Conserving Natural Resources:

4-H group activities that promote understanding of natural resource use and conservation in our homes

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Rationale for the Conserving Natural Resources Curriculum

The comfortable lifestyle that U.S. citizens enjoy depends on numerous conveniences ranging from cell phones to cars to energy efficient homes; these products are created from natural resources. As the population grows, our increasing need for resources is forcing us to consider conservation techniques. How can we help youth understand why conservation is important? We can allow them to model/simulate resource-related issues. The lessons in this curriculum allow youth to simulate the use of shared and private resources, calculate their ecological footprint, determine human population growth rates and graph population growth, explore environmentally friendly techniques for reducing solid waste, model the steps of paper recycling, and analyze product for over-packaging.

The 4-H mission is to help youth develop life skills. The lessons in this curriculum incorporate an essential life skill, **responsible decision making**, and allow youth to practice making decisions. The topic of resource conservation is highly relevant in modern society: Resource availability issues are in the news daily. Current issues in the news include waste management, oil and gasoline pricing, water quality and availability, soil conservation, and air quality/climate change. Learning experiences provided by these lessons will promote behavioral changes that could help youth and their communities approach a more sustainable lifestyle.

The 4-H educator who wrote this curriculum was previously employed as a high school science teacher. Some of the activities contained in this module were inspired by science activities created by Holt Publishing and Addison-Wesley Publishing. Although the activities within this module are formatted significantly differently from those activities used in high school science classrooms, the curriculum author would like to acknowledge both publishing companies for providing a basis on which to build these 4-H activities.

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Activity 1: Sharing Natural Resources

Objective: Simulate the sharing of natural resources and compare the management of public and private resources.

Materials (per group of 4):

- one large plate
- four small plates
- cup to hold "extra" goldfish crackers
- copies of data table
- goldfish crackers, M&Ms, or other snack items
- calculator (optional)

Directions:

Simulation A: Using Shared Resources

1. Work in groups of 4. Place the large plate in the center of a table. Put 16 goldfish crackers on the plate.

   The plate represents a pond and the goldfish crackers represent fish that you need to catch to stay alive. The rules of the simulation are as follows:

   (a) The pond can't hold more than 16 fish.

   (b) Every "month" (round 1, 2, 3, 4) each person needs to catch and eat at least 2 fish to get enough protein to stay alive.

   (c) The fish that are alive at the end of each round will reproduce. For example, if there are 5 fish in the pond they will double to 10. If there are 9 fish in the pond they will all try to double, but the pond can't hold more than 16 so the total will be 16, not 18 (2 of the 9 don't get to reproduce).

2. Start round 1. Have each person take a turn fishing. Remember: You must eat at least 2 fish to stay alive but you may take more than 2 if you are hungry.

3. At the end of round 1, record how many fish each person ate in your data chart. Also record how many fish are left in the pond.

4. Have the remaining fish double but remember that the pond can't hold more than 16 fish (this is important if you have a group of 2 or 3 people instead of 4). Record the number of fish in the pond after they have reproduced.

5. Repeat steps 2, 3, and 4 for round 2; then for round 3; then for round 4.

6. At the end of round 4, add up the total number of fish caught during the simulation and the total number of fish remaining in the pond at the end of the activity.

Simulation B: Using Shared and Private Resources

You will be repeating the simulation above, with a few changes:

(a) The shared pond stays in the center but **each person also has a privately owned pond** (give each person a small plate to represent his or her private pond).

(b) The common pond still holds 16 fish but **each private pond can hold only 3 fish.**

(c) You still need at least 2 fish each round to stay alive BUT **you can take fish from the shared pond and/or your private pond each round** – you can take from the shared pond, the common pond, or from both.

(d) The fish in the common pond can still double (up to 16) each round but the private **pond fish can double but can't go higher than 3**. For example, 1 remaining fish doubles to 2 but 2 remaining fish increase to 3.

Run all 4 rounds of the second simulation and record your data at the end of each round.

Now answer the analysis and conclusion questions at the end of the activity and discuss them with your group and other groups. Your discussion should help you understand why managing and protecting shared or limited resources like air and water is so much more difficult than managing privately owned resources! Protecting our environment and conserving our resources is a worldwide challenge.

