NATURE'S RECYCLERS
ACTIVITY GUIDE

WA-1425

To Naturalists/Interpreters:

Many of us don't realize that while we are rinsing cans and stomping milk jugs for recycling, other creatures are also busy recycling. Lichens, mushrooms, sow bugs, earthworms and beetles spend their whole lives recycling for nature. Nature's recyclers are responsible for turning dead plants and animals back into usable nutrients for other plants and animals. Likewise, humans are responsible for turning trash back into reusable materials.

Parks and outdoor recreation areas are great locations for demonstrating the importance of recycling. The natural setting has visual examples of cycles, recyclers and natural resources. You can use these examples to make connections between natural and human recycling, and between recycling and preservation of natural resources. People coming to parks and nature centers to relax and enjoy the outdoors are generally receptive to recycling hints and ideas that will help save the natural resources they love.

This activity guide book will help you teach about natural recycling, cycles in nature, and the important role people play in recycling. The activities are organized by categories: **Outdoor Activities; Indoor Activities; Longer Projects for Classroom, Home, or Residential Camp**; and **Ideas for Exhibits**.

Each activity is laid out in the same format. You can consider the age level of the group and whether your goal matches the activity's goal, review the background information, gather materials, and then follow the procedural steps. Many of the activities have optional steps listed at the end in case you have extra time. A **Glossary** and **Resources** listing are at the end of the guide for additional information.

This guide is designed for age 5 and older. You are encouraged to tailor the activities to meet each individual group's needs. Remember that action is better than a thousand words. Let them feel it, touch it, smell it, and see it—not just hear it.

If your audience regularly includes children younger than 5, you'll find activities and crafts specifically for that age group in **Wee Recyclers** and **Wee Crafts** (see Resources section).

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WA-1425
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Updated 2016

Trash Hunt

AGE: 6-12 years old

GOALS:
To develop an awareness of littering and the problems it may cause, and to clarify the difference between litter, trash, and items that are recyclable or made of renewable resources.

BACKGROUND:
Knowing the following terms will make the discussion more interesting: litter and trash, recyclable and non-recyclable, renewable resources and non-renewable resources, and biodegradable and non-biodegradable. See the glossary for definitions.

Litter is unpleasant to see, and it can also be harmful to wildlife:

- Little fish can swim through the pop-top of a soda can and get stuck.
- Birds, larger fish, and small mammals can be entangled in the loops of plastic six-pack holders.
- Loose fishing line can get wrapped around the legs, wings and beaks of water birds, impairing their movement and strangling them.
- Some wildlife may even mistake shiny litter for food. Animals are injured if they eat pop-tops and bottle caps. Styrofoam cups, plastic cellophane wrappers and cigarette butts have been found in the stomachs of deer.
- Broken glass, edges of opened cans and empty jars are all dangerous. Animals can get cut, get infections and even die. They also can be trapped in slippery glass jars.

Some people are promoting biodegradable plastics as a partial solution to our litter and landfill problems. These plastics are made with a starch or yeast that binds the plastic polymers together. When they "break down" in the environment, the starches or yeast decompose but the plastic polymers remain. Biodegradable plastics help our litter problem, but not our landfill problem. When buried in a landfill, they do not break down for a long time because of the lack of oxygen. In addition, starches and yeast may contaminate plastic that could otherwise be recycled.

MATERIALS:

- 1 trash bag per pair (reuse old shopping bags)
- 1 pair of gloves per pair

PROCEDURE:

1. Have a discussion with the group about litter. Explain the difference between litter and trash. Ask: How do you feel about litter? Why do people litter? Why is picking up litter helpful to nature and the human community? Does nature litter? What happens to nature's litter?
2. Explain that the group's mission is to find litter in the area and collect it to protect wildlife. It doesn't matter how big or small the pieces are.
3. Distribute bags and gloves to every pair. Set a time limit and boundaries to avoid stragglers. Set them free on their mission. Remind them to be mindful of sharp-edged trash.
4. After the hunt, gather the group in an area sheltered from the wind. Have the children dump their litter in a pile in front of the group.

5. Pick through the pile. Find litter that is harmful to wildlife and explain how it's harmful.
6. Define *renewable* and *non-renewable*. Have the children sort through the pile picking out examples of each.
7. Define *recyclable* and *non-recyclable*. Have the children decide whether the litter pieces should be put in a trash can to go to the landfill, or in a box to be recycled.
8. Define *biodegradable* and *non-biodegradable*. Have the children decide which litter is biodegradable and which is non-biodegradable.
9. Dispose of the litter properly. If time allows, use the items collected as part of a relay race where the students run to the litter pile and take turns placing items in the appropriate bin (trash, recycle, or compost).

GOING BEYOND:

- Use some of the items collected during the hunt in the Mini-Composts activity.
- Put the money made from collecting recyclables towards educational materials.
- Create a "trash monster" or trash collage with the collected litter.
- Draw before and after pictures of the cleaned-up area. Have the children write stories to go along with their pictures.
- Older students might do a photo essay of before, during, & after the clean-up and the journey of the trash & recyclables after they reach their appropriate bins.
- Research biodegradable plastics. How are they made? What might be the best uses for them? How should they be managed when they become trash?

LITTER — IT'S EVERYWHERE!

AGE: 8-15 years old

GOALS:
To raise awareness of litter and to think of ways to help reduce litter.

BACKGROUND:
Waste from food wrappers, extra packaging, soda cans and paper may all be found in your area. Factors contributing to this problem may be too few trash cans, carelessness, the wind blowing trash against a fence, or uncovered trash cans. (For more information, see the background section in Trash Hunt).

MATERIALS:

- 1 map of the nature center area/park per person
- clipboards
- writing utensils

PROCEDURE:

1. Discuss litter and why it is a problem, both at your facility and elsewhere. Talk about why people litter and what can be done to help reduce litter (reusable drink bottles and food containers, recycling, more conveniently placed bins for trash and recycling, etc.). How can we make it easier for people to get trash and recycling in the right places?

2. Give each person a map. Ask them to fill in the details of the area (building, parking lots, campsites, trees, play equipment, soda machines, beaches, fences, trash cans, streets, etc.). Display example graphics for the map legend.
3. Ask them to circle on their maps the places where they predict that the most litter will be found.
4. Have the group share what types of litter they expect to find, and ask for the reasons behind their ideas.
5. Go on a walk to check their predictions. In key littering locations, have them come up with solutions (for example, "No Littering" signs, trash cans, and warnings).

GOING BEYOND:

- If the group comes up with a great solution, tell them you'll implement it. If it's a school group, write to them in a few weeks to let them know how their solution is working.
- Suggest that the school group do this activity on their school grounds. Have them make suggestions to the principal and school board on ways to reduce litter. Suggest that they research local pollution problems and solutions, or invite a guest speaker to class to learn more.
- Do the Trash Hunt activity from this guide, or incorporate the ideas from the activity into the discussion.

DEAD TREE AND ROTTING LOG STUDY

AGE: 8-adult

GOALS:
To develop an understanding of the decomposition process and nutrient recycling, and the role nature's recyclers play.

MATERIALS:

- magnifying glasses or hand lenses
- For optional "windows": clear plastic sheets (3-6 mm thick), dark-colored heavy fabric or plastic sheets (3-6 mm thick), saw, hammer,

BACKGROUND:
The death and decay of a tree is a very dynamic process that provides one of the best teaching examples of recycling in nature. Standing dead trees and rotting logs can be found in most forest communities in various stages of decomposition. They serve as excellent habitats for a variety of organisms known as decomposers or nature's recyclers. By observing and comparing these various stages of decay, you can watch a tree gradually return to the soil.

