Connecting Oceans Academy

New Bedford, Massachusetts

Understanding our Changing Ecosystems
Grades 3-5

Contributing Authors
Simone P. Bourgeois
Arthur A. Dutra
Jack Crowley
Wende Allen
Hugh O'Mara
Jessica Ross

Editor
Jewel Gilbert

Biographical information on ECHO staff members is available at:
http://newbedfordecho.org/newbedford-echo-project-curricula.htm

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Understanding Our Changing Ecosystems

Overview

Look out of the window, take a walk out of doors, explore your neighborhood – stretch your legs and your imagination to visit places beyond your physical boundaries – what do you see, what will you see? You will see "wondrous places and things," as you pass through the boundaries of your neighborhood, town, state, country and, ultimately, across the surface of the planet. Earth, the "Blue Planet," is a giant habitat floating in the void of space. This great blue sphere displays amazing sites full of exotic plants and animals.

Scientists have named more that 1.5 million species and suspect that millions more remain to be discovered. The ability to support varied life forms from single-celled animals and plants to blue whales is referred to as biodiversity. Earth's habitats, specific areas with all the resources needed to support life, exist because of the planet's unique combination of air, water, soil, climate and sunlight.

The destruction of habitat results in species' endangerment or extinction, reducing biodiversity. Habitat destruction or fragmentation, the breaking up of natural habitat areas into smaller patches, makes it difficult for wildlife to survive. As human beings take over more and more land, destroying natural habitats to create homes, factories, farms, and so forth, more and more species become endangered or extinct. The five greatest threats to biodiversity are expressed in the acronym, "HIPPO:" **H**abitat loss, **I**nvasive species, **P**ollution, **P**opulation, and **O**ver consumption."

People affect their habitat either intentionally or unintentionally. We have to be made aware that our decisions affect all parts of the natural ecosystem, from the smallest insect to the largest mammal. Each ecosystem has a delicately balanced and intricate web of life with all its plants and animals interdependent in complex ways. Each species plays a role in its habitat, and what affects one species eventually affects the entire habitat—and ultimately, the ecosystem in which many habitats exist. Not even humans are safe when natural habitats are destroyed. We are an integral component of the ecosystem and are in danger of threatening even our own survival through our choices about the use of our planet.

This module, intended for students in grades three through five, focuses on an understanding of ecosystems to help students understand the causes and consequences of the five threats to biodiversity referenced above: Habitat loss, Invasive species, Pollution, Population, and Over consumption. The ultimate goal

of these learning experiences is for students to develop a sense of stewardship for Earth.

Content

This module uses personal exploration, reflection and hands-on activities to introduce elementary students to ecosystems, habitats and environmental change related to 1) Habitat loss, 2) Invasive species, 3) Pollution, 4) Population changes, and 5) Over consumption (HIPPO). Students study ecosystems using scientific inquiry to explore changes that may affect these systems.The final activity and assessment ask students to use their content knowledge to change their own behaviors to reduce their personal impacts on the environment. They create a poster to inform the rest of their community about what they learned.

There are four Learning Experiences (LEs) in this module. In LE One the teacher assesses students' current level of knowledge about ecosystems, habitats and environmental impacts. In LE Two students create micro habitats in their classrooms and learn about what it takes to maintain them. In LE Three students use scientific methodology to observe and understand the factors that put ecosystems most at risk. Finally, in LE Four students learn how they can reduce their impact on the environment and share their knowledge with the community.

Stage 1 - Desired Results

Established Goals

Established Goals: From Massachusetts State Standards

Science & Technology: Grades Three to Five

- Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beak or feet, placement of eyes on head, length of neck, shape of teeth, color.
- Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration). Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration).
- Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment. Recognize that some animal behaviors are instinctive (e.g., turtles burying their eggs), and others are learned (e.g., humans building fires for warmth, chimpanzees learning how to use tools).
- Recognize plant behaviors, such as the way seedlings' stems grow toward light and their roots grow downward in response to gravity. Recognize that many plants and animals can survive harsh environments because of seasonal behaviors, e.g., in winter, some trees shed leaves, some animals hibernate, and other animals migrate.
- Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem
- Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.

National Science Standards

C. **Life Science**

Organisms and Their Environments, K-4

- All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants.
- An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.
- All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organism or other organisms, whereas

others are beneficial.

- Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.

Populations and Ecosystems, 5-8

- A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
- Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers--they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.
- For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.
- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Diversity and Adaptations of Organisms, 5-8

- Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.
- Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.
- Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the earth no longer exist.

F. Science in Personal and Social Perspectives

Changes in Environments, K-4

- Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad.

Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans.

- Some environmental changes occur slowly, and others occur rapidly. Students should understand the different consequences of changing environments in small increments over long periods as compared with changing environments in large increments over short periods.

Natural Hazards, Grades 5-8

- Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.

Enduring Understandings	**Essential Questions**
1. Ecosystems are delicately balanced interlocking communities of living and non-living things. 2. When changes occur in an environment, it impacts the plants and animals with sometimes unpredictable consequences, resulting in loss of biodiversity. 3. Humans continue to make changes to the natural environment that reduce biodiversity and that ultimately have negative consequences for all living things, including humans. 4. Technology increases the pace of destabilization of an environment.	A. What is an individual's responsibility to the local and global natural environment? B. What is the relationship among people, technology and the natural environment?

Students will know and understand:	**Students will be able to:**
a. Appropriate scientific terms to describe the structure and functions of ecosystems. b. That a food web is composed of producers, herbivores, and carnivores. c. The consequences of human activity on their environment. e. Ways that human beings impact the natural environment	a. Use the internet and other. resources to find information b. Collect and interpret data. c. Educate others about what they have learned.

Stage 2 - Assessment Evidence

Performance Tasks

Students will:

- Create a habitat to observe and experiment on in the classroom.
- Analyze and create a waste-free lunch and share their information with the school by creating a poster.

Student Self-Assessment: How will students reflect upon and assess their own learning?

- Reflective writing about class activities and student's performance assessments.
- Discussion with peers during class activities and in debriefing of class activities with the teacher.

