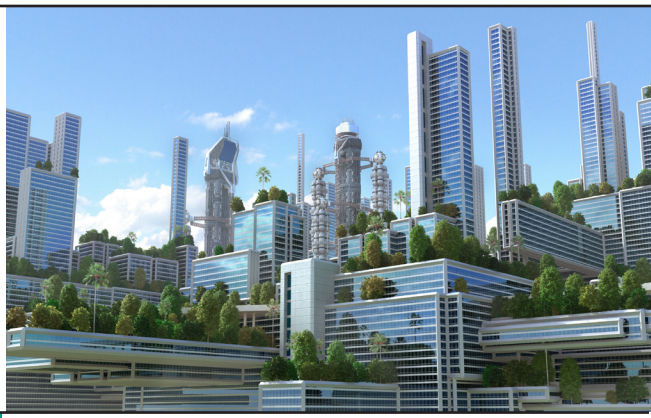
Smithsonian

SCIENCE
for Global Goals

SUSTAINABLE COMMUNITIES!



Part 6:

How can we use resources wisely to help our community thrive?

SUSTAINABLE DEVELOPMENT GOALS

developed by

Smithsonian
Science Education Center

in collaboration with

iap SCIENCE HEALTH POLICY
the interacademy partnership

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Part 6: How can we use resources wisely to help our community thrive?

Find out More!

For additional resources and activities, please visit the Sustainable Communities StoryMap at https://bit.ly/2YdHNqB.

Part 6 Planner

Timing note: *The time used for investigations, observations, and actions can vary. When different options are listed within an activity, some options may take longer than others.*

Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 1: What resources do I use and how renewable are they?					
Discover	Observe and analyze the resources you use.	• Paper • Pens or pencils		25 minutes + observation time	6-9
Understand	Investigate the source and sustainability of the electric energy used in your community.	• Paper • Pens or pencils		25 minutes + investigation time	6-12
Act	Consider ways to make resource use in your community more sustainable.	• Paper • Pens or pencils	*Thriving Community Goals* (Part 1, Task 3)	15 minutes	6-14
Task 2: What waste does my community produce?					
Discover	Explore the waste you produce and what happens to it.	• Paper • Pens or pencils	*List of Things Used* (Task 4)	35 minutes	6-18
Understand	Investigate the amount of plastic waste you produce.	• Paper • Pens or pencils	* StoryMap extension available	20 minutes + investigation time	6-20
Act	Decide how you will reduce the waste you produce and put these ideas into action.	• Paper • Pens or pencils	*Part 6 Organizer* (Task 1)	20 minutes + action time	6-23

Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 3: How can my community reuse instead of waste?					
Discover	Search for evidence of a circular economy system in your community.	• Paper • Pens or pencils	* StoryMap extension available	40 minutes	6-25
Understand	Repurpose an item to create a new use for it.	• Paper • Pens or pencils • Items to repurpose	* StoryMap extension available	25 minutes + creation time	6-27
Act	Share what you have learned about the circular economy with others.	• Paper • Pens or pencils	*Part 6 Organizer* (Task 1)	15 minutes + action time	6-30
Task 4: How can my community recycle waste?					
Discover	Explore recycling options and rules in your community.	• Paper • Pens or pencils	* StoryMap extension available	45 minutes	6-31
Understand	Investigate composting opportunities in your community.	• Paper • Pens or pencils	* StoryMap extension available	40 minutes	6-32
Act	Plan ways you could help your community do more recycling or composting.	• Paper • Pens or pencils	*Part 6 Organizer* (Task 1)	30 minutes	6-37

Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 5: How can we improve transportation in our community?					
Discover	Consider the ecological footprint of your community and how it could be more sustainable.	• Paper • Pens or pencils • Computer (optional)	*Part 6 Organizer* (Task 1) *Thriving Community Goals* (Part 1, Task 3) * StoryMap extension available	25 minutes	6-39
Understand	Decide on individual actions you will take to make your resource use and waste more sustainable.		*Part 6 Organizer* (Task 1)	15 minutes	6-43
Act	Put your idea for individual change into action and reflect on it.			10 minutes + action time	6-45

* StoryMap extension found at https://bit.ly/2YdHNqB

Part 6: How can we use resources wisely to help our community thrive?

People use **resources** to meet our needs. Most people use many different resources in many different ways. For example, we need resources to make the roads we travel on, the homes we live in, the food we eat, and the clothes we wear. The resources we use originally come from natural materials found on Earth. Sometimes these natural materials are found in the ground, like metals or petroleum (oil). Sometimes these materials grow on or in the ground or ocean, such as plants or animals.

Often, we use resources only once and then they become **waste**. Waste are materials that we throw away or get rid of. There are other possibilities for resource use, however. In this part, you will learn about ways to use fewer resources and create less waste. Right now, people on Earth use more resources than the Earth can renew. But by making wise choices about resource use and waste, our **community** and our world can become more **sustainable**.

Remember: In this guide you and your team are in charge. You can always change the instructions in the steps to make them work better for you and your team.

Your Research Mentor

Sharing your experiences with others and learning from others' experiences is part of being a good **action researcher**. In Part 6, you will have a research **mentor** to help you understand some issues of resource use and waste in your community and how to research those ideas. A mentor is someone who has experience and can help guide you.

Meet Steve Nelson, Your Part 6 Research Mentor

Meet Steve Nelson. Steve (pronounced *Steev*) is the zone manager for the Smithsonian's National Zoo and Conservation Biology Institute. Steve is in charge of the buildings and outdoor spaces. He also leads the Recycling

Task Force for the Smithsonian. You, your team, and Steve are all part of the many researchers around the world trying to find

ways to make the spaces around them more sustainable. Steve will be your research mentor to help you understand the use and waste of resources in your community.

Steve has degrees in mechanical technologies, production management, emergency management, technology administration, and homeland security. However, he also has knowledge and **perspectives** that come from other parts of his **identity**. Since Steve is now working with you, it is important to understand who he is. To help you, Steve filled out an identity map, just like you did in Part 1. Steve's identity map includes the following things.

- 55+ years young, male
- 34 years in the military, retired, and a former law enforcement officer
- Spent many years running the environmental program on base
- Born in the United States in Kansas, migrated to West Virginia, now working at the National Zoological Park in Washington, DC, and Front Royal, Virginia
- Grew up working on Grandpa and Uncle Jim's dairy farm . . . still get up hours before the sun rises!
- Interested in the environment, mechanical systems (to take apart and put back together), science, biology, and people (specifically their actions and reasoning driving those actions)
- Actively involved in **composting** and diverting waste away from the **landfills** and oceans
- My favorite hobby is not only a hobby—it is my work!
- Enjoy learning new things and taking on new challenges to better people's lives, improve animal welfare, and help improve the environment
- Quiet, curious about everything, and only engineers seem to understand my sense of humor
- Husband, father, grandfather, brother, and loyal companion to puppy Tuck (gray beard, so not much of a puppy anymore!)

Before you begin the rest of Part 4, think quietly to yourself about Steve's identity map.

- Are there things you have in common with Steve?
- Are there ways you are different from Steve?
- Can you see anything about Steve's identity that would help him understand different perspectives on how to help a community **thrive**?

Throughout Part 6 you will notice Steve sharing ideas and experiences with you. He may help you understand better ways to conduct investigations, or he may share some of the work he has done.

Task 1: What resources do I use and how renewable are they?

All living things use resources. Resources are the materials we use to meet our needs. From the air you breathe, to the food you eat, to the house you live in, you are using resources. In this task you will ***discover*** more about the resources you use. Then you will **investigate** to ***understand*** where energy resources you use come from. Finally, you will ***act*** on this information to consider ways to make your energy use more sustainable.