EARLY SEASON PREPARATION:

1. Early in the season, locate the following near each other: a small live tree, a large live tree, a standing dead tree, a freshly fallen tree, a log in initial stages of decay, a log well along in decay, and the mostly decomposed remains of a log.
2. (optional) Make a "window" in the standing dead tree by cutting out a 10 inch square section of bark at a good viewing height. Cut "windows" into the rotting logs by making two cross

cuts approximately 10 inches apart and one inch deep in each log. Chisel out the section between the cuts to a depth of one half to one inch. Staple a thin sheet of clear plastic over each window, leaving a gap underneath. Punch a few air holes in the plastic. Finally, cover each window with a "curtain" made from a piece of dark fabric or plastic. Staple just the top edge of the material and weight the bottom so that it will not blow around. These "windows" will enable you and your class to view nature's recyclers without continually disturbing them and destroying their homes. The "curtain" keeps the space underneath dark and more inviting to nature's recyclers.

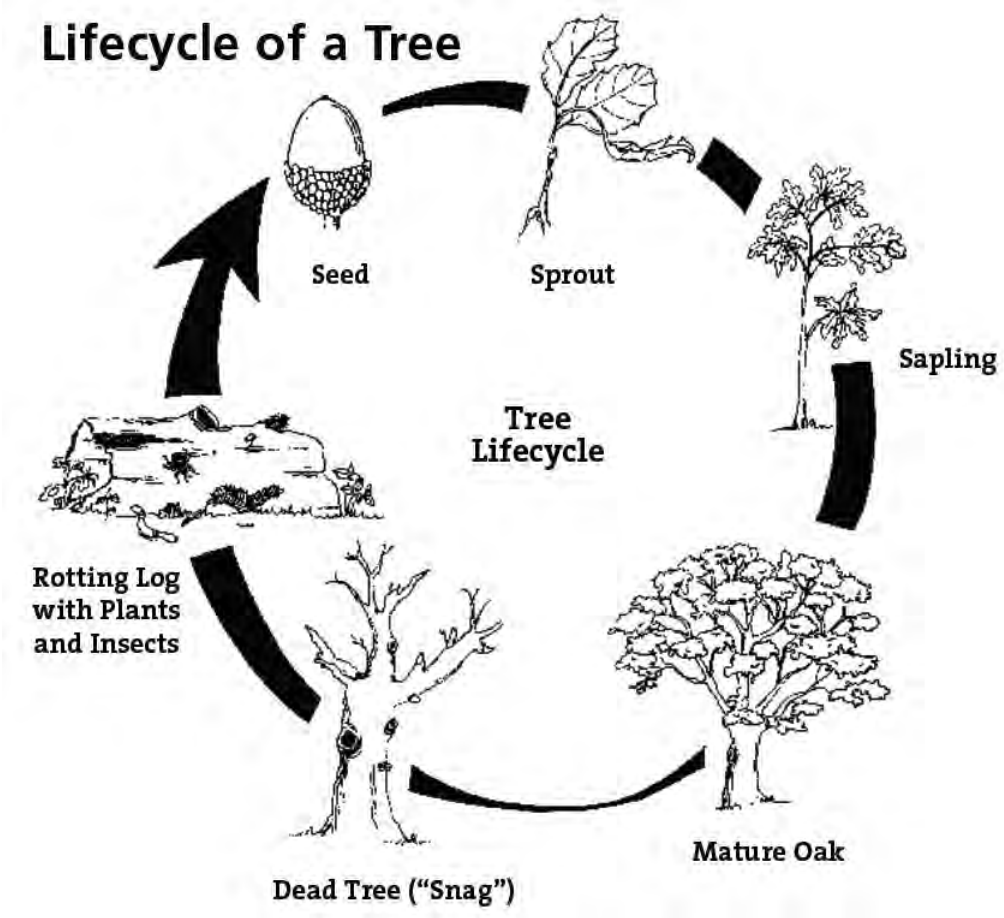
3. If anticipating larger groups, multiple windows or trees may be needed for rotating stations.

ACTIVITY DAY:

1. Take your class on a discovery hike in search of nature's recyclers. You may want to develop a worksheet for older students to record their observations, or just arm them with magnifying glasses and guide them through the discovery process. If possible, let your students work in small groups of three to five. For larger groups, set up rotating stations so everyone has something to look at without lots of waiting.
2. Start with the two live trees and ask:
   - What makes them grow?
   - Where do they get their nutrients from?
   - Will they live forever?
3. Next go to the standing dead tree and ask:
   - What happened to the tree?
   - What caused it to die?
   - What will happen to it now?
4. Direct your students to look for evidence of nature's recyclers at the tree:
   - Open the "windows" (optional).
   - Cautiously inspect the crevices and the ground around the tree. Look for plants, mushrooms and lichens, birds (woodpeckers and sapsuckers), mammals (squirrels and chipmunks), amphibians (salamanders), insects (ants and termites), and other members of nature's recycling crew (such as millipedes, sow bugs, mites, earthworms).
   - Ask your students what role each recycler plays in the decomposition process.
   - Have your students close their eyes and feel the texture of the tree.
   - Ask them to describe what they feel.
   - Have them smell the tree and describe its odor.
5. Visit the freshly fallen tree and the rest of the logs in further stages of decay. Ask similar questions, and have your students make the same observations as they did for the standing dead tree.
6. After your students study the mostly decomposed remains of a log, ask:
   - What is left from the tree/log? (Minerals and some organic matter)
   - Where did the rest of the tree go? (some back into the air and water, some into nature's recyclers)
   - Dig up the first layer of some soil nearby, and compare the way it looks, feels, and smells with the log remains. Are they similar?
   - Review what you have found and learned.
7. Finally, go back to the small live tree and ask your students where it gets its nutrients to grow. Talk about completing the cycle and how the same resources have been used over and over again.

GOING BEYOND:

- Discuss how natural decomposition compares to decomposition in a landfill. Decomposition of biodegradable materials in a landfill occurs extremely slowly because there isn't enough air and water and no sunlight for natural decomposition to work well. Decomposition in nature or a compost pile makes a nutrient-rich substance that is excellent for improving soil quality and plant growth.
- Discuss what we can do to be more like nature's recyclers.
- Study nature's recyclers in the wintertime by collecting some forest floor litter and warming it under a lamp with an incandescent bulb. Dormant "recyclers" will come to life under the heat from the lamp.
- Collect sow bugs, several fallen leaves and other decaying plant material. Place them in a closed container with a few drops of water. Remember to punch a few air holes in the lid. Observe the sow bugs for a few days, and then let them go.



MUSHROOM ADVENTURE

AGE: 10 – adult

GOALS:
To teach about mushrooms and their important role in nature's recycling system.

MATERIALS:
- Mushroom identification book
- Small notebooks/journals and writing utensils for sketching mushrooms (or mushroom species "scavenger hunt checklist" with identification pictures)

BACKGROUND:
Mushrooms are an important part of nature's recycling team. Some mushrooms feed on living trees, but most mushrooms are saprophytic (using only dead materials for food). They cause decay of dead leaves, animals, and wood in the forests. Where forest soils are too acidic for bacteria to grow well, mushrooms are the main decay producers.

Mushrooms have an interesting life cycle. Tiny seed-like spores are released into the air from the fruiting body of mushrooms. When a spore lands in a fertile location, it sends out many root-like threads called hyphae. These tiny threads grow into a tangled mass called a mycelium. The mycelium is the underground part of the mushroom that chemically breaks down the material on which it eats and grows. Mushrooms like soil to be soft, warm, and moist. When the mycelia are strong and these soil conditions are present, small mushroom "buttons" begins to form beneath the soil. The buttons take in water, swell, and push up out of the soil. Gradually the mushroom's stem emerges, and the cap opens like an umbrella. The cap is lined with gills that hang next to each other. Each gill contains many cells that make spores. After spores are mature, they can be dispersed by wind, water, animals and insects. Not all mushrooms are umbrella-shaped. Some grow on the side of trees like shelves. Others are globe-shaped and are called puff balls.