Stage 3–Learning Plan

Learning Experiences

LE One: Introduction to Ecosystems

LE Two: Building a Habitat

LE Three: Five Threats to Biodiversity—"HIPPO"

LE Four: Making a Difference

Learning Experience One

Introduction to Ecosystems

Overview

This Learning experience has three goals: 1) to pique students' interest, 2) to determine the extent of students' scientific knowledge about ecology, and 3) to develop basic vocabulary for future Learning Experiences. In the first activity teachers gather information to assess what students already know about ecosystems in order to modify the unit for maximum impact. The second activity addresses the extensive list of vocabulary terms that will be used and referenced throughout this unit. Students start by exploring the meaning of these words and creating a student glossary to be used through the rest of the learning experiences. Teachers decide the appropriate vocabulary for their grade level. In Activity Three students learn what a habitat and a niche are by researching the habitats and niches of a variety of animals.

Evaluation

Each students selects an animal from a list and writes a three-paragraph essay on that specific animal, its habitat and its niche. Included in the essay is a description of 1) the animal, 2) where the animal's habitat is and 3) how the animal survives in its environment.

Materials

- Chart paper
- Markers
- Masking tape
- Computer with Internet access and/or encyclopedias and other reference books
- Drawing paper 12" x 18"
- 18" x 24" piece of oaktag or cardboard
- Glue
- Scissors
- Handout: One: Who Lives Where?
- List of ecology terms and glossary (at the end of the Learning Experience)
- Pen, pencil, crayons

Activity One: What do I Know about Ecosystems, and Why Should I Care?

- Before class post each of the following eight questions at the top of a sheet of chart paper:
    - What is an ecosystem?
    - What is a habitat?
    - What is pollution?
    - What is an invasive species?
    - What are all the ways that people depend on plants in the natural environment?
    - What are all the ways that people depend on animals that live in the natural environment?
    - Why should we all be well informed about what happens when people make changes in the natural environment?
    - What can I do to protect the environment?
- Explain to students that they are beginning a new unit, and that you are starting with activities that will give them an overview of the unit and also help you understand what they already know about the content. Assure students that the purpose of this exercise is to assess what they already know; that you will therefore collect each student's work at the end of class, but will not grade it. Their work will be returned to them near the end of this unit of study so they can determine how much they have learned.
- Tell students that they will be working in groups. Be sure to remind students about the rules of group work (taking turns, talking quietly, etc).
- Assign groups of students to each question/chart paper, so that students are evenly divided among the seven charts. Provide each group with a marker. Students assign a recorder. Explain that groups will have about two minutes at each chart to list their responses. When told to move, all groups will shift to the chart on their right. Stop after every group has visited each chart. Invite students to read the entries on each chart and add anything else that comes to mind.
- Work with the class to write a summary statement on each chart. For example, regarding the responses to the question, "What are all the ways that people depend on plants in the natural environment?" students might conclude that humans rely upon plants in many ways, some of which are essential for life. If students have not been able to provide a correct or complete answer to the terms ecosystem, habitat, invasive species or pollution, and have omitted responses to the other questions, don't correct them at this time. Instead, identify the omissions or incorrect information and assure students that they will be able to answer all of these questions by the end of this unit of study.
- Students interview a partner on the question: "Why is it important to learn about the natural environment?"
- The class discusses the students' reflections.

- Each student writes a paragraph responding to the prompt: I think it's important for people to understand how natural environments work because . . . (Remind students that this is a pre-assessment.)

Teachers' Notes

- Encourage students to participate in this pre-assessment activity.
- Students are often overly concerned about being correct. Assure students that there is no penalty for incorrect or incomplete responses.
- The value of this exercise is to evaluate what the students do and do not know.
- Stress that it is more important for the students to try hard and be honest with their knowledge.
- Use the outcomes of this activity to structure this unit of study, adapting or omitting activities as appropriate.
- Sometimes students can provide a rote definition for a term without having a deep operational understanding. Probe students' responses to determine their level of understanding.
- More Information on ecosystems can be found on the following websites:
  http://www.ngeo.com/geographyaction/habitats/basics.html

  http://www.nationalgeographic.com/geographyaction/habitats/basics.html

  http://www.amnh.org/nationalcenter/it_takes_all_kinds/

  http://www.metrokc.gov/dnrp/swd/naturalconnections/hippo.htm

  http://ecohealth101.org/classroom/teachers.html

  http://www.ecokidsonline.com/pub/index.cfm

  http://baytrippers.thinkport.org/learn/lesson.htm#sediment

  http://www.nasa.gov/audience/forkids/activities/A_Ocean_in_a_Bottle.html

  http://www.gp.com/educationalinnature/fromforest/activities.html

Activity Two: Vocabulary-Building Exercises

Divide the word list (found at the end of this Learning Experience) according to the number of students in the class, adding or removing words as appropriate for your students. Once students have been assigned their terms, ask them to find the definition, provide the proper spelling and, if possible, an image or visual of the word. If there is Internet access, students can create their lists with an image obtained from the Internet and submit it to the teacher to merge into one master list for the entire class. If Internet access is not available, dictionaries, drawings

and photocopies can easily be used instead. Once the list is compiled it can serve as a glossary of terms to assist in conversations and readings for the rest of the unit

Activity Three: Who Lives Where?

- Introduce the term ecosystem, writing on the board:

An ecosystem includes all the living and nonliving parts of the environment in a particular area.

- Explain that in this unit of study, students will explore ecosystems, learning about how they function, what harms ecosystems, how the changes that humans make in ecosystems sometimes result in serious harm, and our responsibilities for protecting natural ecosystems.
- Pair students and give each pair Handout One. Explain that their challenge is to match as many of the animals as they can to the16 places on the list. You may ask students to match all the animals, or one (or two) animal(s) from each group of three.
- Once students have matched the animals to the places, introduce the term habitat:

A habitat is the place where a plant or animal lives.

- Each pair creates a poster displaying a particular animal and its habitat and how it survives in that habitat.
- Each pair explains its poster to the class.
- Introduce the term, niche:

A niche is what a plant or animal does in its habitat—what role it plays, how it survives in its habitat.

- Each student selects an animal from the list and writes a three-paragraph essay on that specific animal, its habitat and its niche. Included in the essay is a description of 1) the animal, 2) where the animal's habitat is and 3) how the animal survives in its environment.
- Place students in groups of three to read their essays and respond to questions.

LE 1 Handout One

Who Lives Where?

Step 1: Fold the drawing paper in half. Fold it in half two more times. When you unfold it, you will have16 squares on your paper.

