POPULATION EDUCATION

EARTH DAY

• Resources for Middle Grades •

Earth Day 2024's theme is **Planet vs. Plastics**. The activities below explore the magnitude, inequality, and impacts of plastic pollution at home and across the planet. They'll also inspire and guide students to take informed action and be part of a solution to the plastic problem.

Lesson Plans:

Secret Life of Stuff – *Students compare the life cycle stages of four everyday products in order to hypothesize which item has the lowest environmental footprint, and then brainstorm ways to minimize its eco-impact.*

Market Research – *Students visit the supermarket and investigate products' containers and packaging options to determine which products would produce the least solid waste.*

Who Polluted the Potomac? – *Through an interactive story, students experience the pollution of a local river over time and propose methods to protect the river from current and future pollution.*

Eco-Ethics – *Students examine their own values by considering various environmental dilemmas and evaluating how different reactions impact the planet.*

Readings:

The Human Footprint: Pollution & Solid Waste – *Explore the amount and types of waste we create, and the effects it has on the planet.*

Fast Fashion: The Global Impacts of What We Wear – *While fast fashion has made stylish clothing more affordable, it has created an endless cycle of wear–throw away–buy again, that has harmful impacts on both people and the planet.*

***For more great resources, visit us at www.PopulationEducation.org!**

SECRET LIFE OF STUFF

People and the Planet
Lessons for a Sustainable Future

INTRODUCTION

Our "stuff" has a secret life – a life that exists long before it reaches your hand as a consumer and extends long after. For instance, consider the shirt you are wearing. Your shirt may have begun its life in a field of cotton requiring water and, most likely, fertilizers. The cotton was then processed and manufactured, using a lot of energy and chemicals and perhaps traveling quite a distance along the way. Next, the shirt was packaged with a variety of materials, each of which has its own life, and then lastly, it was transported to the store. Once at home, it gets washed and dried regularly, which uses a lot of water and electricity. When it finally wears out (or you become sick of it) it will end up in the landfill, where it lives out the rest of its days.

Most people aren't aware of the stages our stuff goes through, not to mention how those stages impact the planet. A **life cycle analysis, or LCA**, is a technique that assesses the environmental impact of a product and can help identify changes that will decrease a product's eco-impact over the course of its life. With population growing and more goods being consumed, it's important that we consider the impact of not only ourselves, but also our stuff.

MATERIALS

- Student Worksheet
- Several of each "analysis item"
- Life Cycle Analysis Chart (provided)

PROCEDURE

1. Before class, set up four Analysis Stations, each with several of the "analysis items." Make substitutions as necessary. (One station will have several pairs of jeans, the next will have several pairs of sneakers, etc.)

   Analysis Items

Jeans	Ear buds
Sneakers	Small lamp (without lightbulb)

CONCEPT

There are five basic stages in a product's life cycle, and each stage contributes to the product's overall impact on the planet.

OBJECTIVES

Students will be able to:

- Name and sequence the five stages of a product's life cycle.
- Explain what factors influence the environmental impact of each life cycle stage.
- Conduct a basic life cycle analysis of a consumer product.
- Compare the five life cycle stages of four different products, and use reasoning to determine which product has the lowest overall eco-impact.
- Formulate a plan for decreasing the impact of a product by altering one stage of its life cycle.

SUBJECTS

Science (Earth and environmental), social studies (economics), family and consumer sciences

SKILLS

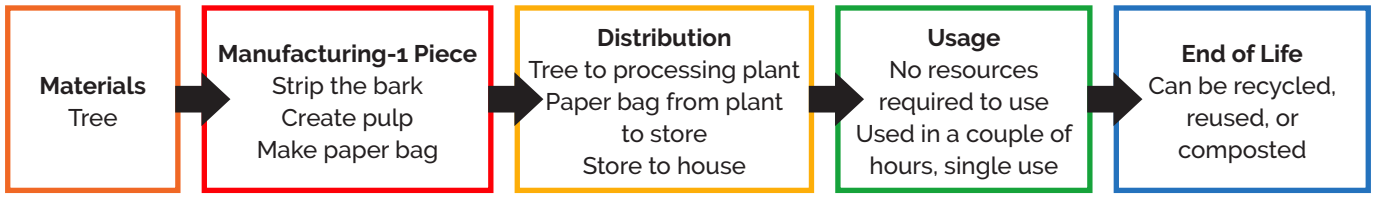
Critical thinking, collecting and analyzing data, comparing and evaluating, communicating using evidence

METHOD

Students compare the life cycle stages of four everyday products in order to hypothesize which item has the lowest environmental footprint, and then brainstorm possible improvements to one product's life cycle to minimize its eco-impact.

2. Hold up a paper grocery bag in front of the class and explain that the bag, an everyday product, has a secret life – a life cycle just like living things.

3. Ask students to hypothesize what they think it means to conduct a life cycle analysis (LCA) of a product and then brainstorm the paper bag's life cycle as a class. You can show students the circle image on the front page if they have trouble determining the five stages. As you go through each stage as a class, ask students to think about what factors influence the environmental impact of that stage.



4. Here's an overview of potential impacts during each stage:

   Materials *– The materials used to create a product must come from somewhere. Some are extracted from mines, others are grown specifically to be used by humans, while others might be taken from the ocean or a forest. Removing these materials impacts the Earth's natural resource base and gathering them requires energy. If the materials are recycled or sustainably managed, their footprint is decreased.*

   Manufacturing *– Each piece of a product has to be created separately before being combined with the other parts. The manufacturing of each piece requires energy and can produce toxic waste. The processing of metals and plastics is especially resource intensive, because they must be melted and refined before use.*

   Distribution *– Many things have to be transported for a product to exist – the raw materials to the production factory, the product to stores, and finally, the product to consumer homes. All of this transportation emits greenhouse gases and contributes to the eco-impact of the product. The product also must be packaged, which can require additional materials and manufacturing.*

   Usage *– Some things require energy, or other resources, in order to be used (appliances, electronics, cars, etc.), and this gets factored into their life cycle analysis. Length of use also plays a role – items that can be used longer have less of a footprint, since they don't need to be replaced by new versions as often.*

   Disposal *– Both the product itself and its packaging must be eliminated. Materials that can be recycled or composted, like cardboard, have less of an impact than those that can't, like Styrofoam. Some items are also easier to reuse or donate than others.*

5. Distribute the Student Worksheet and explain that in small groups, they will be conducting a life cycle analysis for four different products – a pair of jeans, a pair of sneakers, a set of earbuds, and a lamp. Point out the four analysis stations set up around the room.

   Note: The following list provides more information on common materials used in everyday products. You can chose to share this information with students before, during, or after the station analysis, or not at all.

- silver, copper, aluminum, tin, iron, silver, nickel, clay – mined from the ground
- plastic/nylon – made from coal, natural gas, and crude oil that is mined from the ground
- silicon – made from silica, which is mined from sand or rock
- rubber – made from latex which is extracted from rubber trees

6. Before beginning, ask each student to turn to a partner and discuss which of the four products they think has the smallest eco-impact and why. They should record this hypothesis at the top of their Student Worksheet.

7. Divide students into groups of 3-4 and direct each group to one of the four analysis stations – it's okay to have more than one group at a station.

8. Groups should spend 15 minutes at each station working through the phases of the product's life cycle. To record their thinking, each student should fill in their Life Cycle Analysis chart. Students do not need to know the exact information for each product/stage. The goal is to have them think through the stages and make reasonable conclusions. Alternatively, or to save time, small groups could each analyze one product, and then the class could come together to discuss each product and determine rankings in each category.

