November 5 & 6, 2004

What Goes Around, Comes Around

The Art and Science of Recycling and Composting in the Classroom

PISGAH FOREST INSTITUTE

Brevard College
Brevard, North Carolina
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WHAT IS PFI?

The Pisgah Forest Institute (PFI) is the premier learning experience for teachers interested in bringing the forest into their classrooms. A non-profit environmental education effort, PFI was established through a cooperative effort of Brevard College, the USDA Forest Service and the Cradle of Forestry in America Interpretive Association. PFI offers science-based instruction utilizing an inquiry-based approach.

The Pisgah Forest Institute provides environmental science workshops for educators that utilize the forest as a laboratory. Our workshops integrate the elements that make up the natural environment with science and current ecological issues.

The workshop experience combines classroom and field learning opportunities designed to give the participant both subject background knowledge and the opportunity to test that knowledge. The format includes discussions and multimedia presentations in the classroom as well as extensive hands-on, inquiry-based exercises and activities in a natural setting.

PFI workshops introduce a variety of instructors, including K-12 teachers, natural resource and industry agency representatives, and college professors, all of whom bring experience and knowledge to the workshops.

The PFI Workshop Notebook is a collection of teaching materials pertinent to the workshop subject matter, as well as additional related information. The References and Resources section includes a glossary as well as a list of related books, videos, and other resources.
Jeff Brookshire, Operations Supervisor
Jeff has been Operations Supervisor for Transylvania County Solid Waste for 4 1/2 years. I’m in charge of the county’s recycling program and the Household Hazardous Waste and Electronics collection programs. Graduate of Brevard High School and have a B.S. in Wildlife Biology and Conservation from NC State.

Holly Bullman, Planning Technician Assistant
Holly Bullman is Land-of-Sky Regional Council’s Solid Waste and Brownfields Planning Technician. She joined LOSRC as an intern in September 2001 and was hired as a Planning Assistant in May 2003. Holly coordinates the activities of the Mobile Environmental Learning Center and serves as a Brownfields Team member, accomplishing various tasks associated with the Regional Brownfields Initiative. Holly is a graduate of UNC – Asheville with a Bachelor’s degree in Environmental Science. Prior to joining LOSRC, Holly worked as an environmental educator in Pisgah National Forest. She is a seven-year resident of Asheville, active gardener and backyard composter who enjoys Western North Carolina’s backyard outdoor activities and its fine varieties of music.

Heather Cosby, Operations Coordinator, PFI
Heather has been with The Pisgah Forest Institute since 2002 when she bounced off the turnip truck as it was headed from Wyoming where she served with the Bridger-Teton National Forest, Teton County Conservation District, Idaho Department of Environmental Quality, Teton County/Jackson Parks and Recreation, and the Friends of Pathways non-profit organization. A native of Utah, she studied Land Management and Environmental Interpretation at the University of Utah. She worked as a raft guide on the Snake River in Grand Teton National Park and also taught skiing and snowboarding at Grand Targhee Ski Resort where the snow is from heaven, not hoses (500 inches of annual snow). She loves being outside and playing & listening to music.

Keefe Harrison, Waste Reduction Specialist
Keefe joined Division of Pollution Prevention and Environmental Assistance in May 2003 and works to develop waste reduction educational materials for use across
the State. She has more than six years of experience in the field working both at UNC-Greensboro as the Environmental and Sustainability Manager and at NC State University as the Waste Reduction Coordinator. While working on her BA in Human Ecology and Natural Resources from UNC-Greensboro, Keefe researched bog turtles in North Carolina, tagged green sea turtles in Costa Rica, studied Scandinavian ecology in Finland, and spent a semester practicing sustainable forestry at Warren Wilson College in Asheville. She is a 2002 fellow of the North Carolina Natural Resources Leadership Institute and just finished her NC Environmental Education Certification!

**BRIAN M. ROSA, Organics Recycling Specialist**

Brian has served as Environmental Specialist/Organics Recycling Coordinator for The North Carolina Division of Pollution Prevention and Environmental Assistance since May of 2003. He brings more than 15 years of experience in the waste reduction, recycling and composting fields to bear by providing technical assistance to communities, businesses, industries, institutions and individuals, teaching them methods for recycling organic wastes into value-added products such as composts and mulches. For twelve years prior to his work with DPPEA, Brian owned and operated a waste reduction consulting, compost and vermi-composting equipment sales company.

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**Workshop Objectives**

1. To increase the participant’s level of environmental awareness by demonstrating the importance of recycling and composting.

