

Hands Across the Waters: Keeping a Clean Environment through Art and Green Schools

Training Booklet for Educators Part 2: Activities

Based on Workshops in Nakai, Lao PDR and Thanh Hoa, Vietnam

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Reflections

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Teacher's Guide

Grade Level: PS-5
Subject Areas: Science (Kansas)
Science (Missouri)

Objectives and Goals

- Science objectives
 - Taking Action on Plastic Pollution
 - Protecting Our Water; A Precious, Limited Resource
 - Actions in one area can influence areas halfway across the world
 - Scientists are constantly learning more about the inhabitants of our world.
- Life Skill objectives
 - Students will learn to analyze problems and apply solutions
 - Students will learn that working together will often help to solve problems.

Required Materials and Equipment

- Teacher reference sheets
 - Mekong Delta Animals
 - Annamite Striped Rabbit Description
 - Article on Irrawaddy Dolphin
 - Pangolin Fact Sheet
 - Duoc Langur Fact Sheet
 - Local Stream Team Information
 - Kansas Stream Team Training Fact Sheet
 - Missouri Stream Team FAQs
 - Effects of Stream Pollution Classroom Demo
 - What Plastics Can Become
 - Watersheds and Drainage Basins from US Geological Service
 - Articles on Ocean Garbage Patches
 - North Atlantic Garbage Patch
 - Indian Ocean Garbage Patch
 - Great Pacific Garbage Patch
- Art Projects
 - Teacher's Guide for making masks from recycled materials
 - Cutouts to make a paper plate habitat of local fish

- Cutouts to make a paper plate habitat of Mekong Delta animals
- Student Sheets from StoneLion Puppet Theatre
 - Pangolin Coloring Sheet
 - Recycle Word Search
 - Recycle Crossword Puzzle
 - Handout on Ways to Keep Plastic Out of Our Waterways
 - Plastic Detox Idea Sheet
 - 10 Plastic Pollution Facts Handout
 - Storm Sewers are not trash cans
 - Clean up after your pet

Anticipatory Set

- Use the fact sheets on the Mekong Delta wildlife to illustrate that scientists are constantly learning and exploring our world.
- Discuss ways individuals can help to diminish plastics pollution
 - Use the Plastic Detox Handout to guide discussions of how we can use less plastic in our lives
 - Use the Kansas and Missouri Stream Team reference sheets to guide discussions of how students can help remove plastics from our environment.
- Explore how to work in a group to achieve a goal

Direct Instruction

- Discuss the effects of plastic pollution
 - Use the article on the Great Pacific Garbage Dump to discuss world-wide effects of plastic pollution
 - Use the Handout on 10 Plastic Pollution Facts to illustrate the buildup of plastic waste in the world
- Discuss Mekong Delta habitat and compare it to our river habitat.
 - What animals are similar
 - What animals are different

Guided Practice

- Work on the Pangolin Coloring Sheet from StoneLion Puppet Theatre
- Present the Recycle Word Search
- Have students solve the Recycle Crossword Puzzle
- Chose one of the art projects
 - Creating Masks from found (recyclable) materials
 - Making paper plate habitats
 - Local fish
 - Mekong Delta Animals
- Work with students to build the simple compost bin

Watch performance of **Reflections**

Closure

- How to apply lessons learned in our hometowns

Standards Fulfilled

Missouri Science Standards Fulfilled

Kindergarten – Grade Level Expectations

IN: 1-A-K-a: Pose questions about objects, materials, organisms, and events in the environment

IN: 1-C-K-b: Use observations to describe relationships and patterns and to make predictions to be tested

Grade 1 – Grade Level Expectations

IN: 1-A-1-a: Pose questions about objects, materials, organisms and events in the environment

IN: 1-C-1-b: Use observations to describe relationships and patterns and to make predictions to be tested

ST: 3-A-1-b: Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member

Grade 2 – Grade Level Expectations

IN: 1-A-2-a: Pose questions about objects, materials, organisms and events in the environment

IN: 1-A-2-b: Plan and conduct a simple investigation (fair test) to answer a question

IN: 1-C-2-b: Use observations to describe relationships and patterns and to make predictions to be tested

ES: 3-A-2-a: Observe and describe ways humans use Earth's materials (e.g. soil, rocks) in daily life

ST: 3-A-2-b: Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member

Grade 3 – Grade Level Expectations

IN: 1-A-3-a: Pose questions about objects, materials, organisms and events in the environment

IN: 1-A-3-b: Plan and conduct a fair test to answer a question

IN: 1-C-3-a: Use quantitative and qualitative data as support for reasonable explanations

IN: 1-C-3-b: Use data as support for observed patterns and relationships, and to make predictions to be tested

IN: 1-C-3-c: Evaluate the reasonableness of an explanation

IN: 1-C-3-d: Analyze whether evidence supports proposed explanations

ST: 3-A-2-b: Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member

Grade 4 – Grade Level Expectations

EC: 1-A-4-a: Identify the ways a specific organism may interact with other organisms or with the environment (e.g. pollination,

shelter, seed dispersal, camouflage, migration, hibernation, defensive mechanism

EC: 1-D-4-a: Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms (e.g., feeding birds, littering vs picking up trash, etc)

ES: 3-A-4-b: propose ways to solve simple environmental problems (e.g. recycling, composting, and ways to decrease soil erosion) that result from human activity

IN: 1-C-4-a: Use quantitative and qualitative data as support for reasonable explanations

IN: 1-C-4-b: Use data as support for observed patterns and relationships, and to make predictions to be tested

IN: 1-C-4-c: Evaluate the reasonableness of an explanation

IN: 1-C-4-d: Analyze whether evidence supports proposed explanations

Grade 5 – Grade Level Expectations

ES: 3-A-5-c: Propose solutions to problems related to water quality and availability that result from human activity

IN: 1-C-5-a: Use quantitative and qualitative data as support for reasonable explanations

IN: 1-C-5-b: Use data as support for observed patterns and relationships, and to make predictions to be tested

IN: 1-C-5-c: Evaluate the reasonableness of an explanation

IN: 1-C-5-d: Analyze whether evidence supports proposed explanations

Kansas Science Standards Fulfilled

Kindergarten Standards

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

Grade 1 Standards

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Grade 2 Standards

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Grade 3 Standards

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Grade 4 Standards

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Grade 5 Standards

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Reflection – A Self Portrait Art Activity

Purpose: To inspire reflection on how each individual can make a difference in the world we live in. To make the students realize the power we have as a community when we all work together on an issue or problem. To empower students to start small and gain confidence in drawing skills and composition.

Grade Levels: All ages

Material List:

Small mirror for each student

Drawing paper or index card

Colored pencils or markers

Pencil with eraser

Yarn

Tape or hot glue

Hole punch

Steps:

Group discussion on what a community is and how they differ. Discussion can be made on how animals and plants have their own communities/habitats.