Discover: *What resources do I use daily?*

Everyone uses resources to meet their needs. Some of the resources you use are **renewable**, meaning they can easily be replenished. For example, the oxygen in the air you breathe is a renewable resource. It is part of a quick natural cycle that involves plants and animals, such as humans. Plants produce oxygen through **photosynthesis** and release it into the air. Humans get oxygen from the air they breathe in. Other resources you use may be **non-renewable**, meaning it would be impossible or take a long time to replenish them. For example, many things dug out of the ground, like **fossil fuels**, rocks, and minerals, would take millions of years and very specific conditions to form again.

1. **Observe** yourself and your actions for an hour or two. Write down, draw, or find another way to make a list of all the things you notice that you are using. For example:
    a. Are you inside a building? Add the building to your list.
    b. Are you using furniture? Add the furniture to your list.
    c. What is your body using? Add the air you are breathing and anything you drink or eat.
    d. Are you using power for anything that needs electricity or has a battery, such as lights, a phone, or a computer? Add those items to your list.
    e. What are you wearing? Add those items to your list.
    f. Are you using anything to move around, like a car or bicycle? Add that to your list.
    g. What other items are you using? Add those items to your list.
2. Examine your list. Pick one item and list the materials you know are in it. Use Figure 6.1 as an example of a list. The item chosen on that list is a

chocolate ice cream pop on a stick that had a wrapper. The materials include chocolate, cream, and sugar for the ice cream, then wood for the stick, and **plastic** for the wrapper. You also might be able to use the label to find out more details about what is in different items.

Figure 6.1: Sample list of things used and the materials the ice cream pop is made from

3. Next list where the materials come from, if you know. For example, milk may have come from a cow. Sugar and chocolate come from plants. Wood comes from trees. Plastic is made from petroleum, sometimes called oil.
4. Trace the materials that compose each item as far back as possible. What was needed to produce those materials? For example, if the milk came from a cow, a cow needs water and plants to live. The plants it eats also need water to live.
5. If you know that it took energy to make something, show that as well. For example, with your chocolate ice cream, something cold was needed to freeze the ice cream and keep it cold. This needed energy to make ice or keep a freezer cold. A machine that uses energy may have been needed to mix up the ice cream, too. Figure 6.2 shows an example of a list with one completed item. The blue ovals in the figure show the places energy is needed to make the materials. For example, making sugar out of plants takes energy. Using that sugar to make ice cream also takes energy.

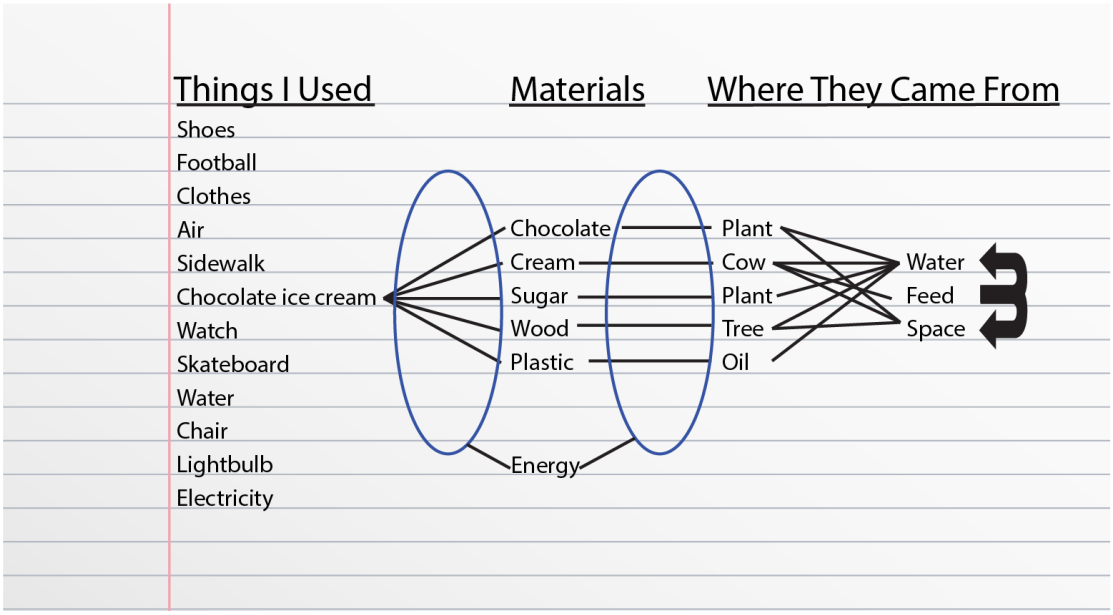


Figure 6.2: A sample list of things used, the materials in the ice cream pop, and where they come from

6. Go through this process again to find all the resources used to make several other items on your list. For example, in Figure 6.2 the resources needed to make the chocolate ice cream would be water, feed, space, plants, cow, tree, oil, chocolate, cream, sugar, wood, plastic, and energy.
7. Compare the resources you found with your other teammates. Discuss:
    a. Are there some resources that were needed to make many of the things we use? For example, maybe a lot of things needed water to grow or be made?
    b. Which of the resources are renewable? Which are non-renewable? Just answer what you know. For example, you may know that plants and water are renewable resources. You may know that oil is not a renewable resource. But maybe you are not sure about energy. Whether energy is renewable or not depends on how the energy is made. You will have a chance to investigate that further in the next activity.
    c. Why do you think some people believe humans should try to use only renewable resources? Do you agree with them?
    d. What would make it easier to use only renewable resources?
    e. Are there some situations where non-renewable resources really should be used?
8. With your team, create a list of resources you use often. For example, the list might include energy, water, oil, wood, and other materials. If several

people on the team are using a resource or one person is using it many times, include it in the list.

Understand: *How renewable is the energy I use?*

The energy used in homes, businesses, and transportation can come from different sources. These energy sources can be renewable, like harnessing the energy of the sun, wind, and water, or the heat of the Earth. Or they can be non-renewable, like burning fossil fuels to generate electricity. Electric energy can be generated in one location and then sent through wires to other locations. Often energy is generated for whole communities at a place called a **power plant**. Electric energy can also be generated at the place where it is used. Do you know where your electricity comes from?

1. As a team or by yourself, go outside, move around nearby, and observe. Do you notice anything related to generating energy or moving it from one place to another?
    a. For example, you may notice wires on poles going to many different buildings. Or maybe you notice solar panels on a roof or a wind **turbine** in a field.
    b. Record any **observations** you make.
2. Read *Energy Source Investigation Instructions* and plan your investigation.

Energy Source Investigation Instructions

Electric energy is often supplied by companies, which are sometimes run by local or national governments and sometimes by **private** companies. The energy **system**, including central power plants and electricity supplied to many locations, is sometimes called the **grid**.

a. Choose one building that is using electricity from the grid to investigate further. Perhaps your school or your home. If there are no buildings using grid energy in your community, you can choose to investigate a building that uses grid energy in another community.
b. Investigate which company provides electricity to the building. If you have trouble finding out, remember that energy companies bill their customers. Ask the adults in charge of the building who charges them to use electricity.

c. Consider how you can find out more about how that company generates its power. You might be able to find this information:
    - Online: Check for websites run by the company, the government, local environmental organizations, or other energy experts.
    - In print: The company may publish a yearly statement, report, or other documents. You may be able to ask them to send you a copy.
    - By interviewing an expert: Someone from the company or an expert on energy generation may be willing to talk with you about how the company generates its energy.
d. When you have found out how the company produces energy, try to consider any problems created by generating electricity this way, such as:
    - Any problems related to getting the resources. For example, if the resource is in the Earth, it may need to be taken out by being mined or quarried. This can damage the surrounding environment.
    - Any waste produced when the energy is produced. For example, if coal is burned to generate electricity, it leaves behind coal ash. A company burning coal needs to find a way to reuse or safely store this ash.
    - Any **emissions** produced by generating the power. For example, burning fossil fuels releases carbon dioxide and other **greenhouse gases** into the air.
    - Any dangerous situations caused by generating the electricity. For example, when nuclear materials are used to generate electricity, they leave behind waste that can be dangerous.
    - Any other environmental problems caused by generating electricity. For example, dams built on rivers can capture the energy of the water and generate hydroelectricity. But damming a river might create problems for the animals living in the river and the people living around it.