2. To develop participants’ consciousness regarding the long-term effects of actions taken today, on the planet and on future generations.

3. To demonstrate ways of effectively teaching about recycling and composting.

4. To provide participants with effective educational materials as well as instruction for using them in the classroom.

5. To expose participants to additional local environmental education resources.
Introduction

The Law of Conservation of Matter says that matter can neither be created or destroyed, but can only be changed in form. In other words, the total mass of the material(s) before the reaction is the same as the total mass of material(s) after the reaction. In daily life, this law may not always be obvious. Many people think that once something is out of sight, it doesn't exist anymore. An example of this is trash. Whether consciously or not, many people in America have the "out of sight, out of mind" perception of trash. They throw it away in one form or another and then no longer worry or think about it.

Why Worry About Solid Waste?

Waste, garbage, trash, junk, debris and refuse are all names given to that "stuff" that is no longer of use in its current form. In contemporary society, many of the items used daily are designed for use and discard --- one way packaging and disposable items from diapers to razors to cameras define many of our consumer patterns. With the increase of disposables has come the added problem of how to get rid of all this "stuff".

The most predominant form of disposal, the licensed sanitary landfill, is a relatively new system that has been around less than three decades. One of the very real problems facing society now is the managing of dumps and fills that have been closed for a long while. Many of these are considered hazardous, though at the time of their use they were considered the "proper' disposal method.

As the issue of waste management emerges as a potential crisis, concern is being given to the appropriateness of disposal methods. The three key words are reduce, reuse, and recover before disposal.

Reduction is using fewer disposable goods; reuse is using items in their same form after their initial consumer use is past: and recovery is recapturing the material or energy value of the item at its highest point. These three words are at the center of the discussion of integrated waste management systems.

What is Integrated Waste Management?

No single solution has been identified that completely answers the question of what to do with our waste. Every community or region
has its own unique profile regarding solid waste. The composition of the waste varies depending upon such diverse variables as urbanization, commercial enterprises, manufacturing, and service sector activities. Similarly, the attitudes of people in different regions of the country and the state vary regarding waste management practice. This is often referred to as the "waste management ethic" and includes the "recycling ethic" and "litter ethic" of a community as subcategories. The diversity of communities and their waste is one reason why no single approach to waste management has been accepted as "the best" method.

Since there is no preferred method, every community must create its own "best approach" to dealing with its waste. However, all communities/districts have the same alternatives. The general strategies are listed below.

The strategy used to develop an integrated waste management system is to identify the level or levels at which the highest values of individual and collective materials can be recovered. For this reason, the list starts with reduction, which suggests using less to begin with and reusing more, thereby saving material production, resource cost, and energy. At the bottom of the list, then, is ultimate disposal—the last resting place for waste.

**Strategies for Change**

**Reduction strategies**

Reduction strategies are any approaches a community may investigate to lower the level of waste being processed. This could be a surcharge on excess bags, containers or household refuse or an incentive program for commercial/industrial reduction efforts. Reuse activities, such as a "waste exchange" program, are contributors to reduction. In any of the change strategies, public education and involvement are crucial and in the case of reduction, they are imperative. Reduction assumes the commitment and involvement of all citizens. This is why education is so essential. One of the best ways to inform citizens is by educating children, the future of communities and the world as a whole.

**Materials Recovery - Recycling**

In recycling, waste materials are processed for industrial use and then reformed into new or similar products. Recycling includes preconsumer waste such as factory cuttings or shavings as well as post-consumer waste items. Although recycling is often viewed as a resource conservation activity, it may offer greater return for many products in energy savings.
Resource Recovery - Composting

A second means of recapturing value is through the use of the natural biodegradation process. The predominant use of composting programs throughout the United States is in yard wastes. In urban areas, the composting of leaf and tree waste alone can reduce landfill dependency by twenty percent. The segregation of yard waste from other organic (biodegradable) wastes is necessary to avoid contamination of the compost which might render the mulch or end product less desirable.

Resource Recovery - Incineration

The third approach to value recapture is to incinerate waste for energy conversion. Although many combustibles are recyclable, there is often a higher total value (due to processing costs) in burning the waste for energy than in recycling. Or, as is often the case, many combustible/recyclable materials are contaminated and rendered difficult or expensive to recycle. By developing an incineration program as a component with materials recovery, furnace and processing equipment life is usually extended because glass, ferrous and non-ferrous metals are removed.