Model holding the mirror up to only part of your face. Encourage the students to look at different sections of their face before deciding on which small area they will draw. Pass out paper, pencils and colored markers. Show examples of creative self-portraits using unusual color combinations and composition. Explain how the portraits will be hung in a group with the mirrors to create a community art project reflecting how we can all make a difference.

Give the students time to draw and explore. Encourage the idea that they should concentrate on small steps to start and now worry about how the final project will look.

After the group is engaged ask them to think about a wish for the planet or their community they would like and to write it on the back of their portrait when they are finished.

Final Step: punch a hole in the portrait. Thread a piece of yarn in it and add it to the community mobile. “Big change starts with a small step.”

Lesson Title: Pollination Puppets

Lesson Objective: The students will engage in an art project while learning about pollination.

Subject(s)	Environmental Science, Art
Topic or Unit of Study	Pollination
Grade / Level	3-5 th Grade (may be adapted to younger students)
Lesson Objective	The students will engage in an art project while learning about pollination.
ESOL Objective	Reading for Informational Text –5.9 – Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
Summary / Overview	The students will create their own puppet show replicating pollination. Prior to creating the art project, students will review pollination, pollen, and pollinators. By the end of the project, students will have a better understanding of what pollination is and the declining bee population.
Background Knowledge for Teachers -Common Misconceptions	Knowing the pollination process, who the pollinators are, what pollen is and why the bee population is declining.
Materials / Supplies Needed	Each student will need 2 paper plates, 2 straws, chenilles or wooden sticks, two yellow pom poms, one black fuzzy sticks/chenilles and several other colors to create the flowers, string, scissors, markers and other art supplies for coloring, and masking tape to attach string to plate. Optional glue sticks.
Safety Consideration	The students will be cutting out the centerpiece of one of the plates. Prior to having the students complete the activity, the teacher could put a hole in the centerpiece of one of the plates to make cutting easier for the students. Remind the students of the safety precautions when using scissors.
Time Allotment	45 – 60 minutes
Essential Questions	Does anyone know what pollination is? How does it work?
Key Vocabulary	Pollinators- is the biotic agent (vector) that moves pollen from the male anthers of a flower to the female stigma of a flower to accomplish fertilization or 'syngamy' of the female gametes in the ovule of the flower by the male gametes from the pollen grain. Pollen- a fine powdery substance, typically yellow, consisting of microscopic grains discharged from the male part of a flower or from a male cone. Each grain contains a male gamete that can fertilize the female ovule, to which pollen is transported by the wind, insects, or other animals.

	<p>Pollination- is a process in which pollen is transferred to the female reproductive organs of seed plants, thereby enabling fertilization and reproduction through growth of the pollen tube and eventual release of sperm.</p>
<p>Procedure / Instructions (Suggest brief 5E format using Engage, Explore, Explain)</p>	<p>To save on time: Strings may be attached to the back of one paper plate. Precut string to provide enough for each child to wear around their neck.</p> <p>Introduction: Introduce yourself to the students you are teaching. Today we are going to make a puppet show focusing on pollination.</p> <p>Ask the two essential questions:</p> <ul style="list-style-type: none"> • Does anyone know what pollination is? • How does it work? <p>Today we are going to make a puppet show! The puppet show will focus on pollination.</p> <p>Explanations: (This is the way we explained to the students)</p> <p>What is pollination?</p> <p>“Transfer of pollen from flower to flower. When a pollinator goes to drink from or feed off a flower, they contract pollen on them, then when they go to a different flower that flower then contracts the pollen and it fertilized the flower. This then allows the flower to make fruits and seeds which is key to us. Different vegetables such as cucumbers and tomatoes or cotton and alfalfa that we use to feed cattle require pollination. Approximately 1,000 plants grown for food, beverages, fibers, spices, and medicines require animal pollination.”</p> <p>Who can tell us what pollen is?</p> <p>“Pollen is a powdery substance in a flower that contains grains used for producing fruits and seeds, which is done through pollination. Without pollen and pollination, plants would not be able to produce fruits and seeds. In the U.S. alone, pollination by insects produces \$40 billion worth of products annually.”</p> <p>What are some different types of pollinators?</p> <p>“Birds, bats, wasps, even the wind can serve as a pollinator, but today we are going to be talking about bees. It is said that bees are responsible for 1 out of every 3 bites of food we take. The main insect pollinator is bees.”</p> <p>Activity:</p> <p>“We are going to be making our own pollinating puppet show that looks like this”: (Show example that was previously made)</p> <p>Teacher will pass out pom poms, black chenilles and paaper plates. Students will have access to choose colored chinelles and markers to use</p>

	<p>their imagination to create. Model wrapping one yellow pomp om with black chenille to create a bee with wings. Show hoe to attach the bee to another chenille or stick to create a rod puppet. Model options on how to create a flower using the second yellow pom pom as the center of a flower and using colored cheniiles for petals. Show how to attach the flower to a rod or stick to creat a puppet. The teacher will demonstrate the next step using a blank paper plate. These blank paper plates have one hole punched just inside the rim of the plate so the students have a starting point to put their scissors. The teacher demonstrates how to cut out the center of the plate.</p> <p>The teacher explains that the center circle the students will be cutting out can be used to create other flowers or pollinators.for their stage.</p> <p>The teacher will hand out one blank paper plate with the hole for the students to cut out for the front of their puppet show. Teacher willthen pass out second paper plate with string attached to use as the back of the puppet stage. Encourage the students to use their imagination to create the background scenery ortheir puppet stage and flowers with markers. While the students are coloring their backgrounds and creating flowers, the teacher will staple the two plates together to finish the stage by stapling the topand two sides leaving the bottom open toinsert the puppets in. After everyone has their puppet stage complete, the students will stand in a circle and present their puppets. Students may use their puppets to create plays to demonstrate the need for pollinators and a clean environment.</p> <p>Closing:</p> <p>Currently, our bee population is declining due to diseases, poor nutrition, parasites, and pesticides as well as other issues. If our pollinator population continued to decline to the point that fruits and seeds were not being produced, we would have to find a way to pollinate by hand. Not only would that take a great amount of time, it would be very expensive. What can we do to protect our bees? (get to know them and learn their needs, plant native plants, be careful when applying pesticides) You all have great ideas and I hope you enjoy your pollination puppet show.</p>
Evaluate (Assessment Opportunities)	<p>Informal Assessment - After creating the puppets and stage, the students will be placed in groups. Each group will present to the class their explanation of what pollination, pollinators, pollen is. The teacher will evaluate their understanding based on their presentation to the class using their puppets and stage.</p>
Extension for Home or Class (Elaborate)	<p>To take this lesson even further, the teacher may purchase small bags of seeds for each student to take home and plant. Seeds are very inexpensive so nearly any student would be able to purchase their own as well if they would like to try to plant more flowers, vegetables, or even fruits. The teacher could also purchase small clay potting plants for each student. The student could paint their own individual pot at home and plant the seeds they are given. They will definitely be able to take home their puppets and</p>