Before the hike, review the specifics about mushroom types which grow in your area. Plan to have a mushroom identification book along on the adventure. The hike is most successful from July to September when the greatest number of species and the heaviest densities of mushrooms may be found after drenching rains.

PROCEDURE:
1. Assemble the group. Depending on the group size, your facility, and visual aids, you may want to teach several points before going out in the field.
   - Emphasize the importance of a detailed study of mushrooms before anyone attempts to gather them for food. Advise people to look at them, photograph them, and to enjoy their many colors and pleasing forms, and forget about eating them. People can die from mistakes in mushroom identification.
   - Describe the lack of chlorophyll in mushrooms and the habitats of various mushrooms. Explain their extensive "root" systems, tremendous spore production and rapid growth rates under favorable conditions.
   - Discuss the mushroom habitat conditions in the area (see background information above) of the hike and where mushrooms are most likely to "happily" grow.

- Point out that mushrooms are the fruiting bodies of their extensive, hidden root-like systems (mycelia) and that most mushrooms grow, ripen, disperse spores, and die in just a few days. Their important roles in the nutrient cycle should also be brought out during the hike.

2. Go on the Mushroom Adventure hike. Look for mushrooms. Practice identifying them. Note key characteristics such as stem length and width, color, habitat, texture, spore color and gill pattern. Have students sketch 3 different types in their notebooks (or have them complete scavenger hunt sheet).

GOING BEYOND:

- Study more about spores and molds. The spores that create mushrooms are similar to those that create molds. To see how airborne spores grow hyphae and fruiting bodies, do the following:
- Place a slice of damp bread in a glass dish. Leave it uncovered for several minutes. Then cover the dish with a glass plate. Set the dish aside for several days in a warm, dark place and see if any mold grows on the food. Observe the molds with a magnifying glass. Can you see the center point from which the hyphae grow? How did the molds start at these points? The air we breathe is filled with spores that produce molds and mushrooms. Like mushroom spores, mold spores can only grow when they land in favorable conditions such as the damp bread.

WHERE DO THINGS COME FROM?

AGE: 8-12 years old

GOALS:
To understand where our products come from and the difference between renewable and non-renewable resources.

BACKGROUND:
To understand the need for recycling, we must understand the source of the products we use and that the earth has a limited supply of resources. Everything we use and make comes from the earth's natural resources in some way. Some natural resources are quite abundant, such as sand and grass, but others like oil and diamonds are scarce. Some resources are renewable (can be replaced in a relatively short period of time), and some are non-renewable (once taken out of the earth, it takes a very, very long time for them for natural processes to replace them). For this activity, earth's resources are lumped into six categories—Water, Air, Rocks & Minerals, Petroleum/Oil, Plants, and Animals.

MATERIALS:

- copies of Resources Scavenger Hunt Worksheet (page 11)
- clipboards
- pencils
- examples from each of the resource categories (see chart below for ideas)

PROCEDURE:

1. Ask "Where do things come from?" Discuss the earth's resources and identify the six categories. Show specific examples of products derived from each category and ask the children for other examples. Talk about renewable and non-renewable resources. Ask the children for specific examples of each. **Remind them they are observing, not collecting.** (Note: if you'd like to also do a litter clean-up, consider combining this activity with Litter—It's Everywhere)
2. Pass out the scavenger hunt sheets, clipboards and pencils. Explain that you will be hunting for items from 4 of the 6 categories (Rocks & Minerals, Petroleum/Oil, Plants, and Animals). Give them the following directions:
   - Find three or more items in each category.
   - Indicate items found with a check in front of the item.
   - **Do not collect items and bring them back**!
   - Identify which resource category the item belongs in by putting an **R** for rocks (or **M** for minerals), **O** for oil, **P** for plant, and **A** for animal on the line behind it.
   - Circle items from renewable resources.
   - Extra points will be given finding an item that is also on the extra credit list. Explain that "nature's packaging" means a shell, cone or pod casing.
3. Give the children 15 minutes to hunt for items outside. They might need to talk to each other and their teachers to get some of the answers.
4. Call them together and go over the answers.
5. Review how reducing, reusing, and recycling help conserve natural resources.

ITEMS BY CATEGORY— ANSWERS				
Rocks & Minerals	**Rocks & Minerals**	**Petroleum/Oil**	**Plant**	**Animal**
Glass	Coin	Plastic bag	Charcoal (yes, before it was a rock)	Lunch meat
Stone wall	Soda can	Frisbee	Bread	Yogurt
Pottery	Diamond ring	Plastic bottle	Firewood	Egg
Stone building	Pencil "lead" (graphite)	Pants from manufactured fabric	Paper	Leather shoes
Leather shoes		Plastic food wrapper	Cotton jeans	Milk

RESOURCES SCAVENGER HUNT WORKSHEET

Find at least three items from each category.

- Indicate items found with a check in front of the item.
- **Do not collect and bring back the items!**
- Identify which resource category the item belongs in by putting an **R** for rocks (or M for mineral), **O** for oil, **P** for plant, and **A** for animal on the line behind it.
- Circle the renewable resources.

❍ glass ____
❍ Frisbee ____
❍ bread ____
❍ pottery ____
❍ butter ____
❍ coin ____
❍ egg ____
❍ nail ____
❍ concrete____
❍ milk ____

❍ lunch meat ____
❍ yogurt ____
❍ soda can ____
❍ stone wall ____
❍ firewood ____
❍ nylon sock ____
❍ pencil lead ____
❍ lettuce ____
❍ food wrapper ____
❍ scrap metal ___

❍ plastic bag ____
❍ charcoal ____
❍ paper ____
❍ diamond ring ____
❍ stone building ____
❍ plastic bottle ____
❍ leather shoes ____
❍ pants made of manufactured fabric____
❍ cotton jeans_____

EXTRA CREDIT

❍ "nature's" packaging ____
❍ manufactured packaging ____
❍ an item that can be used for something else ____
❍ an item made from more than one material ____

RECYCLING FOR THE BIRDS

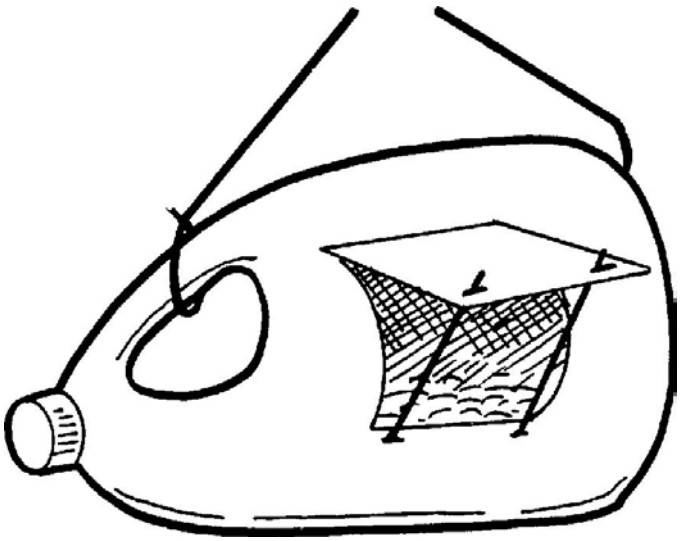
AGE: 5-12 years old

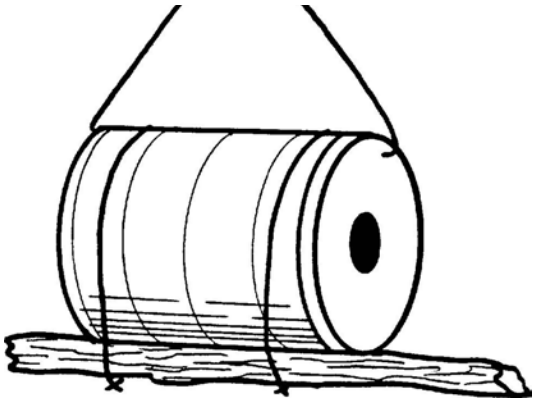
GOALS: To show that many items can have more than one use, and that the longer you keep an item out of the waste stream, the better it is for the environment.