Step 2: At the top of each square, write the name of one place, using this list to fill in all the squares:

1) Polar/arctic area
2) Mountains
3) Deserts
4) Savannah/grasslands/prairies
5) Tropical Rainforest
6) Woodland/forest
7) Tundra
8) Taiga
9) Wetland areas/marshes
10) Oceans
11) Pond
12) Rivers/lakes
13) Coral reef
14) Deciduous forest
15) Tide pool
16) Cave

Step 3: Use the Internet or reference books to match animals from the list below to the places they live.You may draw the animal or print a picture of it and cut and paste into the appropriate habitat square. Make sure each animal is identified. Some animals will live in more than one place.

Animal List:

Caracal
Bobcat
Zebra
Polar Bear
Porcupine
Platypus
Llama
Gila Monster
Pangolin
Ball Python
Dugong
Caribou
Road Runner
Scorpion
Otter
Collared Lemming
Spotted Turtle
Tufted Capuchin
Snake
Koala
Wombat
Tasmanian Devil
Lynx
Raccoon
American alligator
Leopard
Penguin
Black Bear
Hippopotamus
Giant Panda
Great Horned Owl
European Hedgehog
Snowy Owl
Snowy Egret
Snow Leopard
Manatee
Cougar
African Elephant
Asian Elephant
Ostrich
Warthog
Wolverine
Lion
Bullfrog
Green winged macaw
Sea stars
Hoffman's Sloth
Fennec fox
Yak
Clown Anemone Fish
Orangutan
Jamacian Fruit Bat
Throatspot Blenney
Eastern Painted Turtle
Northern Copper Belly

Word and Acronym List

Aluminum
Animal
Backyard composting
Bacteria
Biodegradable
Biodiversity
Biome
Bulk
Byproduct
Cardboard
Carnivore
Climate
Conservation
Consumption
Contamination
Consumer
Decomposer
Deforestation
Disposable
Dump
Ecology
Ecosystem
Energy
Environment
Environmental impact
Food chain
Food web
Glass
Global climate change
Greenhouse effect
Greenhouse gas
Habitat
Hazardous waste
HIPPO
Invasive species
Manufacturing
Metal
Microorganisms
Natural resources
NIMBY (Not In My Backyard)
Nonrenewable resources
Nontoxic
Omnivore
Organic
Organism
Packaging
Plastic
Pollutant
Pollution
Product
Producer
Recycling
Renewable resource
Reusable
Reuse
Source reduction
Steel
Sustainability
Toxic
Waste

Glossary of Terms

Note: This glossary was taken from the EPA's "The Quest for Less", which can be found at http://www.epa.gov/epaoswer/education/quest/quest.htm and the yahoo dictionary for kids http://kids.yahoo.com/reference/dictionary/english

A

Aluminum—a lightweight, silver-white, metallic element that makes up approximately 7 percent of the Earth's crust. Aluminum is used in a variety of ways, but perhaps most familiarly in the manufacture of soft drink cans.

Animal-- A multicellular organism of the kingdom Animalia, differing from plants in certain typical characteristics such as capacity for locomotion, nonphotosynthetic metabolism, pronounced response to stimuli, restricted growth, and fixed bodily structure.

B

Backyard composting—the homeowner's practice of collecting leftover kitchen scraps (excluding meats and fats) and yard trimmings for decomposition in a private compost pile. Backyard composters can use their compost as a soil enhancement for their gardens.

Bacteria—single-celled microorganisms.
Certain types of bacteria break down organic materials (using an aerobic and/or anaerobic process).

Biodegradable—materials that can decompose, usually by bacteria or sunlight, into basic components. Most organic materials (paper, grass clippings, food scraps), under the right conditions, are biodegradable.

Biodiversity (also biological diversity)—indicated by the numbers of different species of plants and animals found in a natural environment. Many different species of plants and animals within an ecosystem is indicative of a healthy environment.

Biome-- A major regional or global biotic community, such as a grassland or desert, characterized chiefly by the dominant forms of plant life and the prevailing climate.

Bulk—when food or other products are sold unpackaged or in large volumes to reduce packaging waste. Consumers who buy one large bottle of juice rather than many small containers of juice, for example, are "buying in bulk."

Byproduct—excess material or waste produced in addition to the primary product. Sludge is a byproduct from the manufacture of paper, for example. Many manufacturers

look for innovative ways to reuse or recycle the byproducts created during the production process to reduce waste.

C

Cardboard—a thin, stiff material made of paper pulp and used in making cartons and other forms of packaging.
Carnivore-- Any of various predatory, flesh-eating mammals of the order Carnivora, including the dogs, cats, bears, weasels, hyenas, and raccoons.

Climate—the average course or condition of weather over a period of years based on conditions of heat and cold, moisture and dryness, clearness and cloudiness, wind and calm, applied to a specific location or globally. Southern Florida, for example, has a sunny, dry, warm climate.

Conservation—the protection or wise use of natural resources that ensures their continuing availability to future generations; the intelligent use of natural resources for long-term benefits.

Consumption—the amount of any product or resource (e. g. , material or energy) used in a given time by a given number of consumers.

Contamination—the process of adding one substance to another substance, such as motor oil to water, that reduces its quality; to make impure or unsafe by contact with potentially harmful substances.

Consumer--A heterotrophic organism that ingests other organisms or organic matter in a food chain.

D

Decomposer-- An organism, often a bacterium or fungus, that feeds on and breaks down dead plant or animal matter, thus making organic nutrients available to the ecosystem.

Deforestation—the clearing and removal of trees from a forested area.

Disposable—products or materials that can be or are usually thrown away after one use or a limited amount of time. For example, used paper plates are disposable.

Dump—site where waste is disposed of in an unmanaged, uncovered area. Current landfill restrictions have made dumps illegal.

E

Ecology-- The science of the relationships between organisms and their environments.

Ecosystem—community of plants and animals that interact with one another and with the surrounding nonliving environment. Examples of ecosystems include ponds, forests, and beaches.

Energy—capacity for a system or an object to do work (i. e. , cause a change by pulling, pushing, or heating). Energy generated from incineration, for example, can be harnessed to provide electrical power for communities.

Environment—the external conditions that influence the development and survival of an organism or population; usually refers to air, water, land, plants, and animals.

