean fruits and vegetables (no dressings or sauces on the veggies). A commercial compost program can compost fruits, vegetables, meats, dairy, bones, food-soiled paper, and more.

LUNCHROOM WASTE AUDIT DATA

School Name: _____ Date: _____

Person in Charge of Audit (Teacher, Administrator, Parent): _____

Have students sort items into collection containers (cans and buckets with signs) as they finish eating lunch. Students will sort their own items with help from Zero Waste Ambassadors and volunteers. All weighing, counting and recording will be done after lunch.

Item(s)	Count	Weight	Currently recycle/ compost/ collect?	List items (if applicable)
RECYCLING				
Milk cartons (count and weight)			☐ Yes ☐ No	
Plastic - water bottles, etc. (count and weight)			☐ Yes ☐ No	
Paper – paper bags, wrapping, etc.			☐ Yes ☐ No	
Glass – bottles, jars, etc.			☐ Yes ☐ No	
Aluminum – cans, foil, etc.			☐ Yes ☐ No	
TOTAL RECYCLING (combine weights above)			**☐ Yes ☐ No**	
LIQUID				
Liquid (milk, water, juice)			☐ Yes ☐ No	
COMPOST				
Food scraps for school compost - all clean fruits and veggies			☐ Yes ☐ No	
Other food scraps for commercial compost - all meat, dairy, eggs, etc.			☐ Yes ☐ No	
TOTAL COMPOST (combine weights above)			**☐ Yes ☐ No**	
REUSE				
Whole uneaten food (weight and list items with count)			☐ Yes ☐ No	__ apples __ packets of crackers __ bananas __ other _____
LANDFILL				
Plastic – ziplock baggies, saran wrap, straws, etc. (weight)				
Polystyrene lunch trays (count and weight)				
TOTAL LANDFILL (combine weights above)				
TOTAL WEIGHT (combine green and orange boxes)				

For assistance conducting a school waste audit, contact Seven Generations Ahead at www.sevengenerationahead.org or (708) 660-9909.

SCHOOL RECYCLING WASTE AUDIT

School Name: _____ Date: _____

Person in Charge of Audit (Teacher, Administrator, Parent): _____

Waste and recycling will be collected, sorted and measured from all parts of the building except the lunchroom (for a lunchroom audit, use Worksheet 7.B.1 or 7.B.2). Determine if there is a need to audit by room/office. If so, use a separate worksheet for each area. Otherwise, have all recycling and waste transported to a central measuring area. Sort into categories and record below.

BACKGROUND INFORMATION		
Item(s)		**Comments**
Is classroom paper recycled?	☐ Yes ☐ No	
Is office paper recycled?	☐ Yes ☐ No	
Can printers print double-sided?	☐ Yes ☐ No	Is this done ☐ most of the time ☐ some of the time ☐ none of the time
Can copiers copy double-sided?	☐ Yes ☐ No	Is this done ☐ most of the time ☐ some of the time ☐ none of the time
Are announcements sent home electronically (email)?	☐ Yes ☐ No	☐ paper ☐ both ☐ electronic
Do bathrooms have hand dryers?	☐ Yes ☐ No	☐ Hand dryers ☐ both ☐ paper towels

WASTE AUDIT DATA				
Item(s)	**Count**	**Weight**	**Currently recycle/ collect?**	**List items (if applicable)**
RECYCLING				
White paper (used only on one side)			☐ Yes ☐ No	
White paper (used on both sides)			☐ Yes ☐ No	
TOTAL WHITE PAPER (combine weights above)			**☐ Yes ☐ No**	
CARDBOARD				
Cardboard			☐ Yes ☐ No	

For assistance conducting a school waste audit, contact Seven Generations Ahead at www.sevengenerationahead.org or (708) 660-9909.

WASTE AUDIT DATA				
Item(s)	**Count**	**Weight**	**Currently recycle/ collect?**	**List items (if applicable)**
OTHER PAPER				
Magazines			☐ Yes ☐ No	
Bills, mail, envelopes, etc.			☐ Yes ☐ No	
White paper (used on one side)			☐ Yes ☐ No	
TOTAL OTHER PAPER (combine weights above)			**☐ Yes ☐ No**	
OTHER RECYCLING				
Plastics			☐ Yes ☐ No	
Metals			☐ Yes ☐ No	
Other			☐ Yes ☐ No	
TOTAL OTHER RECYCLING (combine weights above)			**☐ Yes ☐ No**	
LANDFILL				
Landfill - plastic bags, Styrofoam, etc.				
TOTAL WEIGHT (combine green and orange boxes)				

NOTES:

A ZERO WASTE CURRICULUM

Lesson 8

Become a Zero Waste Ambassador!

Getting Students Involved

Objectives

- Students will apply the knowledge gained in previous lessons for real-world activities.
- Students will design and implement activities, crafts, and events that illustrate a zero waste lifestyle.

Summary

This lesson includes a number of activities that can be used in or out of the classroom. These activities support and apply what students have learned in previous lessons in this curriculum, helping them to become Zero Waste Ambassadors.

ACTIVITIES A-Z

This lesson lists a variety of activities for students (both in the classroom and out) that focus on waste reduction. These activities can be used to support earlier lessons in this curriculum or to develop a Zero Waste Ambassador (ZWA) club or green team.

Background

Now that students understand the waste cycle, implications of current waste systems, that much of what we call garbage can be a recovered resource, and how the choices we make regarding waste can affect our local and global communities, they are ready to become Zero Waste Ambassadors (ZWAs). Empower students to put their knowledge into action by making a difference. Students will use what they've learned to develop solutions for their school, individual households, local community, and global society.

Discussion/Verbal Exploration

There are many challenges with waste in our society? Zero Waste Ambassadors can create solutions! Encourage ZWAs to think about what role they can play in moving their school, community, or household toward Zero Waste.

Ask students:

1. *What is the most important thing that you have learned about zero waste?*
2. *Has this changed your behavior in any way? Why or why not?*
3. *How would oyu go about educating others about zero waste?*
4. *Take a look around your school, household, or local community. Where do you see an opportunity to make a difference in the way waste is handled that could lead to a positive change?*
5. *What is the most important thing we could do at school to reduce waste and save resources?*

Activities

The A - Z BUILDING BLOCKS of being a Zero Waste Ambassador:

Activity A - All Earth EcoBot Challenge

Activity B - Book Swap - Game Swap

Activity C - Conduct a Reuse Drive (collect donations for reuse)

Activity D - Draw a Resource Web of Life

Activity E - Eco-friendly Recycle Mobiles

Activity F - Form a Zero Waste Ambassadors Club (or Green Team)

Activity G - Guest Speakers

Activity H - Harvest Celebration Meal

Activity I - Invite a Master Composter to Visit

Activity J - Jobs in the Classroom for ZWAs

Activity K - Kid-run Events to Celebrate Earth Day/Earth Month

Activity L - Litter Cleanup Walk

Activity M - Movie Night with Waste Free Awards

Activity N - Native Bird House

Activity O - Organize a Paid Performance (Imagination Theatre's Go Green performance)

Activity P - Poster Contest

Activity Q - Quirkzy Recycled Art Show

Activity R - Resource Recovery Relay Race

Activity S - Scavenger Hunt

Activity T - Take the Egg Challenge (sustainable packaging)

Activity U - ReUsable Lunch Materials Sale (fundraising opportnity)

Activity V - Video Making - Create one about Zero Waste

Activity W - Waste Free Wednesdays (waste free lunch day)

Activity X - Seed EXchange

Activity Y - You Can Make a Difference School Campaign

Activity Z - Zero Waste Student of the Week/Month

Activity 8.A: All-Earth EcoBot Challenge

Time: 5 month challenge period

SUMMARY

The All-Earth EcoBot Challenge® is an innovative engineering competition for 5th-8th graders on four-person student teams. In the Challenge, four-person student teams design, build and program autonomous robots to accomplish four missions on a competition table, using a LEGO® MINDSTORMS® Education NXT Robot kit. Teams operate their robots to complete a series of different missions each year that connect to the commercial and industrial future of energy generation, transportation, technological innovation and environmental sustainability like recycling, reusing, and reducing. The Challenge generates excitement by demonstrating the real-world usefulness and workplace applicability of school-based learning and computers. It helps our young learners connect the dots…and, it is great fun! http://www.ecobotchallenge.com

Activity 8.B: Book Swap / Game Swap

Time: 1-3 days planning + 2-4 hours per event

SUMMARY

Setting up a book swap is a great zero waste way to find a home for books and games you no longer want to keep.

METHOD

ZWAs can plan a coordinated swap event and set up any rules for the swap. Some things to consider might include:

- Will this be a one time event or will it be ongoing?
- Can there be a shelf in the library or a classroom where people can swap all year long?
- Do you have to donate an item to take an item?
- What will you do if you have items left over?

Planning: ZWAs can discuss and plan the event.

Marketing: ZWAs can make announcements, create flyers, signs and posters to let everyone know what and when to swap.

Donating: ZWAs can coordinate with a local library, used book store, Goodwill, etc. to take any remaining books that are not taken at the swap.

Activity 8.C: Conduct a Reuse Drive (collect donations for reuse)

Time: 1-2 days planning + length of drive

SUMMARY

The ZWAs can conduct a number of different drives at school including: winter outerwear, Share Your Soles, Funding Factory (small electronics) and more.

METHOD

The ZWAs can be responsible for identifying a place to donate items, announcements to students and parents, sorting donations in the hallways, boxing and then having them delivered.

Activity 8.D: Draw a Resource Web of Life

Time: 30 minutes

SUMMARY

The Resource Web of Life is designed to teach ZWAs about how things on our planet are all interrelated. They will see connections between resources, products we use, and what we do with products when we are done with them.

MATERIALS

- Web of Life Cards (set of cards with images)
- String/yarn

METHOD

1. Assign a card to each student (see ideas below). Ask each child to think about their card and share one fact with the group. (Ideas for cards: sun, clean air, clean water, soil, bacteria, worm, tree, pile of brown leaves, whole apple, apple core, aluminum (from the earth), soda can, plastic pellets, plastic water bottle, recycled art, recycling MRF (material recovery facility).
2. Creating the web of life requires a long piece of string (possibly as long as 300 feet - a yarn ball is a good option) to symbolize the connection between all resources and products. Ask all the students to stand in a circle, facing the center.
3. We all need clean air and clean water to live. And the sun is the source of all energy; ask the student with the sun card to stand in the center of the circle and grab one end of the string.
4. Next, the string is passed from student to student, showing the connection of sun to clean air...clean air to clean water...clean water to tree...tree to leaves on the ground...leaves to worms...worms to soil...soil to tree...tree to whole apple....whole apple to apple core...apple core to bacteria... bacteria to soil...soil to bauxite (mineral to make aluminum)...bauxite to soda can...soda can to recycling MRF...recycling MRF to plastic pellets...plastic pellets to recycled plastic bottle...recycled plastic bottle to recycled/reuse art...
5. Once all ZWAs are a part of the resource web of life, have them observe the web (they may need to all take a small step back to tighten the string a little).
   Is it simple or complicated?
   Does it appear to be strong or weak?
   What happens when you pull on one string?
   Can you feel it in other parts of the web?
6. Have the ZWA holding the sun card give a little tug on the string. Ask who can feel the tugging? Then have the ZWA holding the sun give a tug, then have anyone who can feel the tug, give a tug themselves. Keep this going until everyone has felt the string tug.
7. Talk about things that can interrupt or break the web of life:
   If you send apple cores and soda cans to an incinerator...have the ZWAs holding the apple core and soda can drop out of the web. Observe what happens to the web.
   When an incinerator burns waste, there is pollution released into the air...have the ZWA holding the clean air card drop out of the web. Observe what happens to the web.
   If you send plastic to the landfill, there is pollution released into the ground and water...have the ZWAs holding the soil and clean water cards drop out of the web. Observe what happens to the web.
   When you no longer have clean water and soil, the tree cannot grow and make apples and leaves...have the ZWAs holding the tree and leaves cards drop out of the web. Observe what happens to the web.

   Emphasize connections and, as you introduce each different scenario, discuss who and what will be affected. After each new scenario, observe whether the web of life is growing stronger or weaker. Soon, students will see how everything is connected and affected by natural and unnatural factors in the environment.

Activity 8.E: Eco-Friendly Recycle Mobiles

Time: 45 minutes

SUMMARY

This activity will give the ZWAs an opportunity to think about the different things that they throw away everyday that may be reused or recycled to make other items.

MATERIALS

- Wire hangers
- Scrap papers
- Magazines
- Other recyclables (plastic bottles, jars, cans, small cardboard boxes, etc.)
- Scissors
- Glue
- String

METHOD

1. Collect an assortment of items that are ready to be recycled or thrown away.
2. Show the assortment of items to the ZWAs and have them select a variety to use to create their mobile.
3. ZWAs may cut scrap papers into different shapes and then attach the paper shapes as well as other items to a wire hanger to make a decorative mobile.
4. While the ZWAs are working, discuss the other things that they use everyday that can be reused or made into recycled art.

Activity 8.F: Form a Zero Waste Ambassadors Club (or a Green Team)

Time: Ongoing

SUMMARY

A Zero Waste Ambassadors Club (or Green Team) can be a great way to work with a focused and interested group of students to teach more about zero waste in a fun hands-on way. Projects can be used to educate the ZWAs themselves or to educate a broader community (other students, school staff, parents, neighborhood).

METHOD

1. Identify an adult sponsor (teacher or parent) and other adult volunteers.
2. Determine the age group of students for the ZWA Club. The students can include all ages or target certain grades of students.
3. Set a meeting day/time. Some clubs meet during lunch once or twice a month and others meet after school.
4. Use the activities listed in this lesson to help plan fun "meetings" and projects for the ZWA Club.
5. Take fun photos to document the success of the ZWA Club.

From the ground up: Stories of ZWAs in action

District 97 Irving Elementary School in Oak Park, IL, has a teacher-led L.I.V.E. Green Team environmental club, comprised of students from different grades (Kindergarten, 2nd, 5th, and student council members). The mission of the L.I.V.E. Green Team is to:

Learn about the environment,
Invest time and ideas in promoting green living,
Value the earth and environment, and
Educate others on how to live green.

Students from each of these groups are taking an active role in facilitating the collection of recyclable paper each week and auditing the school's progress toward recycling goals. Student ambassadors continue to assume additional leadership, under the guidance of the staff lead, to help the student population fully embrace the Zero Waste Project goals.

Activity 8.G: Guest Speakers

Time: 30 minutes

SUMMARY

Set up a rotation of guest speakers to address key zero waste topics. Speakers might include: a local sustainability director, a Master Composter, a local parent who raises chickens, a local EPA employee (to talk about water and how water gets polluted via runoff or to talk about waste reduction strategies in your region), waste or recycling hauler, commercial composter, local landfill, city or county public works department, or department of environmental quality.