	stage and I would encourage them to put on a puppet show for their family at home explaining the process of pollination.
Integration suggestions for ELA or Mathematics (trade books, calculations)	<p><i>Flowers Are Calling</i> by Rita Gray is a children’s book explaining the significance of pollination in a forest, back yard, or any outdoor area. To incorporate English Language Arts, this children’s book could be read as a read aloud to the entire class. The students will be encouraged to elaborate on the story and think about their own ideas of how pollination benefits the environment around us, the foods we eat, and our overall well-being.</p> <p><i>Bee Dance</i> by Rick Chrustowski is a children’s book that follows a foraging honeybee as she searches for nectar, and communicates the location to her hivemates. Wonderful photos illustrate the book and could provide inspiration for the students’ pollinator stage art and puppets.</p>
Kansas Science Standards Addressed	5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
Nebraska Science Standards Addressed	SC5.3.1.b- Identify how parts of plants and animals function to meet basic needs.
Missouri Science Standards Addressed	EC: 1-A-4-a: Identify the ways a specific organism may interact with other organisms or with the environment (e.g. pollination, shelter, seed dispersal, camouflage, migration, hibernation, defensive mechanism)
Iowa Science Standards Addressed	5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Scavenger Hunt/Nature Walk

Purpose: To get out and explore. Make observations about the environment and the local food web. To collect small objects to be used in the food chain art activity on the next day.

Material List:

Basket, bag or box to collect objects in.

Pencil

Paper for rubbings

Steps:

Group discussion on what the food web is and how everything connected.

Model how to do a rubbing. Hand out list of items to be collected, pencils and paper for rubbings. Give time limit and discuss where they can search. Divide into groups and let the hunt begin. Groups may have the same list or different lists.

List one:

An object cannot be counted in more than one category.

Find –

- Four green things

- Two hard things

- Something that grows

- Something that smells good

- Something a herbivore would eat

- Four rubbings of different textures

- Two things that are brightly colored, that aren't green

- Anything you find really interesting

List two:

An object cannot be counted in more than one category.

Find –

- Four sticks or twigs in four different sizes

- Three flowers

- Four rubbings of different tree barks

- Something that makes noise

- Something that is soft

- A nut, seed or seed pod

- Anything you find really interesting

Final Step: Share with larger group their favorite experiences and observations during the hunt. What did you hear? What did you smell?

Adaptation Artistry



Objectives

Students will: 1) identify and describe the advantages of bird adaptations; and 2) evaluate the importance of adaptations to birds.

Method

Students design and create imaginary birds and write reports including descriptions of the birds' adaptations.

Materials

Drawing, painting, clay sculpture or Papier Maché materials; construction paper and glue; pencil and paper

Background

All life forms exhibit adaptations to the environments in which they live. Wildlife are adapted to their environment in ways that enable them to survive and maintain their populations. Each habitat is suitable only to those life forms that are adapted to their ecological conditions.

Birds have a variety of adaptations—including characteristics of beaks, feet, legs, wings and coloration. These adaptations have evolved so that the bird is better suited to its particular environment and lifestyle. A variety of major adaptations are listed on the next page.

The major purpose of this activity is for students to realize that there are advantages for birds in looking how they do, recognizing some of the ways in which birds are physically adapted to their environments.

Procedure

1. Discuss with the students the various adaptations given in the background chart for this activity, listing the chart on a chalkboard or overhead display screen for reference by the students. Or the students could bring in pictures of birds along with information about their habitat and food. The class could then group the data to make their own chart. Have the students brainstorm a list of bird characteristics, name the birds with such characteristics and describe the advantage of the adaptation represented by the characteristic.
2. Tell the students they will each have a chance to design their own original bird adapted to its habitat. Each student should decide:
 - where the bird will live;
 - what it will eat;
 - how it moves;
 - its gender or sex; and
 - how it raises its young.

Grade Level: 5-8

Subject Areas: Science, Environmental Education, Expressive Arts, Language Arts

Duration: one or two 45-minute sessions

Group Size: any

Setting: indoors (outdoors optional)

Conceptual Framework Topic Reference: CAIIA, CAIIA1, CAIIB

Key Terms: adaptation

Appendices: Early Education

continued

3. Based on these choices, have the students make a list of the adaptations that are necessary for the bird.
4. Using their list of adaptations, have the students create their own original bird by drawing or sculpting it (or by another artistic technique).
5. In conjunction with each drawing or sculpture, have each student write a short report that includes the name of the bird and its food sources, habitat and lifestyle. Have the students include their lists of adaptations, the reasons for the adaptations and the advantages provided by the adaptations for the habitat of the bird.
6. Completed projects may be presented to the group or displayed in the room. Ask the students to imagine their bird in a habitat different from the one identified in their report. What specific difficulties might the bird encounter in this new environment? Why? **OPTIONAL:** Go outside and identify adaptations displayed by real birds.

Extensions

1. Have the students make mobiles of the completed birds.
2. Prepare a slide presentation on an overhead projector or computer showing different types of bird adaptations.
3. Collect pictures of birds to develop a bulletin board showing some of the adaptations discussed. Look for pictures showing bird parts compatible with the "invented" birds. Display the invented birds.

Evaluation

Name two bird adaptations for each of the following body parts, listing their advantages: beaks, feet, legs, wings and color. Assess the importance of each of these adaptations to a bird's survival in its environment.

Adaptation	Bird	Advantage
<i>Beaks</i>		
• pouch-like	pelican	can hold fish it eats
• long, thin	avocet	can probe shallow water and mud for insects it eats
• pointed	woodpecker	can break and probe bark of trees, for insects it eats
• curved	hawk	can tear solid tissue, like meat it eats
• short, stout	finches	can crack seeds and nuts it eats
• slender, long	hummingbird	can probe flowers for nectar it eats
<i>Feet</i>		
• webbed	duck	aids in walking on mud
• long toes	crane, heron	aids in walking on mud
• clawed	hawk, eagle	can grasp food when hunting prey
• grasping	chicken	aids in sitting on branches, roosting, protection
<i>Legs</i>		
• flexor tendons	chicken	aids in perching, grasping
• long, powerful	ostrich	aids running
• long, slender	heron, crane	aids wading
• powerful muscles	eagle, hawk	aids lifting, carrying prey
<i>Wings</i>		
• large	eagle	aids flying with prey, soaring while hunting
<i>Coloration</i>		
• bright plumage	male birds	attraction in courtship, mating rituals
	female birds	aids in camouflage while nesting
• change of plumage with seasons	owl, ptarmigan	provides camouflage protection (brown in summer, white in winter)

Web of Life

Activity 45

By conducting research and simulating a food web, students will take a close look at a forest ecosystem and discover ways that plants and animals are connected to each other. While this activity focuses on forests, you can also use it to study other ecosystems, such as oceans, deserts, marshes, or prairies by substituting the appropriate information.