Ultimate Disposal--Landfill

The last component is ultimate disposal. Given current technology, there are residuals from the above processes and some materials that are simply not recoverable that must go somewhere. Nearly 90 percent of all waste generated ends up in landfills. The continuing development of more stringent requirements for landfills is making this ultimate disposal less environmentally offensive, but more costly. Likewise, the increasing ability to recover methane from landfills is providing a positive use for what has historically been a non-valued disposal method.

As society moves waste from ‘out-of-sight’ into the forefront of policy and issue action, it is more apparent that the mass of waste we discard annually has a multitude of valuable and recoverable materials. Essentially all ‘waste’ can be recovered because of the law of conservation of matter. Unfortunately complete recovery is not usually practical or economically feasible on a large scale. Yet there is much more that can be done on an individual or community level. At home and in the classroom, it is easier than ever to practice recycling and composting. It is our hope, that through this workshop you will learn more about the science of these practices and about their importance to resource recovery. Furthermore, you will learn how and why it is important to teach children about these processes. Not only do our re-
sources go around and come around again, but so does education. Teaching, after all, is the ultimate form recycling our most important resource... knowledge.

* Some of the information in the above article came from: http://ohioline.osu.edu/cd-fa~/Ol06.html

"What's in Our Garbage?"

Paper and Paperboard
37.5%

Yard Wastes
17.9%

Glass
6.7%

Metals
8.3%

Food Wastes
6.7%

Plastics
8.3%

Rubber, Leather, Textiles & Other
8.3%

Wood
6.3%
Workshop Lessons

What Goes Around, Comes Around

The Art and Science of Recycling and Composting in the Classroom

PISGAH FOREST INSTITUTE
Introduction
In a natural system, very little goes to waste. Everything has its place, and the cyclic processes of nature make sure that virtually every thing is utilized. This can be observed in the major roles of organisms in an ecosystem. Producers utilize energy from the Sun to convert simple inorganic molecules into organic molecules through the process of photosynthesis. Consumers then utilize that organic matter as food. Herbivores such as grasshoppers, elk, and vegetarian humans eat plants directly while carnivores, (i.e. wolves and dragonflies) kill and eat other animals. Omni-vores (i.e. rats, raccoons, most humans) eat both plants and animals. Scavengers such as turkey vultures and coyotes eat meat, but often times the meat they eat is already dead. Scavengers provide a very important role in nature of cleaning up the dead carcasses of animals who have died by accident or illness. Scavengers prevent the spreading of bacteria associated with deceased animals, also called carrion. They have special defense mechanisms to protect themselves from the bacteria. Finally, decomposers such as fungi use nonliving organic matter as a source of food. Through this process, they return the nonliving matter back into inorganic matter such as nutrients in soil, which can then be used again by plants. In this way, nature completes a perfect cycle, and nothing is wasted. While there is some heat lost in each level of a food chain, animals don’t throw out the trash in the same way humans do. In a natural system, everything is used over and over and it is this concept of recycling that has allowed nature to persist throughout time.

Nature, or at least part of nature, is a perfect example of a sustainable society. And what is a sustainable society? According to Lester Brown of the World Watch Institute, a sustainable society “is one that satisfies its needs without diminishing the prospects of future generations”. In nature, every bit of matter, with the exception of naturally occurring heat loss, is on its way to becoming something else.

If there is a part of nature that is not practicing a sustainable philosophy, it is the human race. Although we sometimes consider ourselves separate of nature, we are actually an integrated part of it. As our scientific understanding continues to develop, we realize more and more how interconnected we are to our environment. In this way, if our society is not sustainable, is it possible for our environment to be?

Raising Ecological Awareness
The Law of Conservation of Matter reminds us that energy cannot be created nor
destroyed, but only changed from one form to another. In this respect, when we think of throwing our garbage away, the reality is that there really is no ‘away’. Human beings are part of an Earth system, and our waste not only affects us, but every other organism on the planet. When our trash ends up in a landfill, the cyclic processes of nature are impacted in some ways. Becoming ecologically aware, we must realize that we are not separate from nature and learn to see the world as an integrated whole rather than a collection of separate pieces.

“Deep ecological awareness recognizes the fundamental interdependence of all phenomena and the fact that, as individuals and societies, we are all embedded in (and ultimately dependent on) the cyclical processes of nature” - Fritjof Capra

Raising our ecological awareness begins with each of us. By incorporating practices in our lives that work to sustain our environment, we are respecting our planet, setting examples for others in our communities, and moving toward becoming a more sustainable society.

Is Your Garbage Really Garbage?