From the ground up: Stories of ZWAs in action

District 97 Holmes Elementary School in Oak Park, IL has an Eco Heroes Curriculum for their ZWA Club. This curriculum provides for 8 weeks of having either a guest speaker come to their club meetings or for the ZWAs to take a club "field trip".

Activity 8.H: Harvest Celebration Meal

Time: 3-4 days planning + 4 hour event

SUMMARY

Work with ZWAs to host a harvest celebration meal using food grown in the school garden. A local chef may be willing to work with you to prepare a meal using the garden harvest as well as other ingredients.

METHOD

In addition to celebrating your garden, use the harvest meal as an opportunity to educate guests about your zero waste efforts:

- Serve the meal on reusable dishware (ask everyone to bring their own plate and cup to the event or use ones owned by the school). You may need arrangements for washing the dishes after the event.
- Set up a resource recovery station for the event to sort recyclables, compost and landfill.
- Use schools signs for resource recovery stations so guests not only know how to sort their waste at the end of the event but understand how sorting is happening in the school.
- Demonstrate composting if this is happening at your school (show worm bins or compost pile).
- Have a display of student-created zero waste posters or art at the harvest dinner.

Another option is to have a Harvest Soup event as the school garden is taken down for the season. Garden vegetables can be made into a soup and offered to the school community at the end of a school day.

Activity 8.I: Invite a Master Composter

Time: 45 minutes per presentation

SUMMARY

Master Composters have been taught the art and science of urban home composting and techniques for teaching others. They can teach about the essentials of indoor/outdoor composting, science of composting, anatomy of a landfill, and more. Invite a Master Composter in to teach the students about compost.

METHOD

The University of Illinois Extension Program has a Master Composter certification course. Master Composters who go through this program then volunteer their time teaching about and supporting composting in their communities. Contact the program to schedule a presentation. Presentations have a small fee to cover the costs of materials. Contact information: Nancy Kreith at kreith@illinois.edu, call 708-679-6889, or visit http://web.extension.illinois.edu/cook/chicagomg/. Check your local university extension office, area gardens or arboretums, or garden supply store for local resources.

Activity 8.J: Jobs in the Classroom for ZWAs

Time: 45 minutes

SUMMARY

This activity works to define how waste will be reduced in the classroom and gives students the opportunity to take leadership roles in the classroom on an ongoing basis.

MATERIALS

- Poster board
- Writing utensils/markers
- Magazines with pictures to cut out
- Recyclable items from class
- Scissors
- Glue
- Optional: Clothespins (1 for each student)

METHOD

1. Talk about ways the class can reduce waste going to landfills from the classroom. Write down these ways on the blackboard. Some examples might include: recycling all paper, using both sides of a piece of paper before it gets recycled, having a drive to collect used school supplies at the end of the year, etc.
2. Create jobs that would help with these ways to reduce waste. Some examples might include Classroom Recycling Champion, Classroom Reusing Champion, Classroom Reducing Champion, Classroom Compost Champion.
3. Split the class into groups. Each group will get one job and each group will create specific tasks for the job. Example: Recycling Champion will be in charge of making sure that all students in the class know what can and cannot be recycled. Each group will create a poster showcasing the job and the tasks.
4. Now that each of the jobs are created, these jobs will either be incorporated into the current classroom job system or create a new "Zero Waste" job circle. Each job will get one piece of the circle. Each child's name should be written on a clothes pin and rotated from job to job. Note that with four jobs available, rotating every week or two should allow every ZWA a chance to work in each area.

From the ground up: Stories of ZWAs in action
Chicago Public Schools George Washington Elementary School has a classroom with the rotating job of Recycle Police. The teacher made a poster outlining the job and students each take a week long rotation. The student "officer" wears a badge and has responsibility for helping make sure all of the students sort their waste appropriately every morning after they eat breakfast in the classroom.

Activity 8.K: Kid-Run Events to Celebrate Earth Day/Earth Month

Time: 60 minutes to 1 day

SUMMARY
Celebrating Earth Day or Earth Month is an exciting way to get everyone in the school involved in zero waste efforts.

METHOD
Have the ZWAs plan events for the day/month that educate and excite. Here are some activities to consider for Earth Day/Month:

- Conduct a waste audit at your school so that everyone can see opportunities for recovering resources.
- Ask individuals make a written pledge for one thing they can do daily to take care of the Earth. These can all be written on a large poster board and displayed in the school.
- Organize an environmental fair to highlight green programs in your school.
- Make games out of reusable or recyclable materials.
- Have an environmental parade.
- Create a song, poem, skit, cartoon, announcement, etc. about Earth Day and a resource recovery strategy (reuse, reduce, recycle, compost).
- Read a book about the environment and discuss the book with friends and other ZWAs (or read a book to younger students at your school).

From the ground up: Stories of ZWAs in action
The Solid Waste Agency of Northern Cook County (SWANCC) creates an "April Environmental Awareness Calendar". Each day offers a tip of how to reduce waste or take care of our environment to benefit future generations. There are many websites included to keep your eco-friendly actions going all year long! http://swancc.org/education-sp-2198/earth-day-activities/earth-day-activities

Activity 8.L: Litter Cleanup Walk

Time: 45 minutes

SUMMARY
This activity will show ZWAs the importance of keeping the environment clean. It will encourage them to pick up **litter**, something not disposed of properly, whenever they see it. They will also learn how litter can harm animals and others. A litter cleanup walk can be around the school grounds, on blocks in the neighborhood, or at a local park.

MATERIALS
- Bags for litter and recycling
- Gloves

METHOD
Go on a short walk and pick up litter along the way. Following are a couple tips:

- Come prepared with something to hold the litter you find. This is a good way to reuse a plastic bag. Consider having multiple bags so that you can have recycling in one and garbage in another.
- Discuss the ground rules before going out. Here are a couple suggested rules:
  1) wear gloves at all times
  2) do not touch anything sharp (broken glass, needles, etc.) - ask an adult to collect those items
  3) do not touch gum or cigarettes
  4) do not go on private property
- Go with friends. It is amazing to see ZWAs turn litter cleanup into a game that keeps everyone involved and having fun.

With each piece of litter collected, take time to discuss whether it could be a resource or not. If you find items that could be harmful to animals, talk about why they are harmful (eg. plastic rings that could get caught around birds beaks or legs, etc.). After the litter cleanup is complete, take the opportunity to allow the ZWAs to observe the contents of their collection bags.

Are there items they collected that could have been reused?
Recycled?
What was the most common item they found?

Encourage the ZWAs to never litter and to pick litter up and throw it away when they see it.

From the ground up: Stories of ZWAs in action
Alcuin Montessori School in Oak Park, IL, brings zero waste to after school programs. Their Daisy Scout Troop went on a litter cleanup walk around the neighborhood and then discussed reuse and recycling in terms of items they found on their walk. The Daisies were excited to realize that the plastic bottles they found could be recycled and made into reusable bags, new plastic bottles, or even some of the clothing they were wearing.

Activity 8.M: Movie Night with Waste Free Awards
Time: 3 hours

SUMMARY
Movie night is a great way to showcase how easy it can be to be zero waste while enjoying a family friendly event.

METHOD
Schedule a time to watch a movie with a theme related to the environment. Consider having incentives for bringing your own water bottles and biking/walking to the event. One example might be having popcorn and lemonade for anyone who brings their own reusable cup/bottle/bowl. When we think of a recent kids movie about the environment, The Lorax is one that may come immediately to mind. There are a number of fun movies out there that address environmental issues. We have listed some from the Smithsonian's Top 10 list (2011) as well as The Daily Green's best green movies for kids (2008). Enjoy!

Following is a 2011 list of the Smithsonian's Top 10 kids movies with a green theme:

1) FernGully: The Last Rainforest — This 1992 animated film depicts a magical rainforest inhabited by fairies but threatened by destructive loggers. When the loggers cut down a tree and release the evil spirit Hexxus, Crysta, the fairy protagonist, and her friends (including lumberjack Zak, whom Crysta shrunk

down to miniature size to save his life) must find a way to defeat the pollution-loving demon and save their home. The movie's message is overtly conservationist, villainizing destructive humans and urging viewers to do what they can to preserve the wilderness areas still left on Earth.

2) WALL-E — This hit film from 2008 takes place 700 years in the future, when the Earth has been reduced to a deserted, trash-covered ghost town. Robot WALL-E seems to be the last sentient being on the planet, as all the humans have fled to gigantic space ships that hover in outer space. One day, one of those ships comes to Earth, bringing advanced robot EVE, with whom WALL-E falls in love. He follows her back to space, and his adventures there eventually convince the humans they must return to Earth. The state of the Earth in the movie urges viewers to take notice of how their actions are affecting the environment and warns of what might happen if they don't.

3) Bambi — The classic animated film from 1942 tells the story of a young deer and his friends who live in a forest threatened by hunters. When Bambi is still a fawn, his mother is killed by one of those hunters, and he must grow up without her. Bambi and his friends get older and Bambi falls in love with another deer, Faline. Everything is peachy until the next day, when the forest goes up in flames and Faline is attacked by hunting dogs. Bambi is able to save her, and the couple eventually escapes to an island in a lake, where they live (at least we expect) happily ever after. The scene where Bambi's mom dies would make even the most hardened hunter think about setting down his gun.

4) Over the Hedge — When the forest animals, the main characters in Over the Hedge (2006), wake up from hibernation, they realize that half of their forest has been destroyed and replaced by a suburban neighborhood hidden behind a giant hedge. The animals, especially raccoon RJ, who is paying off a debt to an angry black bear, try to survive by stealing food from the humans who live on the other side of the hedge. The plot revolves more around the interactions among the animals than an environmental message, but some pointed comments are unmistakably meaningful: "That is an SUV," says RJ in the trailer. "It's so big!" respond the animals. "How many humans fit in there?" RJ's reply is priceless: "Usually…one."

5) Hoot — Based on a Carl Hiaasen novel, this 2006 film portrays the adventure of three middle-school students who try to protect a rare breed of endangered owls. The main character, Roy, just moved to Florida from Montana, and quickly makes friends with Beatrice and her truant stepbrother, "Mullet Fingers." The three set out to derail a greedy CEO in his construction of a pancake restaurant on the vacant lot where the rare owls live. Not exactly an award-wining movie, but definitely one that encourages kids to think about the relationship between humans, development and wildlife.

6) Star Trek IV: The Voyage Home — Whether this 1986 film can be considered a movie for kids is debatable, but its environmental undertones are clear. It's the year 2286, and a strange probe is approaching Earth, sending out signals that Spock determines match the calls of the extinct humpback whale. The probe is wreaking havoc on Earth, so the crew of the USS Enterprise decides to go back in time to 1986, where they find two whales in a San Francisco aquarium. A curator there explains to the crew members why the whales are endangered. They take the whales back to the future with them and release them in the San Francisco Bay, where the giant mammals answer the probe's signal and stop the destruction. Logical? Maybe not. But with an environmental message? Most definitely.

7) Free Willy — Another movie with whales and an environmental message, Free Willy was a hit in 1993. It features a young boy who befriends a recently captured orca whale in a local aquarium/amusement park. The boy, Jesse, and the whale, Willy, bond, but Willy is in danger because he doesn't perform tricks well and therefore doesn't earn much money for the park. The park owner and his cronies threaten to kill Willy, so Jesse decides to release the whale into the wild. There's no mistaking the villains in this movie—the park owner, who exploits animals, and the whalers who capture Willy—or the message that wild animals are better off left alone.

8) Disneynature's Oceans — Though a bit more subtle than some of the other films on this list, Oceans still makes an impact. A documentary released on Earth Day in 2010, the film explores the underwater world that covers three-quarters of our planet. While it spends much of its time depicting the weird, wonderful and beautiful life forms that the oceans have to offer, the documentary doesn't miss its chance to show the negative effects human actions can have on wildlife and urge viewers to respect nature.

9) Avatar – Again, it's debatable whether this is a kids' movie, but it's clearly a film with environmental themes. A paraplegic soldier travels to the planet of Pandora, where he, in the form of his avatar, integrates with the indigenous Na'vi people. He is supposed to help conquer the foreign land, but soon finds himself siding with the Na'vi. There are many themes in this 2009 film, but among them are a respect for the environment (demonstrated by the graceful Na'vi), our ultimate reliance on nature and the destructive nature of humans and how it affects the planet.

10) Happy Feet — The main message of this 2006 Disney movie is that it's okay to be different, but environmental themes work their way in as well. The film focuses on a young penguin, Mumble, with a talent for tap dancing—something none of the other penguins can do. It follows his adventures and quest for acceptance throughout the plot, but the environmental aspect shows up when Mumble is blamed for the scarcity of fish in the ocean, a nod to overfishing. In addition, one of Mumble's friends wears a set of plastic six-pack rings around his neck like jewelry, only to later be choked by the piece of trash. Happy Feet is an example of the environment showing up in movies that are not directly about the environment.

The following are a few additional movies from the best green movies from The Daily Green:

Finding Nemo (2003) — A clownfish is taken from his coral reef home and his fretful father braves the Australian waters to find him. Best line from Bruce the shark: "I am a nice shark, not a mindless eating machine. If I am to change this image, I must first change myself. Fish are friends, not food."

Homeward Bound: An Incredible Journey (1993) — A live action remake of the Disney classic-three pets (two dogs and a cat) trek hundreds of miles over the Sierras and through forests to be reunited with their human family. Lassie's got nothin' on these three.

The Lion King (1994) — It was a whole new world when this Hamlet meets Bambi tale became the highest grossing animated film of all time (since then, "Finding Nemo" has taken the crown). Nothing teaches kids the meaning behind the circle of life better than Simba and company.

Arctic Tale (2007) — A National Geographic documentary from the folks who brought us "March of the Penguins." It's both wondrous yet heartbreaking as we watch a walrus and polar bear from birth to maturity as their winter wonderland melts beneath them.

Rescuers Down Under (1990) — A boy rescues a trapped great golden eagle and befriends her. Although this movie underperformed at the box office, five of the film's creative team traveled down under to observe firsthand, then managed to magnificently capture, in animated form, the outback's unique beauty.

A Bug's Life (1998) — The Pixar crew watched "bug cam" footage to make the bug's eye view authentic. Even the animated bug character traits are bona fide- in a bar scene, a snail orders a dish with "no salt." As Hopper the grasshopper explains, "It's a bug-eat-bug world out there, princess. One of those Circle of Life kind of things. Now let me tell you how things are supposed to work: The sun grows the food, the ants pick the food, the grasshoppers eat the food…"

Activity 8.N: Native Bird House

Time: 45 minutes

SUMMARY

Make a birdhouse out of milk cartons and other scrap recyclables. This may be a functional birdhouse, designed to attract native species of birds or it could be a decorative birdhouse.