Environmental impact—the effect of an activity or substance on the environment.

F

Food chain—the transfer of food energy from one organism to the next. As one example of a simple food chain, an insect consumes a plant and is then consumed by a bird.

Food web—the complex and interlocking networks of food chains within ecosystems where plants and animals coexist and depend on one another for energy needs.

G

Glass—hard, brittle, generally transparent or translucent material typically formed from the rapid cooling of liquefied minerals. Most commercial glass is made from a molten mixture of soda ash, sand, and lime.

Global climate change—natural or human induced change in the average global temperature of the atmosphere near the Earth's surface. This condition poses serious dangers around the world, potentially prompting such disasters as flooding, drought, and disease.

Greenhouse effect—the excessive trapping of heat in the Earth's atmosphere by a blanket of gases. Gases such as water vapor, methane, and carbon dioxide exist naturally and help retain the Earth's normal surface temperature. Changes in the normal volume of gases in the atmosphere, due to human-induced activities, are believed to contribute to global climate change.

Greenhouse gas—gas such as methane, nitrous oxide, ammonia, sulfur dioxide, carbon dioxide, and certain chlorinated hydrocarbons that affects the overall heat-retaining properties of the Earth's atmosphere. A build-up of these gases creates a warming of the Earth's atmosphere, thus changing the global climate.

H

Habitat—an area where a living organism is typically located that provides adequate food, water, shelter, and living space for survival.

Hazardous waste—waste that is often produced in large quantities by businesses and industrial facilities that can be defined as toxic, ignitable, corrosive, or reactive. This type of waste is regulated by a law called the Resource Conservation and Recovery Act (RCRA) to minimize risks to human health and the environment.

HIPPO— is an acronym that stands for a list of factors identified by scientists to be the biggest threats to biodiversity. (http://www.nbii.gov)

H: Habitat Destruction
I: Invasive Species
P: Pollution
P: Population Growth
O: Over consumption

I

Invasive species—Is a species that has been introduced usually by humans to a new ecosystem where it disturbs the preexisting natural balance.

M

Manufacturing—the process of turning raw materials into a product or good by hand or machinery.

Metal—an element that usually has a shiny surface, is a good conductor of heat and electricity, and can be melted down, fused, or hammered. Metals include iron, gold, sodium, copper, magnesium, tin, and aluminum.

Microorganisms—organisms of microscopic size, such as bacteria, amoeba, and viruses.

N

Natural resources—raw materials or energy supplied by nature and its processes (e. g., water, minerals, plants). Trees are a natural resource used to make paper, and sunlight is a natural resource that can be used to heat homes.

NIMBY (Not In My Backyard)—a term indicating the attitude of individuals who oppose sitting a disposal facility in their communities.

Nonrenewable resources—naturally occurring raw materials that are exhaustible and become depleted more quickly than they naturally regenerate. Some nonrenewable resources, such as peat, petroleum, and metals, are only available in limited quantities, take a long time to form, and are used up rapidly.

Nontoxic—does not contain substances that are harmful, poisonous, or destructive.

O

Omnivore—an organism that eats both plants and animals.

Organic—from a living organism (e. g. , plant, animal, person, or bacteria). Also refers to a product grown or manufactured only with natural materials (e. g., corn grown with compost and not chemical fertilizer or pesticides; shampoo made from plants instead of human-made chemicals).

Organism—a living body made up of cells and tissue; examples include trees, animals, humans, and bacteria.

P

Packaging—a cover, wrapper, container, or stabilizer (e. g., strapping or pallet) designed to store, transport, display, and protect a product and/or attract purchasers.

Plastic—a material made from petroleum capable of being molded, extruded, or cast into various shapes. There are many different kinds of plastic made from different combinations of compounds.

Pollutant—a liquid, gas, dust, or solid material that causes contamination of air, water, earth, and living organisms.

Pollution—the contamination of soil, water, or the atmosphere by the discharge of harmful substances.

Product—item manufactured by hand or by industry for consumers to purchase and use.

Producer-- A photosynthetic green plant or chemosynthetic bacterium, constituting the first trophic level in a food chain; an autotrophic organism.

R

Recycling—collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.

Renewable resource—naturally occurring raw material that comes from a limitless or cyclical source such as the sun, wind, water (hydroelectricity), or trees. When properly used and managed, renewable resources are not consumed faster than they are replenished.

Reusable—material that can be used again, either for its original purpose, or for a new purpose.

Reuse—a type of source reduction activity involving the recovery or reapplication of a package, used product, or material in a manner that retains its original form or identity.

S

Source reduction (also known as waste prevention)— any change in the design, manufacture, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they become municipal solid waste. Source reduction also refers to the reuse of products or materials.

Steel—a strong, durable material made of iron and carbon, and often other metals, to achieve different properties. Steel is often used as a component in cans and as a structural material in construction.

Sustainability—social and environmental practices that protect and enhance the human and natural resources needed by future generations to enjoy a quality of life equal to or greater than our own.

T

Toxic—containing compounds that pose a substantial threat to human health and/or the environment.

W

Waste—see municipal solid waste.

Learning Experience Two

Building a Habitat

Overview

In this Learning Experience, students construct and observe what occurs in two different habitats: an ant habitat and a terrarium. In the following Learning Experience (LE 3) students ask questions and conduct experiments using their terrarium habitats.

Evaluation

- Students log daily entries into their science journal making observations of their ant habitat and its occupants.
- Students are able to state that a habitat is where an animal or plant lives.
- Students construct a closed terrarium system and explain why the terrarium is a habitat.

Activity One: Ants Are Fun (from: www.NASAexplores.com)

Teachers' Notes: In this learning experience students construct an ant habitat. Students observe and record how ants work best, how they feed themselves; and create hypotheses on how they communicate with each other. Students discover that an Ant Habitat is a self sufficient, well organized living environment. The habitat they create will have the four basic habitat requirements which are: food, shelter from weather and predators, water, and a place to raise their young.

Materials

- Students' Science Journals
- Handout One: How to Make an Ant Habitat

For each group (see Teachers' Note below):

- Unopened soft drink can
- Mason jar
- Screen
- Rubber band
- Natural sponge
- Dark construction paper to fit around the Mason jar
- Trowel
- Honey
- Multivitamin

- Package of unflavored gelatin
- Boiling water
- Egg

Teachers' Note: Handout One instructs students to prepare the ant food and to collect the ants. The teacher may prefer to prepare sufficient ant food for the class and/or purchase ants.