3. Carry out your investigation and discuss the results with your team.
    a. Is the grid electricity used in your community from renewable sources?
    b. Are there problems that you found with the grid electricity in your community?
4. With your team, consider the **impact** of the way the grid power is generated. How does it affect the local and global community? Consider the four perspectives.
    a. **Social** perspective, for example does pollution from the plant affect people's health?
    b. **Economic** perspective, for example is the power **affordable** enough that it is not creating a problem for individuals and businesses?
    c. **Environmental** perspective, for example are greenhouse gas emissions from generating electricity contributing to **climate change**?
    d. **Ethical** perspective, for example is the way electricity is being generated hurting one group of people in your community more than others? Is it hurting future generations?

Act: *How can my community use its resources more wisely?*

A thriving community needs to use resources to meets people's needs. But that resource use needs to be sustainable. Moving toward renewable resources can be an important step.

1. Work with your team. Title a sheet of paper or a digital document *Part 6 Organizer.* Make three columns, just like you did for your *Part 2 Organizer*. Write the words "Know," "Think," and "Wonder" at the top of the columns.
2. Use the *Know* column to list everything you found out about energy and resources in your community. You investigated the resources you use and how people in your community get their energy. Record:
    a. What resources does your team use a lot?
    b. Where does the grid electricity used in your community come from?
    c. How is that electricity generated?
3. Next you will think about what that information means. Record these ideas in the *Think* column. As a team, discuss:
    a. Remember the resources you listed in the Discover activity. Are the resources your team uses often renewable or non-renewable?

    b. What are the impacts you found from a social, economic, environmental, and ethical perspective?
    c. What are the problems with energy generation in your community?
5. Use the *Wonder* column to list any other questions you have about resources and energy.
6. Discuss with your team, are there ways to change the sources of the energy you use to be cleaner and more renewable? Often people try to do this by either:
    a. Encouraging the energy company to switch to more renewable energy sources.
    b. Using renewable energy sources themselves at their homes or businesses.
7. The renewable source of energy that is best for your community may depend on the location and climate of your community. Read ***Renewable Energy Options***. Which options do you think would be the best fit for your community?

Renewable Energy Options

Renewable energy can take many forms, but they all use natural and renewable resources to generate electric energy.

Water

The movement of water can be used to generate electricity. Along a river, some of the water can be rerouted to the side of the river. This moving water can spin a device called a turbine. Water flowing out of dams can also spin turbines. In the ocean, the movement of the tides can spin turbines, as shown in Figure 6.3. The spinning motion of turbines is one part of a system that generates electricity.

Figure 6.3: Tidal turbine

Air

Wind can be used to make turbines spin and generate electricity. Wind turbines are more common in places that are often windy, like on top of rounded hills, on open plains, or near coasts. A group of wind turbines are shown in Figure 6.4.

Figure 6.4: Wind turbines

Biomass

Biomass includes wood and other plant materials. Humans have burned biomass for heat and cooking for thousands of years. It can also be burned to generate electricity. Waste from homes, businesses, or farming is also used. Biomass is renewable if the materials are replenished, like by planting new trees. However, burning biomass releases carbon dioxide and air **pollution**.

Land

The Earth is hotter underneath the surface. **Geothermal energy** uses Earth's natural heat to generate electricity. The heat can be used to make steam to turn a turbine. Sometimes this heat is close to the surface, like in places with volcanic activity. This can make it easier to use. Sometimes people use the heat below the Earth's surface to directly heat and cool their homes, although this does not generate electricity.

Sun

The energy of sunlight can be used to generate electricity in a couple of ways. Solar panels in calculators, on roofs, and in some large installations on the ground use chemical reactions within the panels to convert **solar energy** into energy we can use. In other large solar installations, mirrors direct solar energy to a central area to heat water and make steam, which turns a turbine and generates electricity.

8. Consider the options in the *Renewable Energy Options* box. Then think about the climate and location of your community. Record your ideas in the *Think* column.
    a. Which renewable energy options do you think would be the best fit for your community?
    b. Have you noticed individuals and businesses in your community using these types of renewable energy? If not, why do you think that is?
    c. Are there actions you could take that would help make more of the energy used in your community come from renewable sources?
9. Take out your *Thriving Community Goals*. Your *Thriving Community Goals* show you how your team wants your community to be. Consider:
    a. Are there goals listed that will need a renewable source of energy?
    b. Are there goals listed that are related to using renewable resources instead of non-renewable resources?
10. Record any ideas or problems you notice related to your *Thriving Community Goals* in the *Think* column.

Task 2: What waste does my community produce?

In Task 1 you learned about the resources you use, including energy. In this Task you will consider the waste produced after using resources. You will first ***discover*** more about the waste produced in your community and what happens to it. Then you will investigate to ***understand*** how much plastic waste you produce. Finally, you will ***act*** on this information by figuring out actions you can take to reduce this waste.

Discover: *What are the effects of waste in my local and global community?*

Sometimes we are so used to producing waste, we may not even realize we are doing it. Until we are aware of the waste we produce and what happens to it, it can be difficult to notice what could change.

1. By yourself, examine the list of things you use from Task 1. Next to each item, write down or mark what waste is produced after you use it. These are the things you would get rid of after using the item.
    a. For example, if you are thinking about the ice cream from Task 1, you probably would list the plastic wrapper and the wooden stick as waste.
    b. Sometimes, the item itself becomes waste. For example, if you listed a chair in Task 1 and you would plan to throw the chair away if it broke, then record that information.
2. Next record how often you produce the waste you just wrote down. For example, if you have an ice cream once a week, then you produce that waste once a week. If you think you will throw away and replace your chair every five years, write that down.
3. With your team, read Steve's ideas about waste and discuss:
    a. What are the things you are using that make a lot of waste?
    b. What changes can you think of that would change the amount of waste you produce?
    c. What would happen if you refused to buy things that would be wasted? What if your whole community or whole country refused?

Steve Says . . .

Your first goal on anything is waste reduction. If you don't buy something, then you don't have to worry about **recycling** or anything else. It is a huge deal if you don't buy it in the first place. For example, with packaging, you have choices. You can choose between a brand that uses very minimal packaging or one that's got the big fancy stuff to make it marketable. If you choose the one with minimal packaging, you are helping to save the environment because you're not buying waste.

4. As a team, consider what happens to waste in your community. Write or draw your ideas to help you remember everything you know.
5. Does your waste:
    a. Stay in the place where you live, for example, get buried or burned just outside your home?
    b. Get moved by someone to another place to get rid of it?
6. With your team, think about what might be done to your waste if it gets moved to another place.
    a. Sometimes waste is gathered in a big pile and eventually is buried. This is called a landfill. Can you think of some problems that might happen if your community uses a landfill?
    b. Sometimes waste is burned. In some cases this can help generate electricity. Can you think of some problems that might happen if your community burns your waste?
    c. Sometimes, waste is dumped in a natural environment like the ocean or a ravine. Can you think of some problems that might happen if waste is dumped in the environment?
7. If you can, find out what happens to waste in your community. You could use the Internet or printed documents to research or ask an expert to help you find out.
8. Read *Take Make Waste*. Discuss with your team:
    a. What are the problems created using a *Take Make Waste* system?
    b. What are other possibilities you can think of for a different type of system?