MATERIALS

- Empty 1 qt milk carton
- Stapler
- Masking tape, duct tape
- Colored papers
- Glue
- Permanent markers
- Scissors or small precision knife - adult supervision recommended
- Screwdriver (to poke hole)
- Twine
- Optional: small twig

METHOD

Determine if the birdhouses will be decorative or functional. If they are going to be hung outside, decorate with duct tape and markers. If it will be decorative, colored paper can be glued on the outside as well.

1. Rinse out the carton thoroughly and let it dry.
2. Close the carton and staple it shut. It should look like it did when it was bought.
3. Cover the entire carton with masking tape or duct tape (tear or cut 2-3" long pieces and overlap the edges slightly to make sure the carton is completely covered.
4. Make a door by cutting (or having a grownup cut) a circle that is 1 - 1 ½ inches in diameter. The door should be about 4 inches above the bottom of the carton.
5. Make a perch inside the birdhouse by poking holes in opposite sides of the carton and sticking a twig through the holes.
6. Decorate your birdhouse. Ideas include:
    - Color with markers (waterproof)
    - Glue moss to the outside
    - Glue decorative fabric to the outside
    - Find other items to glue (small sticks, rocks, etc.)
7. Make a few holes in the bottom of the carton to allow any water to drain out. Also put a couple holes near the top for air.
8. Poke a hole through the very top of the house (where the milk carton forms a peak) and string a piece of twine through it. Tie a knot in the twine.
9. Hang your birdhouse in a tree and keep watch to see when the birds move in.

Activity 8.O: Organize a Paid Performance (Imagination Theatre's Go Green Performance)

Time: 50 minutes

SUMMARY

There are a number of groups that can be paid to come perform or present for your ZWAs or for the whole school.

METHOD

The following are examples of some of the groups that can come and do environmental presentations at schools:

Imagination Theater

Environmental issues like climate change and eco-awareness can be pretty daunting for kids. Thankfully, students can exemplify environmental responsibility in a variety of manageable ways! This show empowers youth to take some little steps that make a huge difference. It's important to understand one's role in the big picture and their interactive scenes and role plays succeed in doing just that. Students learn practical things they can do today to benefit the earth. Most importantly they learn to think about their daily routine and see how they can choose to go green! Great for Earth Week.
Different Versions For Grades K-8
Audience Max. 250
Show length: 45-50 minutes
Imagination Theater's "go green" performance for grades K-5.
http://www.imaginationtheater.org/

Food Play

An Emmy-winning national organization that travels all over the country. FOODPLAY is a great way to engage your students and get them excited about healthy habits. This 50-minute, dynamic performance uses fantastic feats of juggling, comedy, magic, music, dance, and tons of audience participation to get students excited about making healthy choices. They will learn how to:

- Increase fruit and vegetable consumption
- Increase daily physical activity
- Read and understand food labels
- Select a balanced diet with MyPlate
- Reduce intake of empty calories, sugar, fat, salt, and additives.
- Balance calorie intake with calories expended

And much more!

Their assembly performance can be followed-up with their standards-based resource materials. These include everything your school needs to incorporate nutrition education and reinforce healthy eating throughout the school year: lesson plans, activity sheets, resource packets for food service, nurse, and parents, interactive DVD's, fun storybooks, and a quarterly newsletter for parents.
The following is a link to their promotional video: http://m.youtube.com/watch?v = eaa9JMAEEa4&feature = relmfu

Live falcon talk/session from the International Heritage Conservancy

(related links are as follows)
http://www.internationalheritageconservancy.org/
http://oppl.org/about/library-information/library-news/kids-meet-falcon-and-learn-falconry-march-5

Activity 8.P: Poster Contest

Time: Choose the length of time the contest will run

SUMMARY

ZWAs can plan a poster contest to encourage other students at school to showcase their artistic talent and their commitment to the environment by participating in a recycling or reuse poster contest.

METHOD

Have the ZWAs plan the contest. The following could be considered:

Prizes: Pick the # of winners and determine what they will be awarded. Will there be a winner for each grade? Each class? Following are a few ideas for recognizing the winning entries: display winning posters in the school, display winning posters in the local library, municipal building or a local business, feature 12 winners in next year's school calendar, give winners a copy of their artwork in a recycled-content frame.

Eligibility: Will all students from the school be eligible or only certain grades?

Poster Requirements: Posters created by students must be their own original artwork. Copyrighted characters (such as Superman) or copyrighted clip art will not be accepted.

Materials: Consider giving guidelines as far as the size of the posters, media to be used, etc. If the winning posters will be displayed or framed, set the size and layout to meet the needs of the display. Following is an example of guidelines you might set:

> Students may use a variety of media, such as watercolor, pen and ink, crayon, chalk, markers, computer graphics, etc. Brighter colors reproduce better, light pencil marks will not show up. Students are encouraged to incorporate recycled or recyclable materials in their creations. NOTE: If students are incorporating recyclables into their artwork, depth is restricted to half an inch.
>
> Size & Layout: Minimum: 8 ½" x 11"
> Maximum: 11" x 17"
> LANDSCAPE LAYOUT ONLY

Themes: Will the poster contest have a theme? The following are a few examples to consider:

- The benefits of waste reduction, recycling, composting, and buying recycled products
- I Like Recycling Because…
- Landfilling Organics Stinks - Compost is Best!
- Plug In to E-cycling, Stop Trashing the Climate

Judging Procedure: Will posters will be grouped into grade categories or all judged together? Who will select the winners? The principal? The Zero Waste Ambassadors Club?

Activity 8.Q: Quirky Recycled Art Show

Time: 60 minutes

SUMMARY

ZWAs can turn trash into treasure by using their creativity to turn one man's junk into art. Consider working with an artist or art teacher with the goal to encourage students to see art in everything, and to spread an underlying message of reducing waste.

METHOD

1. Materials can be obtained through student collections, community donations or through funding from a PTA or other group.
2. Allow ZWAs time to discuss and sketch potential pieces before beginning to create them.
3. Once complete, consider displaying the art around the community. Possible locations might include the local library, municipal building or a local business, the school or even holding an artists' reception.

Activity 8.R: Resource Recovery Relay Race

Time: 30 minutes

SUMMARY

The Resource Recovery Relay Race helps teach students to understand that many items we consider to be waste, can be reused or recycled. It also emphasizes that the best option is reuse, then recycling, then finally landfill. Students who find a way to reuse or recycle items will win.

MATERIALS

- 3 labeled boxes/buckets: 1 recycle, 1 reuse, and 1 garbage
- 2 boxes of clean "garbage" (Assemble items that might typically be thrown away. Include reusable and recyclable items.)

METHOD

1. Collect items to create a pile of reusable, recyclable, and landfill/garbage items - about 20, depending on the age of your group. This pile is called the Sorting Pile.
2. Set up three boxes/buckets: 1) one for Reuse, that is placed closest, 2) one for Recycling, that is placed mid-way, and 3) one for Landfill/Garbage, that is placed the furthest away.
3. Divide ZWAs up into teams of 3-4 students based on the size of your ZWA Club. Explain that each team will line up and one team member at a time will go to the Sorting Pile, select an item, determine which bucket it belongs in (Reuse, Recycle, Landfill) and put it there. As soon as they return to the line, the next team member will take their turn.
4. If you have a large group, each relay team can have their own Sorting Pile.
5. The team that finishes first wins. This can mean that every ZWA has gone once, twice, or that all items in the Sorting Pile have been sorted.

Activity 8.S: Scavenger Hunt

Time: 30 minutes

SUMMARY

This recycling scavenger hunt is designed to help students identify the variety of resources that can be recovered through recycling.

MATERIALS

- Recyclable items
- Checklist of items (with words and pictures)
- Writing utensil

METHOD

1. Prior to this activity, have the ZWAs bring in recyclable items so that you have a big bag of items for this activity. Suggested items might include: assorted plastic - #1, 2, 3, 4, 5, 7 (ie: plastic water bottle #1, yogurt container #5), various paper items (cardboard box, paper that has been used, paper made of recycled content, magazine, toilet paper or paper towel roll), and metals (soup can, aluminum foil).
2. Make a checklist of the items to create a scavenger hunt guide for the students. Students will be able to check off as they find each item.
3. Place the items around the room, or spread them out on the floor (setup may differ depending on the age of the ZWAs).
4. Give each student (or teams of students) the checklist and have them go through a pile of stuff and obtain one of each item. Not only does this educate them on what can be recycled, but it gets them to consider some options (like magazines) that they may not have known are recyclable.
5. Consider an eco-friendly reward like a hand stamp for every ZWA who is able to find all of the items.

Activity 8.T: Take the Egg Challenge (sustainable packaging)

Time: 60 minutes

SUMMARY

This activity is adapted from http://www.kidsciencechallenge.com/pdfs/2011activities/Zero-Waste_Egg-Drop-Challenge.pdf. Protect the Egg Challenge asks students to design a package that keeps an egg from breaking when it is dropped from 10 feet in the air. The challenge for ZWAs is to make a sustainable package that is strong enough to keep an egg in one piece while using as little packaging as possible.

MATERIALS

- Raw egg
- Sheet of newspaper
- Masking tape
- Some of the following materials: cardboard, cotton, toilet paper, socks, glue, straws, plastic bags, balloons, material scraps
- Paper and pencil to record process and results
- A ladder or a second-story window to drop the egg from
- Timer
- Scale (optional)

METHOD

Have the ZWAs research packaging and learn about what makes a package sustainable. It is important not to use too much packaging, but some packaging is necessary.If you do not package some products, they will go bad or break while being transported. The goal of this activity is to use packaging that won't harm the environment and to use as little packaging as possible while protecting the egg.

1. Design a package that will keep a raw egg safe, even when it is dropped from 10 feet in the air. Brainstorm what to do to keep the egg safe. Which materials will you use? How will you put your package together?
2. Work with a sheet of newspaper and tape. Other materials include those listed for this activity. You may choose from any of the materials listed in this activity and you may not use any materials that are not on the list.
3. Do not change the egg in any way. For example, do not paint the egg or coat it with anything.
4. Decide on a design, gather the materials and start building.

5. Weigh the package (if you have a scale). Remember that you are trying to build a package that protects the egg but does not use too much packaging. The package should be both strong and lightweight.
6. When done, test the package. Go to a second story window (or climb up a ladder). Have an adult supervise!
7. Drop the package and check it out. Did the package keep the egg safe?

Activity 8.U: ReUsable Lunch Materials Sale (fundraising opportunity)

Time: 1-2 days planning + length of fundraiser

SUMMARY

In addition to raising funds for zero waste programs, a reusable lunch materials sale provides a great opportunity for ZWAs to research, calculate and compare costs of using disposable vs.reusable lunch products. Students can hypothesize and draw conclusions to present to their class. Does packing a waste-free lunch save money? If so, how much money can be saved by one student in one school year?

METHOD

Compare the costs of taking a disposable lunch vs. reusable lunch

- buying paper lunch bags vs. reusing a cloth, stainless steel or recycled plastic lunch box or bag
- buying packaged food in prepackaged, single-serving sizes vs. making food from scratch, buying food in bulk and packing lunch in large jars or cans that work as reusable containers
- buying juice boxes and water in plastic bottles vs. refilling and reusing a stainless steel water bottle
- buying plastic bags, foil and plastic wrap vs. reusing stainless containers or recycled plastic food kozys
- buying paper napkins vs. reusing cloth napkins
- buying plastic utensils vs. reusing utensils

Source and sell the reusable lunch items as a zero waste fundraiser.

Fun fact: The Center for Ecoliteracy reported: "An average elementary school student eating homemade lunches is estimated to generate between 45 and 90 pounds of Ziploc™ bags, foil pouches, and other packaging waste each year, roughly equivalent to the body weight of a third- to sixth-grader."

Activity 8.V: Video Making - Create one about Zero Waste

Time: 1-2 weeks

SUMMARY

Have the ZWAs plan and make a video of how to recycle in the classroom. This video can be shown in every classroom or at a school assembly to help educate other students on the importance of recycling and how easy it can be to choose to recycle.

METHOD

Have the ZWAs create a video to educate other students about reducing waste in the school. The ZWAs can write the script, select actors, set the stage and create a fun way to educate others. It may be possible to get a middle school or high school student to be the videographer for your project.

From the ground up: Stories of ZWAs in action
The District 97 Hatch Elementary School Green Team in Oak Park, IL, created the video Hatch Green Team Project 2013 on the school's new compost program. A high school student was the videographer and the green team actors demonstrated the new process in the school lunchroom. The video was shown in every classroom to help prepare students for how they would need to sort their trays after each lunch. View the video at: http://youtu.be/ViuoLe84v-o

Activity 8.W: Waste Free Wednesdays (waste free lunch day)

Time: 1-2 days planning + 20-30 minutes per lunch

SUMMARY

Zero Waste Lunches are a fun way to both reduce waste and to draw attention to what students and families can do to make a difference. On average, a student using a disposable lunch generates 67 pounds of waste per school year which equals 18,760 pounds of lunch waste for just one average-size school.

METHOD

Switching to Waste Free Lunches is a learning process for families. Keep in mind that not all families can afford to switch everything at once. It may help to provide low cost items for sale through the school. It is also good to focus on the savings parents will see from buying lunch items in bulk and not needing to buy bags and wraps in the future once they have reusable containers.

Here are a few suggestions for reducing lunch waste:

- Pack a reusable drink container instead of disposable juice boxes, juice pouches, cans, and plastic bottles.
- Pack lunch items in reusable containers. Avoid using plastic wraps, plastic bags, wax-paper bags, and aluminum foil.
- Avoid purchasing pre-packaged items. Buy foods in larger bulk containers, put a single serving in a reusable container, and leave the big package at home for recycling.
- Pack lunches in a lunch box or backpack instead of paper or plastic bags.
- Pack stainless-steel utensils instead of using disposable plastics.
- Pack a cloth napkin instead of a paper napkin.

Waste Free Wednesdays are a fun way to celebrate at school and to encourage students to work on bringing waste free lunches. Some ideas might include having Waste Free Lunches every day for the week that they celebrate Earth Week. Other schools incorporate this into celebrating Earth Month in April. There can be a competition between classes and the winning class gets the Golden Lunchbox award. Or reward the winning classroom every month with a popcorn party. Get creative and keep this fun for the students as well as their parents.