Levels

Grades 4-8

Subjects

Science, Language Arts,
Visual Arts

Concepts

Plant and animal populations exhibit interrelated cycles of growth and decline. (3.2)
Ecosystems possess measurable indicators of environmental health. (3.4)

Skills

Researching, Discussing,
Identifying Relationships and
Patterns, Predicting



Differentiated Instruction

Higher Order Thinking,
Paired/Cooperative Learning,
Prior Knowledge Skills



Technology Connections

Graphics Software,
Internet Resources

Materials

200 feet of string or yarn,
resource materials about forest
plants and animals, folders
(optional)

Time Consideration

Preparation: 30 minutes
Activity: two 50-minute
periods


Related Activities

*schoolyard Safari; Field, Forest,
and Stream; Are Vacant Lots
Vacant?; Planet Diversity;
Dynamic Duos*

OBJECTIVE

- Students will understand that ecosystems are made up of interdependent organisms and other components.

ASSESSMENT OPPORTUNITIES

- Have students select a local bird, fish, reptile, amphibian, or mammal, and find organisms it depends on and organisms that depend on it.
-  Have students write about a local invasive species (plant or animal) that is causing a negative impact on the local environment. Have them research to find when and how the organism came to the area, what problems have been created by its being there, and what is being done to control it.

BACKGROUND

A forest is a complex living system. While its appearance is often dominated by trees, a healthy forest is composed of many different animals and plants that interact with and depend on each other.

One way that forest plants and animals are connected is through the energy from food. A primary function of a forest, like any other ecosystem, is to produce and distribute energy. All life depends on the ability of green plants to use sunlight to synthesize simple sugars from carbon dioxide and water. Through this process, called **photosynthesis**, plants take energy from sunlight and make it available to animals. Plant eaters, or herbivores, eat the plants directly; animal or flesh eaters, carnivores, in turn eat herbivores or other carnivores, thus forming a **food chain**.

A food chain is a simplified way of showing energy relationships between plants and animals in an ecosystem. For example, a food chain of sun*plant seed* mouse*owl shows that a seed is eaten by a mouse, which in turn is eaten by an owl. However, in reality it is rare for an animal to eat only one type of food. A **food web** describes the interconnection of the food chains in an ecosystem and

gives a clearer picture of how plants and animals in an ecosystem are related to each other.

Plants and animals are interdependent in other ways besides food. For example, plants may depend on animals for pollinating flowers, dispersing seeds, and keeping insect populations in check. And animals may depend on plants for shelter and to help modulate the amount of moisture and sunlight in their environment.

In this activity, students will create a "web of life" to show how all living things are connected to others. No matter how unrelated organisms may seem, they are, in fact, connected.

GETTING READY

(Optional) For each student, begin a folder of information on a specific forest animal or plant. Folders might include pictures you cut from magazines or calendars, and articles or other information you glean from nature journals or other sources. If possible, select a variety of plants and animals so folders include at least two of each type: mammal, arthropod (insect or spider), bird, reptile, amphibian, trees, and other plants. *Animal possibilities* include bark beetle,

bat, beaver, bear, box turtle, butterfly, chipmunk, deer, earthworm, field mouse, red fox, tree frog, grasshopper, king snake, lizard, mosquito, hawk moth, opossum, barred owl, rabbit, raccoon, skunk, snail, red squirrel, tick, or woodpecker. *Plant possibilities* include azalea, clover, columbine, cottonwood, honeysuckle, lichen, maple tree, Douglas fir, paintbrush, pine tree, poison ivy, shelf fungus, or violet.

Students will need access to resource materials or the Internet for information about forest plants and animals. Arrange time in the library or media center.

DOING THE ACTIVITY

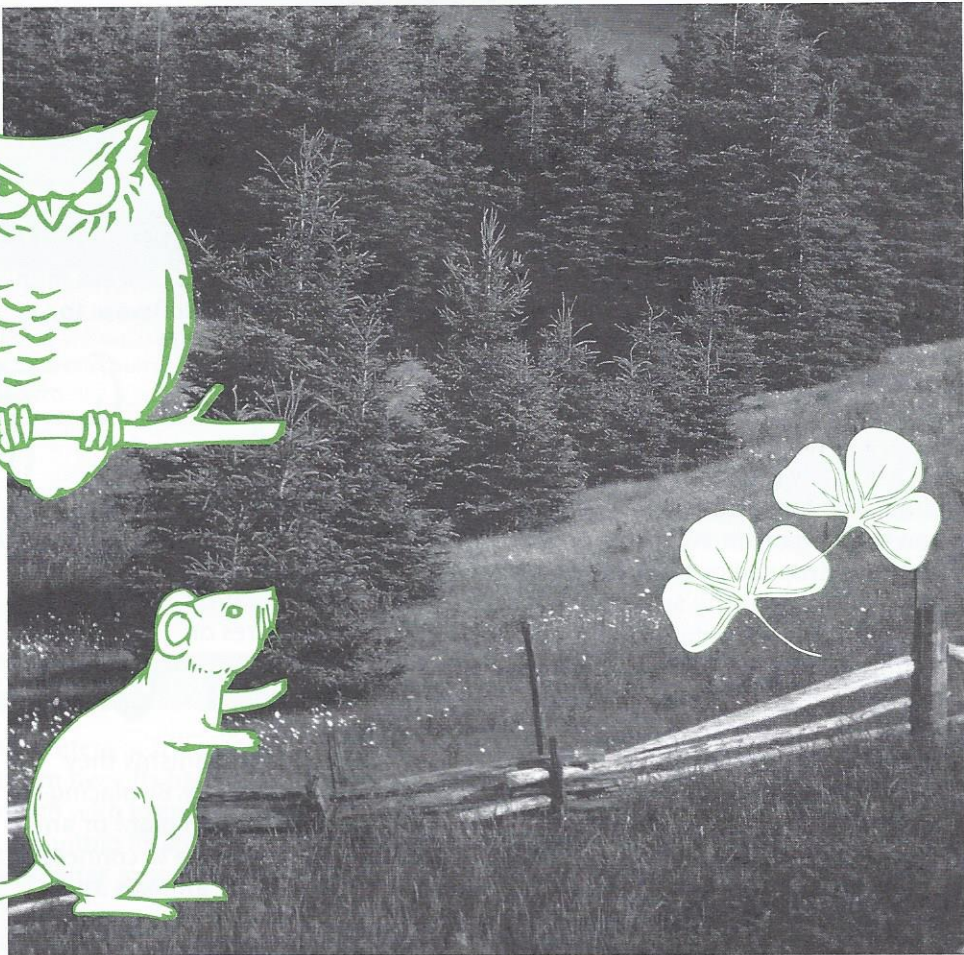
1. Ask students to work in pairs or teams to brainstorm all the components they think would be necessary for a healthy forest. Invite them to share their ideas with the rest of the class.