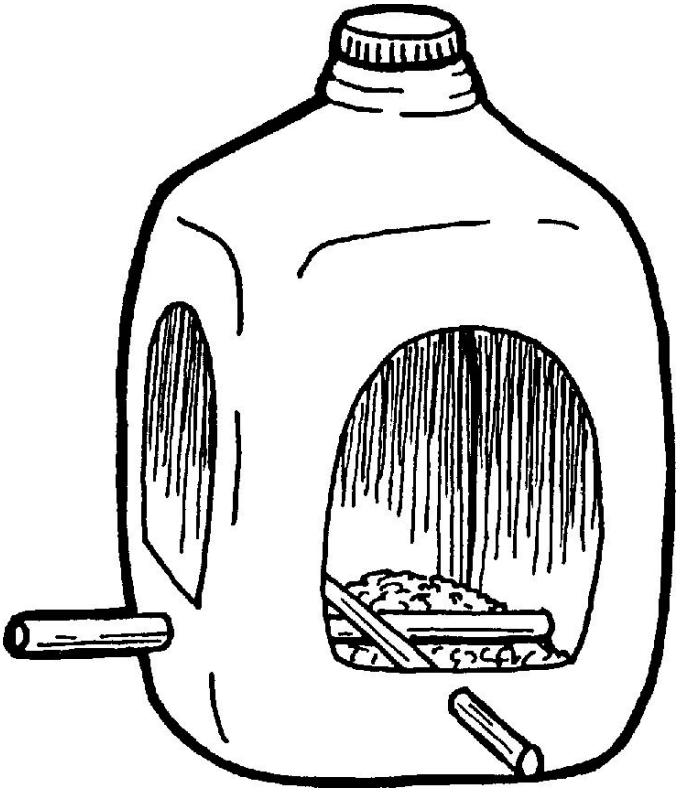
BACKGROUND:
Many containers can have their usefulness extended by finding creative ways to reuse them. In this activity, children will learn to make bird feeders and nesting material bags from common household trash.

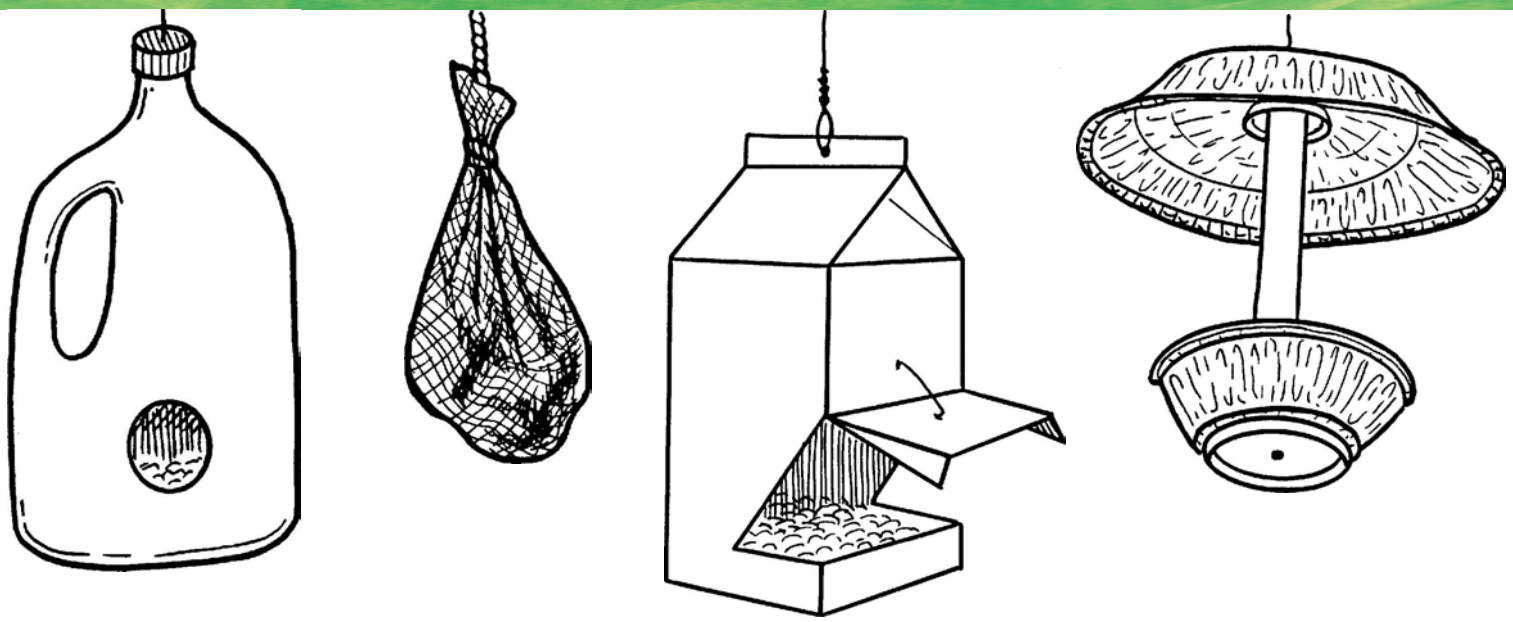
MATERIALS:

- clean household containers such as:
  - milk or detergent jugs
  - milk cartons
  - coffee cans
  - pie tins
  - mesh potato or onion sacks
- mustard jar lid (for tracing circles)
- sticks or dowels (for perches)
- knife
- hammer
- nails
- wire cutters
- pencils
- ruler
- light wire
- coat hangers









PROCEDURE:

1. Create bird feeders out of clean household containers using the drawings for models. Assist younger children with the cutting. Remember to punch small drain holes in the bottom of the containers to let rain water out. **Note: test your cutting tools ahead of time to make sure they work well on the materials you will be using. It is not easy to cut thick plastic bottles without the tools slipping. For younger children, do cutting in advance OR have multiple adults available to assist.**
2. Discuss how bird feeders should be hung in places where predators can't reach the feeder or easily jump to it and also less than 3 feet or more than 10 feet from a building to protect birds from hitting windows. Discuss the types of bird feed available and that feeders need refilling and cleaning. See resource section for a link on feeding birds.
3. Provide string, old yarn, baler twine, cloth strips, etc. for nesting materials. Wind these through an onion sack, attach to a coat hanger, and hang outside in a tree.
4. Discuss the importance of reusing materials, and have students share ideas of common items that can be reused and the new uses for each.

GOING BEYOND:

- Research bird houses and how to create bird houses out of natural or manufactured containers.
- Donate feeders to nursing homes and volunteer to maintain them.

RECYCLING GAMES

AGE: 10-adult

GOALS:
To increase awareness of how we use natural resources and the need to recycle; and to learn about some commonly recycled items.

BACKGROUND:
These games could be good rainy day activities or time fillers. These word games would also work as a pre-program activity to find out what the group already knows about recycling. Use the background information to let people know where materials come from and how they are recycled.

Everything on earth, both natural and manufactured, has the potential to be recycled. However, our current knowledge, technology, facilities and economics prevent many items from being recycled. Most recycling programs are set up to make money as well as recycle materials. They tend to concentrate on "easy to recycle" and "big money back" materials. We could recycle more materials if there were marketable and affordable uses for the recycled materials.