From the ground up: Stories of ZWAs in action
At District 97 in Oak Park, IL, each of the elementary schools has incorporated Waste Free Wednesdays into their school lunches. At one school, a flyer was sent to each home explaining the concept of Zero Waste Lunches and giving examples of how to pack one. Wednesdays in May were designated as "Zero Waste Wednesdays" and students bringing lunch from home were reminded to bring Zero Waste Lunches on those days. Parent volunteers and student Waste Ambassadors stamped students' hands with eco-themed stamps as rewards for Zero Waste lunches. The promotion of Zero Waste lunches began with a display of Zero Waste lunch choices vs. non-Zero Waste lunches at the first PTO meeting as well as at the Curriculum Nights held for all grade levels. Through November of the following year,

students were encouraged to bring Zero Waste lunches once a week and were rewarded with a hand stamp. After that, Zero Waste Lunch days were no longer pre-announced, but rewards were given out periodically.

At another elementary school, families received a flyer in advance outlining what the lunch meant and what kind of items were and were not recyclable or compostable. The principal made repeated announcements on the loudspeaker to remind students in advance. Teachers talked to students and parents about it and incorporated the event into their activities. For example, one first grade class was given the homework assignment of packing their own zero waste lunch for the event. One second grade class volunteered to act as helpers in the lunchroom that day, directing all students on how to sort their lunch. Students who purchased lunch from school were encouraged to only take what they thought they would eat (within school nutritional guidelines) and to try not to waste items on their tray. Students who brought lunch from home were asked to be mindful of the packaging they used so that it could either be returned home for re-use or be recycled in the cafeteria. All students were provided guidance on what they could recycle, what could be composted, and what had to be thrown in the landfill trash. Students seemed very enthusiastic about the experience. Instead of the usual 6-8 bins full of trash (and no recycling or compost), they had less than 1 bin of landfill trash, with 4 overflowing bins of recycling and half a bin of compost. (The bins used were 32 gallons.) They planned to have one Zero Waste lunch a month.

Activity 8.X: Seed Exchange

Time: 1-3 days planning + 3-4 hours per swap

SUMMARY

At local seed exchanges, you can give and receive garden seeds and plants. You can also save money that you would have spent on buying seeds at a store. There are lots of benefits to swapping seeds with neighbors.

METHOD

1. Choose a time and place.
2. Publicize your seed swap.
3. Invite speakers. Contact your local gardening groups to find experts who know how to save different kinds of seeds, and can get folks fired up about why to save and share seeds.
4. Request seed donations from local gardeners or seed companies in advance, to bolster the offerings that people will bring.
5. Print off some handy articles about seed-saving and other gardening techniques to distribute to the gardeners who attend your seed swap.
6. Label everything clearly. Bring plenty of little dishes, or baggies and markers, to help gardeners divvy up and identify everything. Ask seed and plant donors to write down everything they know about their seed that might be helpful.
7. Host a contest to make the event more fun! Prizes could go to the gardener with the widest variety of seeds, the attendee who traveled the farthest, the youngest or oldest gardener, etc.
8. When it's all over, celebrate how it went. Share your story so that others may learn from your experiences.

Activity 8.Y: You Can Make a Difference

Time: 1-2 months

SUMMARY

Have the ZWAs choose and coordinate a school-wide campaign to make their school greener. This could be a paper saving campaign, a zero waste lunch campaign, or any other zero waste idea to reduce waste and recover resources.

METHOD

1. Select a goal (improve recycling, use both sides of a piece of paper before recycling - double-sided paper program, no car idling near the school, no more plastic water bottles, etc.).
2. Get baseline data. Measure how the school is doing before you start.
3. Work together to decide what will make a difference and what steps need to be taken.
4. Publicize the campaign. Make posters, announcements, signs and more.
5. Take photos throughout.
6. Measure impact of campaign.
7. Publicize and celebrate results.

From the ground up: Stories of ZWAs in action

At District 97 Longfellow and District 97 Mann schools in Oak Park, IL, students take part in promotion efforts, making hand-made flyers and posters to promote Zero Waste at the school as well as walk-to-school events and the "No Idling" campaign.

Activity 8.Z: Zero Waste Student of the Week/Month

Time: Determined by length of recognition

SUMMARY

Recognize the zero waste or green student of the week or month. Students who have made a difference by doing something to help the environment and reduce waste can be nominated by students, teachers, and parents.

METHOD

Have the ZWAs plan the contest. The following could be considered:

Nomination Process: Is there a nomination form to be completed and submitted? To whom will the nominations be sent?

Selection Process: How often will winners be announced (weekly, monthly, etc.)? Will nominees be grouped into grade categories or all considered together? Who will select the winners? The principal? The Zero Waste Ambassadors Club?

Recognition: Will winners be recognized through an announcement at school? On a school or classroom bulletin board? Will the broader school community be notified (notification sent home to parents, recognition in a local paper)?

Award: Is there an award for the Zero Waste Student of the Week/Month? A certificate, ribbon or trophy? The ZWAs can make a trophy out of garbage/recycling items that can rotate from winner to winner.

A ZERO WASTE CURRICULUM

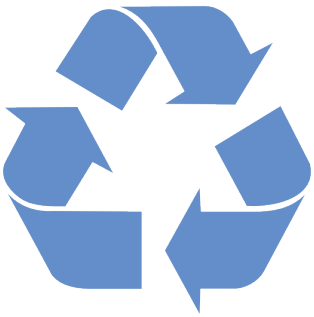
Worksheets

RESOURCE

COMPOSTABLE

RESOURCE

RECYCLABLE



WASTE

LANDFILL

Build a Landfill Worksheet

Hypothesis: _____

_____

_____

_____

_____

_____

Bottle 1
Materials:

_____

_____

_____

_____

Bottle 2
Materials:

_____

_____

_____

_____

Bottle 3
Materials:

_____

_____

_____

_____

Observations:

Bottle 1
Date: _____
Time: _____
Leachate: _____
Description:

_____

_____

_____

_____

Bottle 2
Date: _____
Time: _____
Leachate: _____
Description:

_____

_____

_____

_____

Bottle 3
Date: _____
Time: _____
Leachate: _____
Description:

_____

_____

_____

_____

Conclusion & Analysis: _____

_____

_____

_____

_____

_____

Turning Garbage Into Energy Worksheet

Assuming that you have 100 tons (200,000 pounds) of MSW, use the pie chart to determine the relative weights of each kind of material: paper, food waste, yard trimmings, plastic, metals, rubber, wood and glass. (For example, there will be 12 tons--or 24,000 pounds of plastic) Follow the steps and write your answers below.

a. Use the pie chart on the right to determine the percent (%) of total MSW (municipal solid waste or household waste) of each material in the table below.
b. Use the percent (%) of MSW to determine the tons of each material in your sample. Note that one (1) ton = 2,000 pounds. Round this to the nearest whole number.
c. Convert tons to pounds. Round this to the nearest whole number.

MATERIAL	Percent (%) of MSW	Tons in Sample	Pounds in Sample
Paper (newspaper, cardboard boxes, etc.)			
Food waste			
Yard trimmings			
Plastics			
Rubber, leather, textiles			

Let's take a closer look at these categories. Using the weights you calculated and the chart below, calculate the total energy that would be produced by the 100 tons of MSW in terms of BTUs (British Thermal Units). Show your calculations below.

The Energy Values Of Different Materials When Incinerated*

Material	BTU** per pound
Paper (newspaper, corrugated boxes, etc.)	7,500
Food Wastes	2,600
Yard Trimmings	3,000
Plastics	15,000 (11,000 – 20,000)
Rubber	10,900

*Source: Council on Plastics and Packaging in the Environment

**BTU (British Thermal Unit) is defined as the amount of heat required to raise the temperature of one pound of water one degree (Fahrenheit)

MATERIAL	Pounds in Sample	BTU per pound	Total energy
Paper (newspaper, corrugated boxes, etc.)			
Food waste			
Yard trimmings			
Plastics			
Rubber, textiles, leather			

TOTAL			

Calculate the approximate amount of energy produced by each material:
_____ pounds of material sample x BTU/pound = _____ BTUs produced

3. A "kilowatt-hour" is a method of measuring amounts of electricity. Assuming that 3,142 BTUs will generate 1 kilowatt-hour, how many kilowatt-hours of electricity would be generated from 100 tons of MSW? Show your calculations.

3. Ask your parents about your family's electrical usage:

How many kilowatt-hours per month do you use?

How many months would your house be able to run on the electricity generated by 100 tons of MSW?

Bottle Bonanza Worksheet

[sample - see appendix for full worksheet]

1. Where do students and staff get the water bottles they drink from in school?

Break up into small groups and brainstorm a list of where students and staff get the plastic bottles they drink at school. Come back together as a whole class and develop a complete list of locations. This list might include: brought from home, lunchroom, vending machine, etc.

Location 1 _____
Location 2 _____
Location 3 _____
Location 4 _____
Location 5 _____

2. Identify all of the places where students and staff do dispose of (recycle or put in the garbage) a plastic bottle. Indicate in each location if plastic bottles will be in the garbage, recycling or both.

Location 1 _____ ☐ recycling ☐ garbage ☐ both
Location 2 _____ ☐ recycling ☐ garbage ☐ both
Location 3 _____ ☐ recycling ☐ garbage ☐ both
Location 4 _____ ☐ recycling ☐ garbage ☐ both
Location 5 _____ ☐ recycling ☐ garbage ☐ both

3. Design a plan for collecting all of the plastic bottles used in school during one school day.

This may include having students with recycling containers standing in the lunchrooms, making signs to let students and staff know to put their bottles in a specified collection container, collecting plastic bottles from classroom garbage or recycling containers, etc. Write out the steps in your plan and who will complete each step.

STEP	LOCATION	WHAT IS NEEDED	PERSON RESPONSIBLE

4. Create a chart to keep track of how many plastic bottles were collected in each location.

If there is recycling available at the school, you might want to include how many bottles were being

recycled and how many were going into the garbage.

LOCATION	# OF BOTTLES BEING THROWN AWAY	# OF BOTTLES BEING RECYCLED	# OF TOTAL BOTTLES

5. Analyze your data. Use the data collected to answer/complete the following questions:

What percent of all the bottles collected were going to be recycled?

What percent of all the bottles collected were going to be thrown away?

Create a pie chart showing the difference between the bottles begin recycled and the bottles being thrown away.

6. Use the number of plastic bottles collected in one day to extrapolate.

How many plastic bottles are being disposed of in the school in one school year?

_____ x _____ = _____

bottles collected # days in school year # bottles used for the whole year

About how many plastic bottles are recycled during the school year?

_____ X _____ = _____

bottles recycled # days in school year # recycled for school year

Use ratios to figure the percentage of bottles recycled during the school year.

recycled : X

_____ ____

# of bottles 100

Exploring Our School Waste System

How many garbage dumpsters does your school have? _____

How much garbage does each dumpster hold? _____

How often does the garbage get picked up? _____

How full are the garbage dumpsters at collection time? _____

What company collects the garbage from your school? _____

Where does the garbage travel to? _____

How much money does it cost for the garbage to be picked up from the school? _____

How is the garbage cost determined (# of dumpsters, weight of garbage, etc)? _____

Does your school recycle? _____

What items does your school recycle? _____

Does your school have a recycling dumpster or container outside? _____

What company collects the recycling from your school? _____

How much money does it cost for the recycling to be picked up from your school? _____

What are all of the items your recycling company will collect?

Does each classroom have a recycling bin? _____

Does the office, library and resource center have recycling bins? _____

Does your school recycle in the lunchroom? _____

What does your school recycle from the lunchroom? _____

LUNCHROOM WASTE AUDIT DATA

School Name: _____ Date: _____

Person in Charge of Audit (Teacher, Administrator, Parent): _____

Have students sort items into collection containers (cans and buckets with signs) as they finish eating lunch. Students will sort their own items with help from Zero Waste Ambassadors and volunteers. All weighing, counting and recording will be done after lunch.

Item(s)	Count	Weight	Currently recycle/ compost/ collect?	List items (if applicable)
RECYCLING				
Milk cartons (count and weight)			☐ Yes ☐ No	
All Other Recycling			☐ Yes ☐ No	
TOTAL RECYCLING (combine weights above)			☐ **Yes** ☐ **No**	
LIQUID				
Liquid (milk, water, juice)			☐ Yes ☐ No	
COMPOST				
Food scraps - see below to determine which food scraps should be measured *			☐ **Yes** ☐ **No**	
LANDFILL				
Landfill - plastic bags, straws, Styrofoam, etc.				
TOTAL WEIGHT (combine green and orange boxes)				

* Determine which type of composting will happen at your school. A school compost program can usually compost only clean fruits and vegetables (no dressings or sauces on the veggies). A commercial compost program can compost fruits, vegetables, meats, dairy, bones, food-soiled paper, and more.

LUNCHROOM WASTE AUDIT DATA

School Name: _____ Date: _____

Person in Charge of Audit (Teacher, Administrator, Parent): _____

Have students sort items into collection containers (cans and buckets with signs) as they finish eating lunch. Students will sort their own items with help from Zero Waste Ambassadors and volunteers. All weighing, counting and recording will be done after lunch.

Item(s)	Count	Weight	Currently recycle/ compost/ collect?	List items (if applicable)
RECYCLING				
Milk cartons (count and weight)			☐ Yes ☐ No	
Plastic - water bottles, etc. (count and weight)			☐ Yes ☐ No	
Paper – paper bags, wrapping, etc.			☐ Yes ☐ No	
Glass – bottles, jars, etc.			☐ Yes ☐ No	
Aluminum – cans, foil, etc.			☐ Yes ☐ No	
TOTAL RECYCLING (combine weights above)			☐ **Yes** ☐ **No**	
LIQUID				
Liquid (milk, water, juice)			☐ Yes ☐ No	
COMPOST				
Food scraps for school compost - all clean fruits and veggies			☐ Yes ☐ No	
Other food scraps for commercial compost - all meat, dairy, eggs, etc.			☐ Yes ☐ No	
TOTAL COMPOST (combine weights above)			☐ **Yes** ☐ **No**	
REUSE				
Whole uneaten food (weight and list items with count)			☐ Yes ☐ No	__ apples __ packets of crackers __ bananas __ other _____
LANDFILL				
Plastic – ziplock baggies, saran wrap, straws, etc. (weight)				
Polystyrene lunch trays (count and weight)				
TOTAL LANDFILL (combine weights above)				
TOTAL WEIGHT (combine green and orange boxes)				

SCHOOL RECYCLING WASTE AUDIT

School Name: _____ Date: _____

Person in Charge of Audit (Teacher, Administrator, Parent): _____

Waste and recycling will be collected, sorted and measured from all parts of the building except the lunchroom (for a lunchroom audit, use Worksheet 7.B.1 or 7.B.2). Determine if there is a need to audit by room/office. If so, use a separate worksheet for each area. Otherwise, have all recycling and waste transported to a central measuring area. Sort into categories and record below.