2. Have each student select a forest organism to study. (Or choose one of the folders prepared earlier.) Make sure the students select a variety of plants and animals, including mammals, insects, birds, reptiles, trees, and other plants.

3. Instruct students to collect the following information about their chosen organism.

For Animals:

- Where within the forest does this animal live?
- What does this animal eat?
- What animals prey on it?
- What other animals and plants live in the forest with this animal?
- In what ways does this animal depend on these other animals and plants?



- How does the animal influence its environment?

For Plants:

- Where within the forest does this plant live?
- What animals eat this plant?
- What other plants and animals live in the forest with this plant?
- How does this plant depend on these other plants and animals?
- How does this plant influence its environment?

4. After students have completed their research, have them make a nametag for their forest plant or animal, including a picture. Have students sit on the floor in a circle with their nametag. Introduce the web of life concept (see Background).

5. Starting with one “plant,” ask that student to hold the end of a ball of string, and to name another organism in the circle with which that plant interacts (for example, is eaten by or depends on). Pass the ball to this second student. Ask the second student to name another organism with which his or her organism interacts. This process will continue until each “organism” is linked to the ecosystem, and the ball is returned to the first student.

6. Now, have students slide back until the string is taut. Tell students to keep still. But if they feel a tug, they should tug in response. When everyone is still, tell the student holding the original end of the string to gently begin tugging. Keep reminding everyone that if they feel a tug, they should tug in response. Through this mechanism,

vibration will spread through the food web until everyone is tugging and the whole web is shaking.

7. Ask students how the tugging demonstration might illustrate what happens when one of the links in an ecosystem is damaged through natural or human-made stress. (The rest of the ecosystem feels the effects.)


8. Ask students to pick one organism that seems less important than the others, and have it drop out of the web. Ask if any other organisms should drop out because they depended on that organism. After one or more have dropped out, ask the students again to identify an organism that seems less important, and repeat the procedure. Continue playing for a few more rounds; then ask the following questions:

- What happens when we remove a link in the forest ecosystem? (Organisms that depend on it are affected. The web itself changes shape.)
- Were the changes more dramatic when the system was composed of many parts or when it had fewer parts? (fewer)
- What can we say about the relationship between how many parts the system has (its complexity or diversi-

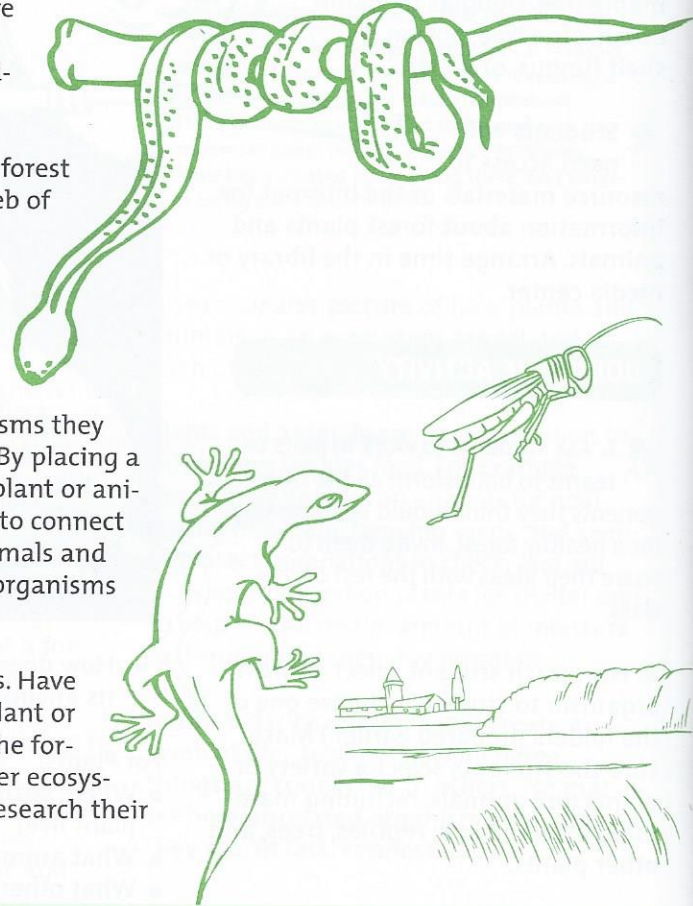
ty) and how stable it is? (In general, complexity makes it more stable.)

- What would happen if humans were introduced to the web?



Enrichment


-  Have students use concept mapping or graphics software to illustrate the web of life using plants and animals the students studied in the activity.
- Help students create a forest mural showing the “web of life.” Have them draw hills, valleys, streams, and other features on sheets of cardboard or poster paper and then add photos or drawings of the organisms they studied in the activity. By placing a push pin next to each plant or animal, they can use yarn to connect organisms to other animals and plants with which the organisms directly interact.
- Make food web mobiles. Have each student select a plant or animal that is part of the forest ecosystem or another ecosystem. Students should research their

organism’s place in the food web and make a cutout of all the food web organisms from construction paper and colored markers. Using a clothes hanger and thread to hang cutouts in the proper arrangement, students can construct a mobile that represents their food web.




READING CONNECTIONS

- Carrighan, Sally. *One Day on Beetle Rock*. Heyday Books. 2002. In the setting of Sequoia National Park, the story describes the lives of the animals that live under and around a granite outcropping. Readers gain a sense of being right there observing the interactions between predator and prey. Grades 4-8. ISBN: 1890771538. 
- Cherry, Lynne. *The Great Kapok Tree: A Tale of the Amazon Rain Forest*. Harcourt. 1990. This inspired look at what the Kapok tree means to the creatures that live in it, and what rain forests mean to the world’s ecology, was at the forefront of the ecological movement ten years ago and continues to resonate profoundly with children everywhere. Grades 4+. ISBN: 0152026142. 


Mason, Cherie. *Everybody’s Somebody’s Lunch*. Tilbury House. 2002. A young girl learns about predators and prey in the animal world when her cat, Mouser, is killed by a coyote. Grades 2-6. ISBN: 0884481980. 

McLimans, David. *Gone Wild: An Endangered Animal Alphabet*. Walker Books for Young Readers. 2006. Colorful illustrations transform each letter into a work of art. An information box identifies each animal’s habitat, range, threats, and status. Grades K-5. ISBN: 0802795633.

Reed-Jones, Carol. *The Tree in the Ancient Forest*. Dawn Publications. 1995. The story of an old fir tree and the remarkable web of plants and animals living around it. Beautifully illustrated. Grades 3-6. ISBN: 1883220319. 