Activity

- Ask students to recall what an animal habitat is. Explain that students will now have an opportunity to study a habitat in depth by creating an ant habitat. Ask students what they already know about ants and what questions they have.
- Before students begin, discuss appropriate behavior when handling ants. Expect students to take good care of their ants, both while collecting them and while observing them in the classroom.
- Distribute Handout One. Students follow instructions on the handout to make the food (alternatively, the teacher may prepare food for the class), construct their ant colony, collect the ants (unless the colonies are purchased), take care of the ant colonies and make observations.
- Students discuss what they are observing. Ask students to look for evidence of how the ants are communicating and to hypothesize about the method of communication. Also ask students to look for any different roles that ants might have in their colony. How do they obtain food? What evidence do you see of cooperation?
- Students conduct research to verify or correct their hypotheses about ant behavior and to find out what niche or role ants play in their ecosystem.

Extension Activities:

- *The World of Ants* by Melvin Burger – Students read this book and hold discussion groups guided by inferential questions such as: What is happening on the front cover of the book – eating nectar; What do ants eat? Where do ants live? Why are ants valuable? What is the difference between ants and other insects?
- *Amazing Anthony Ant and Ant Cities* by Lorna and Graham Philpot – Students read the book and discuss the different ant tunnels. Sing the song, "The Ants Go marching" (song is written in the book).
- A-Maze-ing Ants – Students draw, on a paper plate, simple mazes to represent ant nests, cut ant shapes from construction paper and glue paper clips to the under side of the shapes. When dry, students put ants on paper plate nests with paper clip side facing down. Place magnets underneath plates to cause ants to scurry about. Manipulate ants along tunnels to different rooms.
- Science Journal – At the end of each day for a week, the students write or draw in their journal three facts they learned about ants.

Teachers' Notes

- Ants live in colonies. A colony is a group of related ants. Each colony has at least one queen and a lot of workers.
- Ant bodies have three main parts: the head, the thorax, and the abdomen. Ants have three pairs of legs. The legs connect to the thorax. The front legs are used to grab things. Ants have a pair of antennae. They talk to each other by tapping their antenna together.
- An ant goes through four stages in its life cycle: egg, larva, pupa, and adult.
- The Queen spends her life laying eggs. She sends out odors that tell the workers what jobs to do.
- The Workers are the daughters of the queen. They collect food to feed the colony. They make the nest bigger.
- Soldiers are large workers. They protect the colony.

Activity Two: Home in a Bottle

Materials

For each student or partners (see Handout Two to determine amounts)

- 2 Clear two-liter soda bottles.
- Potting soil
- Gravel / pebbles
- Activated charcoal (purchase at a pet store)
- Seeds: small plants that like moisture (wild bird seed or grass seed should do).
- Sharp scissors
- Tape
- Handout Two: Building a Home in a Bottle

Activity

- Explain to students that they will create a miniature habitat to observe for a few days. The habitat is called a terrarium. Ask if students know what this word means. Help students find a definition. Compare and contrast terrarium to aquarium. Ask students to find out what the root words, terra and aqua mean.
- Provide the materials and Handout Two, assigning students to groups.
- Groups follow the instructions in the handout to prepare their terrariums.
- Each day, for nine days, allow time for students to observe, discuss and document in their journal the changes that occur in the habitat. Discuss the nonliving (abiotic) features inside the terrarium, such as water that may condense on the walls of the terrarium, changes in the appearance of the soil. Ask students whether anything is entering the terrarium or leaving it. Be sure students note that light (both natural and artificial) enters, but the amount of air and water that were closed into the terrarium remain the same. What is in the terrarium that is too small to see?

Teachers' Notes:

- The soda bottle terrarium is modeled after the 1827 accidental invention by Nathaniel Ward, a London doctor. Dr. Ward discovered while studying moths that several plants had grown in the bit of soil he had placed in a bell-shaped glass jar. Among the bottled plants was a fern and it was healthy. Also observed in his glass terrarium was the water cycle and all that was necessary for a healthy plant habitat.
- A habitat is a naturally functioning system that includes living things and the other environmental components that allow those organisms to carry out their life processes. Included in the "Home in a Bottle" activity are many abiotic components, not produced by living organisms, such as water, oxygen, carbon dioxide, soil, and nutrients. One way to understand how a habitat functions is to make a model of one, like a terrarium. The word terrarium comes from the Latin word "terra" which means "earth." A typical terrarium contains soil, plants, and a host of other small living things, ranging from insects and snails to worms and

microbes. Terrariums can be either open or closed systems. In an open terrarium, air is free to circulate in and out of the system and moisture is added regularly to sustain the various life processes. In a closed system, moisture is added at the beginning when the terrarium is first established but then the system is sealed and allowed to run on its own.

LE 2 Handout One

How to Make an Ant Habitat

Prepare the Healthy Ant Food:

- 1 teaspoon honey
- One multivitamin
- One package unflavored gelatin
- 2 ounces of water
- One egg
- Dissolve the gelatin and multivitamin in the boiling water. Cool. Add the honey and egg; mix thoroughly. Keep in an airtight container in the refrigerator. Place in an airtight container and allow to set.

Prepare the ant habitat:

- Place an unopened soft drink can inside a Mason jar (the can will prevent ants from building tunnels in the middle of the jar where they cannot be observed).
- Place a piece of wet sponge on top of the soda can. Make sure it is kept moist.
- Place cracker crumbs, vegetables, and a few drops of "Healthy Ant" food into the glass jar.
- Fill with dirt – loosely packed.
- Place screen over the top.
- Wind a rubber band around it tightly.
- Place the dark paper around the jar.

Collect the ants:

- Locate an ant pile.
- Method 1: Use a trowel to carefully dig ants and enough dirt to fill your jar. (Careful - do not pack the dirt).
- Method 2: Place a piece of cardboard on the ground near an ant pile with cookie crumbs on it. Wait an hour, and then slide the cookie crumbs and ants into a baggie.
- Carefully dig around the ant hill to find the queen. <u>The worker ants will not survive without the queen</u>. Place queen into the jar

Caring for and observing the ants:

- Take good care of the ants
- Replenish the water daily.
- Provide food as needed.
- Every day remove the dark paper and observe the ant habitat.
- Write 3 ant Facts daily in your Science Journal.
- Draw a diagram of what is happening in the ant habitat.