Take Make Waste

The Take Make Waste system has resources moving in only one direction.

Take Make Waste

1. Take: Resources come from the land, water, or air. Resources include things like petroleum to make plastic or cotton to make shirts.
2. Make: Resources are made into different items used by people.
3. Waste: The items are discarded as waste.

When new items are needed, the system begins again.

Understand: *How much plastic do I waste?*

One of the major waste problems today is what to do about plastic waste. Plastic is a material that has been mass-produced since the early 1900s. Most plastics are made from petroleum. Many researchers think it will take up to 500 years for some plastics to **decompose**. However, plastics have not been around for that long, so we don't really know how long it will take.

1. Examine Figure 6.5. Answer these questions by yourself or with your team.
    a. What do you notice about the change in plastic use since 1950?
    b. What do you think is causing this change?
    c. What do you wonder about the effects this change will have on the world and the living things on it?

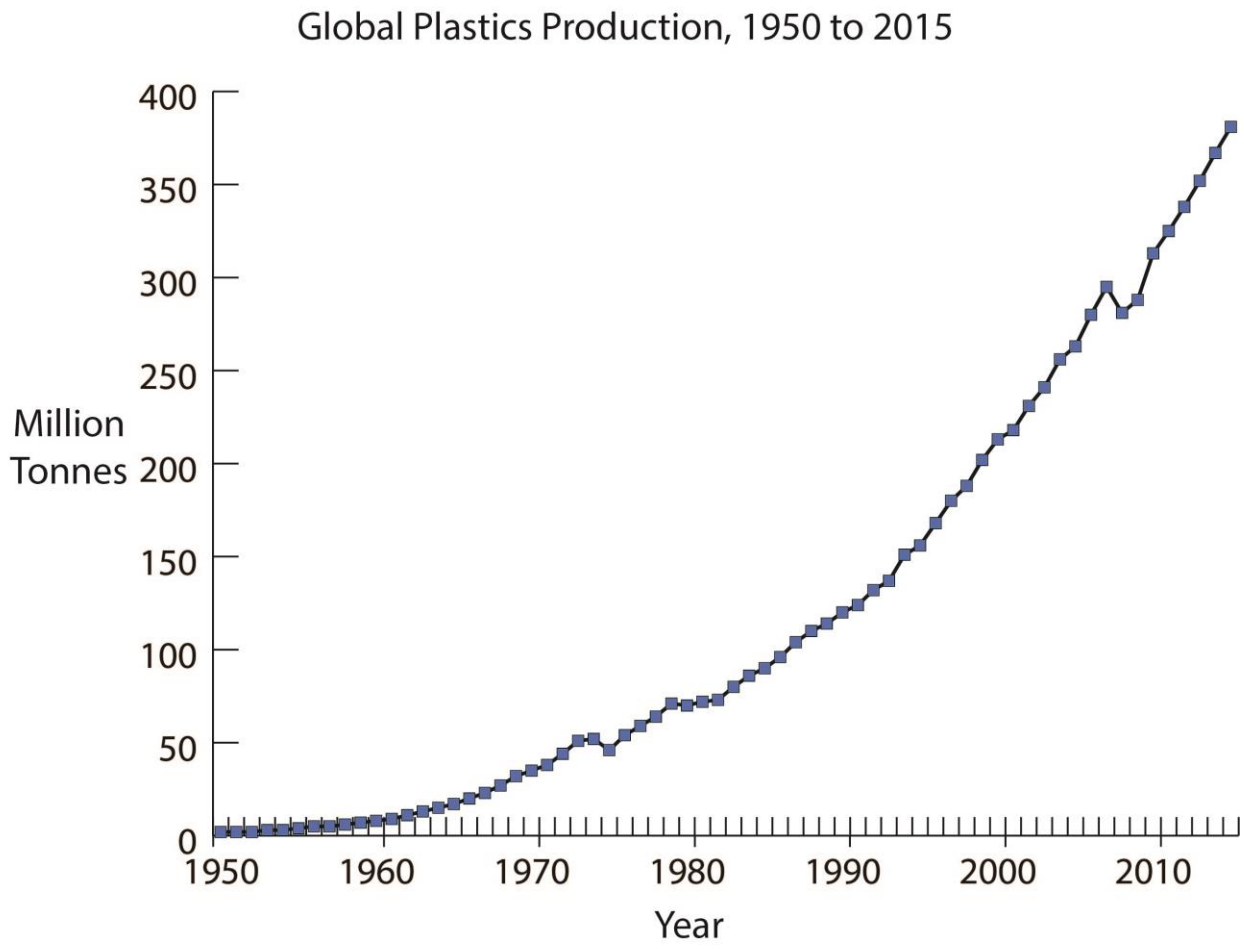


Figure 6.5: Global plastics production[3]

2. Think quietly to yourself: How much plastic do you think you use?
3. Read *Plastic Waste Investigation Instructions*.

Plastic Waste Investigation Instructions

You and your team will be investigating how much plastic waste you produce and where it comes from. Follow the steps to do this investigation.

Search

a. Move around your home or school and search for as many items containing plastic as you can find.

b. Notice plastics in different rooms and used for different purposes. We use plastic for many things other than containers. How many can you find?
c. Come back together with your team and compare answers. Did anyone else find plastic materials you had not thought about?

Collect

a. Pick a period, such as a week, to collect the plastic you use and throw away.
b. Decide whether you will collect just the plastic you use or also the plastic everyone in your household uses.
c. Find a place to store the plastic or find another way to keep a record of the plastic you throw away, such as by creating a list or taking pictures.

Calculate

a. Count the number of pieces of plastic waste you threw away.
b. Depending on how long you collected plastic, multiply that number to figure out how much plastic you use a year. For example, if you collected plastic for one day, multiply the amount of plastic you use in a day by 365 days in a year. If you collected plastic for one week, multiply the amount of plastic you used in a week by the 52 weeks in a year. Record your answer.
c. Imagine yourself at age 70. How much plastic waste will you have made by then, if you continue making the same amount? To find out, figure out how many years between your current age and age 70. Then multiply this number by the number of pieces of plastic you use a year.

4. Discuss your results with your team.
    a. Were you surprised by your plastic waste production?
    b. Are you concerned about how the plastics you are using will affect the Earth?
    c. Out of the plastics you collected, were there some that could be replaced by reusable items, such as cloth bags?

Act: *How could we reduce our waste?*

Reducing waste can be a big part of a more sustainable community. It can reduce the number of resources you use. It can also reduce the waste that is buried, burned, or polluting the environment.

1. Take out your *Part 6 Organizer*. Use the *Know* column to record the information you found out about waste in your community. Record:
    a. Are there some items you throw away that you have only used a short amount of time?
    b. Are there some items you use that make a lot of waste?
    c. Where does the waste from your community go?
    d. How much plastic waste are you making every year?
2. Next you will think about what that information means. Record these ideas in the *Think* column. As a team, discuss:
    a. Do you think there are problems with the amount of waste you and your community produce?
    b. Why do you think you and others in your community decide to throw things away?
    c. Do you think there are things that could be changed to reduce the amount of plastic waste from you and others in your community?
3. Use the *Wonder* column to list any other questions you have about waste and plastic.
4. Examine the list of waste you made and the results of your plastic waste investigation. Write or draw your ideas about:
    a. What changes could you make to reduce the amount of waste you produce?
    b. What would be the easiest thing to do?
    c. What would you need to do to put that idea into action? For example, if water is safe to drink in your community you might start using a reusable water bottle instead of one that can only be used once—a single-use plastic bottle. To do that, you would need a reusable water bottle.
5. Share your plan to reduce your waste with your team or with a partner. After one week, come back and tell them how you are doing with your action. Remember, do not be discouraged; it can be difficult to break habits. Partners and teams should support one another to put their waste reduction ideas into action.