Sharing Natural Resources: Data Sheet

Name _____

Objective: Simulate the sharing of natural resources and compare the management of public and private resources.

Materials (per group of 4):

one large plate
cup to hold "extra" goldfish crackers
goldfish crackers (or similar food items)
four small plates
copies of data table
calculator (optional)

Part A: Shared Resources

Round Number	Fish Caught: Person A	Fish Caught: Person B	Fish Caught: Person C	Fish Caught: Person D	Fish Remaining in SHARED Pond at End of Round	Fish in Pond After Doubling (16 max)
1						
2						
3						
4						
Total Fish Caught per Person ===➔					Grand Total Caught by all 4 people = _____	

Part B: Shared Resources and Private Resources

Round Number	Fish Caught: Person A	Fish Caught: Person B	Fish Caught: Person C	Fish Caught: Person D	Fish Remaining in SHARED Pond at End of Round	Fish in SHARED Pond After Doubling (16 max)	Fish left in PRIVATE Ponds A	B	C	D	Fish Left in PRIVATE Ponds After Doubling (3 max each)
1											
2											
3											
4											
Total Fish Caught per Person ➔					Grand Total Caught = _____						

Analysis and Conclusion: Discuss these questions with your group and with other groups.

1. Describe what tended to happen to each group's fish population in the shared pond during Simulation A. Why do you think this happened?

2. If everyone in your group took 2 fish each round, your group could have caught a total of 32 fish without decreasing the fish population in the pond. How many fish did your group catch? If less than 32, why?

3. Describe what tended to happen to each group's fish population in the shared population during Simulation B. What happened to the fish population in each person's private pond?

4. If everyone in your group took 1 fish from the private pond and 2 fish from the shared pond each round, your group could have caught a total of 48 fish without decreasing the fish populations in any of the ponds. How many fish did your group catch? If less than 48, why?

5. Why do you think shared resources are more likely to be used up than private resources?

Activity 2: Estimating Your Ecological Footprint (an internet activity)

Objective: Estimate your ecological footprint through the use of internet-based calculators.

Materials (per group of 4):
computer with internet access copies of activity data sheet

Background:

An **ecological footprint** is an estimate of the number of acres of land (and ocean) required to supply a person with all of the resources he or she will use in a one-year period. The HIGHER your ecological footprint, the LARGER your effect on the environment with regard to the resources you use. In some developing countries, the average person uses very few resources in a year. People who live in simple hunter-gatherer or agricultural communities often make use of every part of an animal or a plant. These societies do not produce "trash" as we think of it; everything that they use is biodegradable and eventually decays and turns to soil.

In the United States and other industrialized (developed) countries, the average person tends to require large amounts of energy and large quantities of resources to enjoy the "advanced" quality of life that is associated with our way of life. We drive cars that require gasoline for power and our homes are filled with machines made out of many materials. The electricity that powers our homes requires large quantities of coal and other fuels for its generation.

An ecological footprint calculator is an internet site that uses formulas to estimate a person's ecological footprint. Different websites ask for different information. Some websites use simple formulas and some use complex formulas for calculating ecological footprints.

Directions:

1. Use a search engine such as Google or Yahoo and search for "ecological footprint calculator". You will get a long list of websites that can calculate your footprint for you. Some websites will be user-friendly and others will not be as useful. Find 3 different websites that you like and enter the information that is requested. Each site will give you an estimate of your footprint and tell you what your ecological footprint says about your effect on the environment.

2. Record your information on the ecological footprint data sheet for each of the three websites you have used.

3. Discuss your results with other people. What do your results tell you about why we need to manage our natural resources more efficiently?

Name _____

Estimating Your Ecological Footprint

Objective: Estimate your ecological footprint through the use of internet-based calculators.

Website #1:

_____

Your Estimated Ecological Footprint: _____

What a footprint of this size means: _____

_____

_____

Website #2:

_____

Your Estimated Ecological Footprint: _____

What a footprint of this size means: _____

_____

_____

Website #3:

_____

Your Estimated Ecological Footprint: _____

What a footprint of this size means: _____

_____

_____

Conclusion:

1. Considering the three estimates of your ecological footprint, what have you learned about the amount of resources that it takes to support your way of life?
2. Discuss your results with those of other people. What do your combined results tell you about the effects of United States citizens on the environment and its resources?
3. What are some ways that we can reduce our ecological footprint?