Understanding deep ecology sometimes means asking deeper questions. When we buy and use a product, often times, there is an unused portion of a container or food that we don't use. Our first notion may be to throw it into the trash. However, if we take another look, there may be something we can do with that thing other than throw it ‘away’. Many types of food waste can be utilized to create compost, which can, in turn be used as a soil fertilizer. Many of the containers that our food is packaged in can be recycled.

In the last 20 - 30 years, our society has prospered economically. The United States is the wealthiest nation in the world. While many good things have come of this prosperity, we have also become less inclined to use the thriftiness that benefited former less financially well-to-do generations. During the Great Depression, people practiced the concepts of re-use, not so much with environment in mind, but because they had to. They didn’t have the financial means to waste anything. Everything that could be put to use again, was. Spare scraps of material were re-used to make quilts. Mason jars were used over and over to store food. Waste was simply not an option. To save money, everything that could be saved and re-used, was.

Today, as our sanitary landfills are beginning to fill to capacity, we realize that there really is no ‘away’ and working to recycle and re-use things is really a practice of
waste reduction, which in turn, promotes a sustainable society and healthy environment. Interestingly enough, it seems that what is good for the pocket book is also good for the environment. In his book Ectopia, author Ernest Callenbach relates the principle of the Green Triangle. The triangle consists of environment, health, and money. Callenbach relates the principle that every time you do something beneficial for one of them, you will almost inevitably do something beneficial for the other two. For example, when you decide to walk to work once a week to save on gas money, you are also doing a favor to the environment as well as getting exercise, which is great for your health. The author also relates that you could start at any point of the triangle and get the same results. The thriftiness our grandparents used can save us money, lower the amount of waste we generate, and supply us with a host of materials for new products.

**Recycling Trash for Art’s Sake!**

Taking responsibility for our trash can be an illuminating experience. Learning to look at trash as more than something to throw away can be rewarding in many ways. Often times, little scraps that go into the trash could instead be used as materials for art projects. Promoting this concept at home and in the classroom can help children think about their trash and realize that it may not always be trash!

**Why Trash?**

Solid waste materials such as scraps of material, bottle caps, jars, golf tees, old balloons, beads, and more can be utilized in the production of all types of art projects. When you re-use such materials, not only are you cutting down on waste, these materials can also be an inexpensive source for art supplies. Teaching children to look for “special art supplies” and having a receptacle in the classroom for them can promote the idea that not all trash is necessarily trash.

Marilyn Brackney’s website, *The Imagination Factory* lists several guidelines that will help to use solid waste as art materials:

1. Treat scrap materials with the same respect you give to art supplies bought at the store. What you work with is not as important as what you do with your materials.
2. Try to use new and interesting ways to make art. You're familiar with drawing and painting, but there are many other ways to create.

3. Always think about craftsmanship and neatness when making art. This is especially important when you are using trash or solid waste as art materials. Work with clean hands, take care of your equipment and work space, and look over your art to make sure it is in good shape before displaying it.

In addition, Brackney believes that by utilizing solid waste as art materials, we will decrease what is sent to the landfill, as well as the following:

- While most people think that collecting solid waste is recycling, it's only the first step in the process. Using solid waste to make art teaches kids that recycling results in the manufacture of a new product.
- Recycling to make art encourages the collection of solid waste at home, and it can help change attitudes and perceptions about the quality of recycled products, in general.
- Using solid waste as art materials saves landfill space and the energy and natural resources needed to produce virgin materials—this case, art supplies.
- Making art from solid waste saves money. This is especially important for schoolteachers and others working with limited resources. In addition, some of the materials which go to landfills are more interesting and are of better quality than those one can buy.
- Finally, reusing and recycling to make art or crafts encourages creative thinking and problem solving. Kids are challenged when they're presented with solid waste as art materials, and making something from nothing is fun!

Beautiful Bottles
By Heather Cosby
Pisgah Forest Institute

Lesson Summary
In this activity, students will convert an ordinary bottle into a beautiful and artful product they can keep stuff in, or give as a gift to a friend or relative.

Learning Objectives
Students are learning to look at trash as a resource for art supplies as well as concepts of re-use which reduces waste in our society. Building a product from recy-
cled material will strengthen these objectives.

**Competency Goals - Beginning on Page 19**

**Materials Needed**
Every student will need a glass container or jar with a lid. The teacher may opt to assign each student to bring a jar from home that has been used in the house or may collect containers for the activity. As most of the containers will be different, the teacher can promote the idea of individuality throughout the lesson.

In addition, the activity will also require a can of white spray paint, a variety of small paint brushes, and red, blue, and yellow paint (water-based acrylic paints will work great!) A spray fixative can also be utilized to protect painted surfaces. These supplies are available at most art supply or office supply stores.