GLASS is made from sand, lime, and sodium carbonate. Glass is able to hold many items that other materials cannot. However, glass is heavy, breaks easily, and remains in landfills for a long time. To be recycled, glass must first be sorted by color and crushed into small pieces called cullet. The cullet is melted down into a solution and then made into glass containers again. Other products can also be made from recycled glass bottles, such as insulation and road-patching material.

ALUMINUM is made from bauxite, an aluminum ore which is a non-renewable resource. Aluminum is lightweight and corrosion-resistant. When recycled, aluminum is melted and then shaped again into new cans and other items. For every aluminum can recycled, 95% of the energy needed to create a new can is saved.

TIN-PLATED STEEL cans are made of iron ore and tin, which are non-renewable resources. The cans will eventually rust and break down. However, throwing cans away is a waste of valuable metals. When recycled, the cans are put into a huge container with holes in the bottom. This container is immersed into a caustic solution which takes the tin plating off the steel cans. Then the steel cans are washed and sold as Number 1 Grade Steel. The tin is removed from the caustic solution by electrolysis and made into ingots which are sold to companies needing tin.

PAPER is made from a renewable resource — trees. When recycled, paper is shredded into small pieces and mixed with water. This mixture is beaten into a mush-like pulp which flows onto a moving screen through which most of the water passes. The wood or paper fibers remain. The fibers are pressed through heavy rollers that remove more water and then are sent through steam-heated dryers.

PLASTICS are made from petroleum, coal, air, water, and industrial chemicals. By varying the type of chemicals added to plastic resins, the finished product may be

flexible or rigid; transparent, opaque, or colored; or easy to tear or rigid. It takes a lot of energy to make new plastic, and most plastics are made from non-renewable petroleum sources. Throwaway plastic packages also constitute much of our litter and take up valuable landfill space when not recycled. Plastics of similar type are recycled by being melted down and molded into new products.

MATERIALS:

- copies of Recycling Games Worksheet (page 16)
- pencils for each person

PROCEDURE:

1. Distribute copies of the games. Instruct the group to complete the matching games and break the code for the coded recyclables (the coded words are a list of 10 recyclable materials. In this code, one letter is substituted for another. The object of the game is to decipher the 10 recyclables. (Get them started by giving them the first answer, newspaper).
2. If you wish, divide the group into teams.
3. Check their answers. Discuss each answer and its implications.
   - Number Match: 1-g, 2-c, 3-j, 4-e, 5-a, 6-i, 7-b, 8-f, 9-h, 10-d.
   - Word Match: 1-f, 2-d, 3-g, 4-b, 5-c, 6-a, 7-h, 8-e.
   - Coded Recyclables: 1. Newspaper, 2. Glass, 3. Motor Oil, 4. Tires, 5. Aluminum Cans, 6. Cardboard, 7. Asphalt, 8. Metal, 9. Leaves, 10. Cars
4. Let the winners do something special, such as getting to be first in line on a hike or not having to help clean up after an activity.

GOING BEYOND:

- Have examples of the different materials to show the group. Emphasize how important it is to imitate nature by giving new life to materials that are resistant to decomposition, in short supply, or not renewable.
- Invite the group to share their recycling adventures. Ask what they do at home, at school, at work. What can they recycle in their community?
- Further research the cycles of natural resources.
- Do other related activities from this guide: Make Your Own Paper and Where Do Things Come From?

RECYCLING GAMES WORKSHEET

RECYCLING NUMBER MATCH

1. In 2009, Americans produced enough trash to circle the earth ____ times.	a. 700
2. Percent of all paper that is recycled in U.S. ____	b. 80
3. Tons of coal saved by recycling 1 ton of iron . ____	c. 63
4. An aluminum can takes ____ years to decompose in a landfill.	d. 3
5. Plastic takes up to ____ years to decompose in a landfill.	e. 80-100
6. Pounds of solid waste made by average American each year. ____	f. 24
7. Recycling glass reduces mining waste by ____ percent.	g. 24
8. Number of trees it takes to make a ton of paper. ____	h. 100
9. Gallons of gasoline saved by recycling a ton of newspaper. ____	i. 1715
10. The energy saved by recycling one aluminum can could keep a television on for this many hours. ___	j. 1

RECYCLING WORD MATCH

1. Recyclable ground-up glass	a. Motor oil
2. Changes organic material into usable nutrients	b. Cellulose insulation
3. A use for shredded newspapers	c. Aluminum
4. A use for finely ground newspapers	d. Composting
5. Recycling ____saves 95% of the energy to process this material new	e. Natural resources
6. Wisconsin law requires communities to set up collection of: _____	f. Cullet
7. Materials not recycled or composted go here	g. Animal bedding
8. Materials not recycled use up _____	h. Landfills

CODED RECYCLABLES

1. Z B E V N J N B P
2. O W J V V
3. I D A D P D T W
4. A T P B V
5. J W Y I T Z Y I L J Z V
6. L J P F R D J P F
7. J V N C J W A
8. I B A J W
9. W B J S B V
10. L J P V

MAKE YOUR OWN PAPER

AGE: 5-17 years old

Time frame: two sessions 24 hours or more apart

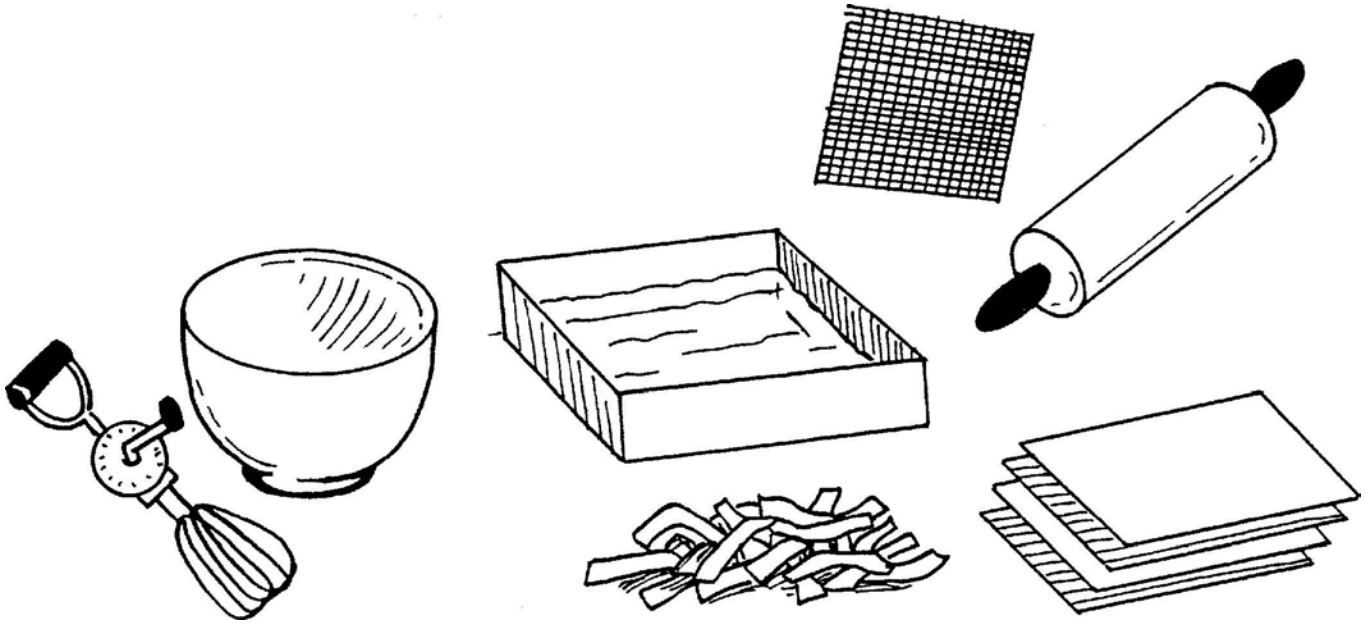
GOALS: To show that used paper can be recycled into new paper.