Activity 3: Relating Population Growth to Resource Use

Objective: Calculate and graph the world's overall rate of population growth; relate population growth to resource use.

Materials:
scientific calculator ruler copies of the activity data sheet

Background:

For thousands of years the human population remained relatively small for a planet the size of Earth. Following the Industrial Revolution in the mid-1800s, however, the size of the human population in Europe and North America began to increase. Machines run by fossil fuels dramatically increased the rate of production of goods, improved methods of agriculture and food preservation such as canning and refrigeration became common, and advances in health care all contributed to increased life expectancy and infant survival. Decreased death rates and increased birth rates led to a gradual increase in human population. The rate of growth has continued to rise in many countries.

Directions:

1. Use the information given on the activity sheet to calculate the human birth and death rates for the United States and worldwide.
2. Plot a line graph of changes in the human population over time on the graph provided.
3. Answer the analysis questions that accompany the calculations and the graph.
4. Discuss the implications of these activities with your group and with other groups. What does increased population size tell you about the rate at which we are using fuels and other resources?

Name _____

Population Growth and Natural Resources

Objective: Calculate the world's overall rate of population growth and relate population growth to resource use.

Materials:
scientific calculator ruler copies of the activity data sheet

The world is not getting any larger but the human population is growing. More people means less available land and resources per person. Simple math can help us calculate the current growth rate of the human population. Population information can also be used to plot a graph and help us visualize the growth of the human population.

The current size of Earth's population is **6 billion people (6,000,000)**. **Worldwide, each year** approximately **150 million (150,000, 000) people are born** and about **50 million (50,000,000) people die.**

Conversion factors:
1 year = 365 days = 52.14 weeks = 12 months

1 day = 24 hours = 1,440 minutes = 86,400 seconds

1 hour = 60 minutes = 36,000 seconds

Part A: Calculations: (Note: if numbers are too large for your calculator you may remove a zero from each number, divide, and then add a zero to your answer)

1. Calculate the number of BIRTHS that occur worldwide every:
   - a. month _____ d. hour _____
   - b. week _____ e. minute _____
   - c. day _____ f. second _____

2. Calculate the number of DEATHS that occur worldwide every:
   - a. month _____ d. hour _____
   - b. week _____ e. minute _____
   - c. day _____ f. second _____

3. Now calculate the NET WORLD INCREASE in human population by subtracting BIRTHS – DEATHS. Each year the births – deaths = 100,000,000. Calculate net increase for:
   - a. month _____ d. hour _____
   - b. week _____ e. minute _____
   - c. day _____ f. second _____