LE 2 Handout Two

Building a Terrarium in a Bottle

- Gather supplies:
    - 2 Clear two liter soda bottles.
    - Potting soil
    - Gravel / pebbles
    - Activated charcoal (purchase at a pet store)
    - Seeds: small plants that like moisture (wild bird seed or grass seed should do).
    - Sharp scissors
    - Tape

- Cut top off of one of the 2-liter bottles 3” from the bottom.
- Cut top off the other 2-liter bottle 5” from the bottom.
- Take the shorter of the two soda-bottle cylinders:
- Fill it with 2 inches of gravel and charcoal.
- Then add about 3 inches of moist potting soil.
- Sprinkle seeds on top of soil.
- Add another 1” of soil on top of the seed.
- Spray the top of the soil with water until it forms puddles.
- Take the taller soda bottle and turn it upside down over the one with the soil in it.
- Slip the open end of the tall cylinder into the short cylinder and push it down until it fits tightly.
- Tape the two bottles together to form a closed system.
- Place the terrarium in a bright location. Lots of direct sunlight can “cook” your plants, so pick a bright spot that does not get a lot of direct sunlight.
- Observe the terrarium carefully. If the container is too moist, slide the top of the container off briefly to allow excess water to evaporate. If it is too dry, open and add water.
- Watch the container for at least 9 days and record all changes that you see.
- Write 3 terrarium facts daily in your Science Journal.
- Draw diagrams each day of what you observe happening in the terrarium.

Learning Experience Three

HIPPO: an acronym that stands for a list of factors identified by scientists to be the biggest threats to biodiversity. (http://www.nbii.gov)

H: Habitat Destruction
I: Invasive Species
P: Pollution
P: Population Growth
O: Over-consumption

Overview

Students participate in five activities that explore the five critical environmental factors: habitat loss, invasive species, pollution, population growth and over consumption (HIPPO). Students pose questions about the potential impacts that each factor might have on the terrarium habitats they created in the previous Learning Experience, and then create and conduct experiments, documenting and discussing the results. Students then explore the real world ramifications of their classroom experiments through discussions and journal writing.

The impact of these factors on global ecosystems is devastating. Students discover what these factors are and how they impact an ecosystem. A focus is on the fact that humans interact and impact their environment and often destabilize the natural balance that exists in all healthy ecosystems.

Evaluation

Students document the design of their experiments, their observations, and conclusions.

Teachers' Notes

- Once the terrarium habitats have become established and the plants are healthy, students can begin the experiments. It may work best to introduce HIPPO all at once and then assign students or groups of students to only one of the following labs, the results of which can be shared and observed by the class. Review the following activity descriptions before deciding how to manage this LE. It is not recommended that students use the ant colony for their studies because the impact of a study may result in the death of the ants.
- Suggestions for experimental studies:
  - H: Habitat Destruction — Add chunks of man-made material such as plastic or concrete. Also consider filtering the sun with a shade to simulate soot in the atmosphere or vary the temperature to simulate global climate change.
  - I: Invasive Species – Watch for an algae bloom or add insects or worms to the terrarium.

- P: Pollution – “Acid rain” in the form of lemon juice or vinegar can be added to the habitats. (Possibly consider using real pollutants like motor oil, household cleaning supplies like bleach or garden supplies like herbicides or pesticides; if using the latter, supervise carefully to ensure necessary safety precautions are taken).
- P: Population Growth – Watch for an algae bloom or add more seed to the environment.
- O: Over-consumption – Remove soil from the plant habitat. Remove all but one of the plants from the habitat and observe whether it can thrive on its own.

Activity One: Habitat Destruction

Teachers’ Notes: One of the biggest threats to global ecosystems is habitat destruction. As the human population soars, demand for natural resources and space increase as well. As humans claim more and more space, all of the organisms on the planet feel the pressure. In this activity, students conduct an experiment in their terrarium to simulate the loss of habitat due to human activity; followed by discussions and journal writing. The Science Lab handout that follows each activity can be adapted to meet your class’ needs.

Materials

- Healthy terrarium habitats
- Science Lab handout (following the Activity)
- Science journals
- Variety of materials such as plastic and cement that can be used to simulate human development in natural environments.

Activity

- Introduce the acronym HIPPO and explain that each of these five environmental factors impacts the survival of plant and animal habitats worldwide:

  H: Habitat Destruction
  I: Invasive Species
  P: Pollution
  P: Population Growth
  O: Over-consumption

- Tell students that they will conduct a series of experiments to study these factors.
- Pointing to the H in HIPPO, pose the question, What does the H or habitat destruction mean? Help students build an understanding of how human development and construction impact natural habitats. Possibly do some role playing or point-of-view writing in the journals for homework.

- Once the concept of habitat loss is understood, tell the students that they will design and conduct an experiment to answer the following question: How can we simulate habitat destruction in our small models and then make a prediction as to how this change will impact the system? The simple lab format below will guide the students through the steps of scientific methodology and it can easily be modified to reflect student ability and institutional formatting.

Science Lab

Name_____ Date_____

Subject: Ecology

Topic: Ecosystems and habitat destruction

Background:

Problem: How can we simulate habitat destruction and loss in our small models, and how will this change impact the Terrarium habitat?

Hypothesis (Educated guess):_____
_____
_____
_____

Materials: What do you need to successfully complete this investigation? Make a complete list below.

Procedure: A brief outline of the steps in your experiment. (Use the back if needed)
Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Observations: (What do you see?)
Day 1:
Day 2:
Day 3:
Day 4:
Day 5:
Day 6:
Day 7:

Conclusions: (What did you learn?)

Activity Two: Invasive Species

Teachers' Notes: Whether it is intentional or by accident, humans have facilitated a global epidemic of invasive species. Global trade and human ignorance have created a system where organisms are transported around the world and released into new ecosystems. Occasionally the new organism fails to thrive or assimilates with little impact, however, in countless other instances these newly introduced organisms destroy the natural balance that existed before they arrived. In this activity, students will create and conduct an experiment on their habitats that simulates the introduction of an "invasive species". Before they actually conduct the experiment make sure they spend time to develop a hypothesis as to what impact the introduced species will have. After the experiment is concluded, engage in classroom discussions and journal writing. For more information on invasive species go to (http://www.invasivespeciesinfo.gov)

Materials

- Healthy terrarium habitats
- Science Lab handout
- Science journals
- Additional water (resulting in growth of algae or mold), seeds, or insects that students hypothesize will have a negative impact on the habitat.