BACKGROUND:
What happens to used paper? Often paper is thrown away in landfills or burned. If we recycle paper, we save landfill space and use valuable wood fibers again. Making your own paper from old paper is similar to what happens in a paper recycling mill. At a mill the pulp is put into a machine with a long moving screen. The water drips through the screen. Then the screen moves through parts of the machine that press and dry the pulp. The final product is new paper. The paper you make will be much thicker and rougher than recycled paper made in a mill. Paper mills have many kinds of machines to make the paper smooth and flat.

If time is limited, most of the pulp can be prepared the night before. If you make it much in advance, it should be refrigerated to prevent fermentation. To make special occasion paper, add colored threads or dried flowers and leaves to the completed pulp.

MATERIALS:

- a blender or egg beater and bowl
- a flat dish or pan, a little larger than the screen
- a round jar or rolling pin
- per child:
  - 10 pieces of tissue or newsprint
  - a piece of non-rusting screen
  - 4 pieces of blotting paper or felt the size of the screen
  - newspaper and blotting paper
  - 2 cups of hot water
  - 2 teaspoons of instant starch



PROCEDURE:

1. Tear the newspaper into very small bits. Add 2 cups of hot water to 1/2 cup of shredded paper.
2. Beat the paper and water in the blender, or with the egg beater, to make pulp. Mix in the starch. Completed pulp should be the consistency of split pea soup.
3. Pour the pulp into the flat pan.
4. Slide the screen into the bottom of the pan and move it around until it is evenly covered with pulp.
5. Lift the screen out carefully. Hold it level and let it drain for a minute.
6. Put the screen, pulp-side up, on a blotter on some newspaper. Put another blotter over the pulp and more newspaper over that.
7. Roll a jar or rolling pin over the "sandwich" to squeeze out the rest of the water.
8. Take off the top newspaper. Turn the blotter sandwich over. Then take off the blotter and the screen very carefully. Do not move the pulp. Look: there is your paper!
9. Put a dry blotter on the pulp and let the paper dry for 24 hours.

GOING BEYOND:

- Ask the students to think about how much paper they use in one day (napkins, lunch bags, school work, books, tissues, paper cups, newspaper, etc.). What would life be like without all of these products?
- Encourage students to use the paper they made in another art project or as gift wrap.

EARTHWORM CASTLES

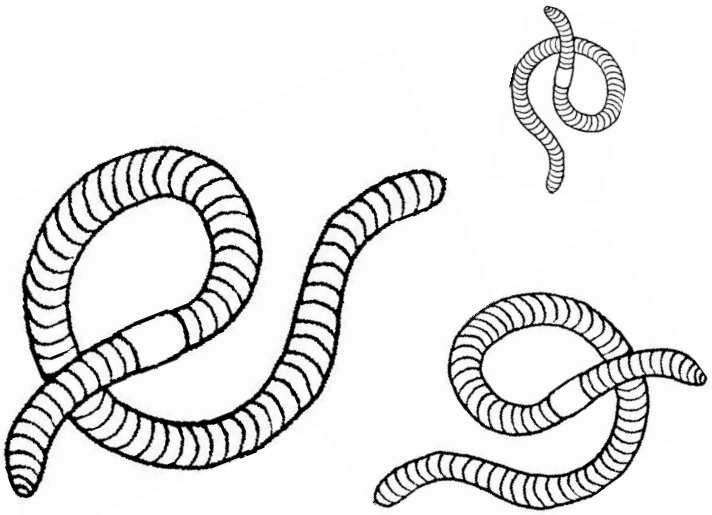
AGE: 5-15 years old

TIME FRAME:
One session to make castles with observations over following days or weeks

GOAL:
To help people observe and learn about one of nature's important recyclers — earthworms.

BACKGROUND:
Earthworms are important recyclers because they eat bits of decayed plants and animals that are in the soil. They also dig through and loosen up garden soil. Earthworms' bodies are simple structures composed of two tubes, one within the other. The inner tube is the digestive system.

Earthworms belong to a group of animals having segmented bodies. Each segment is the same except for the head and the clitellum. The head, the end which moves forward, has a mouth but no eyes. Worms do not need eyes underground. The clitellum is the swollen ring around the body. It contains many glands which secrete mucus to form the walls of a cocoon.



Earthworms lay their eggs in the soil to hatch.

Earthworms do not have any legs. They move by extending their front half forward and anchoring it with hair-like structures called setae. Then their back half is pulled forward. Earthworms dig their tunnels by eating soil in front of them. The soil is then excreted with mucus to form the burrow walls. Castings, which are excreted wastes and dirt clumps, may be found on the surface of the ground. They look like tiny bunches of grapes. Castings have high lime content and help fertilize the soil.

MATERIALS: (per castle)

- magnifying glass
- large jar (clean wide-mouth quart canning jar, used mayonnaise jar, or similar)
- rocks
- soil
- peat moss
- worm food (grass cuttings, tiny table scraps, egg shells, coffee grounds, etc.)
- black paper
- trowels or spoons
- live worms

PROCEDURE:

1. Introduce a group of children to live worms and have them watch the worms move. Using magnifying glasses, observe the setae. Locate the clitellum. Show them how to tell the front part from the rear. Put some of the food items listed above in the Materials section near the worms' mouths and see if they will eat.
2. Lead the children on a worm dig. Talk about where worms live and how they help nature cycle its nutrients. Using the spoons or trowels, have the children hunt for worms to put in the castles they will build.
3. Create the castles by placing a few rocks in the bottom of each jar. Add a mixture of soil and peat moss to a depth of about 10 cm (4 inches). Invite the worms into their new homes by carefully placing them in the jars.
4. Place some worm food on top of the soil. Foods that work well are: apple and banana peels, cantaloupe, watermelon, celery, coffee grounds, eggshells, onion peels, pizza crusts and tea bags. (To avoid fruit flies, completely cover the food with a layer of dirt.)
5. Keep the castle moist, but not wet.
6. Cover the jar with black paper. Explain that worms are sensitive to light.
7. Over time, have them observe the worm tunnels, castings, and eating habits. Remind them to keep the soil moist, to keep the jar covered with the dark paper when they aren't watching the worms, and to add new "worm food" every few days. Suggest that they feed the worms small amounts of table scraps. This way some of nature's recyclers are helping recycle some of the children's waste.

GOING BEYOND:

- Make an "earthworm-track observation spot." Pour water over some soil outdoors to make it muddy. Come back the next day and look for worm tracks. Discuss that worms need air to breathe. They come out of the ground so they do not drown.
- Have young children pretend to be worms. Encourage them to close their eyes and move on the ground like earthworms.
- Make worm pictures by having a muddy worm crawl across a white piece of paper.
- Make an Earthworm Castle to have on display to show those people/groups that are unable to make their own castles.
- To observe another recycler, do the Mushroom Adventure in this guide.
- Start worm composting in classroom or cafeteria.

MICROBE GARDEN

AGE: 8-17 years old

TIME FRAME:
One session to make gardens with observations over following days or weeks

GOALS:
To show decomposers at work and to understand the role microbes (microscopic organisms) play in the decomposition process.

BACKGROUND:
Microbes are plants and animals that help decompose materials. These molds, bacteria, yeasts and protozoa are responsible for turning decomposing matter into nutrient pieces that are small enough for plants to absorb. Microbes are better at this task than earthworms because of the amount of materials they consume. Under favorable conditions, an earthworm eats its own weight in food daily. A microbe digests its weight in food in just a few seconds. Gram for gram, there are more microbes in a compost pile than earthworms. Not only are microbes responsible for more decomposition, but they can digest many things earthworms cannot, including dead earthworms.

While microbes are small, many can be observed without a microscope. The molds that develop in mold gardens may be any color, size, or shape.