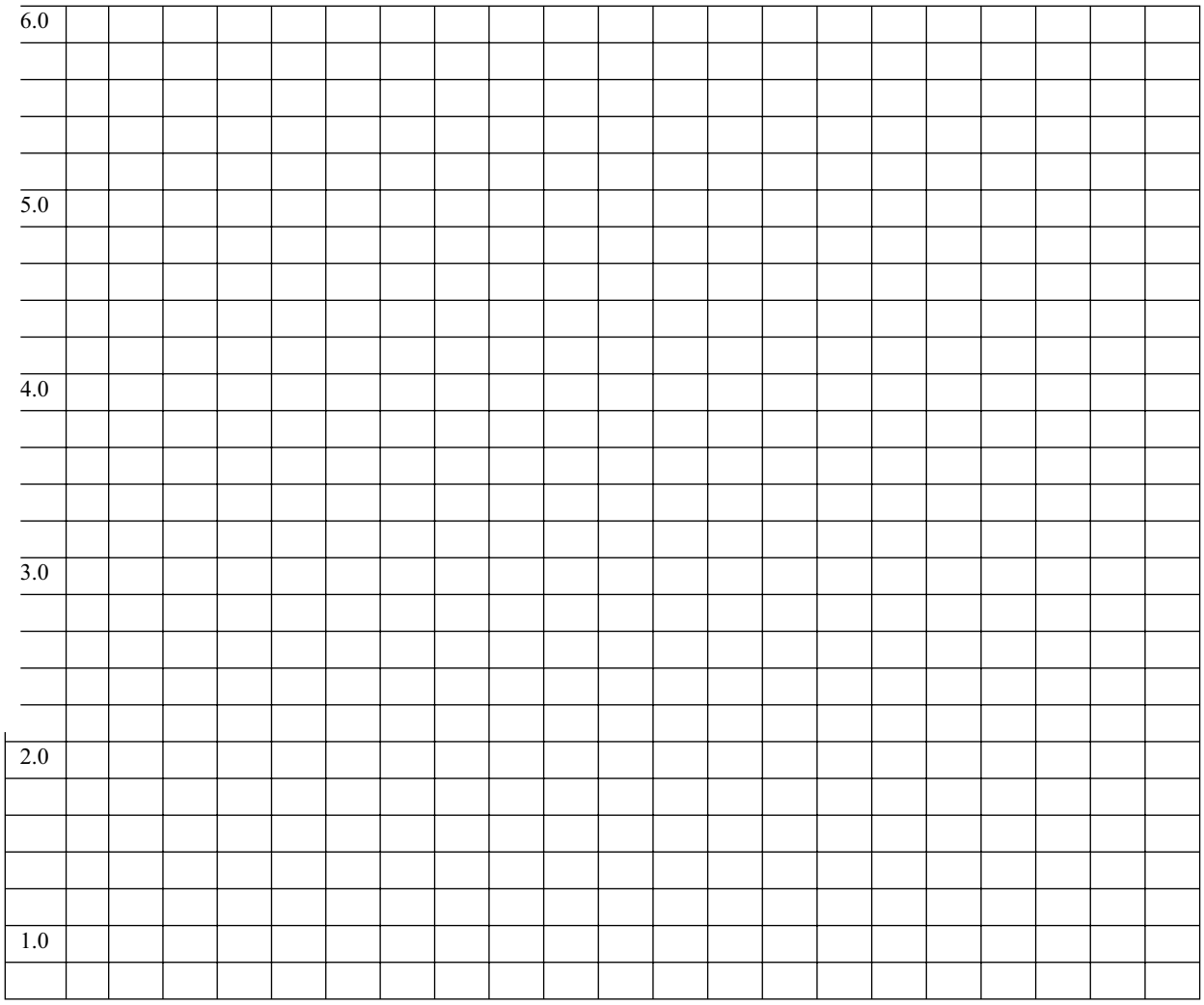
Part B: World Human Population Graphing

Use the data table below to plot a line graph of how the human population has changed since the year 1500.

YEAR	POPULATION SIZE (billions)	YEAR	POPULATION SIZE (billions)
1500	0.5	1850	1.0
1550	0.5	1900	1.4
1600	0.5	1925	1.8
1650	0.6	1950	2.5
1700	0.7	1975	4.0
1750	0.8	2000	6.0
1800	0.9		

World Human Population Size Since the Year 1500

Human Population Size in Billions



0																				
	1500		1550		1600		1650		1700		1750		1800		1850		1900	1925	1950	1975	2000

Year

Analysis and Conclusion:

The U.S. population is growing very slowly when compared with the world population.

1. Look at your answers for the number of births and deaths every second in the world. Do those calculations surprise you? Why or why not?

2. Considering your findings, how do you think human population growth will affect the rate at which we use natural resources in the future?

3. What natural resource challenges or problems might we encounter as our population grows?

4. Look at the shape of the human population graph. This type of growth is called **exponential growth**. Describe this type of growth in your own words.

5. Many resources have started to become harder to obtain and/or higher in price between 1975 and the present. How can you explain our increasing difficulty to obtain all of the resources we need at a reasonable price? Hint: Refer to the population graph.

Activity 4: Reducing Solid Waste

Objective: Determine appropriate environmentally friendly methods of disposal that help to reduce the amount of solid waste sent to landfills.

Materials:
sets of pictures of "trash" items to be sorted
sheets of paper, envelopes, or labeled containers for sorting of trash items into categories

Background:

Americans make up about 6% of the world's population, but many experts estimate that we use as much as 30% of the total energy and resources consumed annually by the world's population. Our way of life is comfortable because of our numerous conveniences: central heating and air conditioning, hot and cold running water, refrigerators, televisions, automobiles, etc. Unfortunately, our lifestyle consumes so much energy and resources and produces so much waste that we are contributing to the depletion, or using up, of many non-renewable resources.