Relf, Patricia. *Magic School Bus Gets Eaten: A Book About Food Chains*. Scholastic. 1996. A forgotten assignment, a soggy shoe, and a tuna fish sandwich set the scene for another Magic School Bus adventure, as Arnold and Keesha travel to the depths of the ocean and end up in the belly of a tuna. Their excursion teaches them about the food chain. Grades K-4. ISBN: 0590484141.

Smith, Howard. *Small Worlds: Communities of Living Things*. Scribner. 1987. Describes a number of small self-contained communities, including a sand dune, tidal pool, old barn, and vacant lot, and examines the ways in which the plants and animals interact. Grades 4+. ISBN: 068418723X.

 Available @ <http://shop.plt.org>





Project Learning Tree®



GreenSchools
**WASTE & RECYCLING
INVESTIGATION**

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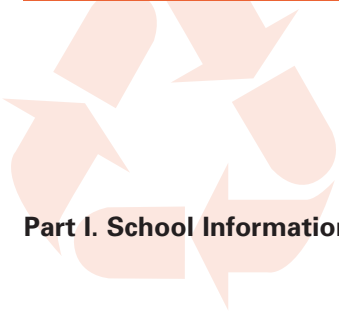
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PART II: WASTE REMOVAL



To find the answers to the following questions, you may want to interview the school's personnel in charge of waste removal. You can also look online for school district policies, as well as local, state, and federal regulations regarding solid waste management. Use the sections that follow to record your findings.

1. Does your school district have written policies about waste disposal and recycling?
 Yes No

2. Who collects the school's waste?
 Town or municipality
 Private disposal service: _____
 Other: _____

3. How much does waste removal cost your school? (This information will provide you with baseline data. After you have taken action to improve waste handling practices at your school, you will be able to determine how much money your actions are saving the school.)

Month: _____ Cost: _____
Year: _____ Cost: _____

4. If figures are available on the school's bill, what is the weight or volume of waste that the school throws away? (This information will provide you with baseline data to allow you to assess changes after taking action.)

Month: _____ Weight/Volume: _____
Year: _____ Weight/Volume: _____

If information on the weight/volume of waste removed is not available, you can obtain baseline data by answering the following four questions:

- How many dumpsters for non-recyclable waste does your school use? _____
- What size are the dumpsters? (This is often noted on the side of the dumpster.) _____
- How often are these dumpsters emptied or exchanged? (For example, is it once a week or twice a week?) _____
- Typically, how full are the dumpsters when they are emptied? (For example, are they full? half full?) _____

5. What type of facility is the waste taken to? (For example, is it a **landfill** or an **incinerator**?)

6. Where is this facility located, and how far is it from your school?

7. Brainstorm and record a list of ways that the waste removal practices at the school could be improved.

Definitions for the words in bold text can be found in the Waste & Recycling Investigation Glossary.



PART III: RECYCLING



You may want to review billing statements from the recycling service and interview the school's personnel in charge of recycling to help find the answers to the following questions.

1. Does your school/school district have a written plan and/or policy about recycling?
 Yes No
2. Is there a recycling program at your school?
 Yes. Continue with question 3 in this section.
 No. Answer the question below, then go to the next section on composting.

Briefly explain why your school doesn't have a recycling program:

Note: In the *Taking Action* section, you can describe how your school could begin a recycling program.

3. Who collects the school's recyclables?
 Town or municipality
 Private service: _____
 Other: _____
4. To what type of facility do **recyclables** go after they have been collected, and how far is it from your school?

5. How much does the recycling service cost the school?
Month: _____ Cost: _____
Year: _____ Cost: _____

6. Does your school receive income from recyclables?
 Yes. Approximately how much per year? _____
 No

7. If figures are available from the recycling service, what is the weight or volume of items being recycled?
Month: _____ Weight/volume: _____
Year: _____ Weight/volume: _____

If information on the weight/volume of recyclables picked up is not available, you can get baseline data by answering the following four questions:

- How many dumpsters for recyclables does your school use? _____
- What size are the dumpsters? (This is often noted on the side of the dumpster.) _____
- How often are these dumpsters emptied or exchanged? (For example, is it once a week or twice a week?) _____
- Typically, how full are the dumpsters when they are emptied? (For example, are they full? half full?) _____





- 8. Which of the following items are recycled at your school? (Check all that apply.)
 - Paper Aluminum containers Plastic bottles Printer cartridges
 - Cardboard Copier cartridges Steel food cans Glass bottles and jars
 - Other: _____

- 9. Who is responsible for collecting recyclables and transporting them to larger recycling bins? (Check all that apply.)
 - Students Teachers Custodians Student club members
 - Other (describe): _____

- 10. Where are recycling bins located at your school? (Check all that apply.)
 - Classrooms Hallways Cafeteria Gym Office
 - Copy room Teacher workroom Teacher lounge Playground/Athletic fields
 - Other: _____

- 11. Are the recycling bins clearly labeled?
 Yes No

- 12. Do people place recyclable items in the appropriate bins?
 Yes No

- 13. Are training or educational programs provided to ensure that the recycling bins are properly used?
 Yes. Briefly describe: _____
 No

- 14. Brainstorm and record a list of ways that recycling efforts at the school could be improved.



PART IV: COMPOSTING



1. Is there a composting program at your school?
 Yes
 No. Skip to question 8.

2. What does your school compost? (Check all that apply.)
 Grass clippings Yard waste Leaves Fruit and vegetable waste from food preparation and lunches
 Other (describe): _____

3. Who collects the materials to be composted? (Check all that apply.)
 Students Teachers Custodians Cafeteria staff members
 Other (describe): _____

4. Where are the indoor food-waste collection bins located?

5. Where is the outdoor compost bin located?

6. What happens to the compost material? (For example, is it used to enrich gardens at the school?)

7. Does your school have a **vermicomposting** program? (Vermicomposting is the process of using worms to compost material.)
 Yes No

8. If your school does not have a compost program, explain how your school could start one and what materials could be composted.

9. Brainstorm and record a list of ways that composting efforts at the school could be improved.



PART V: WASTE REDUCTION, REUSE, AND PURCHASING



You may want to interview the school's personnel in charge of environmental policies and supply purchasing to find the answers to the following questions.

