

# **What a Waste!**

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## **Overview**

This unit is geared towards students in 4<sup>th</sup>/5<sup>th</sup> grade. It can be taught over the span of 3-4 weeks when teaching 2-3 lessons per week. It includes 9 lessons/activities that involve science, social studies, literacy, and math.

This unit is about waste, reusing and recycling waste, and the effects on communities. Students will learn about what items make up garbage and which of these items can be recycled or reused. Items will be classified as biodegradable or trash that will not rot. There will be multiple opportunities for students to conduct surveys and make connections between the content presented in class and how it relates to their own communities and homes.

Throughout the unit, students will learn important vocabulary and learn about how waste is dealt with in a small village in Gambia (Africa). Science experiments will be conducted to learn more about decomposers, evaporation, and the process of water filtration. The teacher will guide the class to work together to sort their own garbage and then recycle the items that can be recycled. The goal is to make students more aware of their environment and how they can be responsible when it comes to waste.

## **Rationale**

Around the world, each year 2.1 billion tons of waste is dumped. Just in the United States, each person averages 4.3 pounds of waste per day. According to a study done in 2011, the U.S. sends over half of its waste to landfills, while only 34.5% is recycled or composted and 11.7% is burned for energy (Chambers, n.d.). Obviously not all items can be recycled, but landfills with items that are not biodegradable emit toxic fumes and produce chemicals that affect the water (Chambers, n.d.). There are many types of waste that can be considered for recycling and/or reusing. These include, but are not limited to, plastic, paper, food, water, glass, and metal.

Plastics are very important in our world, as they can be molded into many shapes and easily cleaned (Chambers, n.d.). They are vital to the agriculture and medical worlds, and the creation of plastic employs hundreds of thousands of people. Unfortunately, plastic waste can last for hundreds of years because it does not break down very easily. In the

process of plastic breaking down, small pieces can fatally affect sea and ocean life (Chambers, n.d.). Some plastic items, like water bottles, can be easily recycled and used to produce new items (like fleece jackets). Other plastic items, like Styrofoam, cannot easily be recycled and emit dangerous gases when being made (that seep into the ground and the water). It might be better just to use alternative materials rather than creating some plastics such as Styrofoam (Chambers, n.d.).

Water is not something we normally think about in the concept of recycling, but it is very important. Water that comes out of a faucet or goes down a drain is considered “gray water” (Chambers, n.d.). Water that comes from sewage is called “black water”. Because such a large number of people in different parts of the world (1 in 8) have such a lack of clean water, it is very important to recycle gray and black water (Chambers, n.d.). One way this can be done is by using high-tech wastewater treatment plants, but this uses a huge amount of energy. Easier ways to reuse and recycle water include individual septic tanks, pipes that divert gray water from showers and sinks to toilets and watering the yard, gutters that harvest rainwater, and even reed beds that naturally purify the water (Chambers, n.d.).

Recycling is an important, and easy, way to improve the environment. Recycling keeps materials out of landfills and reduces the contamination that happens in groundwater from landfills and the greenhouse gases that are created. In addition, recycling keeps items out of incinerators that create air pollution. Collecting, processing and transporting recycled materials often use less energy than extracting, transporting, and processing raw materials.

## **Objectives**

- Students will be able to brainstorm items that are thrown in the trash in order to determine which items can be recycled and which items cannot be recycled.
- Students will be able to identify items that are biodegradable in order to identify their impact on the environment.
- Students will be able to identify what items are made out of in order to determine if they are biodegradable.
- Students will be able to gather data in order to calculate maximum, minimum, mode, mean, median, and range.
- Students will be able to find key words in a math word problem in order to solve multi-step math problems.
- Students will conduct a survey of litter in order to identify the items that are littered the most.
- Students will be able to identify how plastic bags are recycled in other parts of the world in order to explain the negative effects of plastic bags.
- Students will be able to calculate the percentage of different types of trash in order to identify the difference between a theoretical percentage and an actual percentage.
- Students will be able to track water usage in their household in order to determine where the most waste occurs.
- Students will be able to demonstrate knowledge of how water is cleaned in order to understand the water cycle.

- Students will be able to track the evaporation of water in order to understand the importance of surface area.
- Students will be able to filter water in order to demonstrate knowledge of how water is cleaned and reused.