Some common molds that grow on bread include:

Rhizopus stolonifer (shiny black mold)
Aspergillus niger (fuzzy black mold)
Penicillium (fuzzy blue-green mold)

Each mold is really a colony consisting of millions of cells of one particular species. Many different molds may grow at the same time, or there may be changes over time when some molds replace others.

Your mold garden is a model for what microbes do in well-aerated compost piles. Nature's recyclers, including the microbes, digest and oxidize trash. The end product is good rich soil fertilizer!

MATERIALS:

- metal can or plastic jar (6-8" wide and 3-4" deep)
- soil from garden or near shrubs
- water
- mold food (kitchen waste - nut shells, potato peels, banana peels, old cereal, stale bread, apple cores, etc. **Do not use protein materials such as meat, dairy products, or gelatin**)
- rubber band
- clear plastic (cellophane)

PROCEDURE:

1. Firmly pack about 1" of soil in the can or jar. Soil should be moist, but not water-logged.
2. Prepare 5 pieces of mold food, approximately half inch square and 1/8 to 1/4" thick.
3. Place the pieces of food on the soil, not touching one another.
4. Let the garden stand in the open air for about 15 minutes to catch spores.
5. Cover the container with plastic to prevent the garden from drying out. Use a rubber band to hold it in place.
6. Either use this microbe garden as a display, or let members of the group take it with them to observe and nurture.
7. Remove plastic for a few minutes each day to give the molds a good supply of oxygen. Add water to the soil when it dries out.
8. Observe the garden each day and describe the changes

GOING BEYOND:

- Explain that mushrooms are the fruiting bodies of some molds. Go on a Mushroom Adventure hike as found in this guide.
- Suggest that the group build Earthworm Castles to watch how earthworms help decompose materials.
- Make a mold garden using manufactured, less degradable materials (cellophane, brown paper, rubber etc.) Compare the rates of decomposition between the two gardens. Record your observations.
- Chart the life cycle of a mold.

MINI-COMPOSTS

AGE: 9-17 years old

TIME FRAME:
One session to make mini-compost piles with observations over following days or weeks

GOAL:
To help people learn about recycling in nature by watching nature's process at work in a miniature compost pile.

BACKGROUND:

When we mention "recycling," we often think of recycling glass bottles, aluminum cans and newspapers. But a lot more of the household trash we throw out could be recycled instead. Food scraps, leaves, grass clippings and other biodegradable wastes can be recycled by composting.

Simply stated, composting creates optimal conditions for decomposition to occur. Decomposition is the biochemical process by which bacteria, fungi and other microscopic organisms break organic wastes into nutrients that can be used by plants and animals. Decomposition occurs in nature whenever a leaf falls to the ground or an animal dies. It is essential for the continuation of life on earth.

In order for decomposition to occur, a compost pile needs soil, organic wastes, nitrogen, microbes, water, air, time, and heat. Decomposition occurs extremely slowly in a landfill because two necessary components, air and nature's recyclers, are not there. Decomposition in a compost pile makes a nutrient-rich substance that is excellent for improving soil quality and plant growth.

MATERIALS:

- aquarium with cover
- organic wastes
- soil (not potting soil)
- thermometer
- trowel or large spoon

PROCEDURE:

1. Introduce the ideas of decomposition and natural recycling. Ask the group what the verb to "compose" means. (To make. For example, musicians compose or make songs by putting musical notes and sometimes words together.) Explain that decompose means to take things apart. Decomposers help nature recycle by breaking materials down so they can be cycled over and over again. This process can be accelerated in a compost pile. Ask: What is composting? What are the necessary ingredients for a good compost pile? How is composting related to the concept of recycling? How can composting reduce waste?
2. Assemble a variety of biodegradable wastes in the aquarium, including leaves, evergreen needles, grass clippings, pencil shavings, fruit and vegetable scraps, a small amount of newspaper shreddings, etc. Do not use meat scraps, dairy products, fats and oils because these inhibit decomposition, cause odors, and can attract pests. Chop wastes into small pieces. Leave some large pieces of the same materials to compare rates of decomposition between large and small items. Why might there be a difference?
3. Alternate layers of the materials as follows (amounts are approximate): one inch of soil, two inches of organic waste, one inch of dry materials (paper, leaves, etc.), and a sprinkle of water. Repeat.
4. Cover with an inch of soil. Water the pile enough to make it moist but not soggy. It should feel like a damp sponge.
5. Allow a school group to take the mini-compost home with them, or use it as a display piece on site. Place the compost pile where it will be at room temperature, but not in direct sun. Gently mix the compost once a week to aerate it. Use a thermometer to test the temperature of the pile. Graph the results.
6. Discuss: How composting reduces the amount of waste that is thrown out, what happens to organic wastes that end up in the landfill, whether or not the landfill is a gigantic compost pile, and the problems with placing large amounts of organic material in landfills.

GOING BEYOND:

- Suggest that everyone build a full-size compost pile, either as a group at school, or individually at home. For directions, go to **dnr.wi.gov** and search "compost."

- Make a second mini-compost pile with non-biodegradable materials in it. (soda can, glass bottle, comb, can opener etc.) Every week compare and contrast the rates of decay of the two boxes.
- Compare a sanitary landfill with an open dump. Half fill two clear containers with soil. Put examples of solid waste in each container. Leave the open dump uncovered and occasionally water it lightly. For the sanitary landfill, cover the waste with several inches of soil. Observe for six months. What differences are there? What types of solid waste rotted?
- Just before the ground freezes in the fall, set identical compost piles of materials outside and in containers inside. Keep the indoor container moist and warm. Compare the materials in spring. Why is temperature an important factor in decomposition?
- Try building a Compost Column using "Bottle Biology" directions. See Resources.
- Go on a hike to observe decomposition in nature (for example, Dead Trees and Rotting Log Study).

NATURAL DYES

AGE: 5 and up

TIME FRAME: 2-3 hours, with hard-boiled eggs cooked and cooled in advance. Some methods need dye preparation to start the day before.

GOAL: To show that natural products can be substituted for manufactured products.

BACKGROUND:
Many of the products that we purchase are colored or printed with manufactured dyes and inks. Some of these dyes and inks have a petroleum base, and quite a few of the brighter colors are derived from heavy metals like cadmium and lead. These elements move through food chains and accumulate in the tissues of higher organisms. Even trace amounts may impair body functions or cause death. Extraction of these harmful elements is difficult, and the residues may be toxic and persistent in our environment. Many natural dye processes have a lower impact to the environment than using manufactured dyes.

There are numerous sets of instructions available free on the Internet by searching "natural egg dyeing." Here are links to a few:

- chemistry.about.com/od/holidayhowtos/a/eastereggdyes.htm
- www.bhg.com/holidays/easter/eggs/natural-easter-egg-dyes/
- www.foodnetwork.com/recipes/natural-dyes-for-easter-eggs-recipe.html

GOING BEYOND:

- Experiment with making other natural dyes.
- Use dyes for tinting while making paper from recycled paper (see the Make Your Own Paper activity).

Many simple exhibits can be created to give examples of natural and human recycling. Here are a few ideas:

Cycles — Make a poster or a bulletin board display showing natural cycles such as the water cycle, natural decomposition, rock cycle, or human recycling showing paper, aluminum, plastic, etc.

Nature's Recyclers — Make a poster or bulletin board display showing nature's recyclers and the roles that they play.

Nature's Litter — Make a poster or display that shows nature's litter on the forest floor and the various stages of its decomposition. This could be done as part of a soil profile. It could also be used to illustrate the effect of non-native species of worms.