1. Does your school or school district have policies regarding purchasing of supplies, waste reduction, and reuse? Yes No
2. Does your school purchase recycled office paper? Yes No
If yes, what are the specifications of the paper? (For example, what percentage of the paper is postconsumer recycled content?) _____
3. Is the paper certified to ensure that it comes from sustainably managed forests? Yes No
4. Are any of the following strategies followed to reduce paper use at your school?
 - Storing records electronically Yes No
 - Communicating with staff by email Yes No
 - Communicating with students by email Yes No
 - Communicating with parents by email Yes No
 - Using online tests Yes No
 - Using online books Yes No
 - Using double sided printing and copying Yes No
 - Reusing paper that has only been used on one side Yes No
 - Reusing scrap paper for art, notes, and so forth Yes No
5. Does the school employ any of the following strategies to save resources, reuse items, and reduce waste?
 - Food is served on reusable, not disposable, plates. Yes No
 - Metal, not disposable, utensils are used. Yes No
 - Reusable, not disposable, trays are used. Yes No
 - Unclaimed "lost" items are donated to a charity for reuse. Yes No
 - Gently used clothing, toys, and books are collected and donated to charities for reuse. Yes No
 - School holds swap days or an online swap site where families can exchange books, clothing, bicycles, costumes, and so forth. Yes No
 - Items are collected for reuse/donation when desks and lockers are cleaned out at the end of the school year. Yes No





6. Does your school or school district purchase items other than paper that are made from recycled content? (For example, tissues or napkins?) Yes No

If yes, briefly explain: _____

7. When classes go on field trips, do they:

Recycle cans and bottles? Yes No

Minimize the amount of waste generated by bringing lunch boxes or cloth bags and reusable containers? Yes No

8. Brainstorm and record a list of ways that purchasing practices, reuse of items, and reduction of waste at your school could be improved.



PART VI: WASTE ANALYSIS



The purpose of this analysis is to help you determine whether waste items are being placed in the appropriate container (garbage can, recycling bin, compost bin) and whether items are being thrown away that could be reused, recycled, or composted.

Directions: Complete the waste charts and questions on pages 10-15 to analyze the waste generated at your school in a single day. Work with the school administrators and custodians to find a time to conduct the analysis. Plan to conduct it on a typical day; if you do it right after a big event is held, it can affect the data.

- For each room that will be included in the assessment, you will need a copy of the **What To Do With Waste Chart**, the **Individual Room Waste Chart**, and the analysis questions (pages 9-11). (Please use the front and back of paper or create an online entry form for paperless data recording.) Try to include as many rooms as possible.
- You will also need one copy of the **Schoolwide Waste Chart**, **Cafeteria Waste Chart**, and the analysis questions that follow these charts (pages 12-15).

Measuring Weight (Optional)

Although this is optional, the data collected will provide baseline information that can be used to track improvements after action is taken to reduce waste. This analysis is particularly useful if the company that picks up waste does not provide data on the weight of waste collected.

Materials Needed:

- A large scale (like a spring scale or shipping scale)
- At least one container
- Large tarp
- Goggles and gloves for each participant
- Aprons to protect clothing

Directions: Weigh the empty container(s) and record the weight. For each room, sort the waste on a tarp into the categories on the chart. Place each category of material into a container. Weigh it, subtract the weight of the empty container, and record the results on the waste chart.





WHAT TO DO WITH WASTE CHART

Type of Waste	Recycle It	Compost It	Throw It Away	Comments
Mixed paper	✓	✓		Mixed paper includes white and colored paper, magazines, and newspapers, all of which can be recycled. Most of these items can also be composted if they are clean and in small pieces or shredded.
Used paper products			✓	Includes used paper towels, tissues, cups, and plates. These items should not be recycled or composted because they can contaminate the recyclables and compost.
Cardboard and posterboard	✓	✓		These items are usually recycled, however, clean cardboard and poster board can be shredded or cut into small pieces and composted.
Recyclable plastics	✓			This includes any plastic material that is accepted for recycling by the school's recycling company. Look for recycling symbols on containers. Empty containers before placing them in the recycling bin.
Glass bottles and jars	✓			Glass containers used for food and beverages are recyclable. Empty containers before placing them in the recycling bin.
Aluminum containers	✓			Aluminum containers are recyclable. Empty containers before placing them in the recycling bin.
Styrofoam	✓		✓	Styrofoam may or may not be recycled in your community. Regardless, it should not be included with other recyclables because it can only be recycled at special facilities. Contact the companies that collect your school's waste and recycling to find out how to handle it.
Milk cartons	✓			Milk cartons may or may not be accepted for recycling; check with the company that collects your school's recyclables.
Food waste		✓		Fruit and vegetable waste, as well as coffee grounds, tea bags, and egg shells can be composted. Keep meat, bones, grease, fats, oils, and dairy products out of the compost because they can turn rancid and attract rodents and other pests.
Printer or copier cartridges	✓			Printer and copier cartridges should not be placed in the school's regular recycling bins. They have to be returned to the manufacturer for recycling. Many manufacturers provide pre-paid shipping labels or have partner retailers where you can drop off cartridges.





INDIVIDUAL ROOM WASTE CHART

Directions: Record information on the waste generated in the room at the end of the day. For each type of waste, use a check mark to indicate whether it is mainly recycled, thrown away, or composted. You can do this with a visual inspection. If you measured weight, record the results in the last column. Then answer the questions that follow.

SAFETY: Students should wear gloves and goggles when inspecting the waste. If the bins are too full to do a visual inspection, dump the contents onto a tarp to complete the visual inspection.

Room #/ Name: _____ Average # of people using the room: _____ Date: _____

Type of Waste	Mainly Recycled	Mainly Composted	Mainly Thrown Away	Total Weight Generated in One Day (Include units)
Mixed paper				
Used paper products				
Cardboard and posterboard				
Recyclable plastics				
Glass bottles and jars				
Aluminum containers				
Styrofoam				
Milk cartons				
Food waste (Fruit and vegetable)				
Printer or copier cartridges				
Other				
Total				





Individual Room Waste Chart Analysis

1. Are waste items being placed in the appropriate container (garbage, recycling, or compost)?
 Yes Somewhat No

Briefly explain your answer:

2. What was the total weight of all the waste generated in the room?

3. According to your findings, what can you conclude about the waste-management practices in the room?

4. Brainstorm and record a list of ways to reduce waste and improve recycling and composting in this room.





SCHOOLWIDE WASTE CHART

Directions: Aggregate the data from the Individual Room Waste Charts and record it on the top half of the chart. Then complete the bottom half of the chart and answer the questions that follow.

Number of people in the school: _____ Date: _____

Type of Waste	Mainly Recycled	Mainly Composted	Mainly Thrown Away	Total Weight Generated Schoolwide in One Day (Include units)
Section 1. Aggregate the data collected on the Individual Room Waste Charts to complete this section.				
Mixed paper				
Used paper products				
Cardboard and posterboard				
Recyclable plastics				
Glass bottles and jars				
Aluminum containers				
Styrofoam				
Milk cartons				
Food waste (Fruit and vegetable)				
Printer or copier cartridges				
Other				
Total				
Section 2. Interview school administrators and custodians to help you complete this section.				
Computers*				
Other electronics*				
Fluorescent light bulbs*				
Total				

* Most computer equipment and electronic devices contain hazardous materials and fluorescent light bulbs contain very small amounts of mercury, so these items do not belong in a landfill. Check with your local health and sanitation agencies for ways to safely dispose of electronics and fluorescent light bulbs.