Students will also need paint palettes to mix paint on (plastic lids from coffee cans or styrofoam plates which can be re-used work well). One per student is ideal.

**Time Required**
The lesson will require two periods. The first period consists of a background lesson on the importance of re-using and recycling to minimize solid waste as well as the benefits of being thrifty and utilizing solid waste materials as art supplies. The teacher will also need to either assign each student to bring a container from home or collect enough for one per person.

**Preparation of Containers**
Containers and lids should be washed well. Labels should be peeled away to leave a clean surface. “Goo-Gone”, finger nail polish remover, or other cleaning substance may need to be utilized to clean the surfaces of sticky labels.

Once containers and lids are clean, all lids may be placed on a large piece of cardboard and sprayed with white spray paint. If both the inside and outside of the lid will be painted, spray both surfaces to prepare them for the students.

The teacher may want to complete some or all of the preparation of the containers outside of class to cut down on time.

**Procedure**
Once the background information lesson is complete, and containers are properly cleaned and prepared, students may proceed by painting their lids. Utilize the color wheel to invite students to mix primary colors to make secondary colors. Some students may feel reluctant to paint (some students don’t feel that they are ‘artists’). You can reassure them by giving them creative freedom to paint whatever they
wish. Their picture may be an actual picture of something tangible or a beautiful design. Students can use the brush end or the handle end dipped in paint to created dots on their picture. Encourage individuality throughout the process, reminding them that their art is an expression of their personalities...and since no two people are exactly alike, their art will be very different from each other. Encourage students to celebrate the differences!

If students will be painting both surfaces, be sure that one side has completely dried before turning it to paint the other side. If both surfaces will be painted, you can always utilize two sessions. Once the surface(s) are completely dry, they can be sprayed with a fixative to protect them. The lids should not be washed or put in a dishwasher.

Follow-up
- Students may wish to add stickers to the container for decoration. Once the containers are finished, they can be taken home.

- Middle and High School students could research topics such as virgin production vs. recycled products. Some examples include:
  1. petroleum to plastic vs. plastic to recycled plastic
  2. bauxite to aluminum can vs. aluminum to recycled aluminum
- Have students research impacts of landfills

References

Excerpts from The Web of Life. Fritjof Capra, 1996

The Green Triangle. Ernest Callenbrach, from In Context, 1993

The Imagination Factory Website (www.kid-at-art.com)
This site has many wonderful lesson plans that utilize recycled materials...check it out!
<table>
<thead>
<tr>
<th>Grade</th>
<th>Goal</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 3.02</td>
<td>3.02 Investigate several ways in which objects can be described, sorted or classified.</td>
<td></td>
</tr>
<tr>
<td>2 3.06</td>
<td>3.06 Observe that a new material is made by combining two or more materials with properties different from the original material.</td>
<td></td>
</tr>
<tr>
<td>K 3.01</td>
<td>3.01 Observe and describe the properties of different kinds of objects (clay, wood, cloth, paper, other) and how they are used.</td>
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<tr>
<td>5 1.02</td>
<td>1.02 Identify and analyze the functions of organisms within the population of the ecosystem: Producers. Consumers. Decomposers.</td>
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<tr>
<td>5 1.07</td>
<td>1.07 Determine how materials are recycled in nature.</td>
<td></td>
</tr>
<tr>
<td>6 4.01</td>
<td>4.01a Describe the flow of energy and matter in natural systems: Energy flows through ecosystems in one direction, from the sun through producers to consumers to decomposers.</td>
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<tr>
<td>6 4.02</td>
<td>4.02 Evaluate the significant role of decomposers.</td>
<td></td>
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<tr>
<td>6 4.03</td>
<td>4.03 Examine evidence that green plants make food. Photosynthesis is a process carried on by green plants and other organisms containing chlorophyll. During photosynthesis light energy is converted into stored energy which the plant uses to carry out its life.</td>
<td></td>
</tr>
<tr>
<td>6 4.04 Cont</td>
<td>4.04b Green plants are the producers of food that is used directly or indirectly by consumers.</td>
<td></td>
</tr>
<tr>
<td>6 4.05</td>
<td>4.05 Evaluate designed systems for ability to enable growth of certain plants and animals.</td>
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<tr>
<td>6 6.07</td>
<td>6.07a Analyze the Law of Conservation of Energy: Conclude that energy cannot be created or destroyed, but only changed from one form into another.</td>
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<tr>
<td>6 7.05</td>
<td>7.05 Examine evidence that overpopulation by any species impacts the environment.</td>
<td></td>
</tr>
<tr>
<td>9-12 Biology 5.02</td>
<td>5.02 Analyze the flow of energy and the cycling of matter in the ecosystem: Relationship of the carbon cycle to photosynthesis and respiration. Trophic levels - direction and efficiency of energy transfer.</td>
<td></td>
</tr>
<tr>
<td>9-12 Biology 5.03</td>
<td>5.03 Assess human population and its impact on local ecosystems and global environments: Historic and potential changes in population. Factors associated with those changes. Climate change. Resource use. Sustainable practices/stewardship.</td>
<td></td>
</tr>
<tr>
<td>9-12 E/ES 2.06</td>
<td>2.06a Investigate and analyze the importance and impact of the economic development of earth's finite rock, mineral, soil, fossil fuel and other natural resources to society and our daily lives:</td>
<td></td>
</tr>
<tr>
<td>9-12 E/ES 2.07</td>
<td>2.07 Analyze the sources and impacts of society's use of energy. Renewable and non-renewable sources. The impact of human choices on Earth</td>
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</tbody>
</table>