Packaging — Gather examples of the following packages for a "hands-on" table:
Natural packaging— acorn, cones, milkweed pods, egg shell, orange peel, coconut
Old — returnable bottle, pottery, birch bark container, paper egg carton, basket
Modern — plastic bags and bottles, aluminum can, tin-plated steel can, medication blister pack, polystyrene egg carton

Deadly Litter — Create a display or collage using plastic 6-pack holders, balloons, fishing line, aluminum flip or tab tops, polystyrene particles, nylon netting, broken glass, open cans, and appropriate magazine pictures or photographs showing their deadly impact on wildlife.

Renewable/Non-renewable Resources — Collect and display the following examples:

cereal box: paper—pulp—wood—tree—soil—earth
glass bottle: glass—sand—rock—earth
aluminum can: sheet aluminum—aluminum ingot—bauxite—earth
plastic bottle: melted plastic—oil—earth
apple—tree—soil—earth

Natural Reuse — Collect and display examples of natural objects being recycled in nature: grass, leaves, mud and hair for nesting material, shells for invertebrate homes, etc. Show human uses of natural items, too — reed chairs, grass mats, etc.

Composting — Set up and use a compost bin (or examples of several types of bins)! Create a display comparing leaf litter decomposition with composting.

Community Recycling — Find out what is recyclable in your community and set up a display showing recyclable items, their preparation for recycling, and their journey after they are collected.

Your Daily Waste — Assemble examples of an individual's daily and weekly accumulation of trash. Use photos for monthly and yearly trash.

Why Waste? — Set up a display using pictures, products, and narrative information to explain the magnitude of the resources that we use and dispose of each year.

Hazardous Household Products — Set up a display of these products and environmentally safe alternatives.

Shopping Choices that Reduce Waste — Set up a display or pictures showing shopping alternatives to our disposable/throw-away society (i.e., buying in bulk, buying returnable bottles, etc.)

Low-waste picnic— Set up a display that compares a picnic using a picnic basket with its reusable plates, cups, utensils, napkins and food containers with a picnic using all disposable plates, cups, utensils, napkins and food containers. Show the amount of trash that each one generates.

• GLOSSARY •

Bauxite: A rock that is the primary ore of aluminum.

Biodegradable: Able to decay over a short period of time. Biodegradable materials can be broken down by microorganisms into simple, stable compounds such as carbon dioxide and water.

Chlorophyll: A green pigment in plants, algae, and some bacteria that is used to carry on photosynthesis.

Composting: Mixing food scraps, grass clippings, and leaves in an optimal environment for decomposition to form a rich soil conditioner.

Cycle: To circle or occur again, over and over.

Decay: To break down biodegradable material through bacterial or fungal action.

Decompose: To break down into basic elements; to rot.

Decomposer: An organism that feeds on dead material and causes it to break down. Examples include fungi, earthworms and bacteria. These are nature's recyclers.

Dump: An open and unmanaged waste disposal site used before the development of sanitary landfills.

Fungi: (singular = fungus) Simple organisms that cannot use the sun's energy to make food because they do not have chlorophyll.

Habitat: The area where an animal or plant lives and finds nutrients, water, shelter, and living space.

Incinerator: A facility designed to reduce waste volume by burning. Incinerators may also be set up to generate energy.

Ingots: A block of metal in a convenient shape for storage or transportation.

Leaf litter: Slightly decayed leaves lying on the forest floor.

Lichen: An organism composed algae or bacteria living together in a partnership with fungi.

Litter: Waste material discarded in an inappropriate place. Littering is illegal in Wisconsin.

Microbe: Very small plants and animals, some of which are decomposers.

Mold: A type of fungus that grows on decaying materials.

Natural resources: Valuable, naturally occurring materials such as soil, wood, air, water and minerals.

Non-biodegradable: Made of materials that will not decay and cannot be recycled.

Non-recyclable: Made of materials that cannot be recycled.

Non-renewable resource: A natural resource that is considered limited in amount because of its scarcity, the great length of time it takes to form, or its rapid depletion (for example, coal, copper, and petroleum).

Nutrients: Food, minerals, or other substances needed for growth.

Open dump: A waste disposal site that does not have modern construction or engineering controls to protect the environment.

Organic: Derived from living things. In this guide, "organic" refers to materials that will naturally decompose or the end products of natural decomposition. Since the word "organic" has several meanings, this might need to be clarified for those who have seen food labeled as "organic" (grown or raised without human-made chemicals) or are familiar with "organic" chemistry (the chemistry of compounds based on the element carbon).

Photosynthesis: The process by which green plants use the sun to change carbon dioxide and water into sugar and oxygen.

Recyclable: Made of materials which can be reused either in the same form or as part of a different product.

Recycle: To collect and reprocess manufactured materials for reuse either in the same form or as part of a different product.

Reduce: To lessen in extent, amount, number or other quantity.

Renewable resource: A natural resource derived from an endless or cyclical source. With proper management and wise use, replacement of these resources by natural or human assisted systems can be approximately equal to their consumption.

Reuse: To extend the life of an item by using it again, repairing it, modifying it, or creating new uses for it.

Sanitary landfill: A specially engineered site for the disposing of solid waste on land.

Trash: Materials considered worthless, unnecessary, or offensive that are usually thrown away.

Yard waste: Biodegradable wastes generated in the yard including leaves, grass clippings, sticks, etc.

A-Way with Waste (downloadable curriculum), Washington State Department of Ecology, www.ecy.wa.gov/programs/air/aawwaste/awwresources.html

Audubon Field Guides, available as books or mobile apps.

Bottlebiology.org, online lessons using recycled 2-liter bottles to understand ecosystems, decomposition, and more.

Compost Microorganisms, N. Trautmann & E. Olynciw, Cornell Composting. compost.css.cornell.edu/microorg.html

Golden Guides, St. Martin's Press. Previously Golden Nature Guides and Golden Guides — Nature Series

Do-it-yourself toys or other items from recycled materials: many ideas and directions available by searching the Internet

Feeding Birds, information on feeder care and placement. feederwatch.org/learn/feeding-birds/

Hands-On Nature: Information and Activities for Exploring the Environment with Children. Jenepher Lingelbach and Lisa Purcell, 2000, Vermont Institute of Natural Science, Woodstock, VT 05091.

Keepin' It In The Loop, Wisconsin DNR, recycling activity and learning guide for educators and students (grades K-8), dnr.wi.gov/org/caer/ce/eek/teacher/recyclingstudyguide.htm

The Magic School Bus Meets the Rot Squad: A Book about Decomposition by Linda Ward Beech & Joanna Cole. A fun book on nature's recycling. Supporting material online at www.scholastic.com/teachers/lesson-plan/magic-school-bus-meets-rot-squad

Nature's Recyclers, Wild About Utah, November 11, 2011 blog post. wildaboututah.org/natures-recyclers/

Nature's Recycler's Multidisciplinary Classroom Activities, Minnesota Conservation Volunteers Young Naturalists Teachers Guide, files.dnr.state.mn.us/education_safety/education/teachers/activities/volunteer_studyguides/natures_recyclers_studyguide.pdf

OBIS (Outdoor Biology Instructional Strategies), downloadable ecology and natural resources activities including "Junk In the Box," "Logs to Soil," and a simulated oil spill using popcorn: www.outdoorbiology.com

Peterson Field Guide Series. Houghton Mifflin Harcourt, Boston.

Project Learning Tree, 2000 M Street, Suite 550, Washington DC 20036, www.plt.org/

Rethinking Recycling: An Oregon Waste Reduction Curriculum, downloadable at: www.deq.state.or.us/lq/education/curriculum.htm

Rotten Truth About Garbage, online exhibition from the Association of Science-Technology Centers, Inc. and Smithsonian Institution Traveling Exhibition Service. Includes a lesson on how nature recycles. www.astc.org/exhibitions/rotten/rthome.htm

Wee Crafts and Wee Recyclers, recycling publications for preschoolers, plus other waste and recycling downloadable publications education and outreach from Wisconsin DNR: dnr.wi.gov/topic/Recycling/outreach.html

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