## Strategies

The teacher will utilize multiple strategies to reach all learners. Most lessons will involve an anchor chart or visual representation of new information or documentation of student feedback. This will provide a resource for visual and spatial learners. These charts should be colorful, organized, and labeled appropriately. Several lessons will involve science experiments where students can make observations and track progress. Students can use Science Journals to record their findings and observations. Students will conduct at least two (2) surveys where they must gather data from their community, home, or classroom. The teacher should guide students through the process of conducting a survey, the importance of accurate record-keeping, and how to collate data from several resources and combine it into one large set of data.

Throughout this unit students will have many opportunities for hands-on learning through the process of scientific experimentation. Students will work together as a class to analyze their trash and sort it into categories.

Important vocabulary will be presented in each lesson and these terms can be collected in a central location (a growing chart displayed throughout the unit in the classroom) or in each students' science journal. The teacher can also reinforce the importance of the terms by creating flashcards, playing bingo, or using Document 2 for students to match the terms to the correct sentence.

## Classroom Activities

What a Waste!

**Materials:** chart paper, items to demonstrate unnecessary packaging (box of chocolates)

Students will brainstorm items that are thrown out and the teacher will create a list of various types of waste (these might include food, clothing, tires, cars, electronics, bottles, paper, boxes, etc.). The teacher will explain to students that all of this trash needs to be stored somewhere and the amount of waste created by humans is enormous (approx. 4 ½ pounds per person per day in the U.S.). Approximately 70% of these items can be recycled or reused. The teacher will guide students back down the list they had created and identify all of the items that can be reused or recycled. The class will discuss how different items can be reused (tires can be shredded for flooring in playgrounds, cars can be taken apart and the metal can be recycled, etc.).

The teacher will then demonstrate how much waste is created from the packaging of everyday items. The teacher will open up three items to show all of the layers of packaging. One great example would be a box of chocolates. This often contains a plastic shrink-wrap, a lid, a protective cover, a tray, and a base (and maybe even individual chocolate wrappers).

## Where Does It Go?

**Vocabulary:** biodegradable, landfill, compost, incinerated

**Materials:** video from website, chart paper

The teacher will begin class by showing students a video about what happens to trash (From Lunch to Landfill, 2012). Students will discuss the steps of trash disposal they observed in the video. The teacher will point out to students that trash could be incinerated (although that emits harmful gases), turned into methane gas to make electricity, taken to a landfill, used for compost, or recycled (Harlow & Morgan, 2001). The class will make a list of items that are biodegradable (will rot) and garbage that will not rot.

Example of chart:

Trash that will rot (biodegradable)	Trash that will not rot
food	Nails/bolts
Dead leaves	Soda cans
Old clothes	Plastic bottles
Cardboard boxes	Plastic wrap
newspaper	Styrofoam box
Banana peel	Potato chip bags
	Batteries
	Tires

“Recycle!”

**Vocabulary:** biodegradable, polystyrene

**Materials:** Recycle! book, chart paper, student worksheet with outline of chart, copies of Document 1 for each student.

Before reading this story, explain to students that many items that are normally thrown in the garbage can be recycled. Create a chart listing paper, glass, cans, plastic, and polystyrene (Styrofoam). Provide each student with an identical chart that they can complete as you complete the one on the board. As you read through the book, complete the chart by listing for each item what it is made out of, how long it takes to biodegrade, and how they can be recycled or reused. After creating the chart and discussing the aspects of each item, students will complete the math problems based on facts from the book on the worksheet “Recycle!” (Document 1).

Example of chart:

Item	What is it made out of?	How long does it take to biodegrade?	How can it be recycled/reused?
PAPER			
GLASS			
CANS			
PLASTIC			
POLYSTYRENE			

Why Is There No Waste in Nature?

**Vocabulary:** Maximum, minimum, mode, mean, median, range, decompose, decomposers, biodegradable, litter, leaf litter

**Materials:** Thick construction paper, black construction paper, jar, heat lamp, leaf litter (a damp mixture of rotten leaves and soil), damp tissue/paper towel

The teacher will explain to students that there are never huge piles of dead trees and/or animals in woodlands because natural materials quickly decompose (break down) and are recycled. Materials that can break down and decompose quickly are called biodegradable. Creatures that break down the waste are earthworms, insects, fungi, and microscopic bacteria. They are called decomposers (Harlow & Morgan, 2001). The teacher will tell students that they are going to “catch” some decomposers. Students will take a thick piece of construction paper and fold the paper to create a funnel, leaving a half-inch hole in the point of the funnel. Students will tape the paper so that the funnel holds its shape. Students will place damp tissue/paper towel in the bottom of a glass jar and wrap the jar with black paper to simulate a damp dark place (like the ground). The paper funnel will be placed in the top of the jar. Students will collect some leaf litter (a damp mixture of rotten leaves and soil) from under some trees and fill the funnel with it. The jar will need to sit under a heat lamp for two hours. Insects gravitate towards dark damp places. Any insects in the leaf litter will move away from the heat and light and drop to the bottom of the jar (where it is damp and dark).