   Notes:
   - Students should use a pencil to write rankings, as they will likely change as the lesson progresses.
   - You may need to clarify that the rank identifies how they think that product compares to the other three products on that particular stage of the LCA. For example, in the Materials stage, sneakers may be ranked 1 (most eco-friendly), lamp ranked 2, earbuds ranked 3, and blue jeans ranked 4 (least eco-friendly).
   - You may want to structure the 15 minutes so that students spend the first three minutes observing and the next 12 minutes discussing with peers and recording notes.

9. After all groups have moved through all of the analysis stations, give them time to answer the three questions on the Student Worksheet.

10. Go through the Discussion Questions as a class.

Answers to Student Worksheet

Materials used - You can share this information after the analysis stations (during discussion), can provide a "word bank" of these materials for students to choose from during the analysis, or not share them at all.

Jeans: *cotton; indigo dye; copper (rivets); steel (buttons, zipper)*

Sneakers: *rubber (sole); foam, polyurethane, silicone (middle sole); canvas, leather, nylon (body); plastic (eyelets for laces)*

Earbuds: *plastic (outer covering); copper (wire); nickel or copper (plug); plastic or foam (earbud covering)*

Lamp: *ceramic, metal, glass, or plastic (base); ceramic, plastic, aluminum, or brass (socket); brass or silver (plug); copper (wire); plastic (wire covering, switch)*

Answers to other categories and rankings will vary.

DISCUSSION QUESTIONS

1. How accurate do you think your rankings were? Why?

   Answers will vary. You may need to explain to students that there is not one right answer to which product has the smallest impact. Rankings may differ depending on which criteria individual students focused on (energy use, materials, packaging, etc.)

2. What did you find difficult about conducting a life cycle analysis?

   Answers will vary.

3. Are there aspects of any of the product life cycles that weren't included in this analysis but would impact their eco-impact?

   Production of the packaging materials (in addition to their disposal), how energy intensive it is to extract different types of materials, what type of energy is being used during the manufacturing stage (coal vs. natural gas vs. renewables), the impacts of maintaining the materials' source (fertilizers, habitat destruction, etc.).

4. Our human population is rapidly growing. How will this impact the story of our global family's "stuff?"

   With more people on the planet, there is demand for more products. It is important that we consider ways to reduce the eco-impact of material goods as our population continues to grow.

5. As a consumer, how could you use your knowledge of LCA to decrease your own personal footprint?

   Reduce your consumption of "stuff" – if you don't buy it in the first place, there is less demand for products to be made. When you do purchase "stuff," buy products that are locally-made and with locally-sourced materials whenever possible; buy from second hand stores; don't buy more than you need and don't buy a replacement until it's absolutely necessary; support brands that use sustainably managed materials; buy from companies that are making an effort to decrease the eco-impact of their products; buy products with less packaging. Once you've purchased an item, unplug it between uses, line dry clothes and cut-down on washing, reuse it or donate it instead of throwing it away after use.

6. Do you think companies should be required to perform LCA's on their products and to make the results public for consumers? Why or why not?

   Answers will vary.

7. In addition to its eco-impact, what other aspects of a product could a consumer consider before buying it?

   Answers may include: the work environment and wages for the workers who create the product, manufacturing in the U.S. versus abroad, or if a product is fair trade (producers, like farmers, receiving a fair price for their product and their work).

ASSESSMENT

Students pick one item that they are wearing and create a basic flow chart that illustrates that item's life cycle.

FOLLOW-UP ACTIVITIES

1. Ask students to compare and contrast the life cycle of a man-man product with that of a familiar plant or animal.

2. Have students research one of the "analysis" items to see if anything is being done to lower its environmental impact. For example, Nike uses a program called Nike Grind to create sports fields out of pieces of old shoes that were otherwise bound for the landfill.

3. Watch the following videos as a class to give students a real glimpse of what's inside earbuds, LED shoes, and a MacBook pro.

    - How Earbuds are Made – An Inside Look at a Headphone Factory
    - What's inside LED shoes?
    - What's inside a Rose Gold MacBook?

Sources: United States Environmental Protection Agency, "Climate Change and Waste."

SECRET LIFE OF STUFF

STUDENT WORKSHEET

Name: _____ Date: _____

Spend 15 minutes at each station conducing a life cycle analysis of that station's product. As you move through each stage of a product's life, rank how you think the product compares to the other three products in regard to that life cycle stage. (Rank of 1 = most eco-friendly within that stage; Rank of 4 = least eco-friendly within that stage) For example, the item that requires the least miles in distribution would rank 1 for the distribution stage.

1. Hypothesis: Which of the four products do you hypothesize will have the smallest eco-impact? Why?

_____

_____

_____

2. Fill out the Life Cycle Analysis chart on the next page. Then answer questions 3-5.

3. Consider your rank of each product along each phase of its life cycle. Do you agree with your hypothesis? Why? If not, which product do you now think has the lowest eco-impact?

_____

_____

_____

4. Choose one product and determine which stage of that product's life has the biggest environmental impact. What could be done differently during that stage to reduce the product's overall eco-impact?

_____

_____

_____

5. What might be the challenges of enacting this change? Would any aspect of the product suffer?

_____

_____

_____

LIFE CYCLE ANALYSIS CHART

	Materials Remember that each material has to be extracted from the Earth and has its own life cycle.	**Manufacturing** Remember that each piece has to be produced separately, and plastics and metals need to be processed.	**Distribution** Remember to consider where the materials come from and where the product is produced.	**Usage** Some products require resources during use. Some can be used longer while others have to be replaced quickly.	**End of Life** Remember to consider the end of life for the packaging too. Some materials are easier to recycle, compost, or reuse.
Blue Jeans	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4
Pair of Sneakers	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4
Earbuds	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4
Lamp	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4

MARKET RESEARCH

People and the Planet
Lessons for a Sustainable Future

INTRODUCTION

We usually choose grocery items based on their taste, usefulness, or cost. But the amount of waste that will be left when we're finished with the product is also an important consideration. "**Precycling**" refers to the act of selecting products with efficient packaging and minimal wrapping. To effectively "precycle" while shopping, we should ask: Was the manufacturer careful to use a container with no more material than necessary? Is the wrapping and packaging excessive or not needed? Did the manufacturer use recycled and recyclable materials wherever possible? Making grocery store selections while considering these questions encourages smaller amounts of solid waste and keeps unnecessary garbage from entering our landfills Considering that the average person in the U.S. produces about 4.5 pounds of waste per day (almost twice as much as an average person in Japan), this is a worthy effort that can have big impacts on the planet.

MATERIALS

- Student Worksheets 1 – 6
- Clipboard (optional)
- Calculator (optional)

PROCEDURE

This lesson assumes that students know how to read the price per unit on a grocery store price tag.

1. Take a class field trip to the supermarket. (If a field trip isn't possible, bring in various grocery items for students to evaluate in-class.)

2. Divide students into six small groups, and assign each group a Student Worksheet to complete: Group 1 – Pop Shop; Group 2 – Package Baggage; Group 3 – Bag Drag; Group 4 – Size Wise; Group 5 – Disposer Exposure; Group 6 – Green Screen. Distribute one copy of the appropriate Worksheet to each group member.

CONCEPT

Each of us can reduce the amount of waste we generate by purchasing products with minimal amounts of packaging and environmentally friendly containers.

OBJECTIVES

Students will be able to:

- Compare different sizes, containers, and packaging of products to determine which produce the least amount of solid waste.
- Create summary statements after completing real-world data collection.
- Identify at least three ways shoppers can make choices that help reduce solid waste and conserve natural resources.

SUBJECTS

Science (Earth and environmental), math, social studies (economics), family and consumer sciences

SKILLS

Collecting and analyzing data, comparing and evaluating, researching, summarizing

METHOD

Students visit the supermarket and investigate products' containers and packaging options to determine which products would produce the least solid waste.