Every trash item that we throw away eventually ends up at a waste disposal facility. Some trash is burned to reduce its volume but the majority of solid waste in the United States ends up buried in a landfill or "dump". Every trash item that is sent to a landfill removes natural resources from availability for use by people in the future. The good news is that people can drastically reduce the amount of solid waste we send to landfills. We can **reduce** the amount of waste we produce by buying fewer unnecessary products and products that have lots of disposable packaging materials. Of course, we will always end up producing some trash. There are several techniques that we can use to help us conserve resources and reduce the amount of solid waste we send to landfills:

Reuse – using an item again for the same or a different purpose
(ex: using a glass pickle jar as a container for change or an old tire as a tree swing)

Donate – give the item to charity or to a friend or relative who can use it
(ex: giving a small TV you don't want any more to the Salvation Army)

Recycle – send the item to a recycling center or place the item in a neighborhood recycling bin

Compost -- placing biodegradable items in a pile or container that lets them decompose and turn back into soil; the compost can be used to provide nutrition for other plants in your yard (ex: composting apple cores, potato peels, coffee grounds, even small paper scraps)

Burn – although burning doesn't allow us to directly re-use resources, it DOES reduce the volume of trash that we sent to landfills; it is not the best option for conserving resources but it is sometimes useful or necessary

Landfill –sometimes there is no way to save the resources in a product and it MUST be landfilled

Directions:

1. Ask participants why throwing large quantities of trash away in landfills is an unwise method for managing natural resources. Discuss ideas and ask for suggestions of methods that can be used to reduce solid waste.

2. You might want to read the background information (above) aloud prior to beginning the activity below.

3. Have participants form groups of four and give each group a set of pictures of trash items to sort and a set of papers or containers labeled (re-use, donate, recycle, compost, burn, landfill, other).

4. Allow participants to sort the pictures of trash items into categories that would be the "best" or most environmentally friendly method of waste disposal. The key in this step is to get people talking and debating different possible fates for each item – there may not be one "correct" category for each item. For example, a glass bottle could be reused or recycled. You may want to allow people to put certain items aside if they can't determine a single best fate for them.

5. Lead all groups in a discussion of how they classified each item. If people disagree about how certain items can be dealt with, encourage them to complete the extension activity.

6. **Extension Activity**: Research different methods of disposal for trash items, particularly those that are not easily composted or recycled. Share the information that you find out with other people in your area or in your local club.

Reuse

Recycle

Donate

Compost

Burn

Landfill

Other

styrofoam cup

batteries

cardboard box

envelopes with plastic windows

flea collar

used motor oil

iPod with broken headphones

milk jug

grass and leaves

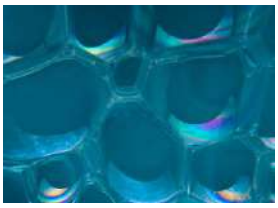
plastic butter bowl

old window air conditioner

old tire (flat)

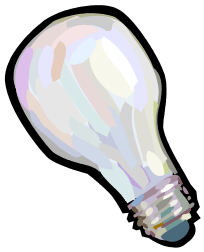
rubber band

plastic bubble wrap

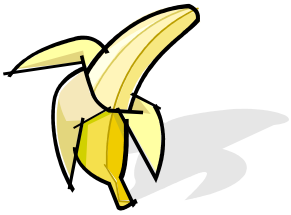


old athletic shoes

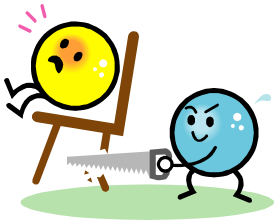
light bulb



banana peels



wooden chair,
missing a leg

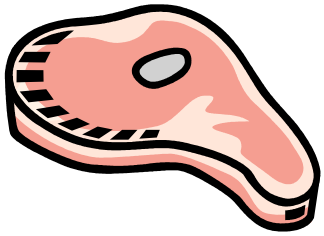


glass soda bottle

soda can

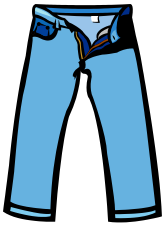
plastic forks

spoiled meat

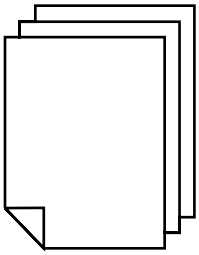


shoe box

old clothes



junk mail (white paper)



CD case

used cat litter

plastic grocery bags

Activity 5: Recycling and Resource Conservation

Objective: Simulate the process of paper recycling and explain how recycling can help us conserve natural resources.