As a homework assignment, students can do a “Litter Survey”. Students can list materials on a piece of paper, such as glass, paper, plastic, metal, etc. Students can then make tally marks under each category every time they see a type of trash in their travels. Students can perform this survey over one 24-hour time period. Students will report out in class and the teacher will record the class-wide findings. Students will discuss the data for each category and identify the maximum, minimum, mean mode, and range for each type of litter. This can precede a discussion on what type of trash is littered most often, what the reasons might be for the particular item being found the most, and what community resources could be put in place to reduce the amount of litter (i.e. more trash cans, recycling receptacles, reduction of certain items, etc.).

## “One Plastic Bag”

**Vocabulary:** see vocabulary words in Glossary of book

**Materials:** Word search from website, One Plastic Bag book, facts about the country of Gambia

Before reading this story, the teacher will use words from the *Wolof Glossary and Pronunciation Guide* in the back of the book to create flashcards for the class (Paul, 2015). The flashcards will include the word, pronunciation, and any illustration that might relate to the word. These words will be introduced to the students before reading, and the class will practice pronouncing each word. The teacher will then read the true story “One Plastic Bag” to students. After reading, the teacher will read the Author’s Note from the back of the book and reinforce to the students this story is based on real facts. The teacher will also provide facts about the country of Gambia so that students have a connection to the setting of the story (Pockets, n.d.). As a culminating activity, students will complete the word search reinforcing vocabulary and important terms from the story ([http://oneplasticbag.com/wp-content/uploads/2014/10/word\\_search\\_gambia\\_oneplasticbag.pdf](http://oneplasticbag.com/wp-content/uploads/2014/10/word_search_gambia_oneplasticbag.pdf), 2015).

## Waste Research

**Vocabulary:** percentage, raw materials, pollution, theoretical, actual

**Materials:** 7 plastic bags, labels, daily classroom trash, chart showing percentages of items found in garbage

It is very wasteful to throw things away if they can be reused or recycled. Raw materials have to be taken from the environment to make new things, which uses energy and causes pollution (Harlow & Morgan, 2001). So the more we throw away, the more the environment will be harmed. The types of materials we can recycle have been increasing for decades. Once, only glass and metal were recyclable. Today, we can also recycle paper, cardboard, rags, batteries, plastics, and much more (Harlow & Morgan, 2001). The teacher can share with students that an estimate of what trash consists of includes approximately:

- 30% wastepaper and cardboard
- 30% kitchen waste (food scraps, etc.)
- 10% metal
- 10% glass
- 8% plastics
- 4% old clothes
- 8% other materials

If people were more careful, approximately 70% of trash could be recycled. The teacher will tell students that they will find out how much garbage their class generates in a week and sort it into bags for recycling. The teacher will take seven (7) plastic bags and label them metal, plastics, paper, cardboard, glass, rags/fabrics, and food scraps. Throughout the span of a week, the class will sort their garbage into the different bags and see how much is collected at the end. Students will then compare their amounts with the estimated percentage. Students will discuss any differences from between the

“theoretical percentage” and the “actual percentage” (teacher will use this specific vocabulary as it aligns with Common Core Standards).

### Where Does the Water Go?

**Vocabulary:** drought

**Materials:** Chart paper

Every day, we each use gallons of water to clean ourselves and to flush the toilet. We also use water for washing dishes, washing clothes, cleaning our cars, and cooking. Once we are finished using the water it disappears down a drain and we don't think about it again. However, this is not the last we see of our water. The water is cleaned and then recycled so it can be reused. Even though it seems like there is an endless supply of water, sometimes there can be a drought and there is not enough to go around. There are even states out west (like California and Oregon) that have had a water shortage for years and years. Therefore, we must do our best to conserve water and try to reduce the amount we use each day (Harlow & Morgan, 2001).