Steve Says . . .

Manufacturers will continue to create single-use plastics as long as there is a market for single-use plastics. You can influence what the manufacturer does if you stop buying single-use plastics and choose a different type of container. It puts a lot of pressure on the company to do something different. I think the biggest message is that one person can make a difference. One person cannot change everything, but one person can change what they do. If that one person becomes a million people, they are going to make a big change. Collectively, you have power. You are the ones that are making the purchases. Your choices help decide whether that manufacturer is making that single-use plastic. Choose something that does not use single-use plastics, but it has the same function. It's all about our choices.

Task 3: How can my community reuse instead of waste?

Sometimes when you are finished using a thing for one purpose, it can be used for another purpose. In this task, you will ***discover*** ways in which your community may already be repurposing things. Then you will investigate to ***understand*** new opportunities to repurpose items. Finally, you will ***act*** on your ideas by creating a repurposed item of your own.

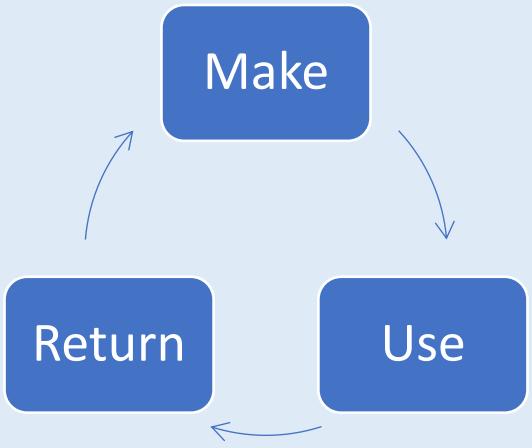
Discover: *How does my home, school, and community reuse and repurpose instead of waste?*

Have you ever used something, like clothing, a bicycle, furniture, a book, or another item, that was originally used by someone else? This is called **reusing**. Have you ever reused a thing for a reason other than its original purpose? This is called **repurposing**. Maybe you used a plastic food container to grow seeds. Or maybe you changed a shirt into a pillow. Reusing and repurposing things is an important strategy when trying to reduce resource use and waste. When we reuse existing items, it uses less energy and fewer materials than it takes to produce new items. We also prevent the things we are reusing from creating waste.

1. Read *Searching for the Circular Economy Investigation*.

Searching for the Circular Economy Investigation

Keeping items in use creates a cycle called the **circular economy**. The circular economy does not move in only one way, like the Take Make Waste system.



Returning items to the system may include reusing, repurposing, repairing, or recycling. In this investigation you will be searching for items that have been reused, repurposed, or repaired. You will learn more about recycling in Task 4.

Location

You can search for evidence of reused, repurposed, and repaired items anywhere.

a. If you are working by yourself, it may be easiest to search at your home.
b. If you are working with your team, it may be easiest to search at school.

Where to Search

a. If you are in a home, make sure to examine the bathrooms, any place where cleaning supplies are kept, the kitchen, and any place where things are grown or created.
b. If you are at a school, make sure to examine art or other creativity supplies, outdoor areas, and classrooms.

Observe

Move around your location, paying close attention to items that are being reused, repurposed, or repaired. You can also search for items that could be reused, repurposed, or repaired.

Reuse

Some groups or businesses help reuse things that might have been thrown away by matching them with new owners. Used clothing, cars, bikes, toys, and other items are often sold or donated to new owners. Do you notice any items that may have originally been used by a different owner?

Repurpose

Some items may have had a different use or appearance originally but were changed and used some more, maybe in a different way. For example, maybe furniture was repainted to match the room, rather than thrown away. Maybe a hat is now being used as a lampshade. Do you notice any items that originally had another purpose?

Repair

When items break, it is a choice whether to get rid of them or repair them. Repairing items is one way to reduce waste. Do you notice any items that might have been repaired?

2. By yourself or with your team, go on a search for things that have been reused, repurposed, or repaired. Draw, write, or make another record to help you remember the items you found.
3. When you have finished your search, come back together with your team. Share all the information you found. Discuss with your team:
    a. Were you surprised by any of the items you noticed being reused, repurposed, or repaired?
    b. When items were reused from another owner, were there groups or businesses that helped connect the old owner to the new owner?
    c. Are there any ways that you noticed items being repurposed, reused, or repaired that could be used in other locations? For example, maybe you noticed at home that torn T-shirts were being used as cleaning rags. You could share this idea with your teammates for them to use at home.
    d. What makes someone repair an item rather than throw it away and buy a new one?

Understand: *How can things be repurposed?*

Reusing and repurposing things is an important way we can reduce our waste and resource use. Often there are opportunities to repurpose items that we have not yet thought of because we haven't paid close attention. In this activity, you will have the chance to pay close attention to new possibilities for repurposing things.

1. Read Steve's story about starting the Banners to Bags program. What can you learn from this story?

Steve Says . . .

Consider everything that's being wasted now with an open mind. At the Smithsonian we've got these huge display banners in the museums. They are up for a while and then the exhibit changes. They take the banners down and put up new ones. In the past those banners went to the landfill. Now we turn them into tote bags, like the ones in Figure 6.6.

Figure 6.6: Tote bags made out of Smithsonian display banners

By doing that, we've just removed all the banner waste from the landfill. We've also taken a bunch of single-use plastic bags out of the waste stream, because now people can reuse this tote bag instead. We need to start thinking beyond what we are doing right now. We need to consider what is possible.

2. By yourself or with your team, observe what is being thrown away at your house, at your school, or another location.
    a. You may have noticed that one of the ways the Smithsonian Institution thought of the Banners to Bags program was by considering what they threw away. You can do the same thing.
    b. Record the waste you are creating. This is a list of materials that you have available.

3. Notice items you currently have to buy. What is being bought new that could be replaced by materials you already have?
    a. Pay attention to things you, your household, your school, or another location are buying.
    b. Record these items. This is a list of needs that are currently being filled by buying new things.
4. By yourself, with a partner, or with your team, examine the two lists together. Is there anything you notice that would allow you to fill the needs you have by repurposing materials that are currently going to waste?
5. Examine Figure 6.7 to help inspire you. How can you creatively repurpose something that is usually wasted?

Figure 6.7: Repurposed items, including a pallet bench, drink carton toys, boot planters, and a jeans bag

6. Create your repurposed item.

Act: *How can I contribute to a circular economy?*

Shifting from a Take Make Waste system to a circular economy needs the support of many people. Now you can consider your role in making this shift.

1. Take out your *Part 6 Organizer*. Use the *Know* column to record the information you found out about reusing, repurposing, and repairing items in your community. Record:
    a. What examples did you find of items being reused, repurposed, or repaired when you searched?
    b. What are the types of things that are being thrown away?
    c. What are the types of things people are buying?
2. Next you will think about what that information means. Record these ideas in the *Think* column. As a team, discuss:
    a. Where are the opportunities you noticed to reuse, repurpose, or repair items?
    b. Are there things being thrown away that someone else might be able to use, like clothing, school supplies, or toys?
    c. Why are people not already doing these things? For example, is it because they have not thought of reusing? Or they do not understand why reusing items is important? Or is it because there is no group to coordinate reusing items?
    d. Why do people throw items away instead of repairing them?
    e. What do you think you could do to help others in your community start to consider reusing, repurposing, and repairing?
3. Use the *Wonder* column to list any other questions you have about reusing, repurposing, and repairing things.
4. Take the item you repurposed and consider how you can share the story of it with others. For example:
    a. Can you tell your friends or family about your repurposed item?
    b. Could you display it at your school with information about it?
    c. Could you, or an adult, post a picture to a social media site telling others about it?
5. Put your ideas into action.