3. After completing their Worksheets, ask each group to report on their experience and share their summary statement with the rest of the class. Then go over the Discussion Questions.

DISCUSSION QUESTIONS

1. What are some specific choices individual shoppers can make to help reduce solid waste and conserve resources?

   Answers may include:
   - *If you only buy a few items, ask the cashier not to put your purchases in a bag from the store at all. If you have a book bag or purse with you, you could carry your items there.*
   - *Use cloth or mesh bags instead of paper or plastic. Many stores sell cloth bags that you can reuse on each shopping trip.*
   - *Buy items with as little packaging as possible. Choose paper packaging over plastic (if the type of plastic used isn't part of your community recycling program).*
   - *Buy reusable products rather than disposable ones.*
   - *Reuse or recycle packaging items as much as possible. For example, reuse glass jars as storage containers for food bought in bulk.*
   - *If you drive to the supermarket, plan your trips before you go and make a list of what you'll need for the week. That way you'll be sure to get everything you need on the first try, rather than driving to the supermarket more frequently to pick up the things you forgot.*

2. Precycling is a term used by the U.S. Environmental Protection Agency. What do you think this term means? Do you think it is an effective way to reduce solid waste?

   Precycling refers to the act of reducing consumer waste by opting to purchase items that are unpackaged, reusable, or recyclable.

3. What factors do you think most shoppers consider when buying products from the grocery store? What other factors do you think shoppers should consider?

   Answers will vary. In addition to price, shoppers may pay attention to brand preference, taste, visual appeal of packaging, nutritional content, etc.

4. What do you think companies consider when choosing packaging for their products?

   Answers may include: visual appeal, durability, cost to produce, convenience for the customer, etc.

5. We looked at the environmental impact of products' packaging in this lesson. What other aspects of a product might have an impact on the planet?

   Answers may include: how much the product is processed, how far the product traveled during production and while being transported to the store, if the product is organic or was made using fertilizers, etc.

ASSESSMENT

Students complete an exit ticket listing three choices grocery store shoppers can make to help reduce solid waste.

FOLLOW-UP ACTIVITY

Students call or write to one or more beverage packaging companies and ask them the following questions about different beverage packaging options (e.g. cans, no-return bottle, returnable bottles). Companies should be asked to consider not only the type of container (e.g. bottle or can), but also the materials used to make it (glass, plastic, aluminum, other metals).

- Which option for packaging beverages uses the least amount of raw materials? Why?
- Which option uses the least water in processing? Why?
- Which option produces the least amount of water pollution? Why?
- Which option produces the least amount of air pollution? Why?
- Which type of packaging costs the least to produce? Why?

MARKET RESEARCH

STUDENT WORKSHEET 1 – POP SHOP

Name: _____ Date: _____

In the beverage section of the supermarket, compare four different packaging options of the same soda: a 12 oz can and three different volumes of plastic bottles.

1. Fill in the table below.

Soda Name: _____

Package	Cost	Cost per unit of volume
12 oz Can		
Volume 1: oz		
Volume 2: oz		
Volume 3: oz		

2. Which one is the most cost effective purchase? Defend your conclusion below. *1-3 sentences*

3. Which one produces the least amount of solid waste? *1-2 sentences*

4. What are environmentally conscious options for disposing of each type of packaging? *Describe them in 1-3 sentences*

5. Write a summary statement to share what you've learned with the class.

MARKET RESEARCH

STUDENT WORKSHEET 2 – PACKAGE BAGGAGE

Name: _____ Date: _____

In the supermarket, find one kind of non-beverage product that is packaged in two or more different ways. Hint: Check the dairy or meat aisles!

1. Fill in the table below.

Product	Package material/size	Cost	Cost per unit of volume

2. Which one is the most cost effective purchase? Defend your conclusion below. *1-3 sentences*

3. Which one produces the least amount of solid waste? *1-2 sentences*

4. What are environmentally conscious options for disposing of each type of packaging? *Describe them in 1-3 sentences*

5. Write a summary statement to share what you've learned with the class.

MARKET RESEARCH

STUDENT WORKSHEET 3 – BAG DRAG

Name: _____ Date: _____

Observe five people who are leaving the supermarket.

1. Fill in the table below.

Shopper #	Type of bags used	# of bags used	Were all bags necessary? (Y/N)

Total number of bags used: _____

Average number of bags/person: _____

What proportion of people left with two or more bags? _____

What proportion of shoppers could have walked out with fewer bags? (e.g. The bagger put two items in the bag instead of filling it.) _____

2. What types of bags does the store offer? *1-2 sentences*

3. Does the store collect used bags from shoppers for reuse or recycling? Does the supermarket offer a bonus or discount to shoppers who bring their own bags? *2-3 sentences*

4. How do you "get rid of" a bag once it has been used? Where does it go? Which type of shopping bag – paper or plastic – can be disposed of with the least harm to the environment? *4-6 sentences*

5. How could paper shopping bags be reused? Plastic ones? Can you think of a way a person could cut down on the use of disposable shopping bags? How could you avoid using them altogether? *3-5 sentences*

6. Write a summary statement to share what you've learned with the class.

MARKET RESEARCH

STUDENT WORKSHEET 4 – SIZE WISE

Name: _____ Date: _____

In the supermarket, select four products and check prices per unit of the products across several different sizes of packages (same brand).

1. Fill in the table below.

Product	Package size 1	Package size 2	Package size 3
	Size: Cost/unit:	Size: Cost/unit:	Size: Cost/unit:
	Size: Cost/unit:	Size: Cost/unit:	Size: Cost/unit:
	Size: Cost/unit:	Size: Cost/unit:	Size: Cost/unit:
	Size: Cost/unit:	Size: Cost/unit:	Size: Cost/unit:

2. Select two items that are sold in bulk. Compare the cost per unit of weight with the cost of the same item pre-packaged in the largest quantity available. Fill in the table below.

***Hint**: Try toilet paper or paper towels!*

Product/Brand	Individual	Bulk
	Size: Cost:	Amount of units in package: Cost/unit:
	Size: Cost:	Amount of units in package: Cost/unit:

3. Are larger or smaller packages generally the more cost effective purchase? Why do you think this is the case? *3-5 sentences*

4. Which produces the least amount of after-use waste? *1-3 sentences*

5. Write a summary statement to share what you've learned with the class.

MARKET RESEARCH

STUDENT WORKSHEET 5 – DISPOSER EXPOSURE

Name: _____ Date: _____

Find three or more products sold in the supermarket that are designed to be disposed of after only one or a few uses.

1. Fill in the table below.

Product	Describe how long it is used and how it is disposed	Is there a non-disposable alternative?

2. Were there any products that did not need to be disposable? Why or why not? *2-4 sentences*

3. Can any of the products you selected be refilled or otherwise reused? *2-4 sentences*

4. How is each product disposed of? What happens to it when it is disposed of? *3-5 sentences*

5. Write a summary statement to share what you've learned with the class.

MARKET RESEARCH

STUDENT WORKSHEET 6 – GREEN SCREEN

Name: _____ Date: _____

In the supermarket, choose four or more items that are advertised as 'green.'

1. Fill in the table below.

Product	What about it is advertised as 'green'?	Is it environmentally conscious?

2. In the table above, which item has the longest list of ingredients? Which has the most packaging? *1-2 sentences*

3. Are there any items whose amount/type of packaging conflicts with their 'green' label? *1-2 sentences*

4. Why do you think a company would advertise a product as 'green'? *Describe them in 3-5 sentences*

5. Write a summary statement to share what you've learned with the class.

WHO POLLUTED THE POTOMAC?