The teacher will have the students conduct a water survey over the weekend to determine how much water is used by their family each day. Students will create a list of all the items in their house that use up water in the home, including toilet, bathtub, dishwasher, washing machine, hose, faucet, etc. Students will then mark a tally next to each item every time it is used on Saturday and every time it is used on Sunday. When students come back to school on Monday, the data can be reported out, charted, and discussed. Where is the most water used in each house? Where is the least amount of water used? Is there anything that can be done to reduce the water usage?

### The Water Cycle

**Vocabulary:** Reservoir, evaporation, surface area

**Materials:** water, saucer, drinking glass, glass bottle, chart of water cycle

The teacher will describe to students what happens to water after it is used in order for it to be recycled, cleaned, and reused. Dirty water from your home goes to a treatment plant to be cleaned. Then it is poured into rivers and carried to the sea. Some water evaporates and turns into gas and then forms clouds. When rainwater falls, it fills up reservoirs that supply us with water (Harlow & Morgan, 2001).

Your Home >>>> Treatment Plant >>>>>> Clean Water Pumped Into River >>>>>>>> Water Evaporates >>> Reservoir Supplies Homes with Water

The teacher will guide students in an experiment to determine how quickly water evaporates. The class will measure out  $\frac{1}{4}$  cup of water into three different containers, a saucer, an opened-mouth glass, and a glass bottle. The class will leave them on a sunny windowsill for 24 hours. After a full day, students will examine the three containers and determine which one had the most water disappear. The water will evaporate faster from

the saucer because it has a larger surface area that is open to the air. It will take the longest for the water from the bottle to evaporate because there is little surface area open to the air (there is only a small hole for the water to escape through).

## Water Cleaning

**Vocabulary:** filter, sewage

**Materials:** funnel, coffee filter, fine sand, soil, clear jar, water

Water is cleaned at a treatment plant by filtering it through soil, sand, and gravel to remove all the dirt. The teacher will guide the class in creating their own water filter. The teacher will use a funnel with a coffee filter paper. A layer of fine sand will be placed in the funnel about 1½ inches deep to create a “filter” and it will be placed over a clear jar. Soil will be mixed with water (to make dirty water) and this dirty water will be poured into the funnel/filter. Students will observe if the water draining into the bottom of the jar comes out clean. The teacher can explain to students that water, containing sewage (human waste), is treated at a sewage plant. The solids are removed and then the liquid part is poured through filter beds where bacteria break down any germs.



## **Annotated Bibliographies/Works Cited/Resources**

### **Bibliography for Teachers**

Chambers, C. (n.d.). *How effective is recycling?* This is a more detailed book with content more appropriate for middle school students and even adults. It provides facts about several types of waste (plastic, food, water, building materials, etc.) and how these items get recycled and how effective it is to recycle each item.

Dimick, Dennis. National Geographic PUBLISHED April 06, 2015. (n.d.). 5 Things You Should Know About California's Water Crisis. Retrieved June 6, 2015, from <http://news.nationalgeographic.com/2015/04/150406-california-drought-snowpack-map-water-science/>. This short article provides some background on why California has a water shortage and the affects this is having on several states in the West.

Harlow, R., & Morgan, S. (2001). *Garbage and recycling*. Boston: Kingfisher. This book has quick facts and short paragraphs about garbage and the importance of recycling. It is geared towards children and provides some activities that children can do to learn more about garbage and its effect on the environment.

Pockets. (n.d.). Retrieved April 2, 2015, from <http://pockets.upperroom.org/for-educators/where-in-gods-world-2/>

This website contains important facts and a quick history of the African country of Gambia (where the true story of “One Plastic Bag” is based)

SFS Leads Anti-Litter Campaign -- The School for Field Studies. (n.d.). Retrieved April 2, 2015, from [http://www.fieldstudies.org/sfs-turks-and-caicos-students-lead-anti-litter-campaign\\_1639](http://www.fieldstudies.org/sfs-turks-and-caicos-students-lead-anti-litter-campaign_1639) This website is about a program on the island of Caicos to educate students on the environmental consequences of littering and the importance of trash cans and recycling

### **Reading List for Students**

Bergen, L., & Snyder, B. (2009). *Don't throw that away!: A lift-the-flap book about recycling and reusing*. New York, N.Y.: Little Simon. This is a simple, short, interactive book that stresses the importance of reusing everyday items and provides specific ideas for children on how to reuse these items.