BACKGROUND INFORMATION		
Item(s)		**Comments**
Is classroom paper recycled?	☐ Yes ☐ No	
Is office paper recycled?	☐ Yes ☐ No	
Can printers print double-sided?	☐ Yes ☐ No	Is this done ☐ most of the time ☐ some of the time ☐ none of the time
Can copiers copy double-sided?	☐ Yes ☐ No	Is this done ☐ most of the time ☐ some of the time ☐ none of the time
Are announcements sent home electronically (email)?	☐ Yes ☐ No	☐ paper ☐ both ☐ electronic
Do bathrooms have hand dryers?	☐ Yes ☐ No	☐ Hand dryers ☐ both ☐ paper towels

WASTE AUDIT DATA				
Item(s)	**Count**	**Weight**	**Currently recycle/ collect?**	**List items (if applicable)**
RECYCLING				
White paper (used only on one side)			☐ Yes ☐ No	
White paper (used on both sides)			☐ Yes ☐ No	
TOTAL WHITE PAPER (combine weights above)			**☐ Yes ☐ No**	
CARDBOARD				
Cardboard			☐ Yes ☐ No	

For assistance conducting a school waste audit, contact Seven Generations Ahead at www.sevengenerationahead.org or (708) 660-9909.

WASTE AUDIT DATA				
Item(s)	**Count**	**Weight**	**Currently recycle/ collect?**	**List items (if applicable)**
OTHER PAPER				
Magazines			☐ Yes ☐ No	
Bills, mail, envelopes, etc.			☐ Yes ☐ No	
White paper (used on one side)			☐ Yes ☐ No	
TOTAL OTHER PAPER (combine weights above)			☐ **Yes** ☐ **No**	
OTHER RECYCLING				
Plastics			☐ Yes ☐ No	
Metals			☐ Yes ☐ No	
Other			☐ Yes ☐ No	
TOTAL OTHER RECYCLING (combine weights above)			☐ **Yes** ☐ **No**	
LANDFILL				
Landfill - plastic bags, Styrofoam, etc.				
TOTAL WEIGHT (combine green and orange boxes)				

NOTES:

A ZERO WASTE CURRICULUM

Glossary

Glossary

Aerobic/Aerobic Decomposition: With oxygen / During the composting process, certain bacteria need oxygen to break down the mix of organic materials. This is known as aerobic decomposition. Because it is exposed to oxygen, carbon dioxide is produced instead of methane.

Aluminum: A hard, yet lightweight metal we get from a mineral called bauxite found in the earth's crust. Infinitely recyclable, aluminum can be used again and again without losing its main properties.

Anaerobic/Anaerobic Decomposition: Without oxygen / In a landfill, certain bacteria decompose organic materials without oxygen and create methane gas through a process known as anaerobic decomposition. When waste buried in a landfill does not receive oxygen, it will produce methane.

Ash (also combustion ash, fly ash, bottom ash): Solid residue that remains after the combustion, or burning, of waste. Fly ash is more of a potential health hazard than bottom ash as it often contains high concentrations of heavy metals.

Backyard composting: Composting outside; typically in a bin or a pile that can break down food scraps (except meat and dairy products) and yard waste. The practice of collecting leftover kitchen scraps (excluding meats and fats) and yard trimmings for decomposition in a private compost pile. Backyard composters can use their compost as a soil enhancement for their gardens.

Biodegradable: Materials that can decompose, usually by bacteria or sunlight, into basic components. Most organic materials (paper, grass clippings, food scraps), under the right conditions, are biodegradable.

Browns: Compost materials that are high in carbon such as dead leaves, dried grass clippings, and woody materials like brush

Bulk: When food or other products are sold unpackaged or in large volumes to reduce packaging waste. Consumers who buy one large bottle of juice rather than many small containers of juice, for example, are "buying in bulk."

Carbon: A non metallic element found in all organic compounds. All organic matter is made up of substantial amounts of carbon combined with lesser amounts of nitrogen. Carbon provides energy. The brown material used in composting provides carbon.

Carbon dioxide: A naturally occurring gas in the atmosphere, released by oceans, decaying vegetation, and the respiration of living creatures and plants. Also a greenhouse gas created by human activities such as fossil fuel combustion.

Carbon-to-nitrogen ratio (C:N 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

Commercial composting: Composting in an industrial facility that can break down all food scraps (including meat and dairy products) and yard waste and turn it into nutrients for soil.

Compost: A mixture of decaying organic matter, as from leaves, yard waste and food scraps that can be used to improve soil structure and provide nutrients. To convert (vegetable matter) to compost.

Composting: Nature's way of recycling organic wastes like food scraps and yard trimmings. It is a part of the nutrient cycle of life and returns needed nutrients to the soil.

Consumer: A person who buys products or services that they will use. They make the decision whether or not to purchase an item at the store.

Conserve: To use wisely, avoiding waste.

Decompose: To decay, to rot; to break down into basic elements given the right combination of light and air and moisture. Refers to materials such as food and other plant and animal matter. See also, biodegradable.

Decomposition: Decomposition (or rotting) is the process by which organic substances are broken down into simpler forms of matter. After garbage is dumped in a landfill, this is the chemical deterioration that our garbage undergoes. This process releases methane, a greenhouse gas.

Disposable items: Made to be used only one time and then thrown away, e.g. disposable diapers, ball point pens.

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.

Energy: The ability to do work. For example, energy is needed to cause a change by pushing, pulling or heating things. The light that comes to the Earth from the sun is pure energy. Nearly all other sources of energy originally got their energy from the sun. Energy generated from burning things (incinerating garbage, burning coal, etc.) can be used to provide electricity. Coal is a fossil fuel that was formed many millions of years ago when plants took energy from the sun and were then eaten by animals. Those animals died and their remains decomposed into a source of fuel.

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.

Extrapolate: To estimate based on known facts or observations.

Fossil Fuel: Fuels formed millions of years ago from decomposed plants and animals. Plants took energy from the sun and were then eaten by animals. Those animals died and their remains decomposed into a source of fuel.

Greens: Compost materials that are high in nitrogen such as kitchen food waste, green plants, and green grass clippings.

Incineration: Incineration means to burn something up completely. Most often incineration refers to the process of getting rid of waste materials by burning them until nothing but ash remains.

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 specially constructed site for disposing of garbage, typically large and outdoors. To reduce smells and vermin, after a layer of garbage is spread, a layer of dirt is spread. This process prevents oxygen from entering the landfill. The lack of oxygen also causes material which is normally biodegradable to not decay. Modern well-run landfills are also lined with plastic or bentonite clay to prevent toxic leachates from entering the groundwater. They also usually have methane wells to safely exhaust methane from the deepest parts.

Leachate: Liquids that come from compacted and decomposing waste. Rain, snow and other liquids seep through a landfill and the leachate that results is a potential source of pollution for surface and groundwater.

Life Cycle: A life cycle is defined as the complete succession of changes undergone by an organism during its life. A new cycle occurs when an identical set of changes is begun.

Litter: Something that is not disposed of properly. A result of people dropping unwanted items no the ground or tossing them out of a car window instead of throwing them in garbage or recycling bins.

Manufacturing: The process of turning raw materials into a product or good by hand or machinery.

Materials Recovery Center (MRF - pronounced Murf): A place where recyclables are recovered and sorted. Your trash collectors bring all of your recyclables to this facility. Most MRFs use Single Stream Recycling, which means there is no pre-sorting and all of your recyclables go to the MRF mixed together (paper, glass, plastic, etc). They are dumped onto a conveyer belt and separated by both manpower and machinery. Often the material is placed on a conveyor belt and magnets are used to pull out metals, blowers and vacuums pull out plastic, electrical currents force out aluminum, and paper is separated with a screen. Glass usually falls off the end of the conveyor belt. Workers watch over and help the whole process, making sure that everything is being sorted correctly.

Methane Gas: A colorless, odorless greenhouse gas that is produced as a byproduct of anaerobic (without oxygen) decomposition. It is highly flammable and must be removed from landfills in order to prevent dangerous fires and explosions. As a greenhouse gas, methane contributes to global climate change. Many sanitary landfills have systems in place for methane gas recovery as methane can be used as a source of energy for heating buildings or manufacturing products.

Municipal Solid Waste (MSW): All items that consumers use and throw away, including grass clippings, product packaging, paper, food scraps, appliances, batteries and other common items. This waste originates from households, commercial businesses (restaurants, stores, offices, etc.) and institutions (hospitals, schools, museums, etc.).

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: A non metallic element found in green material used for composting. All organic matter is made up of substantial amounts of carbon combined with lesser amounts of nitrogen. Nitrogen allows protein production.

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.

Non-biodegradable garbage: Wasted resources that won't break down (eg: plastics and metals). If you leave a soda can, plastic water bottle, glass bottle, or plastic bag exposed in the open air, it will not change or break down for hundreds of years.

Non Renewable Resources: Naturally occurring resources that can be used up more quickly than they can regenerate.

Nutrient: Something that provides nourishment required for growth and the maintenance of life.

Ore: Metal comes from ore (a mineral or rock) in the ground.

Organic matter: Material that has come from something that was alive at one point and nutrients from decomposed plants and animals (ie: leaves)

Over-Packaged: Term describing goods which have more packaging material than is necessary to simply wrap, contain, or protect the product; over packaging is a source of waste that can be reduced.

Packaging: The materials used to wrap, contain, and protect products.

Plastic: Made from oil found underground, plastic begins its life as a semiliquid mixture of crude oil and natural gas. Plastic can be easily molded into shape while soft and then set into a rigid or slightly elastic form.

Polymer: A chemical compound formed from long chains of the same molecule group. These chains repeat over and over. Plastics are polymers.

Products: Made from raw or recycled materials, consumers buy these every day.

Raw materials: Unprocessed materials used in the manufacture of products. These unprocessed materials can be either natural substances such as wood or metals or recovered materials such as crushed glass from residential recycling.

Recyclable: Able to be recycled.

Recycle: Collect already used materials and make them into another product. Large amounts of plastic, metal, glass and organic matter are discarded as waste every year. Recycling is a resource recovery practice that refers to the collection and reuse of these materials so that they can be reprocessed into new products.

Recycled: Made from recycled materials.

Recycling Baler: Machines used to compact recyclables such as aluminum, cardboard, paper, and plastic into blocks that can easily be stacked and transported.

Reduce: Find ways to create less waste. The most effective way to reduce waste is to not make it. See also the definition for Source Reduction.

Resource: A part of the Earth that helps animals, plants, and people live and grow. Air, water, and land are other types of resources. For example: a tree is a resource as trees make food like apples and nuts and provides wood for items like paper and furniture. From a human perspective a natural resource is anything obtained from the environment to satisfy human needs and wants. From a broader biological or ecological perspective a resource satisfies the needs of a living organism. Resources have three main characteristics: utility, limited availability, and potential for depletion or consumption.

Resource Life Cycle: It is a complete succession of changes undergone by an organism. The steps a resource goes through from the moment it's formed to the last moment it is used.

Resource Recovery: Using materials that would have been thrown away for a specific next use, such as recycling, composting or energy generation. The aim of the resource recovery is to extract the maximum practical benefits from products, delay the consumption of virgin natural resources, and to generate the minimum amount of waste.

Reuse: Thinking of a new use for an item you have already used. Rather than throwing out items like clothing or food jars, consumers can find new uses for them -- and thereby reduce their consumption of new resources. Using jars to store beverages or leftover food, and trading or selling used DVDs rather than throwing them out are examples of ways people can reuse.

Source Reduction: Creating less waste. You can create less waste in a variety of ways including reusing things so that you do not need to purchase more.

Sustainable: Conserving an ecological balance by avoiding depletion of natural resources. Does not cause problems for the environment, people and animals.

Toxic: Something that can harm people or the environment if not disposed of properly is called toxic.

Vermicomposting: A method of composting that uses worms to convert food waste into a healthy, rich soil conditioner.

Waste: Food scraps, soiled paper, and other things you throw away. Any material that is useless, superfluous, or not used and is discarded, such as ashes, garbage, sewage, etc. Another word for garbage is waste. Waste occurs when we take a product out of the system and don't allow the cycle to continue. Waste is all of the unwanted materials and substances left over when we are finished using things.

Waste Audit/Assessment: Collecting all waste and resources from garbage (landfill), recycling, and composting streams, separating them into categories, weighing each category, and documenting the findings. Findings can be useful for determining what resources that are currently sent to the landfill that can be diverted into resource recovery streams to move toward zero waste.

Zero Waste: A goal of many communities and businesses hat includes: reducing what we consume, maximizing recycling, minimizing waste, and ensuring that products are made to be reused, repaired, recycled or returned to nature.

Zero Waste Ambassador: Any student who has learned about waste and resources and works to help conserve resources and reduce waste in their school and community.

A ZERO WASTE CURRICULUM

Learning Standards

Don't Throw Me Away!: A Zero Waste Curriculum
Curriculum Alignment with Common Core State Standards

LESSON 1	
GRADE K	
CCSS.Math.Content.K.OA.A.1	Represent addition and subtraction with objects, fingers, mental images, drawings1, sounds (e.g. claps), acting out situations, verbal explanations, expressions, or equations.
CCSS.Math.Content.K.OA.A.2	Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.
CCSS.Math.Content.K.CC.A.2	Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
CCSS.Math.Content.K.CC.A.3	Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).
CCSS.Math.Content.K.CC.B.4	Understand the relationship between numbers and quantities; connect counting to cardinality.
CCSS.Math.Content.K.CC.B.4a	When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.
CCSS.Math.Content.K.CC.B.4b	Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.
CCSS.Math.Content.K.CC.B.4c	Understand that each successive number name refers to a quantity that is one larger.
CCSS.Math.Content.K.CC.B.5	Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.
CCSS.Math.Content.K.CC.C.6	Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
CCSS.Math.Content.K.CC.C.7	Compare two numbers between 1 and 10 presented as written numerals.
CCSS.Math.Content.K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.
CCSS.Math.Content.K.MD.B.3	Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

CCSS.ELA-Literacy.RI.K.1	With prompting and support, ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RI.K.2	With prompting and support, identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RI.K.4	With prompting and support, ask and answer questions about unknown words in a text.
CCSS.ELA-Literacy.RI.K.8	With prompting and support, identify the reasons an author gives to support points in a text.
CCSS.ELA-Literacy.RI.K.10	Actively engage in group reading activities with purpose and understanding.
CCSS.ELA-Literacy.RF.K.1a	Follow words from left to right, top to bottom, and page by page.
CCSS.ELA-Literacy.RF.K.1b	Recognize that spoken words are represented in written language by specific sequences of letters.
CCSS.ELA-Literacy.RF.K.2	Demonstrate understanding of spoken words, syllables, and sounds (phonemes).
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.L.K.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on kindergarten reading and content.
CCSS.ELA-Literacy.L.K.4a	Identify new meanings for familiar words and apply them accurately (e.g., knowing duck is a bird and learning the verb to duck).
CCSS.ELA-Literacy.L.K.5a	Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.
CCSS.ELA-Literacy.L.K.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

GRADE 1	
CCSS.Math.Content.1.OA.A.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.
CCSS.Math.Content.1.OA.A.2	Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.
CCSS.Math.Content.1.NBT.A.1	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
CCSS.Math.Content.1.MD.C.4	Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.3	Describe characters, settings, and major events in a story, using key details.
CCSS.ELA-Literacy.RL.1.7	Use illustrations and details in a story to describe its characters, setting, or events.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.2	Identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RL.1.4	Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
CCSS.ELA-Literacy.W.1.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.SL.1.5	Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.Math.Content.2.NBT.B.5	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
CCSS.Math.Content.2.MD.D.10	Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.
CCSS.ELA-Literacy.RL.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.RL.2.3	Describe how characters in a story respond to major events and challenges.
CCSS.ELA-Literacy.RI.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.RI.2.3	Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
CCSS.ELA-Literacy.RI.2.4	Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.
CCSS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.L.2.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 2 reading and content, choosing flexibly from an array of srategies.