People and the Planet
Lessons for a Sustainable Future

INTRODUCTION

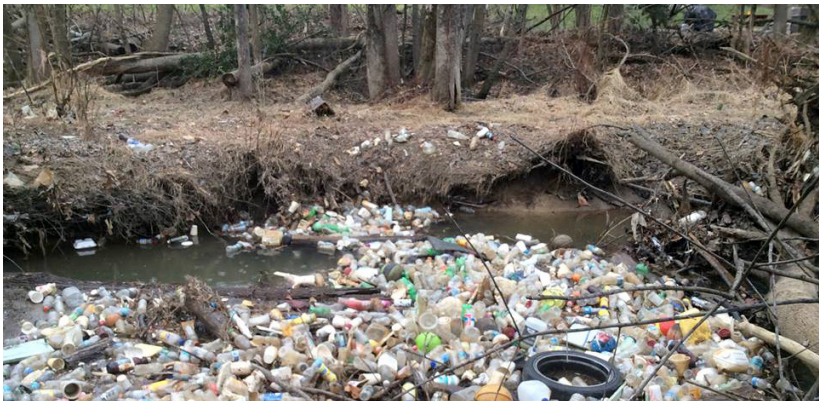
The history and health of our rivers are inextricably tied to the history of the human communities that have settled along their banks. Rivers are a vital water source, home to wildlife, a means of transportation, and more. As the numbers and sizes of our communities have increased over time, the health of our rivers has suffered. Sewage, agricultural runoff, and industrial wastes are just some of the pollutants that find their way into our rivers. This activity demonstrates that, just as we each contribute to the problem, we must also be part of the solution.

MATERIALS

- Clear gallon jar or bowl of water
- Small lidded containers
- Container Labels (provided)
- Container Ingredients
- Story: "Who Polluted the Potomac?" (provided)

PROCEDURE

1. Before class, prepare and label the small containers using the items in the chart below. Tape the 'Volunteers' label to a slotted spoon or tea strainer. Prepare enough characters for each student to have at least one. There are 17 different characters, so for large classes, double some characters and some students will have identical containers.



CONCEPT

The histories of local rivers provide insight into human impacts on an environment, especially as populations and technology change over time.

OBJECTIVES

Students will be able to:

- List three pollutants that can impact rivers.
- Draw connections between individual actions and the pollution of a watershed.
- Develop strategies for minimizing and counteracting water pollution.
- Explain how population growth impacts the health of our nation's rivers.

SUBJECTS

Science (Earth and environmental), social studies (civics, geography, history), English language arts, family and consumer sciences

SKILLS

Critical thinking, listening comprehension, observing, role playing, identifying trends and patterns

METHOD

Through an interactive story, students experience the pollution of a local river over time and propose methods to protect the river from current and future pollution.

Character (Container Label)	Container Ingredients
Natural Debris	Leaves, pebbles, and/or twigs
Soil	Soil
Construction sites	Soil
Picnicking	Litter, assorted
Person fishing	Fishing line or dental floss
Volunteers	Slotted spoon or tea strainer with paper towels
Farmers	Baking soda
Gardeners	Baking soda
Commuters	Vinegar
Coal mine	Vinegar
Electric power plant	Vinegar
Barnyards	Water + instant coffee grounds
Washing the car	Water + 1 drop of dishwashing soap
Homeowner	Water + 1 drop yellow food coloring
Antifreeze	Water + 1 drop green food coloring
Mysterious liquid	Water + 1 drop red food coloring
Motorboats	Water + 1 drop each of red and green food coloring

2. Fill a clear jar or bowl with water. Place the jar or bowl in a location that can be seen by all students.

3. Distribute one container to each student. Ask them to keep the containers closed and upright, and not to reveal the identities of their characters.

4. Read the story "Who Polluted the Potomac" aloud to the class. Add emphasis as you read each bolded character name, and pause after each question to give the students time to think and respond.

   Note: Italicized names in the story are specific to the Washington, DC area. Feel free to change the names and other details to reflect your own community and history. This map of Native lands may help: https://native-land.ca/.

5. Go over the Discussion Questions as a class.

DISCUSSION QUESTIONS

1. Who polluted the Potomac?

   Everyone played a role, either directly or indirectly, in polluting the Potomac River.

2. What effect did the increasing population have on the health of the river and **watershed**? Can you think of any ways population increases could improve a river's health?

In this situation, population growth led to increases in pollution sources and decreases in open space and in available wetlands, which filter water. However, an increase in population may also lead to stronger environmental laws, more efficient uses of resources and public services like sewage treatment plants.

3. Think about the pollution represented in the containers. Could something be done to prevent those types of materials from entering the water in the first place? How?

Answers may include: implementing soil erosion control at the construction site, applying smokestack technology at the power plant, walking or riding a bike instead of driving, picking up trash off the ground, taking a car to the car wash, keeping cars and boats in good repair, etc.

4. Many of the pollutants were the result of an individual person's action. Is an individual the only person impacted by their decision? Does something added to the river in one location, stay there? Where does it go and what is the impact?

No. Rivers are a shared resource, so individual actions and choices impact the entire community. Because rivers run through multiple municipalities and states, pollutants that enter the river at one point move downstream and the effects are felt along the river's path and across municipal and state boundaries.

5. Do upriver cities or states have a responsibility to keep rivers clean for downriver cities or states? Do you think they should?

Answers may vary.

6. Challenge students to come up with ways to clean the water in the bowl. Once these types of pollution have entered the river, how can we get them out? How can we clean up the river?

To practice engineering skills, invite students to propose a way to clean the water in the bowl. They should design a plan, make notes on the effectiveness of their strategy, and propose ways to improve their design. In the classroom, solids can be strained using a kitchen strainer or netting. Students may also find coffee filters or absorbent cotton helpful. In reality, humans clean up waterways using a variety of methods. Examples include using nets to retrieve large items, treating the water with chemicals, or introducing organisms that filter or digest pollutants from the water.

7. Do you think that it is easier to prevent pollution, or to clean water that is already polluted? Have students explain their ideas. What could each of us do to help improve the health of our rivers by preventing some of this pollution?

   Preventing pollution is known to be a more effective approach to ensuring clean waterways. Answers may include: biking or walking instead of driving, conserving water, picking up litter, advocating for changes to environmental policies at your school or in your town, pulling weeds instead of spraying them, etc.

ASSESSMENT

Students complete the following sentences and share with a partner.

Water pollution happens because _____.
Water pollution can be prevented by _____.
Human population growth impacts watersheds because _____.

FOLLOW-UP ACTIVITIES

1. Learn what members of your community are doing to address a current watershed issue. Brainstorm ways that your students can help. For inspiration, learn about this initiative to restore one of Washington, DC's rivers with mussels, https://www.youtube.com/watch?v=lAgduqV0BPs and this project to sustainably clean Baltimore's Inner Harbor with Mr. Trash Wheel, https://www.youtube.com/watch?v=RkQbcrzyAeE.

The "Mr. Trash Wheel" trash interceptor at the mouth of the Jones Falls River in Baltimore's Inner Harbor. (CC BY-SA 4.0)

2. Create a timeline of human impacts on your own watershed. Research the people, industries, policies, and events that have changed it over time. Include things like photos, primary source documents, and articles to explain the history.

3. Ask students to search online for local water services in your community, or ask a local government official to visit your class and discuss your region's water facilities and programs for waste and pollution management.

4. Ask someone from a local indigenous group to speak with your students about their experience with the river. In their community, how was the river used in the past and how is it used currently? What are current watershed issues in their community?

5. For a STEM connection, students can design an invention, product, or system that would minimize the impact of a pollutant on the river. The solution can be realistic or far-fetched. Students should submit a rough draft and design of their solution.

Adapted with permission from Hard Bargain Farm Environmental Center, Accokeek, MD.

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STORY: WHO POLLUTED THE POTOMAC?

Italicized names are specific to the Washington, DC area. Feel free to change the names and other details of the story to reflect your own community and history.