**KINDERGARTEN**

**COMPETENCY GOAL 1:** The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.

**Objectives**
1.01 Use immediate environment, including family, home and surroundings, as source of ideas.
1.02 Use imagination as a source of ideas.
1.03 Understand and follow step-by-step presentation of art activities.
1.04 Begin to develop appropriate art vocabulary
1.05 Develop symbols for visual expression
1.06 Select color according to emotional appeal
1.07 Explore a variety of media
1.08 Create work that does not conform to adult standards of realism.
1.09 Select artwork they "like the best" and simply explain why.

**COMPETENCY GOAL 2:** The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard1)

**Objectives**
2.01 Become familiar with a limited number of basic art media, techniques and processes which may include:
   - Drawing - crayons, oil pastels, non-toxic markers, brushes, computers, pencils, sidewalk chalk
   - Cut paper - glue, scissors, folding, bending 3-D - clay, paper, found objects, including wood scraps
   - Printmaking - stamps, gadgets, found objects, vegetables, monoprint
   - Painting - tempera, watercolors, large brushes, sponges, finger paint
   - Ceramics - pinch, coil, found stamps.
2.02 Explore media freely.
2.03 Develop fine and gross motor control

**COMPETENCY GOAL 3:** The learner will organize the components of a work into a cohesive whole through knowledge of organizational principles of design and art elements. (National Standard 2 )

**Objectives**
3.01 Name and identify colors.
3.02 Identify primary and secondary colors.
3.03 Mix secondary colors
3.11 Use solutions that do not rely on copying or tracing others work.
3.12 Recognize others may view or interpret differently.
3.13 Use his or her own ideas and feelings when creating artwork.
3.15 Explore a variety of materials.

**COMPETENCY GOAL 5:** The learner will understand the visual arts in relation to history and cultures. (National Standard 4)

**Objectives**
5.03 Recognize that an artwork may serve functional purposes.

**COMPETENCY GOAL 6:** The learner will reflect upon and assess the characteristics and merits of their work and the work of others. (National Standard 5)

6.03 Recognize that no two people are alike; therefore, their artwork should be alike.

**COMPETENCY GOAL 8:** The learner will develop an awareness of art as an avocation and profession.

**Objectives**
8.01 Develop a positive attitude about working with art materials and the art making process.

**FIRST GRADE**

**COMPETENCY GOAL 1:** The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.
Objectives
1.01 Understand the purpose of the activity.
1.02 Uses logical sequence to complete an activity

COMPETENCY GOAL 2: The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)

Objectives
2.01 Become familiar with additional basic art media, techniques and processes which may include: fibers - papermaking and paper weaving.

COMPETENCY GOAL 3: The learner will organize the components of a work into a cohesive whole through knowledge of organizational principles of design and art elements. (National Standard 2)

Objectives
3.06 Create visual textures with basic drawing, sculpture and painting tools.

COMPETENCY GOAL 4: The learner will choose and evaluate a range of subject matter and ideas to communicate intended meaning in artworks. (National Standard 3)

Objectives
4.01 Recognize that an artist's work has certain characteristics that distinguish it from that of others.

SECOND GRADE

COMPETENCY GOAL 1: The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.

Objectives
1.01 Understand the process involved in using the media.
1.02 Plan and organize for creating art.
1.03 Develop strategies for imagining and implementing images.
1.05 Recognize that in a world of imagination there is no right or wrong, but that some solutions are better than others.