Activity

- Refer again to the acronym, HIPPO. Pointing to the I, pose the question, What does the I for invasive species mean? Work with students to build an understanding of how global trade facilitates the movement of foreign plants and animals (e.g., in the form of seeds or insect eggs) into habitats.
- Once the concept of invasive species is generally understood, tell the students that they will design and conduct an experiment to answer the following question. How can we simulate an invasion in our small models and then make a prediction as to how this change will impact the system? The simple Science Lab format found at the end of this activity will guide the students through the steps of scientific methodology.

Extension Activity

Students develop an educational product on invasive species. For example, students might conduct research on a selected invasive plant or animal species that has impacted their state, then design and display a "Most Wanted Invasive Species Poster" for their state.

Science Lab

Name_____ Date_____

Subject: Ecology

Topic: Ecosystems and invasive species

Background:

Problem: How can we simulate the introduction of a non-native organisms into our small models, and how will this invasion impact the Terrarium habitat?

Hypothesis (Educated guess):_____
_____
_____
_____

Materials: What do you need to successfully complete this investigation? Make a complete list below.

Procedure: A brief outline of the steps in your experiment. (Use the back if needed)
Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Observations: (What do you see?)
Day 1:
Day 2:
Day 3:
Day 4:
Day 5:
Day 6:
Day 7:

Conclusions: (What did you learn?)

Activity Three: Pollution

Teachers' Notes: The pollution produced by human activity has found its way to every corner of this earth. The introduction of harmful substances into any ecosystem will have adverse effects. However, the long-term impact of some of these chemicals is not known and despite the high, long-term costs, humans continue to produce and improperly dispose of these substances. In this activity, students will conduct an experiment in their habitats to simulate pollution.

Materials

- Healthy terrarium habitats
- Science Lab handout
- Science journals
- Lemon juice, vinegar, motor oil, bleach, pesticide or herbicide

Activity

- Refer again to HIPPO. Pointing to the first P, pose the question, What does the first P for pollution mean? What is pollution and what are some of the many forms it takes? After your initial discussions, ask the students write in journals or discuss in small groups to extend their understanding.
- When a solid understanding of pollution is achieved, tell the students that they will design and conduct an experiment to answer the following question: How can we simulate pollution in our small models and then make a prediction as to how this change will impact the system? The Science Lab format that follows will guide the students through the steps of scientific methodology.

Extension Activities

- Research the oil spill from the Exxon Valdez. Make a collage from the photographs collected.
- Research the story of the Argo Merchant.
- Make a list of what could be done to reduce oil spills.
    - Resource: Marine Spills Response Corporation
      1350 I Street NW, Suite #300
      Washington, DC 20005

Science Lab

Name_____ Date_____

Subject: Ecology

Topic: Ecosystems and pollution

Background:

Problem: How can we simulate pollution in our small models, and how will this change impact the Terrarium habitat?

Hypothesis (Educated guess):_____
_____
_____
_____

Materials: What do you need to successfully complete this investigation? Make a complete list below.

Procedure: A brief outline of the steps in your experiment. (Use the back if needed)
Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Observations: (What do you see?)
Day 1:
Day 2:
Day 3:
Day 4:
Day 5:
Day 6:
Day 7:

Conclusions: (What did you learn?)

Activity Four: Population Growth

Teachers' Notes: The unchecked population growth of any species can have a devastating effect on the ecosystem of which it is a part. However, human population growth has gone well beyond impacting a single system or habitat. Our growth as a species is one of the biggest threats facing our species' continued survival, as well as the survival of other species. Humans have already been the cause of extinction and endangerment of thousands of species worldwide. The impact of increased population may be so subtle as to go unnoticed by an individual that is part of a large system. However, your students' micro-habitats will give them the opportunity to get first-hand knowledge of the damages and dangers of over-crowding.

Materials

- Healthy terrarium habitats
- Science Lab handout
- Science journals
- Additional seed

Activity

- Reference the acronym, HIPPO, pointing to the second P. Pose the question, what does population growth mean? Why is population growth a bad thing? Can it ever be a good thing? Take the students on a photo tour of some of the world's largest cities. Help them build an understanding of human growth and expansion.
- Once the concept of population growth is understood, tell the students that they will design and conduct an experiment to answer the following question, How can we simulate population growth in small models and then make a prediction as to how this change will impact the system? The science lab handout that follows will guide the students through the steps of scientific methodology.
    - Remember that an uncontrollable algae bloom could be a great learning opportunity for this activity / experiment. Other options would be to add more seed to the terrarium.

Science Lab

Name_____ Date_____

Subject: Ecology

Topic: Ecosystems and population growth

Background:

Problem: How can we simulate a population explosion in our small models, and how will this change impact the Terrarium habitat?

Hypothesis (Educated guess):_____
_____
_____
_____

Materials: What do you need to successfully complete this investigation? Make a complete list below.

Procedure: A brief outline of the steps in your experiment. (Use the back if needed)
Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Observations: (What do you see?)
Day 1:
Day 2:
Day 3:
Day 4:
Day 5:
Day 6:
Day 7:

Conclusions: (What did you learn?)

Activity Five: Over-consumption

Teachers' Notes: "Although the United States accounts for less than 5% of the world's population, Americans consume over 25% of the world's resources. We use more natural resources and produce more waste per capita than any other nation." "**BIO-FACT:** A typical North American consumes resources equivalent to the renewable yield from 12 acres of farmland and forests. If the entire world's population consumed the same amount, we'd need four Earths' worth of productive land!" (from: http://www.nbii.org) In this final activity students participate in activities that lead them to recognize that human activities that consume excessive quantities of the Earth's natural resources have many negative consequences that impact both the balance of nature, and human needs.