This is the story of the *Potomac River*, and the changes to the river that humans made over time. Listen for the name of the character printed on your container. When you hear your character named, come up to the river (bowl of water), open your container and dump in its contents.

(Story begins:) For more than 10,000 years, people lived on the banks of this river. During that time, they raised families, hunted in the forests, grew crops, and caught fish. Imagine that the bowl of water in front of you was taken from the *Potomac River* by a *Nacotchtank (na-COTCH-tunk)* about 500 years ago.

- How does the water look to you?

- Does this look like water that you might drink? Swim in? Eat fish from?

The *Nacotchtank* built small seasonal villages and a fur trading town on the banks of the *Potomac*. They cut down trees and used the lumber and bark to build buildings. They cleared sections of wetland and planted crops of corn, beans, squash, and potatoes. They quarried rock to create tools like axes and arrowheads. They fished from the river during the seasonal fish runs. We can guess that all of these actions led to **NATURAL DEBRIS**, like twigs, leaves and pebbles, being washed into the river. While there is some archeological evidence that helps us imagine what their life may have been like, there isn't evidence that they greatly impacted the river itself.

- How do you think the *Nacotchtank* used the river?
  Answers may include: bathing, drinking and cooking water, transportation, food source, etc.

About 400 years ago, European colonists arrived to this place. One of the first Europeans kept a journal of his discoveries. He wrote about the Native American communities, the tributaries of "sweet water," and seeing so many fish that he and his crew tried to scoop them out with a frying pan. The colonists pushed the *Nacotchtank* away from the banks of the Potomac, and many other *Nacotchtank* died from diseases the colonists introduced. They established permanent plantations to feed the city's growing population and grew tobacco to sell. **SOIL** washed off plantations and into the river. The European settlers introduced new animals to this land, including livestock. Farmers kept pigs and other animals in their **BARNYARDS**. As rainwater drained out of the barnyard, it carried some of the manure into a little creek behind the farm. The creek flowed into the river.

- How do you think the European colonists used the river?
  Answers may include: bathing, food, drinking and cooking water, transportation, food source, etc.

By 1800, *Washington, DC* had been established as the new nation's capital, and, gradually, the city grew on the banks of the *Potomac*. Developers cleared wetlands and forests to build houses and businesses. Rains washed loose soil from **CONSTRUCTION SITES** into the river. So much soil entered the river that the city dug out a channel to make the river deeper so that ships could reach *DC*.

By the early 1900s, electric power arrived in the city. Far upstream, a **COAL MINE** was dug. Rain water drained down into the mine shaft and soaked the piles of wastes and scraps from mining. This made the rain water become acidic – sort of like a strong vinegar. Then the acid water trickled off the banks and back out into the river.

To burn the coal and produce the power, an **ELECTRIC POWER PLANT** was built along the river. Gasses coming out of the smokestacks combined with moisture in the air to form acids. The pollution fell back to the Earth as acid rain or smog.

- Would you drink this water now? Would you swim in it? Go boating?

- How could we determine if this water is safe for wildlife?
  Answers may include: noticing evidence of dead animals, counting the different animal species in and around the water, viewing water samples under a microscope, and doing chemical tests on the water.

Upstream, large farms planted crops to feed the city's increasing population. **FARMERS** used fertilizers and pesticides to grow enough food for the city. Some of these crops grew right up against the banks of the river, and fertilizer washed off the land and into the water.

Washington, DC is now one of the largest metropolitan areas in the country. Traffic congestion is a big problem for **COMMUTERS** who drive their cars to and from work. Car exhaust fumes (just like power plant fumes) cause acid rain. If a car is not kept in good repair it may also leak oil or other fluids, which will be washed off the pavement and into the river with the next rain.

As the city grew, more and more people moved to the nearby countryside. These rural houses were not connected to the city sewer system. Wastewater from these houses flowed into septic tanks under the ground. One **HOMEOWNER** did not maintain the septic tank, and poorly treated sewage seeped into the river.

And how do the residents of the city and its suburbs spend their time? In one neighborhood, **GARDENERS** work in their yards. Many of them use weed killers and chemicals to keep their lawns green. The next rain will wash these chemicals into a little creek nearby, and then into the river.

One parent teaches their child how to change the **ANTIFREEZE** in their truck. They pour out the used antifreeze into the driveway. Animals can lick the sweet-tasting antifreeze and be poisoned. It can also trickle into the nearby creek and poison fish.

In another neighborhood, a teenager is **WASHING THE CAR**. The soapy water rushes down the driveway into the storm drain; the storm drain empties into the river. The grease and grime on a car can contain asphalt from the roads, rubber particles from the tires, toxic metals, and rust. If the teenager had gone to a local car wash, the water would have been treated before it returned to the river.

Next door is a family cleaning out their garage. They find an old rusty can with a tattered skull and crossbones label still stuck on it. This **MYSTERIOUS LIQUID** looks dangerous and they want to get rid of it before someone gets hurt. They decide to pour it down the storm drain out by the curb. The mysterious liquid is out of sight, but it is headed for the river.

On nice days, many people head down to the river. Some zoom up and down the water in **MOTORBOATS** and don't notice that a little engine oil leaks into the water. Families are **PICNICKING** in the parks along the riverbanks. Some of these people leave trash on the shore. With the next storm, that trash will wash into the river. Further upstream is a **PERSON FISHING**. The person snags their hook on a log and rather than untangling it, breaks off the nylon fishing line and leaves it behind.

One weekend, a group of **VOLUNTEERS** visits the river. They walk up and down the riverbanks and collect trash. [Note: Student uses the slotted spoon or tea strainer to scoop out some garbage. Place spoon and wet garbage on the paper towels.] They gather over 100 bags of garbage that will go to a recycling center or proper landfill and will no longer pollute the river.

The *Nacotchtank* people living today see a very different river than their ancestors saw 500 years ago. People changed the river in many ways.

- How do we use the river today?
  Answers may include: recreation, fishing, and using the river to generate electricity.

- What are similarities and differences in the way we use the river compared to the *Nacotchtank* people and the European colonists?
  Answers will vary. Students may recognize direct similarities like transportation and food, but may not realize that the water they use every day also may come from a local waterway to their tap.

- What do you imagine the river will look like in another 50 or 100 years?

WHO POLLUTED THE POTOMAC?

CONTAINER LABELS


Natural Debris

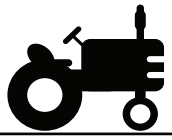

Soil


Construction Sites


Picnicking


Person Fishing


Volunteers

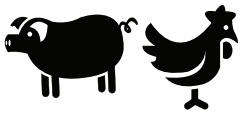

Farmers


Gardeners


Commuters


Coal Mine


Electric Power Plant


Barnyards


Washing the Car


Homeowner


Antifreeze


Mysterious Liquid


Motorboats

ECO-ETHICS

People and the Planet
Lessons for a Sustainable Future

INTRODUCTION

This activity is designed to give students the opportunity to examine their own values and beliefs as they relate to the environment, population and social issues, while gaining an understanding of the complex issues in many of today's environmental debates. It is not the intent of this activity to prescribe "right" and "wrong" answers for the students. In some cases, students may perceive what would be the most ethical solution to a given problem, while admitting that they realistically might not choose that option. On each Dilemma Card, the action choices are preceded by "will you" rather than "should you." This will encourage students to offer their most likely action in each given situation.

MATERIALS

- Dilemma Cards (provided)

PROCEDURE

1. Before class, copy and cut the Dilemma Cards so there are enough cards for each student to get one. Since there are only 12 cards, you will most likely need 2-3 copies of each.

2. Divide the class into groups of four and give each group a set of four different Dilemma Cards.

   Note: The card about sex education may only be appropriate for older students. Use your discretion on whether to include this one in the set.