Chambers, C. (n.d.). *How effective is recycling?* This is a more detailed book with content more appropriate for middle school students and even adults. It provides facts about several types of waste (plastic, food, water, building materials, etc.) and how these items get recycled and how effective it is to recycle each item.

Gibbons, G. (1992). *Recycle!: A handbook for kids*. Boston: Little, Brown. This book is great for children to read independently or for a teacher to use as a read-aloud. It provides a description and facts about recycling. The book then discusses several types of waste, how biodegradable they are, how they can be recycled, and what children can do to reduce the number of each item that is wasted.

Harlow, R., & Morgan, S. (2001). *Garbage and recycling*. Boston: Kingfisher. This book has quick facts and short paragraphs about garbage and the importance of recycling. It is geared towards children and provides some activities that children can do to learn more about garbage and its effect on the environment.

Paul, M., & Zunon, E. (2015). *One plastic bag: Isatou Ceesay and the recycling women of the Gambia*. This is a children's book based on a true story of one woman's efforts to reduce the waste of plastic bags by reusing them to create purses that were sold to villagers in the country of Gambia (in Africa)

### **Materials for Classroom Use**

From Lunch to Landfill (video). (2012, May 10). Retrieved June 6, 2015, from <http://www.fastcoexist.com/1679817/an-adorable-video-teaches-you-what-happens-to-your-trash>. This video is less than 2 minutes long and shows the journey of trash from the lunch table to a landfill. Also provides several facts about recycling and includes views from a factory sorting trash for recycling.

Gibbons, G. (1992). *Recycle!: A handbook for kids*. Boston: Little, Brown. This book is great for children to read independently or for a teacher to use as a read-aloud. It provides a description and facts about recycling. The book then discusses several types of waste, how biodegradable they are, how they can be recycled, and what children can do to reduce the number of each item that is wasted.

(n.d.). Retrieved April 2, 2015, from [http://oneplasticbag.com/wp-content/uploads/2014/10/word\\_search\\_gambia\\_oneplasticbag.pdf](http://oneplasticbag.com/wp-content/uploads/2014/10/word_search_gambia_oneplasticbag.pdf)

This website contains a word search related to the true story of "One Plastic Bag"

Paul, M., & Zunon, E. (2015). *One plastic bag: Isatou Ceesay and the recycling women of the Gambia*. This is a children's book based on a true story of one woman's efforts to reduce the waste of plastic bags by reusing them to create purses that were sold to villagers in the country of Gambia (in Africa)

## **Appendix/Content Standards**

Health 10.2.3 E Identify environmental factors that affect health (pollution, waste disposal, temperature extremes, insects/animals)

Social Studies S4.B.3.3.5 Describe the effects of pollution (ie. Litter) in the community

Science (the Common Core Standards for science at this grade level are currently being updated)

Math 4.MD.B.4 Make a line plot to display a data set of measurements in fractions of a unit

Math 5.MD.B.2 Make a line plot to display a data set of measurements in fractions of a unit

Math 4.NBT.A.3 Use place value understanding to round multi-digit numbers to any place value

Math 5.NBT.A.3 Read, write and compare decimals to thousandths

## Recycle!

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Each person in the United States throws out about four pounds of garbage every day. How much garbage do all the students in your class throw out each day?
2. In one day, Americans get rid of 20,000 cars and 4,000 trucks and buses. How many would be gotten rid of all together in 1 week?
3. Every ton of paper that is recycled saves seventeen trees. How many tons of paper would need to be recycled to save 100 trees?
4. Sixty-five billion aluminum soda cans are used each year. How many are used each day?
5. Each hour, people in the United States use two and a half million plastic bottles. How many are used in a complete day?

## What a Waste!

Name: \_\_\_\_\_

Date: \_\_\_\_\_

filter

sewage

reservoir

evaporation

drought

pollution

raw material biodegradable

decomposers

leaf litter

polystyrene landfill

compost

incinerated

1. \_\_\_\_\_ occurs when water turns into a gas.
2. A deficiency in water supply is often called a \_\_\_\_\_.
3. A \_\_\_\_\_ is used to remove impurities or particles from a liquid.
4. An item is \_\_\_\_\_ when it is destroyed by burning it.
5. The \_\_\_\_\_ is the basic material from which an item is made.
6. The scientific name for Styrofoam is \_\_\_\_\_.
7. A place to dispose of refuse by burying it and covering it with soil is \_\_\_\_\_.