Schoolwide Waste Chart Analysis

1. Are waste items being placed in the appropriate container (garbage, recycling, or compost)?

Yes Somewhat No

Briefly explain your answer:

2. If measured, what was the total weight of all the waste generated in Section 1 of the chart?

3. According to your findings, what can you conclude about the waste-management practices at your school?

4. Brainstorm and record a list of ways to reduce waste and improve recycling and composting at your school.





CAFETERIA WASTE CHART

Directions: Use this chart to monitor cafeteria waste for a day.

Average number of students and staff using the cafeteria each day: _____ Date: _____

Type of Waste	Mainly Recycled	Mainly Composted	Mainly Thrown Away	Total Weight Generated in One Day (Include units)
Mixed paper				
Used paper products				
Cardboard and posterboard				
Recyclable plastics				
Glass bottles and jars				
Aluminum containers				
Steel food cans				
Styrofoam				
Milk cartons				
Food waste (Fruit and vegetable)				
Other				
Other				
Total				





Cafeteria Waste Chart Analysis

1. Are waste items being placed in the appropriate container (garbage, recycling, or compost)?
 Yes Somewhat No

Briefly explain your answer:

2. What was the total weight of all the waste generated in the cafeteria?

3. According to your findings, what can you conclude about the waste-management practices in the cafeteria?

4. Brainstorm and record a list of ways to reduce waste and improve recycling and composting in your cafeteria.



PART VII. EDUCATION, TRAINING, AND COMMUNITY CONNECTIONS



You may want to interview the school's personnel who manage environmental policies and professional development. Information about academic standards may be available on school websites.

1. Have at least two members of your staff participated in PLT Professional Development? Yes No
2. Are PLT Professional Development opportunities available to all teachers? Yes No
3. Do at least 10% of classes or courses embed environmental education, including PLT? Yes No
4. Do your school's academic standards include content requirements for waste management, waste reduction, recycling, and composting? Yes No
5. Have members of your school staff participated in professional development programs and workshops that include waste reduction, recycling, and composting education? Yes No
6. Does your school sponsor any waste education, reuse, or recycling projects that help the community? . . Yes No
7. Are community recycle or hazardous waste days offered so that items such as computers, batteries, and cell phones can be properly disposed of? Yes No
8. Some waste management facilities can be used as educational resources for field trips and guest speakers. Which facilities are found in your community?
 - Landfill? Yes No
Location: _____
 - Municipal Composting Site? Yes No
Location: _____
 - Material Recycling Facility? Yes No
Location: _____
 - Transfer Station? Yes No
Location: _____
 - Local solid waste or recycling office? Yes No
Location: _____
9. What community partners in your region support recycling and waste reduction?

10. Brainstorm and record a list of ways for how your school could improve waste education, training, and community connections.

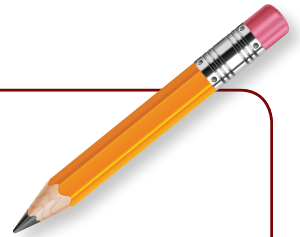


PART VIII: WASTE & RECYCLING ACTION PLAN



Review the list of ideas for improving waste practices that you brainstormed for each section of this investigation. Prioritize the ideas and decide on a few action projects that you can do to improve the waste practices at your school. See the next page for examples of action projects.

List your action project ideas for each section of the Waste and Recycling Investigation.



Waste Removal

Recycling

Composting

Waste Reduction, Reuse, and Purchasing

Education, Training, and Community Connections





Waste and Recycling Action Project Ideas

Here are just a few ideas to help get you started. You can check out what other PLT GreenSchools are doing by watching PLT's short video *GreenSchools in Action: Waste & Recycling* (available on PLT's YouTube channel at <https://www.youtube.com/user/ProjectLearningTree>) and by reading stories posted at <https://www.plt.org/project-learning-tree-greenschools-stories>.

- Reduce paper waste—for example, by photocopying and printing on both sides of paper and by saving scrap paper for notes and art projects.
- Reduce cafeteria waste—for example, by using less Styrofoam, by serving food on reusable trays, and by using metal utensils instead of disposable ones.
- As your school reduces the amount of waste produced, dumpsters may no longer be full when waste is picked up. “Right size” the dumpsters by selecting the appropriate size. This will give your school the best value from the waste hauling service.
- Start a recycling program, or increase recycling efforts and the types of items that are recycled.
- Start or increase composting efforts.
- Implement grasscycling, the practice of leaving grass clippings on a lawn to compost and to nourish the grass.
- Reuse items—for example, by organizing an exchange day for students to swap items they are no longer using such as sports equipment, clothes, CDs, posters, and so forth.
- Encourage students across the whole school to use refillable water bottles, reusable lunch boxes or cloth bags, and reusable containers.
- Have an end-of-school year locker and desk cleanout and have students donate unwanted items to a local charity or needy school.
- Educate others about reducing waste, recycling, and composting through flyers, posters, articles in the school newspaper, skits, assemblies, and school announcements.



INTERNATIONAL SCHOOL GROUNDS MONTH ACTIVITY GUIDE



INTERNATIONAL SCHOOL GROUNDS ALLIANCE
internationalschoolgrounds.org

HANDS FOR THE ENVIRONMENT

AGES

3-18+ years old

CONTRIBUTED BY

Hong Duc University

Thanh Hóa City, Thanh Hóa, Vietnam

hdu.edu.vn



© SHARI WILSON

This activity, where participants trace their own hands on colorful paper and write or draw their wish for the environment, is a wonderful addition to a school or community festival. It inspires children and adults to consider their personal role in protecting our environment by sharing a wish with others. A sea of hands swaying in the breeze makes a striking art installation with meaning. The activity can also be used in a classroom setting to encourage reflection after discussions or activities where environmental stewardship is a topic.



MATERIALS

- Colorful paper, such as construction paper, that is plain on at least one side
- Markers, pencils, scissors, tools to punch holes in paper
- String or yarn
- A place to hang the finished hands

DIRECTIONS

- Ask each participant to choose a piece of colored paper, trace their hand, and cut it out.
- Encourage participants to write or draw their wish for the environment on one or both sides of their hand cut-out. The wish should be something they would like to share with others.
- Use the hole punch tools to put a hole at the top of each paper hand. Tie a piece of yarn or string through the hole and make the string long enough to hang from a tree branch, low enough so the text on the hands can be read.
- Hang the paper hands from tree branches or other places where they can blow in the breeze, in a place they will be seen. Celebrate your good work by taking a tour of the installation, and reading all of the messages for the environment!

Reference: Activity created by Hoang Ha, Shari Wilson, Heather Nisbett-Lowenstein, and teachers Nguyen Thi Thu Hien, Ly Thu Hang, Le Thi Hien, Hoang Van Anh, Vo Thi Thanh Phuong, Ngo Thi Thu, Hoang Phuong Thuy, Nguyen Thi Thuy, Le Thi Xuan, Duong Thi Thu Phuong.