3. Each student silently decides what they would do and formulates their reason.

CONCEPT

We make many difficult decisions in our everyday lives that can have an impact on the environment and society.

OBJECTIVES

Students will be able to:

- Participate in a collaborative, issue-based discussion within a small group.
- Take and articulate positions on dilemmas.
- Formulate and present reasons for their positions.

SUBJECTS

Science (Earth and environmental), social studies (civics, geography), English language arts

SKILLS

Decision making, critical thinking, values identification, communicating

METHOD

Students examine their own values by considering various environmental dilemmas and evaluating how different reactions impact the planet.

4. When all the students in the group are ready, the first student reads their dilemma and the options aloud to the rest of the group. The student gives the option they have chosen and briefly describes the reasoning involved. In turn, each member of the group is invited to comment on the dilemma and what they might do in the situation. The discussion of each dilemma by the members of the group should take about five minutes. Remind students to be respectful when sharing and hearing each other's ideas.

   The person whose dilemma is being discussed should have the opportunity to ask questions of the other group members and offer clarification about their decision. The discussion gives the students experience in having ideas examined by peers and is intended to remind the students of the need to take personal responsibility for decision making. It is not necessary and may not be desirable for the students to reach consensus; there are legitimately diverse views of the most appropriate and responsible actions to take in many situations. The purpose is to provide students with an opportunity to examine, express, clarify and take responsibility for their own reasoning.

5. Continue this process until each student has had the opportunity to present their dilemma along with their decision and rationale about the dilemma.

6. Bring students together and go over the Discussion Questions as a class.

ALTERNATE PROCEDURES

1. Have students write their own Dilemma Cards, incorporating local issues and debates. These may even be dilemmas they have experienced or observed.

2. Cut off the suggested options on the Dilemma Cards and have students create their own responses.

DISCUSSION QUESTIONS

1. Which of the dilemmas generated the most discussion in your group? Why do you think that was the case?

2. Aside from environmental impact, what are some of the other considerations when choosing an option?

3. For any of the dilemmas, did you choose an option that was different from what you think you should do in that instance? If so, what were the reasons?

4. Are any of these situations similar to something you have encountered? If so, how did you resolve that dilemma?

5. In discussing possible responses to one of the dilemmas, did any of your group members persuade you to choose a different option from the one you originally considered? If so, what about that person's arguments persuaded you? If not, can you think of any other times when you changed your opinion based on persuasive arguments?

ASSESSMENT

Students choose a dilemma and write a short paragraph on the positive and negative effects of all the options listed for that dilemma. Students should indicate what additional information, if any, is needed to make a responsible and informed decision. Students should identify what seems, in their judgment, to be the most responsible decision and explain their reasoning.

FOLLOW-UP ACTIVITY

Even when trying to make the most eco-friendly choices, it's difficult to know what the best strategies are. There may be environmental pros and cons to different choices and the best choice may not be obvious and may require some research. Choose one of the situations below and structure a student debate. Have each side conduct research to find evidence for their position.

- Which creates the worst environmental impact – paper grocery bags or plastic grocery bags?
- Which creates the worst environmental impact – disposable coffee cups or a coffee mug that needs to be washed repeatedly?
- Which creates the worst environmental impact – disposable diapers or cloth diapers?

Adapted from the Project WILD activity "Ethi-Reasoning." ©2003 Council for the Environmental Education.

ECO-ETHICS

DILEMMA CARDS

Here's Your Dilemma

You are at a park with your family for the day. One of the park rules is that visitors are responsible for bringing their trash out of the park (there are no trash cans). You see another family leaving to go home without gathering up their soda bottles and food waste. It is clear the other family intends to leave it behind. What will you do and why?

Will you:

- Go up to them and ask them to pick up the trash before leaving?
- Wait for them to leave and pick up the trash they left and add it to your family's garbage bag?
- Do nothing?
- Other? (specify)

Here's Your Dilemma

Your friend gives you a lovely ivory necklace that she purchased on a trip to Botswana, Africa. You are aware that African elephants are being slaughtered for their ivory tusks and are now an endangered species. What will you do and why?

Will you:

- Accept the necklace and wear it often?
- Accept the necklace but not wear it?
- Explain to your friend why you do not wish to accept her gift?
- Other? (specify)

Here's Your Dilemma

Your school cafeteria prepares food items that are popular with students and familiar to them (burgers, hot dogs, pepperoni pizza, chicken nuggets, etc.). You know that most of these items are high on the food chain, requiring lots of water and energy to produce. You are also aware that much of the grain produced in this country is used to feed livestock. What will you do and why?

Will you:

- Visit with school administrators to suggest having meatless lunches served at least once a week?
- Bring your own lunch and not worry about the cafeteria menu?
- Eat whatever is served?
- Other? (specify)

Here's Your Dilemma

Your parents make you mow and water your lawn. The area hasn't had much rainfall for some time and area officials are recommending that everyone conserve water. However, your neighborhood has strict rules about keeping each yard in order and without regular watering, your lawn will turn brown. What will you do and why?

Will you:

- Ignore the conservation warning and continue watering your lawn to keep it looking nice?
- Sacrifice the beauty of your lawn by watering less often?
- Plant different things in your yard that do not require so much care?
- Other? (specify)

ECO-ETHICS

DILEMMA CARDS - PAGE 2

Here's Your Dilemma

A friend asks you a question about sex and how to prevent pregnancy. Although you don't know the answer for sure, you know enough to guess. What will you do and why?

Will you:
- Make up an answer based on the facts you know?
- Try to help find the answer in online?
- Suggest your friend talk to his/her parents or a teacher?
- Admit to your friend that you do not know for sure?
- Other? (specify)

Here's Your Dilemma

The school you attend is not in walking distance from your home. Your parents give you the option of catching the bus on the corner or getting a ride from one of them in the family car. The car would get you to school faster and without waiting outside. But the bus uses less gas per passenger. What will you do and why?

Will you:
- Take the bus?
- Get a ride in the car?
- Carpool with other kids nearby?
- Ride your bicycle?
- Other? (specify)

Here's Your Dilemma

There is an undeveloped green space in your town where you and your friends sometimes go to hang out. It is home to some local wildlife and a small creek. The town officials are thinking about developing the land as a recreation center with a skateboarding park, basketball and tennis courts. What will you do and why?

Will you:
- Support the building of the proposed recreation facilities?
- Oppose the project altogether?
- Go to a city planning meeting to see if the committee would consider a different site for the project?
- Do nothing and let the adults decide?
- Other? (specify)

Here's Your Dilemma

Your soccer team is raising money to buy new uniforms and decides to sell chocolate bars as a fundraiser. In science class, you've been learning about the threats to tropical rainforests and how millions of acres are cleared to plant palm oil plantations. Palm oil is in many foods, including popular chocolate bars, but its production often leads to the destruction of rainforests. What will you do and why?

Will you:
- Urge your coach and team members to only sell palm-oil free chocolate bars for the fundraiser and raise awareness of rainforests while raising money for your new jerseys?
- Sell mass-market chocolate bars that contain palm oil because it's more economical.
- Suggest the team sells something other than chocolate bars.
- Other? (specify)

ECO-ETHICS

DILEMMA CARDS - PAGE 3

Here's Your Dilemma

After months of pleading, you were given a small pet fish for your birthday, along with a book discussing how to best care for your pet. Until then, you and your parents were not aware that fish can live up to 20 years in captivity. Several months have passed and you are tired of feeding and cleaning up after your new pet. What will you do and why?