LESSON 2	
GRADE K	
CCSS.Math.Content.K.MD.A.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
CCSS.Math.Content.K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.
CCSS.ELA-Literacy.RI.K.1	With prompting and support, ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RI.K.2	With prompting and support, identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RI.K.4	With prompting and support, ask and answer questions about unknown words in a text.
CCSS.ELA-Literacy.RI.K.8	With prompting and support, identify the reasons an author gives to support points in a text.
CCSS.ELA-Literacy.RI.K.10	Actively engage in group reading activities with purpose and understanding.
CCSS.ELA-Literacy.RF.K.1a	Follow words from left to right, top to bottom, and page by page.
CCSS.ELA-Literacy.RF.K.1b	Recognize that spoken words are represented in written language by specific sequences of letters.
CCSS.ELA-Literacy.RF.K.2	Demonstrate understanding of spoken words, syllables, and sounds (phonemes).
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
CCSS.ELA-Literacy.L.K.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

GRADE 1	
CCSS.Math.Content.1.NBT.A.1	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.3	Describe characters, settings, and major events in a story, using key details.
CCSS.ELA-Literacy.RL.1.7	Use illustrations and details in a story to describe its characters, setting, or events.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.2	Identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RL.1.4	Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
CCSS.ELA-Literacy.W.1.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).
CCSS.ELA-Literacy.W.1.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).

GRADE 2	
CCSS.Math.Content.2.NBT.B.5	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
CCSS.Math.Content.2.NBT.B.6	Add up to four two-digit numbers using strategies based on place value and properties of operations.
CCSS.Math.Content.2.MD.D.10	Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.
CCSS.ELA-Literacy.RI.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
CCSS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

LESSON 3	
GRADE K	
CCSS.Math.Content.K.OA.A.1	Represent addition and subtraction with objects, fingers, mental images, drawings1, sounds (e.g. claps), acting out situations, verbal explanations, expressions, or equations.
CCSS.Math.Content.K.OA.A.2	Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.
CCSS.Math.Content.K.OA.A.5	Fluently add and subtract within 5.
CCSS.Math.Content.K.CC.A.2	Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
CCSS.Math.Content.K.CC.A.3	Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).
CCSS.Math.Content.K.CC.B.4	Understand the relationship between numbers and quantities; connect counting to cardinality.
CCSS.Math.Content.K.CC.B.4a	When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.
CCSS.Math.Content.K.CC.B.4b	Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.
CCSS.Math.Content.K.CC.B.4c	Understand that each successive number name refers to a quantity that is one larger.
CCSS.Math.Content.K.CC.B.5	Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.
CCSS.Math.Content.K.CC.C.6	Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
CCSS.Math.Content.K.CC.C.7	Compare two numbers between 1 and 10 presented as written numerals.
CCSS.Math.Content.K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.

CCSS.ELA-Literacy.RI.K.1	With prompting and support, ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RI.K.2	With prompting and support, identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RI.K.4	With prompting and support, ask and answer questions about unknown words in a text.
CCSS.ELA-Literacy.RI.K.8	With prompting and support, identify the reasons an author gives to support points in a text.
CCSS.ELA-Literacy.RI.K.10	Actively engage in group reading activities with purpose and understanding.
CCSS.ELA-Literacy.RF.K.1a	Follow words from left to right, top to bottom, and page by page.
CCSS.ELA-Literacy.RF.K.1b	Recognize that spoken words are represented in written language by specific sequences of letters.
CCSS.ELA-Literacy.RF.K.2	Demonstrate understanding of spoken words, syllables, and sounds (phonemes).
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-Literacy.W.K.5	With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.
CCSS.ELA-Literacy.W.K.6	With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
CCSS.ELA-Literacy.L.K.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

GRADE 1	
CCSS.Math.Content.1.OA.A.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.
CCSS.Math.Content.1.NBT.A.1	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
CCSS.Math.Content.1.MD.C.4	Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.3	Describe characters, settings, and major events in a story, using key details.
CCSS.ELA-Literacy.RL.1.7	Use illustrations and details in a story to describe its characters, setting, or events.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.2	Identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RL.1.4	Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
CCSS.ELA-Literacy.W.1.3	Write narratives in which they recount two or more appropriately sequenced events, include some details regarding what happened, use temporal words to signal event order, and provide some sense of closure.
CCSS.ELA-Literacy.W.1.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).
CCSS.ELA-Literacy.W.1.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.

CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.Math.Content.2.NBT.B.5	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
CCSS.Math.Content.2.NBT.B.6	Add up to four two-digit numbers using strategies based on place value and properties of operations.
CCSS.ELA-Literacy.RL.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.RL.2.3	Describe how characters in a story respond to major events and challenges.
CCSS.ELA-Literacy.RI.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.W.2.3	Write narratives in which they recount a well-elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.
CCSS.ELA-Literacy.W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
CCSS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.2.4	Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences.

LESSON 4	
GRADE K	
CCSS.ELA-Literacy.W.K.1	Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book (e.g., My favorite book is...).
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-Literacy.W.K.5	With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.
CCSS.ELA-Literacy.W.K.6	With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
GRADE 1	
CCSS.ELA-Literacy.W.1.2	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
CCSS.ELA-Literacy.W.1.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).
CCSS.ELA-Literacy.W.1.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.

CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.SL.1.5	Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.ELA-Literacy.W.2.3	Write narratives in which they recount a well-elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

LESSON 5	
GRADE K	
CCSS.ELA-Literacy.RI.K.10	Actively engage in group reading activities with purpose and understanding.
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-Literacy.W.K.5	With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.
CCSS.ELA-Literacy.W.K.6	With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).
CCSS.ELA-Literacy.W.K.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
GRADE 1	
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.

CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.ELA-Literacy.RL.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.RL.2.3	Describe how characters in a story respond to major events and challenges.
CCSS.ELA-Literacy.W.2.2	Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.

LESSON 6	
GRADE K	
CCSS.Math.Content.K.MD.A.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
CCSS.Math.Content.K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-Literacy.W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).
CCSS.ELA-Literacy.W.K.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
CCSS.ELA-Literacy.L.K.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts.
GRADE 1	
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.3	Describe characters, settings, and major events in a story, using key details.
CCSS.ELA-Literacy.RL.1.1	Ask and answer questions about key details in a text.
CCSS.ELA-Literacy.RL.1.2	Identify the main topic and retell key details of a text.
CCSS.ELA-Literacy.RL.1.4	Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.

CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.Math.Content.2.MD.A.1	Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
CCSS.ELA-Literacy.RL.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.RL.2.3	Describe how characters in a story respond to major events and challenges.
CCSS.ELA-Literacy.RI.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Literacy.W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.2.3	Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.

LESSON 7

GRADE K	
CCSS.Math.Content.K.OA.A.1	Represent addition and subtraction with objects, fingers, mental images, drawings1, sounds (e.g. claps), acting out situations, verbal explanations, expressions, or equations.
CCSS.Math.Content.K.OA.A.5	Fluently add and subtract within 5.
CCSS.Math.Content.K.CC.A.2	Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
CCSS.Math.Content.K.CC.B.4	Understand the relationship between numbers and quantities; connect counting to cardinality.
CCSS.Math.Content.K.MD.A.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
CCSS.Math.Content.K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.
CCSS.Math.Content.K.MD.B.3	Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.
CCSS.ELA-Literacy.W.K.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
GRADE 1	
CCSS.Math.Content.1.OA.A.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.
CCSS.Math.Content.1.NBT.A.1	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
CCSS.Math.Content.1.MD.C.4	Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

CCSS.ELA-Literacy.W.1.2	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
CCSS.ELA-Literacy.W.1.5	With guidance and support from adults, focus on a topic, respond to questions and suggestions from peers, and add details to strengthen writing as needed.
CCSS.ELA-Literacy.W.1.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).
CCSS.ELA-Literacy.W.1.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.1.5	Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.ELA-Literacy.W.2.2	Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.
CCSS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.

LESSON 8	
GRADE K	
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-Literacy.W.K.5	With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.
CCSS.ELA-Literacy.W.K.6	With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).
CCSS.ELA-Literacy.W.K.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.K.1a	Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.K.1b	Continue a conversation through multiple exchanges.
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-Literacy.SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
CCSS.ELA-Literacy.SL.K.5	Add drawings or other visual displays to descriptions as desired to provide additional detail.
GRADE 1	
CCSS.ELA-Literacy.W.1.2	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
CCSS.ELA-Literacy.W.1.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).

CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.1.1a	Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.1.1b	Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
CCSS.ELA-Literacy.SL.1.1c	Ask questions to clear up any confusion about the topics and texts under discussion.
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-Literacy.SL.1.3	Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
CCSS.ELA-Literacy.SL.1.5	Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
CCSS.ELA-Literacy.L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).
GRADE 2	
CCSS.ELA-Literacy.W.2.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCSS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-Literacy.SL.2.1a	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-Literacy.SL.2.1b	Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-Literacy.SL.2.1c	Ask for clarification and further explanation as needed about the topics and texts under discussion.

Next Generation Science Standards

GRADE K	
K-ESS2-2 Earth's Systems	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
K-ESS3-1 Earth and Human Activity	Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
K-ESS3-3 Earth and Human Activity	Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
GRADE 2	
2-PS1-1 Matter and its Interactions	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
GRADE 3	
3-LS1-1 From Molecules to Organisms: Structures and Processes	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
GRADE 4	
4-ESS3-1 Earth and Human Activity	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
GRADE 5	
5-PS3-1 Energy	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
5-ESS3-1 Earth and Human Activity	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

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Resources

Books

The Adventures of an Aluminum Can: A Story about Recycling, by Alison Inches
This storybook is told from the point of view of an enthusiastic aluminum can. The diary entries are fun and humorous, yet point out the ecological significance behind each product and the resources used to make it.
Grades K-3

The Adventures of a Plastic Bottle: A Story About Recycling, by Alison Inches
Told from the point of view of a free-spirited plastic bottle, kids can share in the daily experiences and inner thoughts of the bottle through his personal journal. The diary entries will be fun and humorous yet point out the ecological significance behind each product and the resources used to make it.
Grades K-3

Amazing Earth, by Heather Maisner
Explore the world through amazing photographic images that move and change!
Grades K-3

Arthur Turns Green, by Marc Tolon Brown
Arthur Turns Green teaches kids about the things they can do around their homes to be greener.
Grades K-3

Brother Eagle, Sister Sky, by Susan Jeffers
This picture book is adapted from a speech purportedly delivered by Chief Seattle at treaty negotiations in the 1850s. His remarkably relevant message of respect for the Earth and every creature on it has endured the test of time and is imbued with passion born of love of the land and the environment.
Grades K-3

Cartons, Cans, and Orange Peels: Where Does Your Garbage Go?, by Joanna Foster
Outlines the composition of garbage and trash and discusses the various methods of disposing of it with an emphasis on recycling.
Grades 3-6

Celebrating Earth Day, by Janet McDonnell
Ms. Webster's class plans a party to celebrate Earth Day.
Grades K-3

Charlie and Lola: We are Extremely Very Good Recyclers, by Lauren Child
This adventure is printed on FSC-approved paper and includes recycling tips as well as a tree poster... so kids can keep track of their recycling projects and help to save the planet all on their own.
Grades: Pre K-2. Listed in Lesson 5.

City Green, by DyAnne DiSalvo-Ryan
Right in the middle of Marcy's city block is a littered vacant lot. Then one day she has a wonderful idea that not only improves the useless lot but her entire neighborhood as well.
Grades K-3. Listed in Lesson 6.

Climate Change, by Helen Orme
This book is part of the Earth in Danger series. It discusses the topic of climate change - what it is, what causes it, and what we can do to stop it.
Grades 2 +

Common Ground: The Water, Earth, and Air We Share, by Molly Bang
Through the example of a shared village green and the growing needs of the townspeople who share it, Molly Bang presents the challenge of handling our planet's natural resources. Full color picture book.
Grades K-3

Compost Critters, by Bianca Lavies
Nature's recyclers receive a close-up look, in an informative, photographic study, at the creatures, from bacteria and fungi to worms and millipedes, that break down our garbage, returning raw materials to the earth.
Grades 5-8

Composting: Nature's Recyclers, by Robin Koontz.
Learn more about compost and how you can use it in your garden or yard.
Grades K + . Listed in Lesson 6.