Task 4: How can my community recycle waste?

Reducing what we use is one important strategy to reduce the waste we produce. Another important strategy is to reuse items we already have in different ways. If that is not possible, then we should try to recycle items as much as possible. Recycling allows the materials that things are made out of to be reused for other purposes. It is an important part of the circular economy. Taking materials out of the Earth requires energy and uses up materials. Recycling can reduce the amount of new material taken from the Earth and the energy needed to make things. It can also reduce the waste we make. In this task you will ***discover*** opportunities to recycle things in your own community. You will ***understand*** how recycling natural materials through composting can help reduce waste. Then you will ***act*** to share these ideas with others.

Discover: *What are the opportunities to recycle things in my community?*

Recycling keeps materials in the circular economy. Certain materials are easier to recycle than others, though. For example, metal, glass, and paper can be recycled again and again—almost forever. However, plastic is more complicated. Different types of plastic must be recycled separately. As plastic is recycled, the quality gets worse. After a little while, new materials must be added.

Some places only recycle certain types of materials. Each community has different recycling rules and options. Do you and others know how to recycle in your community?

1. With your team, discuss the options you know about for recycling items in your community. Consider:
    a. If waste is collected from your home, is there a possibility to separate different types of waste, like paper, metal, garden waste, and general recycling?
    b. Are there places in your community you can go to drop off recycling, such as glass or plastic bag collection sites?
    c. Some items must be treated carefully because they could harm the environment. Items such as computers, phones, batteries, paint, and fluorescent lightbulbs all can be hazardous if they are thrown away

improperly. Is there a place in your community to recycle or dispose of these items safely?

   d. Sometimes people or businesses in the community gather items for recycling and sell them. Does your community have any people or businesses doing that?

2. With your team, discuss if there are rules for recycling in your community. For example, if plastics are being recycled, are there only some types of plastic that can be accepted? Record what you know.
3. With your team, write down questions you still have about recycling options and rules in your community.
4. Make a plan and investigate further with your team. How could you learn more about recycling in your community? For example, you could:
   a. Use a local government website or online search to find out more.
   b. Search for signs, posters, or flyers with information about recycling.
   c. Ask people who might know, like adults in your community or people who work with waste in your community.
   d. Use your own ideas.
5. With your team or by yourself, examine the list of things you use that you made in Task 1.
   a. Which items on your list could be recycled in your community?
   b. Are there some items that you could take apart, like a skateboard, and then recycle some parts of them?
   c. Do you normally recycle the items on the list that can be recycled?
6. Have each team member interview one person in your community to find out what they know about recycling. You could interview a friend, a younger student, a family member, a neighbor, or someone else. Ask the person questions and record their answers.
   a. Do they know the options for recycling in your community?
   b. Do they understand the rules for recycling in your community?

Understand: *How can I recycle natural waste?*

Many materials need to be recycled by professionals. However, natural materials from plants can be composted by anyone. Composting is a way of recycling plant material to add back into soil; compost can be used to help other plants grow.

1. Examine Figure 6.8 closely. Write or draw your answer to these questions.
   a. What do you notice about the picture?

b. What do you think is happening in the picture?

Figure 6.8: Rotting log

2. Now discuss with your team:
   a. How does this picture relate to composting?
   b. How do you think composting works? Write or draw your ideas. Don't worry if you are not sure. You can keep adding ideas as you go.
3. Read *Composting Instructions*. What would you need to do to compost in your home, school, or other place in your community? Take notes to remember your ideas.

Composting Instructions

In natural systems, living things break down and turn into soil after they die. This is called **decomposition**. Composting is when people deliberately encourage decomposition. This reduces waste going to landfills and creates a material that can help plants grow. Food and other natural materials decomposing in landfills often produce **methane**. Methane is a greenhouse gas that contributes to climate change. Composting and keeping food waste out of landfills helps limit the production of methane and helps slow climate change.

People have been composting their waste for thousands of years. Anyone can compost. All that is needed is space, plant materials, decomposers, water, air, warmth, and time.

Space

Find a place for the compost. Compost can take up a lot of space or just a little. It can be done in a box or a heap on the ground if you have a lot of space. It works best if you have a 1-meter-(3-feet)-by-1-meter-(3-feet) space if you are composting on the ground. Composting can also work if you dig a hole, fill it partway with plant materials, and then cover it up. You can compost in a small bucket or other container if you only have a little space or no access to land.

Figure 6.9: Examples of composting locations

Plant Materials

Compost is formed by breaking down plant materials. These materials can be divided into browns and greens. You need to add about equal amounts.

Browns include things like small twigs, dried leaves, straw, paper, newspaper, and cardboard.

Figure 6.10: Examples of brown materials for composting

Greens include green plants, grass clippings, coffee grounds, tea leaves, and vegetable and fruit scraps. You should not put meat, dairy, or bones in your compost if you are doing it at home.

Figure 6.111: Examples of green materials for composting

Decomposers

Most compost is decomposed by microscopic decomposers like bacteria and fungi. These living things are found in the environment around the compost; they do not need to be added. If the decomposers have enough moisture, air, and plant materials to decompose, they will do their job. Other living things, like worms and centipedes, can also help to decompose the compost.

Water

Often the moisture in the greens provides enough water for your compost, but you need to be sure. If your compost is slightly moist, that is good. If it is too dry, add some water. If it is too wet, try adding some additional brown materials.

Air

Many of the compost decomposers need air to be able to do their job. When you choose where to compost, you will need to figure out how to make sure your compost gets air. For example, you usually need to turn the compost to add air to the material in the middle. If you are composting on the ground, you can use a shovel or other tool to turn the compost. Some composters are designed to spin. If you are composting in a bucket, you may be able to

turn the bucket on its side and roll it to add air. If you are using a closed container to compost, you will need to add air holes.

Figure 6.122: Compost tumbler designed to spin to add air to compost

Warmth

Compost works best when it is hot but not too hot. The decomposers will release heat as they start to work. If it is cold outside, you may want to leave your compost in a sunny spot to help heat it. If it is hot outside, you may want to leave it in the shade.

Time

Making compost can take from a few weeks to a few years. Warm, moist compost that is turned often and has small pieces of plant material in it decomposes the fastest.

4. Move around an area of your community. You could choose your home, your school, a local garden, or other location.
    a. Do you notice anything decomposing?
    b. Do you notice any composting?
    c. Do you notice any plant materials being thrown away that could be composted instead?
    d. Are there spaces that might work for composting?
5. Come back together and share what you noticed with your team.

6. Discuss with your team about how you could encourage composting. Consider:
    a. Where did you notice composting materials going to waste?
    b. What are some of the things people think are difficult about composting?
    c. What would you need to do to start your own compost at home, school, or another location?
    d. Does your local government or another group collect compost materials?
    e. How could you encourage others to compost?

Act: *How can we encourage recycling and composting in our community?*

Where are the best opportunities to make a difference with recycling in your community?