COMPETENCY GOAL 2: The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)

Objectives
2.01 Become familiar with additional art media, techniques and processes that may include: Cut paper - tape, and Printmaking - styrofoam, water soluble printing ink
2.02 Recognize specific media and processes
2.03 Express moods and feelings.

COMPETENCY GOAL 6: The learner will reflect upon and assess the characteristics and merits of their work and the work of others. (National Standard 5)

Objectives
6.01 Begin to understand that the purpose for a work of art affects how a work is made.
6.02 Find diversity in art as a natural and positive expression of individuality.
6.03 Value art that does not rely on copying or tracing others' work.

THIRD GRADE

COMPETENCY GOAL 2: The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)

Objectives
2.01 Expands control and manipulation of the media and tools which may include the following: Photography - sun prints
Drawing - chalk, fine and broad markers, colored pencils, creates a variety of lines with tip, point and side, computer and software.
Cut paper - papers, found objects, fibers, glue, sharp-edged scissors, curling, scoring and stapling, cutting a variety of single and multiple shapes.
3-D - paper mache, small hand tools.
Printmaking - cardboard
Painting - liquid acrylics, large and small brushes, computer and software.
Ceramic - coil construction, compound pinch and slab, addition, smoothing, self-created stamps.
Fibers - Knotting, small hand looms for fibers.

2.02 Explore unique properties and potential of materials.

**COMPETENCY GOAL 5:** The learner will understand the visual arts in relation to history and cultures.
(National Standard 4)
5.02 Differentiate between decorative and functional purpose in one's own artwork.

**FIFTH GRADE**

**COMPETENCY GOAL 1:** The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.

**Objectives**
1.01 Use the imagination as a source for symbolic expression.

**COMPETENCY GOAL 2:** The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)

**Objectives**
2.01 Use additional art media, techniques and processes, which may include:
Drawing - charcoal
Printmaking - easy cut, mixed media, collographs
3-D - wire
Photography - pin-hole cameras

**SIXTH GRADE**

**COMPETENCY GOAL 1:** The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.

**Objectives**
1.01 Plan and organize for creating art.
1.02 Explore strategies for imagining and implementing images.
1.03 Recognize in a world of imagination there is no right or wrong, but some solutions are better than others.

**COMPETENCY GOAL 2:** The learner will develop skills necessary for understanding and applying me-
dia, techniques, and processes. (National Standard 1)
Objectives
2.01 Recognize the unique properties of various media.

COMPETENCY GOAL 4: The learner will choose and evaluate a range of subject matter and ideas to communicate intended meaning in artworks. (National Standard 3)
Objectives
4.04 Convey meaning through original imagery that does not rely on copying, tracing, patterns or duplicated materials.

COMPETENCY GOAL 6: The learner will reflect upon and assess the characteristics and merits of their work and the work of others. (National Standard 5)
Objectives
6.03 Acknowledge and discuss how other’s work and ideas are unique expression of themselves.

SEVENTH GRADE
COMPETENCY GOAL 1: The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.
Objectives
1.01 Expand knowledge for organizing and creating art.
1.02 Develop strategies for imagining and implementing images.

COMPETENCY GOAL 2: The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)
Objectives
2.03 Learn various techniques and processes for working with each material.
2.04 Use a variety of media and techniques in an expressive manner.

COMPETENCY GOAL 4: The learner will choose and evaluate a range of subject matter and ideas to communicate intended meaning in artworks. (National Standard 3)
Objectives
4.04 Invent original imagery to convey meaning.

COMPETENCY GOAL 6: The learner will reflect upon and assess the characteristics and merits of their work and the work of others. (National Standard 5)
Objectives
6.03 Explain how other’s work and ideas as unique expression of themselves.

EIGHTH GRADE
COMPETENCY GOAL 1: The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.
Objectives
1.01 Plan and organize for unique and original solutions.

COMPETENCY GOAL 2: The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)
Objectives
2.01 Discriminate in deciding the effectiveness of various media techniques to reach an artistic solution.
2.04 Determine an original solution through expressive media techniques.

COMPETENCY GOAL 4: The learner will choose and evaluate a range of subject matter and ideas to communicate intended meaning in artworks. (National Standard 3)
Objectives
4.04 Invent original and personal imagery to convey ideas that are both personal and have meaning.

COMPETENCY GOAL 6: The learner will reflect upon and assess the characteristics and merits of their work and the work of others. (National Standard 5)
Objectives
6.03 Interpret how a given work of art expresses the uniqueness of the individual artist.