Crafts from Junk, by Violaine Lamérand
Young readers will delight in creating the craft projects in this new series, using simple techniques and materials that are easily available. Clear instructions and step-by-step photographs make these projects perfect for school and home.
Grades K-3

Cups & Cans & Paper Plate Fans:Craft Projects from Recycled Materials, by Phyllis Fiarotta
Gives step-by-step instructions for making a variety of craft projects from such recyclable items as paper bags, boxes, cans, dairy containers, and jars.
Grades 3-6

Earl the Earthworm Digs for His Life, by Tim Magner
From the first wiggle, Earl takes us deep into his world and together we explore his surroundings and learn about his connections to nature.
Grades K-6

Earth, by Penelope York
Offering a new level of information through powerful visuals, the Eye Wonder reference series was specially developed for children ready for their first books about the natural world.
Grades K-3

Earth Day, by Linda Lowery
Lowery addresses the concerns that eventually brought about Earth Day and the laws and programs that have come about due to its establishment in 1970.
Grades K-3

Earth Day, by Nancy I. Sanders
Ideal for today's young investigative reader. It includes lively sidebars, a glossary and index, plus a comprehensive "To Find Out More" section.
Grades 3-6

The Enchanted Amazon Rain Forest: Stories from a Vanishing World, by Nigel J. H. Smith
Between 1976 and 1994, the author collected stories from peasants (caboclos) in the Amazon basin, seeking insight into their perception of their environment, both social and ecological.
Target Audience: adults

Energy for the Future, by Helen Orme
Following brief definitions of renewable and nonrenewable energy sources, the spreads introduce various methods of producing Earth-friendly power… Orme presents concepts in clear, simplified language that may leave students with questions, such as how fossil fuels form or what, exactly, are the "dangerous wastes" that a nuclear plant produces.
Grades 2 +

An Environmental Guide from A to Z, by Tim Magner
By examining the elements, habitats and cycles in nature, An Environmental Guide introduces basic environmental science to elementary school readers.
Grades 3-6

Gaia Girls Enter the Earth, by Lee Welles
Ten-year-old Elizabeth lives on a thriving farm owned by her family since the 18th century. Remarkably attuned to nature, she learns why when she meets a talking otter that claims to be Gaia, the spirit of the Earth.
Grades 3-6

Garbage and Recycling, by Sally Morgan and Rosie Harlow
Explaining the difference between biodegradable and non-biodegradable garbage, this book shows how glass, metal, and wool can be easily recycled. How Can I Help? boxes give suggestions for the young environmentalist who wants to recycle at home.
Grades K-3. Listed in Lesson 5.

Garbage and Recycling, by Helen Orme
Young environmentalists will be inspired as they learn why recycling is important, which materials can be reprocessed into new goods, and how improved design can make products easier to recycle. Clear, easy-to-read text paired with vibrant photos will engage kids as they explore this hot topic.
Grades 2 +

Go Green With Me, by Rebecca Mattano and Kristen Collier
The earth notes offered in the book provide parents and educators with simple steps that everyone can take to conserve energy, water, and other natural resources.
Grades K-2

Going Green, by Kris Hirschmann
A green revolution is taking place. People are going green, which means they are making Earth-friendly choices in hopes of keeping the planet healthy for all living things. These choices are green because they save energy and reduce pollution. When enough people go green, everyone including Mother Earth will reap the rewards.
Grades 3 +

The Great Trash Bash, by Loreen Leedy
The animals of Beaston realize something's wrong: litter mars their landscape, landfills are filling up, and no one wants a new dump in their neighborhood. Their solutions are exemplary, and followed up with a list of ``Ideas for cutting down on trash.''
Grades K-3

Green Power: Eco-energy Without Pollution, by David Jefferis
Our future depends on environmentally friendly energy and Green Power explores current research into such solutions as biofuels, wind, and solar energy.
Grades 3-6

Habitat Destruction, by Helen Orme
Part of a high-interest, low vocabulary non-fiction series of books about conservation topics for struggling and reluctant readers.
Grades 2 +

Help your Parents Save the Planet: 50 simple ways to go green now!, by Gregory Rutty
An uncomplicated guide for kids who know they "know better," How to Help Your Parents Save the Planet is filled with actions you can take immediately and implement easily. With a focus on the Three R's—Reduce, Reuse, and Recycle—this is the perfect introduction to a lifetime of care and nurturing of planet Earth.
Grades K-3

Here Comes the Recycling Truck, by Meyer Seltzer
Elisa stresses the importance of recycling and shows readers how she drives through the city, collecting glass, cardboard, newspapers, and cans in her recycling truck named "Uncle Bud".
Grades PreK-3. Listed in Lesson 5.

I Can Save the Earth, by Alison Inches
Meet Max the Little Monster. He is a cute, furry green monster who is an environmental nightmare... Max finds there is a whole big world outside that he can make a difference in.
Grades K-3. Listed in Lesson 1.

In My Neighborhood: Garbage Collectors, by Paulette Bourgeois and Kim LaFave
This book in the In My Neighborhood series is a fun and informative behind-the-scenes look at garbage collectors.
Grades K-3. Listed in Lesson 2.

In One Tidepool: crabs, snails, and salty tails, by Anthony D. Fredericks
Go on a field trip between two covers with Tony to a special, brilliant habitat, a tidepool. A whole community of creatures lives there! Humor, a fun rhyme, good science, and brilliant illustrations come together in a clear, easily understood package.
Grades K-4

Living Green, by Helen Orme
Part of a high-interest, low vocabulary non-fiction series of books about conservation topics for struggling and reluctant readers.
Grades 2 +

The Lorax, by Dr. Seuss
Long before saving the earth became a global concern, Dr. Seuss, speaking through his character the Lorax, warned against mindless progress and the danger it posed to the earth's natural beauty.
Grades K-4

The Magic School Bus Meets the Rot Squad, by Joanna Cole
Everybody agrees that mold is just disgusting, until the class goes on a field trip inside a rotting log. They discover that all the dead-looking stuff is actually alive...and it's pretty neat after all. Join the class on their "rotten" adventure, and learn about how nature recycles through decomposition.
Grades K-2. Listed in Lesson 6.

Michael Recycle, by Ellie Bethel
Just in time for Earth Day on April 22, "Michael Recycle" tells the adventures of a young superhero whose power allows him to teach people about recycling.
Grades 1 +

Michael Recycle Meets Litterbug Doug, by Ellie Bethel and Alexandra Colombo
Litterbug Doug is lazy. He is wasteful. He is messy. But worst of all, he hates recycling! It's up to Michael Recycle, planet Earth's green-caped crusader, to show dastardly Doug the error of his ways... before it's too late!
Grades K-3. Listed in Lesson 2.

My First Green Book, by Angela Wilkes
A visual introduction to some of the problems facing our planet. A step-by-step method for every project is shown and accompanied by easy-to-follow instructions.
Grades K-3

Pollution, by Helen Orme
Part of a high-interest, low vocabulary non-fiction series of books about conservation topics for struggling and reluctant readers.
Grades 2 +

Quaid McQueen, Trash Machine, by Amanda Medress
Rosy the skunk helps a mischievous boy discover how his wasteful ways are harming natural habitats.
Grades K-3. Listed in Lesson 1.

Rachel Carson, by Marty Jezer
A biography of the marine biologist and author whose writings stressed the interrelation of all living things and the dependence of human welfare on natural processes.
Grades 5-8

Rachel Carson: Caring for the Earth, by Elizabeth Ring
A biography of the biologist focusing on the events that led her to expose pesticide pollution in her book "Silent Spring" and her legacy as a founder of the environmental movement.
Grades 3-6

Recycle!: A Handbook for Kids, by Gail Gibbons
This lively and informative handbook explains the process of recycling from start to finish.
Grades 3-6 Listed in Lesson 5

Recycled Crafts Box, by Laura C. Martin
Master crafter Laura C. Martin shows kids how to make art out of the paper, plastic, metal, and cloth we usually consign to the recycling bin or the garbage can.
Grades 3 + . Listed in Lesson 5.

Recycling, by Joan Kalbacken
Shows how the ever-growing tide of refuse threatens the environment and wastes resources, and how recycling helps in conservation efforts.
Grades K-3

A River Ran Wild: An Environmental History, by Lynne Cherry
Learn how the modern-day descendants of the Nashua Indians and European settlers were able to combat pollution and restore the beauty of the Nashua River in Massachusetts.
Grades 3-6

Saguaro Moon : A Desert Journal, by Kristin Joy Pratt-Serafini
A young narrator explores Arizona's Sonoran Desert, cleverly recording her musings, scientific facts and questions, and accounts of her experiences in a nature journal decorated by her paintings of the native plants and animals and of her new friends.
Grades 3-6

The Story of Rachel Carson and the Environmental Movement, by Leila Merrell Foster
Grades 3-6

The Tin Forest, by Helen Ward
In the middle of a dark, lonely wasteland filled with old scrap metal lives an old man… Every morning he wakes to gloom and bad weather. Then one day, he comes up with an idea to change things.
Grades K-3

Trash!, by Charlotte Wilcox
Examines various methods of garbage disposal, with an emphasis on sanitary landfills but also surveying such alternatives as mass burn and recycling.
Grades 3-6

The Tree, by Dana Lyons
An 800-year-old Douglas fir ponders the many things it has seen in the natural world as it hears the bulldozers coming, and then some people arrive to save it from destruction.
Grades K-3

Waste Management (Environment in Focus), by Cheryl Jakab
Cheryl Jakab's 'Environment In Focus' series each provide some 32 pages of detail with each book in the series providing readers with information about major environmental problems.
Grades 4 + . Listed in Lessons 1, 4,5 and 6.

What in the world is green energy?, by Oona Gaarder-Juntti
Explains what green energy, its benefit to the environment, and what one can do to be more environmentally friendly.
Grades K-3

What planet are you from Clarice Bean?, by Lauren Child
Clarice Bean needs a science project or she's in BIG trouble. Her brother Kurt just wants to save the planet. And now they're both up a tree.
Grades K-4

When is it great to turn green?, by Michele Ingber Drohan
Presents information about various aspects of the environment, including recycling, radiation, pollution, rain forests, deserts, coral reefs, and more, in question and answer format.
Grades K-2

Where Does Garbage Go?, by Isaac Asimov
Briefly examines how we get rid of the things we throw away, describing some of the problems of waste disposal and some of the solutions.
Grades K-3. Listed in Lesson 2

Where does the garbage go?, by Paul Showers
Filled with graphs, charts, and diagrams, Where Does the Garbage Go? explains how we deal with the problem of too much trash and provides ideas for easy ways to be a part of the solution.
Grades K-3

Where the Sidewalk Ends, by Shel Silverstein
"Sarah Cynthia Sylvia Stout"
Poem featured in Lesson 2.

Why should I protect nature?, by Jen Green
The enlightening and entertaining four-book Why Should I? series demonstrates the importance of protecting nature. Books present brief, entertaining stories that answer children's questions and feature amusing color illustrations on every page. A note at the back of each book is for parents and teachers, suggesting ways to use these books most effectively.
Grades K-3

Why should I save energy?, by Jen Green
See description above.
Grades K-3

Why should I save water?, by Jen Green
See description above.
Grades K-3

Why should I recycle?, by Jen Green
See description above.
Grades K-3

The Worm Cafe: mid-scale vermicomposting of lunchroom wastes, by Binet Payne
This book describes how a teacher and her students developed a system to compost lunchroom waste with worms and save their school $6000 per year.
Target Audience: adults.

Worms eat my garbage: How to Set Up and Maintain a Worm Composting System, by Mary Appelhof
A new edition of the definitive guide to vermicomposting--a process using redworms to recycle human food waste into nutrient-rich fertilizer for plants. Internationally recognized as an authority on vermicomposting, Appelhof has worked with worms for over three decades.
Target Audience: adults. Listed in Lesson 6.

Movies:

Arctic Tale (2007)
A National Geographic documentary from the folks who brought us "March of the Penguins." It's both wondrous yet heartbreaking as we watch a walrus and polar bear from birth to maturity as their winter wonderland melts beneath them.
Rating: G. Time: 96 min.

Avatar (2009)
It's debatable whether this is a kids' movie, but it's clearly a film with environmental themes. Among them are a respect for the environment, our ultimate reliance on nature and the destructive nature of humans and how it affects the planet.
Rating: PG-13 Time: 162 min.

Bambi (1942)
The classic animated film tells the story of a young deer and his friends who live in a forest threatened by hunters. The scene where Bambi's mom dies would make even the most hardened hunter think about setting down his gun.
Rating: "Approved". Time: 70 min.

A Bug's Life (1998)
The Pixar crew watched "bug cam" footage to make the bug's eye view authentic. Even the animated bug character traits are bona fide.
Rating: G. Time: 95 min.

Disneynature's Earth (2007)
Earth is a nature documentary film which depicts the diversity of wild habitats and creatures across the planet. The film begins in the Arctic in January of one year and moves south, finishing in Antarctica in the December of the same year.
Rating: G. Time: 90 min.

FernGully: The Last Rainforest (1992)

The magical inhabitants of a rainforest called FernGully fight to save their home that is threatened by logging and a polluting force of destruction called Hexxus. The movie's message is overtly conservationist, villainizing destructive humans and urging viewers to do what they can to preserve the wilderness areas still left on Earth.
Rating: G. Time: 76 min.

Finding Nemo (2003)

A clownfish is taken from his coral reef home and his fretful father braves the Australian waters to find him. Best line from Bruce the shark: "I am a nice shark, not a mindless eating machine. If I am to change this image, I must first change myself. Fish are friends, not food."
Rating: G. Time: 100 min.

Free Willy (1993)

It features a young boy who befriends a recently captured orca whale in a local aquarium/amusement park. There's no mistaking the villains in this movie—the park owner, who exploits animals, and the whalers who capture Willy—or the message that wild animals are better off left alone.
Rating: PG. Time: 112 min.

Happy Feet (2006)

The main message of this Disney movie is that it's okay to be different, but environmental themes work their way in as well. The film focuses on a young penguin, Mumble, with a talent for tap dancing—something none of the other penguins can do. It follows his adventures and quest for acceptance throughout the plot, but the environmental aspect shows up when Mumble is blamed for the scarcity of fish in the ocean, a nod to overfishing. In addition, one of Mumble's friends wears a set of plastic six-pack rings around his neck like jewelry, only to later be choked by the piece of trash.
Rating: PG. Time: 108 min.

Hoot (2006)

This film portrays the adventure of three middle-school students who try to protect a rare breed of endangered owls. Encourages kids to think about the relationship between humans, development and wildlife.
Rating: PG. Time: 91 min.

The Lion King (1994)

Nothing teaches kids the meaning behind the circle of life better than Simba and company.
Rating: G. Time: 89 min.

Disneynature's Oceans (2010)

A documentary released on Earth Day in 2010, the film explores the underwater world that covers three-quarters of our planet. While it spends much of its time depicting the weird, wonderful and beautiful life forms that the oceans have to offer, the documentary doesn't miss its chance to show the negative effects human actions can have on wildlife and urge viewers to respect nature.
Rating: G. Time: 84 min.

Over the Hedge (2006)
When the forest animals wake up from hibernation, they realize that half of their forest has been destroyed and replaced by a suburban neighborhood hidden behind a giant hedge. The plot revolves more around the interactions among the animals than an environmental message, but some pointed comments are unmistakably meaningful.
Rating: PG. Time: 83 min.

Rescuers Down Under (1990)
A boy rescues a trapped great golden eagle and befriends her. Five of the film's creative team traveled down under to observe firsthand, then managed to magnificently capture, in animated form, the outback's unique beauty.
Rating: G. Time: 77 min.