Will you:

- Flush the fish down the toilet?
- Release the pet into a local river knowing it will not have a good chance of surviving in this new habitat?
- Beg a friend to take your fish without telling them about its long life?
- Secretly drop the pet off on the door step of a local veterinarian or pet rescue agency?
- Other? (specify)

Here's Your Dilemma

You love playing video games and own a couple of different game consoles. You recently learned that these consoles use a lot of energy. One recent study showed that all of the country's game consoles use roughly the same energy as the entire city of San Diego, California! Most of the energy is generated from coal-burning power plants. You are concerned about the environmental impact of playing these games, but it's one of your favorite forms of recreation. What will you do and why?

Will you:

- Keep playing the games but diligently turn off the consoles when not in use to save energy?
- Give away your consoles and only play video games when you go to friends' houses?
- Keep playing the games at home, but write to the game console manufacturers urging them to make more energy-efficient models?
- Other? (specify)

Here's Your Dilemma

At the recreation center, you see the trash cans full of empty, plastic water bottles. You have heard that all of these bottles pile up at trash dumps or float around in the ocean. What will you do and why?

Will you:

- Ask the people running the center to offer water filling stations and provide visitors with refillable bottles?
- Ask the manager to set up recycling bins for plastic bottles?
- Bring your own refillable bottle from home to use and maybe talk to your friends about doing the same?
- Do nothing?
- Other? (specify)

Here's Your Dilemma

As your class is going to lunch, you notice that the AV equipment and lights are still on. You know that high energy use has a negative impact on the planet. What will you do and why?

Will you:

- Turn off everything yourself?
- Point it out to the teacher or principal?
- Start a class discussion about saving energy?
- Do nothing?
- Other? (specify)

THE HUMAN FOOTPRINT:
AIR POLLUTION AND SOLID WASTE
UNIT 5 STUDENT READING

People and the Planet
Lessons for a Sustainable Future

Everything we consume creates some kind of waste. Think about it. The food we eat fuels our bodies, but some of that becomes sewage or food waste. The gas we burn in our cars produces exhaust. The **fossil fuels** we burn in our power plants produce smoke and ash. And all of the product packaging and things we don't want any more wind up as trash. What goes in must come out – in some form or another.

Back in the days when there weren't so many people or so much productivity, waste didn't seem like much of a problem. When archaeologists dig up the remains of ancient civilizations, the "garbage" they find consists of animal bones and pottery shards; maybe some coins, tools or scraps of clothing. Before the **Industrial Revolution** starting in the late 1700s, there were no factories making lots of things or power plants burning energy. Until a century ago, there were no cars or trucks burning gasoline. And it's only been since the mid-1900s that we started to make lots of items out of plastic. In short, the types and amounts of waste we produce have changed a lot in a small span of time.

UP IN THE AIR

When the first Model Ts rolled off the assembly line in 1908, few could have realized how many cars would be on the roads just a hundred years later (over a billion!). Or that a world population of fewer than 2 billion would grow to nearly 8 billion. Nor would early factory owners have foreseen a truly global economy where products are made all over the world. All of this can be considered evidence of human progress, productivity and growing wealth. But it does come at a cost. With fossil fuels (coal, oil and natural gas) as our main sources of energy, all of the miles driven and items manufactured create an ever increasing amount of air pollution.

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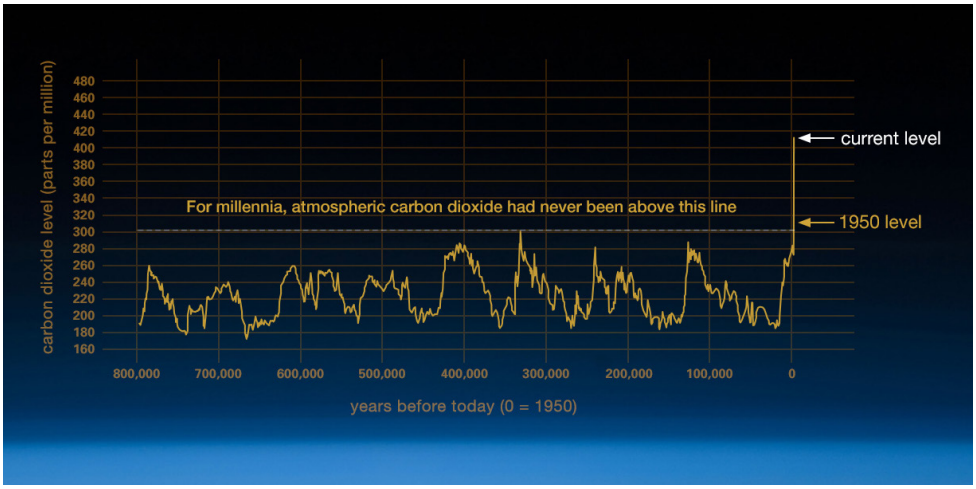
Air pollution is any substance that humans introduce into the atmosphere that has negative effects on living things and the environment. Air pollution takes many forms but most commonly comes from the burning of fossil fuels. These emissions threaten public health and release **greenhouse gases** which trap heat in the atmosphere. When we think of air pollution, we may picture a city with a visible layer of smog or haze in the air. Much of the pollution in our air though, is invisible. It's in the form of gases and **particulate matter** – very tiny suspended particles of soot, ash, dust, acids, metals and chemicals. In the United States, laws are in place to help keep harmful levels of chemicals and gases out of our air, but this isn't the case all over the world.

More than half of the world's people now live in cities with increasing emissions from cars, power plants and factories. In places where strict limits on air pollutants don't exist, many people suffer from **respiratory diseases** (like asthma and lung cancer) and heart disease. In fact, about 1 of 8 deaths in the world is related to air pollution exposure. Air pollution also threatens the health of plants and animals.



Source: NASA

A HOTTER PLANET

The leading byproduct of burning fossil fuels is **carbon dioxide** released into the atmosphere. Carbon dioxide is the primary greenhouse gas that contributes to **climate change**, or global warming. The Earth's atmosphere is a complicated system of gases and energy. It allows energy from the sun to pass through to the Earth and also allows energy from the Earth to escape into space. In this way, the atmosphere regulates our climate. The burning of oil, coal, and natural gas has increased the concentration of certain gases in our atmosphere. These gases act like a blanket, trapping Earth's heat energy and preventing it from passing through to space. This causes the planet to warm, much like a greenhouse.

The cumulative effect of all of the carbon dioxide we've released into the atmosphere is already causing major changes to our climate and ecosystems. The overall global temperature is warmer now than it has been since we started recording that information in 1880. This has caused a whole series of events. Glaciers are melting, which raises the sea level, which then floods coastal communities and submerges islands. Warmer ocean temperatures and more acidic water (from the carbon dioxide) has been destroying coral reefs, which is habitat for lots of marine life. Weather patterns are changing, causing more droughts in some places and more violent storms in other places. This affects our food crops.

Most world leaders consider climate change to be the biggest threat to our planet, and there are plans to try to prevent it from getting worse. While the greenhouse gases already in the atmosphere are expected to continue warming the Earth by at least 2˚ Celsius (3.6˚ F) this century, scientists agree that any warming beyond that could be devastating to ecosystems. Many countries are making commitments to drastically reduce carbon dioxide emissions by switching to non-polluting energy sources like wind and solar, and planting more forests to help absorb more carbon dioxide.

TRASH TALK

The most visible kind of waste we produce finds its way to our curbs or down the trash chutes. The average American produces over 4 pounds of **solid waste** each day. Everything from empty containers, plastic packaging and uneaten food to old clothes, cell phones, used tires and more. What we do with that solid waste can have a big impact on the environment. Much of it gets dumped in landfills – big holes in the ground. Some is burned, producing ash and smoke. A growing amount of trash is recycled to make new items. Food waste can be **composted**, which creates enriched soil for growing new plants. Many cities are looking for ways to get residents to recycle and compost more in an effort to reduce the amount of discarded trash.