Materials (per group of 4):

plastic tub or pan	pieces of window screen	wooden picture frame
blender	blender	paper towels or newspaper
construction paper	water	corn or laundry starch (optional)
		electric iron (optional)

You may also want to show a recycling video clip from VHS, DVD, or the internet

Background:

Americans make up about 6% of the world's population, but many experts estimate that we use as much as 30% of the total energy and resources consumed annually by the world's population. Our way of life is comfortable because of our numerous conveniences: central heating and air conditioning, hot and cold running water, refrigerators, televisions, automobiles, etc. Unfortunately, our lifestyle consumes so much energy and resources and produces so much waste that we are contributing to the depletion, or using up, of many non-renewable resources.

Every trash item that we throw away eventually ends up at a waste disposal facility. Some trash is burned to reduce its volume but the majority of solid waste in the United States ends up buried in a landfill or "dump". Every trash item that is sent to a landfill removes natural resources from availability for use by people in the future. The good news is that people can drastically reduce the amount of solid waste we send to landfills. We can reduce the amount of waste we produce by buying fewer unnecessary products and products that have lots of disposable packaging materials. Of course, we will always end up producing some trash. **Recycling** refers to the process of turning waste items into new products that can be used by consumers. Every trash item that is recycled helps us conserve natural resources by allowing us to use resources again instead of sending them to a landfill. Recycling also saves energy because it takes less energy to recycle than to extract minerals from ores or other sources. In fact, each recycled can saves enough energy to run a small television for about an hour!

Directions:

1. Ask participants what they know about conserving natural resources. Why is conservation of natural resources important? Discuss ideas. You may want to read the background information (above) and use it to help stimulate conversation. During the discussion of recycling, ask what types of materials can be recycled and compile a list of typical trash items that could potentially be recycled.

2. Have each group choose a few different kinds or colors of paper to make into new paper. Each person will need to tear up the equivalent of about ½ to 1 sheet of loose leaf paper. Students should put about an inch of water into the bottom of a plastic shoebox or similar container and tear their small sheet(s) of paper into small pieces and placing the pieces in the water. The smaller you tear the pieces of paper, the better the final quality of the recycled paper. Explain to students that paper is made from trees and that soaking the paper in water allows the small wood fibers to separate so that they can be made into new paper.

3. Place each group's paper pulp (take turns) in a blender and blend it for about 30 seconds to further loosen the pulp. You may want to add a little starch to help the new paper bind together. Pour a small amount of paper pulp onto a piece of screen that is stapled to a wooden picture frame or stretched over a circular embroidery hoop. Spread the paper pulp thinly and allow most of the water to drain through into the plastic container. (Alternately, you can put everyone's paper pulp in one large tub and then dip the screens into the pulp until they are covered.) Press down on the paper pulp and squeeze out excess water, then blot the paper between paper towels or newspapers to soak up more water. You may remove the paper from the screen and continue blotting out excess water. If you have time, you have the option of running an iron over the newspaper to speed up the drying of the newly created paper. Allow 24 hours for paper to dry.

4. Show a video clip about recycling. The best video clips show how different materials are recycled. Recycling video clips can be found on the internet. Also, National Geographic sells a great 23-minute recycling video called Recycling: The Endless Circle. You may be able to order it online or check it out from a local school or library.

5. **Extension Activity**: Have participants do library or internet searches for recycling and related topics. They should make a list of materials that are accepted for recycling in their home state. Remember that there are several types of plastic and other products (each plastic type has a different number) and not all recyclable materials are currently recycled in all states. Findings can be shared with the group through demonstrations or illustrated talks. Recycling programs are great community service projects for youth to carry out in their local area. Recycling is one of the EASIEST ways for an individual person to make a difference in promoting sustainable use of natural resources.