Schoolhouse rock! Earth (2009)
Schoolhouse Rock! Earth has all the heart and musical soul of the original Schoolhouse Rock, designed for a new generation of fans. Eleven all-new songs with all-new animation prove that caring about the environment can be rockin fun!
Rating: Not rated. Time: 50 min.

Star Trek IV: The Voyage Home (1986)
Whether this can be considered a movie for kids is debatable, but its environmental undertones are clear. It's the year 2286, and a strange probe is approaching Earth, sending out signals that Spock determines match the calls of the extinct humpback whale. The probe is wreaking havoc on Earth, so the crew of the USS Enterprise decides to go back in time to 1986, where they find two whales in a San Francisco aquarium. A curator there explains to the crew members why the whales are endangered. They take the whales back to the future with them and release them in the San Francisco Bay, where the giant mammals answer the probe's signal and stop the destruction.
Rating: PG. Time: 119 min.

WALL-E (2008)
This hit film takes place 700 years in the future, when the Earth has been reduced to a deserted, trash-covered ghost town.The state of the Earth in the movie urges viewers to take notice of how their actions are affecting the environment and warns of what might happen if they don't.
Rating: G. Time: 98 min.

Videos:

Bill Nye the Science Guy: garbage.
In Garbage, Bill digs up the dirt on ever-expanding landfills from New York to Florida. He also exposes the vast amounts of non-biodegradable waste that humans create.
Season 1, Episode 13.
Time: 30 min.

Compost Kids
http://www.youtube.com/watch?v = Njbn34JrKnE
Hamilton County Recycles provides a guide on how to start backyard composting.
Listed in Lesson 6.
Time: 4.05 min.

Creatures of the Compost
http://vimeo.com/6754174
Explore the inside of a compost heap with the award-winning short film
Time: 12.35 min.

A Day in the Life of Your Garbage and Recyclables
http://www.youtube.com/watch?v = Prigs6dLLCQ
A video about how garbage and recyclables move through the Sunnyvale Materials Recovery and Transfer Station (aka the SMaRT Station) in Sunnyvale, CA.
Listed in Lesson 1.
Time: 7.5 min

Great Pacific Garbage Patch
http://www.schooltube.com/video/bfb7d59e02cb49f79c7d/Great%20Pacific%20Garbage%20Patch-Johnston,Khalife
Listed in Lesson 2.
Time: 1.58 min.

How it's Made, The Life of a Plastic Bottle
http://www.youtube.com/watch?v = ZfyPCujUPms
Discovery/Science Channel's "How It's Made" Plastic Bottles & Jars episode.
Listed in Lesson 3
Time: 4.51 min.

It's Not Scary, It's Decayed!
http://www.youtube.com/watch?v = pCD4h8Pp7qM
Sing along with Sid the Science Kid, from PBS kids.
Time: 2.59 min.

Kids and Recycling (part 4) - How are recyclables sorted at a MRF?
http://www.youtube.com/watch?v = 2g2OHGSNBfs
In this segment of Curiosity Quest Goes Green, kids get curious about a MRF (Materials Recovery Facility). This episode will discuss the reasons why the MRF needs to separate out all the various commodities and how they get separated.
Listed in Lesson 5
Time: 3.57 min

Land and Lakes - Commercial Composting - Virtual Tour
http://www.youtube.com/watch?v = 8Q6Fl34mWGw
Land and Lakes is one of the largest commercial composting operations in the Midwest. Land and Lakes operates from several locations; the site profiled here is located at Romeoville, Illinois. Using both heavy machinery and manual labor to process and manage yard waste (branches, brush, leaves and grass clippings), each year, Land and Lakes processes hundreds of thousands of cubic yards of natural waste into a premium finished compost product. This video was funded through a grant from the Illinois Department of Commerce and Economic Opportunity (DCEO).
Listed in Lesson 6
Time: 2:14 min.

Landfill Harmonic
Trailer. A heartfelt & moving story of how instruments made from recycled trash bring hope to children whose future is otherwise spiritless. In Spanish with English subtitles.
http://www.youtube.com/watch?v = fXynrsrTKbI
Listed in Lesson 4
Time: 3.28 min.

Story of Stuff
http://www.storyofstuff.org/movies-all/story-of-stuff/
The Story of Stuff is a short polemical animated documentary about the lifecycle of material goods. The documentary is critical of excessive consumerism and promotes sustainability.
Listed in Lesson 3.
Time: 21.25 min.

Story of Bottled Water
http://www.storyofstuff.org/movies-all/story-of-bottled-water/
The Story of Bottled Water, released on March 22, 2010 (World Water Day) employs the Story of Stuff style to tell the story of manufactured demand—how you get Americans to buy more than half a billion bottles of water every week when it already flows from the tap.
Listed in Lesson 3.
Time: 8.05 min.

Websites:

The Adventures of Garbage Gremlin
http://www.epa.gov/osw/education/kids/gremlin/gremlin.pdf
A fun comic book from the US EPA.
Grades 2-5. Listed in Lesson 1.

Adventures of Herman the Worm
http://urbanext.illinois.edu/worms/
Follow the Adventures of Squirmin' Herman the Worm.

The Aluminum Association Website
http://www.aluminum.org/AM/Template.cfm?Section = News_Statistics
There is a link to a PowerPoint presentation called Aluminum 101. This is an overview of the history of aluminum, how it is produced, used and recycled.
Listed in Lesson 3.

America Recycles Day
A yearly event by Keep America Beautiful. Website has many resources for organizing events to promote recycling.
americarecyclesday.org

Back at the Barnyard
http://www.nick.com/games/back-at-the-barnyard-compost-the-most.html
Online game. Compost the Most.

Clean Air Counts; A Chicago Region Initiative
cleanaircounts.org
A public/private initiative to voluntarily improve air quality in the Chicago metropolitan region.
Listed in Lesson 8.

Community Learning Network
cln.org
A site designed to help teachers integrate technology into the classroom K-12. Over 5,800 annotated links to educational sites with free resources.
Listed in Lesson 8.

Compost Crunch
http://www.earthrangers.com/games/compostcrunch/
Online game. Worm your way through the Compost Crunch.

Composting for Kids
http://aggie-horticulture.tamu.edu/kindergarden/kidscompost/cover.html
Scripted slideshow

Compost Office Game
http://www.cleansweepusa.org/compost_intro.aspx
Can you keep a microbe happy? Tend your own virtual compost heap with this online game.

Consumer Reports
greenerchoices.org
Green Products Rating Guide.
Listed in Lesson 8.

Earth 911
earth911.org
Good general information on the benefits of waste reduction.
Listed in Lesson 8.

Earth Day Network
Growing out of the first Earth Day, Earth Day Network (EDN) works with over 22,000 partners in 192 countries to broaden, diversify and mobilize the environmental movement.
http://www.earthday.org/

Environmental Defense Fund
Learn about a major nonprofit environmental advocacy group and what they're doing to preserve the natural systems on which all life depends.
environmentaldefensefund.org

Environmental Protection Agency: Recycle City
http://www.epa.gov/recyclecity/
Explore Recycle City to see how the people of the town reduce waste, use less energy, and even save money by doing simple things at home, at work, and in their neighborhoods.
Listed in Lesson 6.

Environmental Yellow Pages
enviroyellowpages.com
Worldwide Directory.
Listed in Lesson 8.

EPA.gov (to be used for research as listed in Lesson 4)
Common waste and materials: http://www.epa.gov/epawaste/conserve/materials/index.htm
Paper: http://www.epa.gov/epawaste/conserve/materials/paper/index.htm
Aluminum: http://www.epa.gov/epawaste/conserve/materials/alum.htm
Plastic: http://www.epa.gov/epawaste/conserve/materials/plastics.htm

Grassroots Recycling Network
grrn.org
GRRN is a national network of waste reduction activists and recycling professionals.
Listed in Lesson 8.

Grist
Environmental news, commentary, advice. "A beacon in the smog"
grist.org

Herman the Worm
http://urbanext.illinois.edu/worms/
Learn about worm history, anatomy, feeding, and care from Squirmin' Herman.
Listed in Lesson 6.

Idaho Public Television: Garbage Facts-Dialogue for kids
http://idahoptv.org/dialogue4kids/season6/garbage/facts.cfm
Listed in Lesson 6.

IL Dept. of Commerce and Economic Opportunity
istep.org
School resource materials.
Listed in Lesson 8.

Junk Food
http://www.recycledevon.org/kidszone/junkfood/
Online game. Guide Wallace the Worm to eat the compostable items, while avoiding all the bad stuff.

Kids Recycle: Composting Websites by State
http://www.kidsrecycle.org/composting.php
Listed in Lesson 6.

Make an Indoor Garden
http://www.activityvillage.co.uk/make_an_indoor_garden.htm
Create a model garden. Don't forget the compost bin!

The National Association for PET Container Resources

http://www.napcor.com/PET/kcorner.html
A website with links for kids to learn more about PET plastic and what kids can do to make sure more PET containers get recycled in their community.

National Energy Education Development Project
eia.doe.gov
Energy facts, games & activities.
Listed in Lesson 8.

National Environmental Education Week
eeweek.org
EE Week is the nation's largest celebration of environmental education held each year the week before Earth Day and inspires environmental learning and stewardship among K-12 students.
Listed in Lesson 8.

New American Dream
newdream.org/procure
Responsible Purchasing Network.
Listed in Lesson 8.

Organic Gardening Guru
http://www.organicgardeningguru.com/composting-101/carbon-nitrogen-ratio/
Website on composting and the carbon-nitrogen ratio

Ollie Recycles!
http://www.olliesworld.com/aus/html/sortgame.html
An online game to help him sort it all out.

Soil Formation Activity
http://www.harcourtschool.com/activity/dirt/composting.html
Sort items for composting in this online game.

Terrific Science
terrificscience.org
Fun science resources for teachers, parents and kids.
Listed in Lesson 8.

Treehugger
treehugger.com
Green design & living news covering technology, architecture, transportation and more. Featuring sustainable living commentary, features and solutions.

Upside-Down Tomato-a-Go-Go
http://www.recycle-more.co.uk/images/static/pdf/tomato_agogo.pdf?referer=Tomato-a-Go-Go%20download
This project demonstrates 'rubbish as a resource', lets you be super-efficient with water and gives you the opportunity to grow organically without the use of pesticides.

US EPA Planet Protectors Program
http://www.epa.gov/epawaste/education/kids/planetprotectors/index.htm
Activities and game to help kids learn about reducing wastes and saving resources.
Listed in Lesson 8.

U.S. Department of Energy
eere.energy.gov
Listed in Lesson 8.

U.S. Environmental Protection Agency
epa.gov
Free resource materials for educators and businesses.
Listed in Lesson 8.

Worm Interviews
http://www.middleschoolscience.com/worminterview.htm
Check out this interview with Eddie the Earthworm.

Worm World
Visit Worm World to get all the dirt on Worms: http://kids.discovery.com/tell-me/animals/bug-world/worm-world

From SWANCC

Eco-Friendly Product Fundraisers

Cell Phones /Printer Cartridges:

- Midwest Laser Cartridges Corp. (Park Ridge) – 847-292-2274 or midwestlasercartridgecorp.com. Ask for Scott.
- Cartridges for Kids – cartridgesforkids.com
- Cartridge World – cartridgeworldusa.com – check with local stores
- Cure Recycling – proceeds can go toward childhood cancer research – earthtonesolutions.com
- Funding Factory – fundingfactory.com

Waste-Free Lunchtime Items:

- Bright Bin compartmental lunch box (Evanston) – BrightBin.com or 888-886-5527. Ask for Stephanie.
- Aluminum water bottles and sandwich container with coldpac lid – addedincentives.com
- Wrap-n-Mats – wrapnmat.com
- Stainless steel containers - lunchbots.com
- Lunch bags, food containers and beverage bottles - lunchwithoutwaste.com

Light Bulbs:

- Green Light Bulb – helpfundraise.com
- Lights for Learning – CFL light bulbs – lights4learning.org

Gardening:

- Flower Power Fundraising – flowerpowerfundraising.com
- T-Shirts/Clothing:
- Eco-Promotional Products (Libertyville) – ecopromotionsonline.com. Ask for Michelle.
- Eco Sprouts – ecosprouts.com
- Global Goods Partners - globalgoodspartners.org/schools
- Paper/Pencils/Gift Wrap/Note Cards:
- Smencils – #2 graphite and colored pencils made from recycled newspaper, scented and packaged in a biodegradable tube – smencils.com
- Abitibi Bowater – Paper Retriever – recycling program for non profits – paperretriever.com
- Acorn Designs – nature-inspired note cards on recycled paper – acorndesigns.org
- Earth Presents – gift wrap, cards and bows designed by art students – made from post-consumer recycled materials. - earthpresents.com
- Cancel junk mail – Tonic MailStopper (formerly Greendimes) – precycle.tonic.com
- Stop junk mail - 41pounds.org

Miscellaneous Products:

- Chico Bags Company – chicobag.com
- Bags – reusethisbag.com
- Coffee – cafemam.com
- EcoLabel Fundraising – fair-trade and eco-friendly products - ecolabelfundraising.com
- Eco-Promotional Products – ecopromotionsonline.com – (online shopping)
- The Enterprising Kitchen, a local nonprofit providing job training to low-income women, sblanchard@theenterprisingkitchen.org or call (773) 506-3880
- Equal Exchange – socially responsible, environmentally sustainable and fair-trade products – equalexchange.coop
- Green Fundraising - Raising funds, raising awareness, raising the bar - GreenRaising.com Items include: gifts and wrap; goodies; home & office; lunchtime; and reusable bags.
- Green Market – greenmarketfundraising.com
- Green New Earth – greennewearth.com (online shopping) Items include: reusable and biodegradable bags, toys, compact fluorescent light bulbs, pet products
- Kick Start Green Fundraising – kickstartgreen.com
- Let's Go Green – letsgogreen.biz
- Reclamation of Materials for Reuse or Recycling:
- Preserve's Gimme 5 Plastic Program – preserveproducts.com/gimme5
- Terracycle's Brigades – collects Plastic PET beverage bottles and #2 HDPE milk jugs for worm tea, variety of chip bags, pens, etc. – terracycle.net/brigades

- Textiles recycling (clothes/shoes):
- USAgain - usagain.com or (630) 293-1239, Carlo Cavallaro
- Unique Thrift Store - uniquethriftstore.com
- Chicago Textile Recycling – chicagotextilerecycling.com or (708) 544-7247

Contributors

Seven Generations Ahead would like to thank everyone who contributed toward the development of *Don't Throw Me Away!*: A Zero Waste Curriculum. This curriculum is dedicated to all of the student Zero Waste Ambassadors who are out there working to make a difference for our planet by conserving resources and teaching others about sustainability.

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