The best way to reduce solid waste is to use less stuff that creates trash. This might mean choosing items with less packaging and buying only the food that you will eat before it spoils. There are other ways to be a smart shopper that can reduce both solid waste and air pollution. Find out more about the products you want to buy by reading labels. How far did those items have to travel to get to your local store or online retailer? (More miles mean more air pollution and carbon dioxide emissions.) How long would you expect the product to last or be useful? When you're done with it, can it be recycled or reused by someone else? Thinking about the lifecycle of a product can help us choose items that will have a lighter impact on the environment. As consumers, we can also put pressure on businesses to be more mindful of the environmental impacts of the products they make and sell.

Glossary

air pollution: any substance that humans introduce into the atmosphere that has negative effects on living things and the environment.
carbon dioxide: a colorless, odorless gas produced by burning carbon and organic compounds and by respiration. It is naturally present in air (about 0.03 percent) and is absorbed by plants in photosynthesis.
climate change: a long term change in Earth's weather patterns attributed largely to increased levels of carbon dioxide produced by the use of fossil fuels.
compost: a mixture of decayed organic matter (plants, food scraps, manure) that can be used to fertilize plants.
fossil fuel: a natural fuel such as coal, oil or gas, formed in the geological past from the remains of living organisms.
greenhouse gases: gas in the atmosphere that allows sunlight to pass through but absorbs heat that is radiated back from the warmed surface of the Earth.
Industrial Revolution: a period in history (mid 1700s through late 1800s) when there was a surge of new advances in science and technology.
particulate matter: very tiny suspended particles of soot, ash, dust, acids, metals and chemicals.
respiratory diseases: diseases that affect the lungs and tissues that are part of our respiratory system. These can range from mild (like the common cold) to serious (like asthma, pneumonia and lung cancer).
solid waste: any garbage or refuse plus sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility.

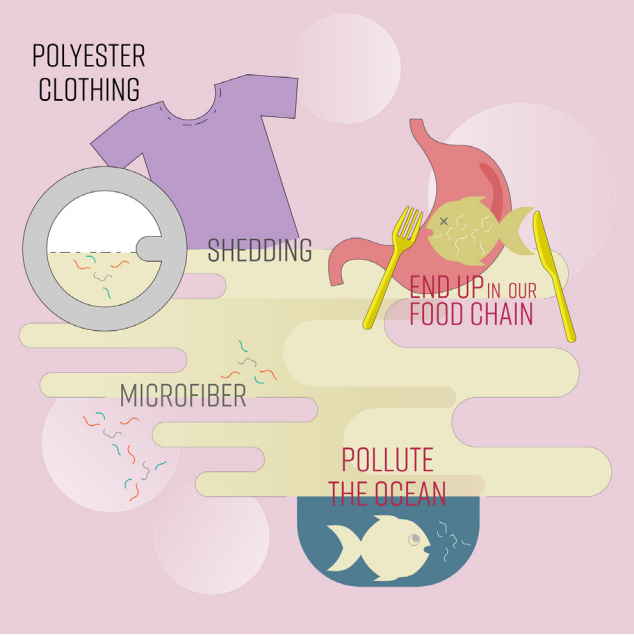
FAST FASHION:
THE GLOBAL IMPACTS OF WHAT WE WEAR

People and the Planet
Lessons for a Sustainable Future

One of the most harmful environmental problems that we face today is hidden in a familiar place – your closet. **Fast fashion** refers to low quality clothing that is designed, produced and distributed quickly and cheaply. It usually copies current runway trends at a low price, and will be "out" of style almost as quick as it was "in" style. While fast fashion has made stylish clothing more affordable, it has created an endless cycle of wear–throw away–buy again, that has harmful impacts on both people and the planet.

FASHION WOES FOR THE AIR AND SEA

When people think of environmental damage, clothing may not be the first thing that comes to mind. Yet, fashion can take a huge toll on the environment. The fashion industry produces 10 percent of the world's carbon emissions. That is more emissions than international flights and maritime shipping put together.[1] Additionally, people in the U.S. throw away about 85 percent of their clothes each year. The equivalent of one garbage truck full of clothes is burned or dumped in a landfill every second.[2] While some discarded clothing is recycled, not all fabrics are able to be recycled and the process involves a lot of time and effort.



Microfiber shedding pollution. ©Rawiwan Chiamsakul | Dreamstime.com

The production and washing of clothing is also damaging our oceans, especially with the release of **microplastics**. Microplastics are tiny pieces of plastic that do not **biodegrade.** Many **synthetic fabrics** (like polyester, acrylic and fleece) shed fibers in the laundry that contain microplastics. The wastewater from the rinse cycle winds up in the ocean. Although they are tiny, microplastics can cause big problems, since they contain chemicals and toxins that can harm humans and animals. When released into the ocean, microplastics are eaten by **zooplankton**, fish, and other aquatic creatures. Microplastics are also making their way into table salt, tap water and bottled water, and even in the air that we breathe. Scientists are still researching the impacts that microplastics cause to humans and wildlife, but they are certain of one thing – microplastics are all around us.[3]

TREATMENT OF GARMENT WORKERS

The damage of fast fashion goes beyond the environment. In order to sell clothing at low prices, companies tend to manufacture their goods in **less developed countries** where they pay garment workers very low wages. Workers toil long hours in often unsafe conditions. The

largest group that is exploited are women, who are already vulnerable to discrimination in their everyday lives. Eighty percent of the garment workers worldwide are women of color.[4] Approximately 300 million people around the world rely on the fashion industry for their **livelihoods**. As this industry has created so many jobs, what can be done to make it healthier for the Earth and for the many people it employs?

SUSTAINABLE FASHION SOLUTIONS

In response to the increasing problems caused by the fashion industry, the United Nations created the Alliance for Sustainable Fashion in 2019, which works to hold the industry more accountable for its practices. The organization works on social issues, like improving conditions and pay for workers, as well as environmental issues, like reducing the waste and water pollution caused by the fashion industry.

A clothing rack of blouses. ©Lenutaidi | Dreamstime.com

The need for change is present at all levels of the **supply chain**, from the producers that are making clothes, to consumers who are buying more clothing than ever. The rise of fast fashion has been linked to social media influencer and celebrity culture, and brands work to target young people who are using social media. Young people have the power to change this by becoming "influencers" for sustainable habits. Before buying new clothes, swap with a friend and get some "new to you" clothes. Secondhand clothing is now becoming readily accessible through resale websites and apps. Try to reuse your clothes and convert them in to something different. Don't be afraid to be an outfit repeater – the Earth will thank you for it!

Glossary

biodegrade: to break down naturally through bacteria or other organisms.
fast fashion: rapidly produced clothing created to replicate current runway fashion trends.
less developed countries: poorer countries that do not produce as many goods and services as more developed countries.
livelihood: source of income.
microplastics: small pieces of plastic (less than 5mm in size) that do not biodegrade.
supply chain: sequence of processes involved in the production and distribution of a product.
synthetic fabric: fabric made by a chemical process by humans, as opposed to natural fabric made from fibers from plants or animals.
zooplankton: tiny shrimp-like animals that drift with water currents.

[1,2] McFall-Johnsen, M. (2019, October 21). The fashion industry emits more carbon than international flights and maritime shipping combined. Here are the biggest ways it impacts the planet. *Business Insider*. Retrieved from https://www.businessinsider.com/fast-fashion-environmental-impact-pollution-emissions-waste-water-2019-10
[3] How harmful are microplastics? (n.d.). Science Learning Hub. Retrieved January 26, 2022, from https://www.sciencelearn.org.nz/resources/2809-how-harmful-are-microplastics
[4] Legesse, K. (2020, June 11). Racism is at the heart of fast fashion – it's time for change. Retrieved from https://www.theguardian.com/global-development/2020/jun/11/racism-is-at-the-heart-of-fast-fashion-its-time-for-change