Activity 6: Analyzing Product Packages

Objective: Analyze several products to determine if their packaging wastes resources; suggest packaging options that waste fewer materials.

Materials:

several store-bought products in their original packaging
copies of the activity data sheet
large poster paper
markers and rulers

Background:

Much of the trash we throw away is just the packaging that the products we use came in. Packaging is sometimes very useful; it protects products from damage during shipping and makes products easier to store or handle. Many products, however, are over-packaged. Some products come in packages that are much too large or are made from materials that are very difficult to re-use or dispose of in an environmentally friendly way. For example, tiny cellular phones are often packaged in plastic, surround by lots of foam cushioning, and placed in boxes much larger that the size of a phone. In fact, the instruction manuals for some cell phones are heavier than the phones themselves! Sometimes over-packaging is done to protect products but other times it is done because manufacturers know that large, attention-getting packages can catch the eye of shoppers and increase sales. Products in larger or more attractive packages tend to sell much faster than similar products in smaller or less attractive packages.

One of the best ways that consumers can conserve resources is to make a conscious effort to buy products that are not over-packaged. Careful shopping on our part can reduce the amount of solid waste from packaging that we send to the landfill. A small reduction in solid waste, if accomplished by large numbers of people, can drastically reduce the amount of package-related materials that our society sends to landfills each year.

Directions:

1. Place a large assortment of products in their original store packaging on a table and spread them out so that they are easily visible by everyone. Have participants work in groups of two, three, or four. They should choose several packaged items and analyze each one to determine if it is over-packaged. The activity sheet provides space for recording information.

2. Have participants discuss the analysis and conclusion questions at the end of the activity sheet. Bring everyone together as a group and discuss their findings and thoughts/ideas.

3. Challenge each group to choose two or more products and re-design their packages so that they are still functional but they use fewer resources. They can draw their newly

designed packages on large sheets of paper and label changes that have been made to reduce packaging waste.

4. Have all participants share their ideas with the large group and lead a discussion about how these and other products can be re-designed so as to attract buyers in a store while simultaneously conserving resources.

5. **Extension Activity**: Have each person select a product package re-design that he or she thinks would function and sell well in a store. Each person should create a 3-dimensional version of his or her new package. The new packages can then be shared with the group or used at club promotional events. Youth with entrepreneur spirit could also share their package re-designs with the companies who package each product in an attempt to make the companies aware of the need for reduction of packaging waste.

Analyzing Product Packages

Name _____

Objective: Analyze several products to determine if their packaging wastes resources; suggest packaging options that waste fewer materials.

Materials:

A large assortment of store-bought products in their original packaging poster paper markers and rulers

Directions:

Choose several packaged items and determine if they are over-packaged and waste resources. Use the chart below to guide you.

PRODUCT NAME 	TYPES O F PACKAGING MATERIALS (plastic, foam, paper, metal, glass, etc.)	**SIZE** OF **PACKAGE** COMPARED TO **PRODUCT** (close in size, larger, much larger)	**WEIGHT** OF **PACKAGE** COMPARED TO **PRODUCT** (lighter, same weight, heavier)	DOES PRODUCT APPEAR TO BE **OVER-PACKAGED?** WHY OR WHY NOT? 	HOW WOULD YOU **IMPROVE THE PACKAGING** TO REDUCE WASTE? 

Analysis and Conclusion:

1. Are there certain types of products that tend to be over-packaged? For example, do food items, clothing, electronics, etc. as a group tend to have more packaging than they need? Explain.

2. Manufacturers want to save money, not waste it. Why do you think some of the items you analyzed are over-packaged? In other words, why would the company use more packaging than necessary? What's in it for them?

3. Which product, out of all the ones you studied, is the MOST over-packaged in your opinion? Why?

4. Which product package wasted the LEAST amount of resources? Why?

5. Choose any two or three over-packaged products that you examined today or that you might buy at the store. Using large poster paper and markers, re-design the packaging for these products to make it less wasteful of natural resources. Draw you designs on the large poster paper and label the changes you have made to the packages. Keep in mind that the packages still need to do their job in protecting the products they contain!

Extension Activity: Build new, re-designed 3-dimensional packages for one or more products that protect the products but reduce the amount of packaging waste. Share your new packages with your group or club! Get your creative juices going!