1. Take out your *Part 6 Organizer*. Use the *Know* column to record the information you found out about recycling in your community. Record:
    a. What are the possibilities to recycle waste in your community?
    b. Do people in your community understand how to recycle?
    c. Do people in your community understand how to compost?
2. Next you will think about what that information means. Record these ideas in the *Think* column. As a team, discuss:
    a. What do you think stops people from recycling?
    b. Are there recycling options that you wish were available in your community?
    c. What do you think stops people from composting?
    d. What could you do as a team to encourage composting or recycling?
3. Use the *Wonder* column to list any other questions you have about recycling and composting.
4. Discuss with your team whether you are more interested in starting to help your community do more recycling or more composting.
5. If you choose recycling, gather everything you know and have found out about recycling in your community. Discuss with your team:
    a. Do you think everyone in your community understands the information you now know about recycling in your community?

b. If not, how could you share this information with them?
c. Make a flyer, poster, play, song, or podcast, talk to family, friends, or another class, do a demonstration, or find another way to share the information you have learned about recycling in your community.

6. If you choose composting, plan for how you could start composting at your school or another location. Think about:
   a. Who do you need permission from?
   b. What would you need to do?
   c. What materials would you need?
   d. Read Steve's idea about starting a composting program. What challenges should you be prepared for?

Steve Says . . .

The thing people fear the most is the smell. But once the compost starts you don't have the smell of the food. You mix your brown materials in there and you stir it up. You are not going to have a stinky mess. You're going to have compost cooking.

Sometimes people worry about pests. You need to be cautious about putting your compost somewhere where pests can't reach it. Have a container to put stuff that's got a lid. If you are collecting food scraps, it helps to have a location where you can put the container so it can be sealed off until it gets to the compost area.

If you are doing it at a school or at your home, you have to get an adult to support the idea. You can compost yourself or you can often pay someone to come pick up food scraps and they will compost them.

But anybody can do it. You don't have to invest in a composting machine to compost. You can compost in a pile in your backyard. It is a sustainable loop. Instead of putting your food in the landfill, you have compost you can use for gardening, to grow new plants.

Task 5: How can we improve resource use in our community?

Using fewer resources is an important part of making our local and global communities sustainable. The Earth's natural systems are impressive. They can provide many resources and dispose of a lot of waste. However, today people use more resources than the Earth can provide over the long term. People make more waste than the Earth can process. In this task you will ***discover*** how resource use could be more sustainable in your community. Then you will ***understand*** actions you could take individually to make your own impact more sustainable. Finally, you will ***act*** on these ideas to improve your local and global community.

Discover: *How can resource use make my community sustainable?*

You have investigated how your community generates waste and uses resources. Now you will consider whether those levels are sustainable. You will think about changes in your community that could make resource use and waste more sustainable.

1. Read *Ecological Footprint and Sustainability*.

Ecological Footprint and Sustainability

Remember, when something is sustainable it can keep working for a long time. On Earth, this means the **biocapacity** of Earth needs to be greater than the **ecological footprint** of people.

Biocapacity

The natural systems on Earth can generate resources and help process waste. The amount of resources and waste processing available on the Earth is called biocapacity. In Figure 6.13, biocapacity is measured in global hectares per person. A **hectare** is a certain amount of land. A global hectare is the global average of the resources produced by that amount of land. In 2017, the Earth's biocapacity was 1.6 global hectares per person.

This means if all the resources available were divided evenly among all the people on Earth, each person would get the resources produced by 1.6 hectares of land.

Ecological Footprint

If you did the activities in Part 5, you learned about **carbon footprint**, the emissions created because of the actions of one person. An ecological footprint is a bigger measure that includes the resources and space used and the emissions and waste created by a person. The ecological footprint is also measured in global hectares. In 2017, each person on Earth used an average of the resources of 2.8 global hectares.

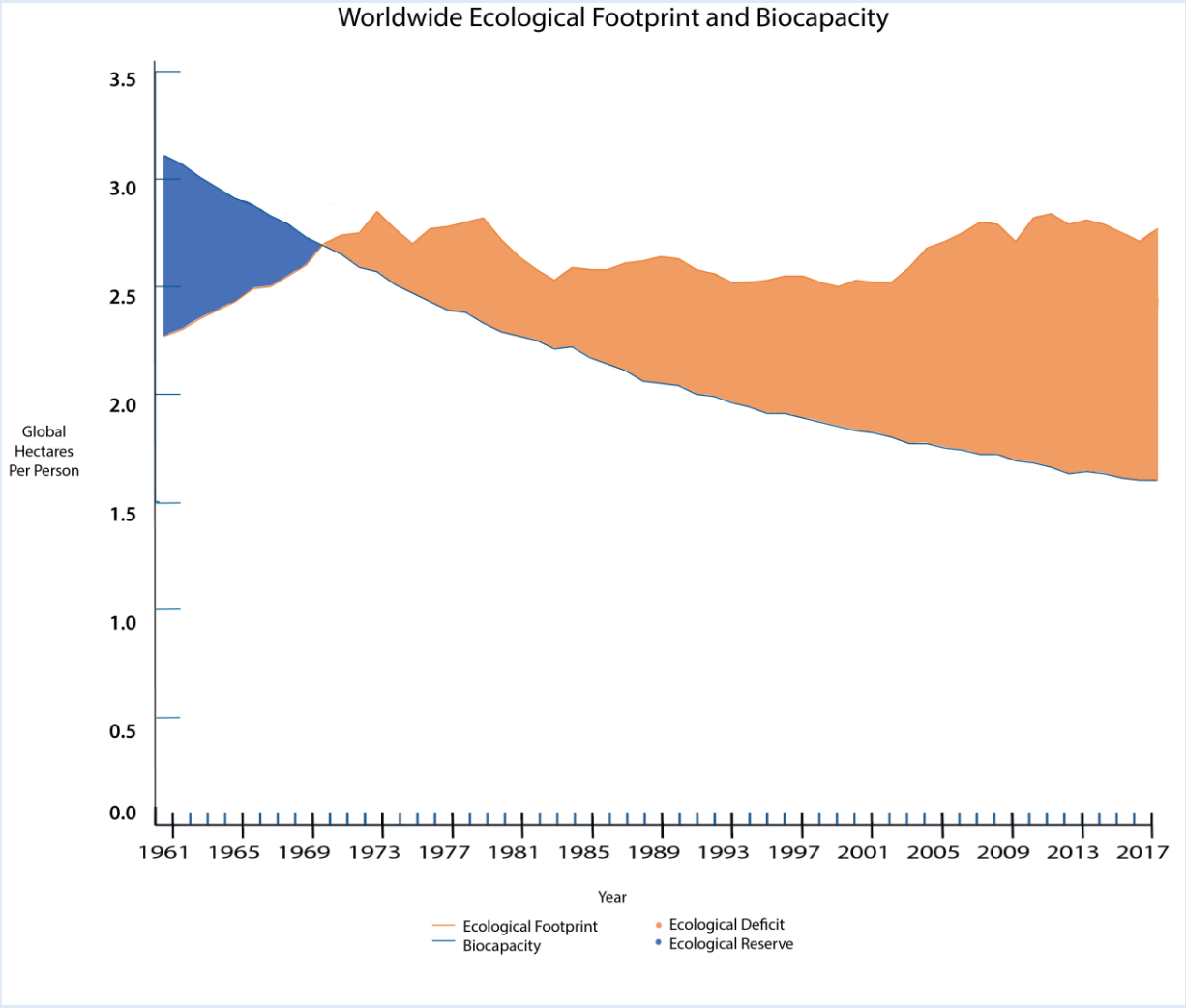


Figure 6.13: Chart of Earth's biocapacity and ecological footprint[4]

Sustainability

Sustainability requires that people do not use more resources or create more waste than the biocapacity of the Earth can meet. However, since 1970, worldwide the ecological footprint per person has been greater than the biocapacity of the Earth. Examine Figure 6.13.

a. What do you notice about the graph?
b. What are the problems you think the graph shows?
c. What do you wonder about what could happen in the future?