Materials

- Healthy terrariums
- Science Lab handout
- Science journals
- Scoop or spoon to remove soil from the terrarium

Activity

- Refer to HIPPO, pointing to the O. Ask what it means to consume something. Then ask, What does it mean to over-consume something? Using photographs or even film, make the students aware of the fact that American consume much more than the average global citizen.
- Once the concept of over-consumption is understood, it is time to explore what effects this type of activity will have on an ecosystem. Ask the students to design and conduct an experiment to answer this question. How can we simulate over-consumption in our small models and then make a prediction as to how this change will impact the system? The Science Lab handout below will guide the students through the steps of scientific methodology.

Activity Six

- Assign as homework: Students bring in articles from magazines or newspapers (some students may need to may photocopies of articles found in the school media center) that highlight human action that has resulted in one of the five factors they have been studying, and the consequences of the action.
- Students present the news items and the class discusses the environmental impact:
    - Was this action mainly H, I, P, P, or O?
    - Could it have been prevented or avoided? Why or why not?
    - Why was it necessary for humans to have conducted actions that resulted in this harmful environmental impact? Do the reason(s) outweigh the damage to the environment? Why or why not?

Science Lab

Name_____ Date_____

Subject: Ecology

Topic: Ecosystems and over-consumption

Background:

Problem: How can we simulate habitat destruction and loss in our small models, and how will this change impact the Terrarium habitat?

Hypothesis (Educated guess):_____
_____
_____
_____

Materials: What do you need to successfully complete this investigation? Make a complete list below.

Procedure: A brief outline of the steps in your experiment. (Use the back if needed)
Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Observations: (What do you see?)
Day 1:
Day 2:
Day 3:
Day 4:
Day 5:
Day 6:
Day 7:

Conclusions: (What did you learn?)

Learning Experience Four

Culminating Activity: Making a Difference
Reduce, Recycle, Reuse

Overview

In this final Learning Experience, students participate in an activity that addresses many of the five factors from the previous learning experience. The students will undoubtedly be upset by, and concerned about the impact that humans in general and specifically they are having on their environment. In Learning Experience students are encouraged to apply their new knowledge. Students are introduced to the "3R's" (reduce, recycle, reuse), and explore how they can reduce their negative environmental impacts through a waste-free lunch activity.

Evaluation

Students create a poster that represents what they have learned about how to conserve resources when preparing a meal.

Activity One: Make a Waste-Free Lunch - The Three R's (Reduce, Recycle, Reuse)

Teachers' Notes: This activity focuses on learning how to be as waste-free as possible. It is an adaptation of the Environmental Protection Agency's Waste-Free Lunch Poster and a NASA lesson plan (http://media.nasaexplores.com/lessons/01-034/k-4_2.pdf). Students learn how to reduce, reuse, and recycle items in their school lunches. Students first investigate items that are recyclable and can be used to make a waste-free lunch. They then prepare a lunch using recyclable items instead of eating their regular school lunches. The activity concludes with students using the knowledge they have acquired to develop a Waste-Free Lunch poster that can be used to educate others.

Materials

- Chart paper and markers
- Poster paper and markers
- Letter to Parents (at end of Learning Experience)

Activity

- Introduce this Learning Experience by asking students to brainstorm ways that humans damage the natural environment. Many ideas should flow from the previous activity. Scribe students' comments, including those that may be very similar, or the same thing worded in a different way. The purpose is to begin to focus on the fact that humans have many kinds of negative interactions with the natural environment that generally can be categorized as either some form of pollution or as a way that we overuse/waste natural resources (some activities are a combination). Ask the students to name from the list the ways that fit in the latter category (waste, overuse of resources). Tell them that in the next activity—the last in this unit of study—they will investigate some of the ways that humans waste natural resources, and how we can be more conservation-minded.
- Ask students to make a list of what they usually eat for lunch, when not eating in the school cafeteria, and what kinds of snacks they eat. Students should include how the items are packaged.
- Place students in small groups to create a combined list. On a separate paper, students create two columns: column 1 = a list of what gets discarded (e.g., wrappers, bottles) and column 2 = what, if anything gets re-used or recycled. As groups finish this task, one person from each group can write their answers on the board or chart paper to create a class list. Rather than writing the same item again, students can place a check mark beside anything that has already been written into the list.
- In their groups, ask students to list how the items on the 'discarded list' can be eliminated from their lunches and snacks. Examples include:
    - Food in reusable containers
    - Whole fruits
    - Drinks in containers that can be reused, such as a thermos, or recycled, such as a can or a bottle
    - Snacks purchased in bulk and brought in reusable containers
    - Don't include: individually wrapped snacks, plastic baggies that are not reusable, disposable forks and spoons, straws.
- Each student write what she plans to either bring to school for lunch tomorrow or, if eating the school lunch, for lunch on Saturday, eliminating as much waste as possible. Students share their menus and offer suggestions.
    - Send a letter home to the parents (letter follows) ahead of time so that they understand the purpose of the activity and have time to gather supplies.
- Students work in groups to create an informational poster to hang in a classroom or hallway (obtain permission as appropriate) that educates students and staff on how to enjoy waste-free lunches and snacks.

Extension Activities

- Organize a school wide "Waste-Free Lunch" Day
- Compile sample menus to know what to pack in a waste-free lunch and distribute copies to their friends and family.

- Use a tracking chart to log how much waste they prevented by packing waste-free. This can become a class chart that is kept for a week or month.
- Take a trip to the local landfill.
- Keep a trash journal documenting every item you throw away or recycle.
- Play the bin game on the EPA's website. The Bin game is an interactive game in which students' determine whether an item is recyclable or not and if so they must place it in the appropriate bin.

http://www.epa.gov/osw/kids/games/bingame/index.html

- If your students want to continue to make a difference, or if you would like to offer extra credit opportunities, suggest that they become habitat heroes. The habitat hero program can be found on either of the following websites.

http://www.leonardodicaprio.org/kids/index.html

http://www.nationalgeographic.com/ngkids/0304/

Waste-Free Lunch Day

Dear Parents,

We are planning on having a waste-free lunch day on _____. Please help your child pack a lunch that contains no waste. Simply send all of his/her food in reusable containers, with washable utensils and napkins.

Remember:

- No paper products
- No individual throw away containers
- No plastic bags

Thank you for your help in this. It is our hope that by developing an understanding of the amount of waste we generate and the simple steps we can take to reduce this waste, we can have a major positive environmental impact. If you have any questions or concerns please feel free to contact me.

Sincerely,

NASA PDF Picnic to be inserted here Can’t find this