If you want to examine data from your country, you can go to https://data.footprintnetwork.org/#/ to find out the biocapacity and ecological footprint per person in your country. Consider:

a. How does your country compare to other countries?
b. What are the reasons for your country's ecological footprint?
c. How do you feel about the differences between countries?
d. What can be learned from countries that have a small ecological footprint?

2. Take out your *Part 6 Organizer*.
3. Your team has already listed information you found out from your investigations in the *Know* column. Add any additional information you want to remember. For example, if you found out the ecological footprint for people in your country, you may want to record that.
4. You have also recorded some of your thoughts in the *Think* column. Now that you have investigated resource use and waste in different ways, you can think a little more. Consider:
    a. Why do you use the things you do? For example, do you need all the clothes you buy or is it part of your culture to frequently have new clothes?
    b. Do you think you use and waste too many resources?
    c. Do you think others in your community use and waste too many resources?
    d. What do you think are the most important things to change?

    e. What do you think are the most important alternatives to resource use and waste?
5. Take out your *Thriving Community Goals*. Compare them to the things you *Know* and *Think*. Your *Thriving Community Goals* show you how your team wants your community to be. What you *Know* and *Think* shows you how your community is. When your community is not the way you want it to be, that is a problem.
6. As a team, discuss:
    a. Did you find any information in Part 6 about your community that shows you are not meeting your *Thriving Community Goals*?
    b. If so, did you already list that as a problem?
    c. If you spot new problems, record those now in your *Think* column.
7. List or draw what your team still wonders about resource use in your community under the *Wonder* column. Consider:
    a. Are there questions listed in the *Wonder* column that you have already answered?
    b. Are there questions you still have about resource use and waste in your community?
    c. If everyone understood what you now know about resource use and waste, do you think anything would change in your community? For example, maybe you wonder if everyone understood how much plastic they use, would they change their behavior and use less?
    d. Are there actions that you think would make resource use more sustainable in your community? For example, maybe you think your school could start a composting program or could help match used items with new owners.
    e. Are there other ideas you would like to remember?
8. Keep the *Part 6 Organizer*. You will need it again.

Steve Says . . .

Cultural change does not happen quickly. It can take years. Persistence is very important. If somebody hears you talking about a thing five times, they are more likely to listen than if they hear you saying something one time. Work you do carries over. Cultural shifts happen when people take what they have learned and move it to new places.

Understand: *What can I do individually to help?*

In this Part you found out information about using resources wisely. It is important to use the resources available in a sustainable way. You just thought about changes your whole community could make. You will have a chance to put some of these ideas into action in Part 7. However, there are always ways that you could make things in your community better through your own individual actions.

1. Examine your *Part 6 Organizer*.
    a. Are there any problems you saw that you could help to change all on your own?
    b. Are there any ideas you listed under *Wonder* that you might be able to do by yourself?
2. Think to yourself or discuss your ideas with your team. For example, maybe you could:
    a. Investigate and share how you could use renewable energy at your home or school.
    b. Reduce your use of plastic or other materials.
    c. Challenge yourself to repurpose things instead of throwing them away.
    d. Start composting by yourself or with others.
    e. Teach others how to recycle in your community.
    f. Come up with your own ideas.
3. Think quietly to yourself about a change you want to make.
    a. Why do you think this change is important?
    b. How is it connected to problems you noticed in your community?

Act: *How will I put my ideas into action?*

Changing our own behavior is often the first step. Now that you have decided what you will do to improve your community, you can put that idea into action.

1. Make a plan for how you will put your idea into action. If you need to share information, where, when, and with whom will you share it? If you need to do something, what do you need to do it?
2. If you already completed other actions as part of this guide, what did you learn? Remember to use what you learned before to make this action even better.
3. Put your plan into action.
4. Think quietly to yourself to **reflect** on your action.
    a. What seemed to go well?
    b. What was hard?
    c. Were you able to make the changes you thought you would be able to make?
    d. Will you keep going with your change or are there things you would do differently in the future?

Steve Says . . .

It's the habit. Individually, we will can only make a small difference. But collectively, if each individual is doing their part, we will make a huge difference. Young people can make the most difference, because if they build habits of waste reduction and diversion, those actions can carry over and last for a lifetime. You may start asking questions like, why don't we recycle? Why don't we compost?

Congratulations!

You have finished Part 6.

Find out More!

For additional resources and activities, please visit the Sustainable Communities StoryMap at https://bit.ly/2YdHNqB.

Glossary

This glossary can help you understand words you may not know. You can add drawings, your own definitions, or anything else that will help. Add other words to the glossary if you would like.

Action researchers: People who use their own knowledge and information they find out from their community to make decisions and take action on important issues

Affordable: Something you are able to pay for

Biocapacity: The amount of resources and waste processing available on the Earth

Biomass: Wood and other plant or organic materials

Carbon footprint: Amount of greenhouse gases emitted because of the actions of a person

Circular economy: A system that keeps items in use by reusing, repurposing, repairing, and recycling

Climate change: Rapid warming of the global climate

Community: A group of people that have a place or other thing in common

Composting: Deliberately encouraging the decomposition of natural materials

Decompose: Break down into smaller parts

Decomposition: Turning living things into soil after they die

Economic: About money, income, and use of wealth

Ecological footprint: The resources used and waste created by a person

Emission: Something released into the air

Environmental: About the natural world

Ethical: The fairness of something

Fossil fuels: Substances like oil or natural gas that are taken out of the Earth

Geothermal energy: Heat from the Earth that can be used to generate electricity

Greenhouse gases: Gases such as carbon dioxide or methane that cause the atmosphere to get warmer.

Grid: The system that that supplies electricity to many locations in a specific area

Hectare: A specific amount of land

Identity: Characteristics that make up each person or thing

Impact: The effect one thing has on another.

Investigate: Find out more information

Landfill: A place where waste is gathered in a big pile and eventually is buried

Mentor: Someone who has experience and can help guide you

Methane: A greenhouse gas that contributes to climate change

Non-renewable: Impossible or difficult to replenish

Observation: Recording what you notice without adding your own opinion

Observe: Use your senses to get information about something

Perspective: A specific way of thinking about the world around us

Photosynthesis: Process that plants use to make food, taking in carbon dioxide and releasing oxygen

Plastic: A material that has been mass-produced since the 1900s, most often made out of petroleum

Pollution: Things that do not belong in and can harm an environment

Power plant: A place where energy is generated for many people

Private: Owned by one person, group, or company

Recycling Reusing the materials that things are made out of for other purposes

Reflect: Think carefully about something

Renewable: Easily replenished

Repurpose: Using an item again for a new purpose

Reuse: Using an item again

Resources: Materials we use to meet our needs

Social: About the interaction of people in a community

Solar energy: Electricity that has been generated by sunlight

Sustainability: An idea that requires that people do not use more resources or create more waste than the biocapacity of the Earth can meet

Sustainable: A balanced, long-term approach to social, environmental, economic, and ethical concerns

System: Something made up of parts that work together

Thrive: When something that is working or growing well

Turbine: A device spun by wind, water, steam, or gas that generates electricity

Waste: Materials that we throw away or get rid of

Other words:

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Parents, Caregivers, and Educators
Action Plans can be shared with us by using hashtag #SSfGG!

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Smithsonian Science for Global Goals (SSfGG) is a freely available curriculum developed by the Smithsonian Science Education Center in collaboration with the InterAcademy Partnership. It uses the United Nations Sustainable Development Goals (SDGs) as a framework to focus on sustainable actions that are student-defined and implemented.

Attempting to empower the next generation of decision-makers capable of making the right choices about the complex socio-scientific issues facing human society, SSfGG blends together previous practices in Inquiry-Based Science Education, Social Studies Education, Global Citizenship Education, Social Emotional Learning, and Education for Sustainable Development.

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