NINTH – TWELVTH GRADE
COMPETENCY GOAL 1: The learner will develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing art.
Objectives
1.01 Plan and organize for creating art.

COMPETENCY GOAL 2: The learner will develop skills necessary for understanding and applying media, techniques, and processes. (National Standard 1)
Objectives
2.01 Explore and discuss unique properties and potential of art materials.
2.02 Demonstrate techniques and processes for working with each art material.

COMPETENCY GOAL 4: The learner will choose and evaluate a range of subject matter and ideas to communicate intended meaning in artworks. (National Standard 3)
Objectives
4.03 Invent original and personal imagery to convey meaning and not rely on copying, tracing, patterns or duplicated materials.

COMPETENCY GOAL 6: The learner will reflect upon and assess the characteristics and merits of their work and the work of others. (National Standard 5)
Objectives
6.03 Accept other’s work and ideas as unique expression of themselves.
What’s in My Trash Can?
(From KAB Waste in Place Handbook and Waste Reduction Curriculum)

Lesson Summary

*What’s in My Trash Can* is a fun way to get students thinking about what typically goes in the trash can and what can be diverted from the waste stream. This lesson exposes them to the concepts: Reduce, Reuse, Recycle and Composting and enhances critical thinking skills through identifying ways trash can be reduced, reused, recycled or composted.

Learning Objectives

Students will be able to:
- Identify items disposed in household trash
- Categorize and classify items into material type
- Describe ways to reduce, reuse, or recycle these items.

Competency Goals:

(see attached Curriculum Guide on page 29)

Method

Students will brainstorm items in their trash cans, illustrate them, and categorize them according to material type.

Materials

A large sheet of paper or bulletin board, index cards made from the backs of reused office paper, and four large cards with the words “REDUCE” “REUSE” “RECYCLE” and “COMPOST” on them. Masking tape or some form of temporary adhesive.

Procedure

Before class, copy the “What’s in Our Garbage” Statistics and place on a trash-can looking drawing in proportion on a large piece of paper. (on page 10). I’ve laminated a large piece of regular paper and that’s worked well. Also, put the words “reduce” “reuse” “recycle” and “compost” each on a sheet of paper. Be creative so
that the cards have pictures or something to help kids remember the definitions and distinctions of the words.

Lead a discussion with your students about the waste that each family throws out every day. List these items on one sheet or go ahead and hand out the index cards made from reused office paper to each student (about 3-5 per student, depending on the size of the group).

Show the students the Trash Can diagram. Discuss with them the different categories of waste found on the trash can: paper, yard waste, glass, metals, food waste, plastics, and other ("Other" includes things that don’t fit neatly into any of the listed categories, such as tires, wood, clothes, old furniture, etc. “Paper” includes cardboard and “Metals” includes aluminum and steel.

Have the students take turns and place their index cards with trash items on the appropriate part of the diagram that the item is classified under. For example, magazines would be “paper” and plastic forks would be “plastic.” Continue until all “trash” has been “thrown away.”

Lead a discussion with the students about the concepts Reduce, reuse, recycle, and compost, give examples of each. Tell them we will be finding if there are ways to reduce, reuse, recycle, and compost each item in our “trash can.”

Have a volunteer count the total number of pieces of trash in the can.

Place the Reduce, Reuse, Recycle, and Compost cards in front of the poster board to serve as “piles.” Also place a trash can nearby.

Introduce the game: a student will come up to the board and remove a piece of trash, explain how it could be reused, recycled, composted, or avoided as trash in the first place (reduced) and then put the trash card beside the Reduce, Reuse, Recycle or Compost cards. If it can’t be any of these (like tissues for example) put in the trash can.

Before the students do so, also teach the song to go along with the game.

To the tune of “99 Bottles,” “Trash in the Can”

23 Pieces of trash in the can,
23 pieces of trash
Take one out,
Then you can SHOUT!
22 pieces of trash in the can!! (and so on...)
Assessment
Have the students list the major categories of waste in their trash at home, and cite examples of each. Ask them what is the one comment from this lesson they will tell mom and dad.

Follow-up
Challenge students to go home and take a 5-second pause every time they go to the trash can to think, “Can I reuse this, recycle this, compost it, or was there a way I could've avoided creating this waste in the first place?” (“reduce” examples to mention are tissues or paper towels: if a student used a bandana, old cut up towel, or cloth rag as a tissue instead, would they be throwing that away? No! Could throw it in with laundry and use it again!) Ask the students the next week what they were able to reduce, reuse, recycle or compost at home or if their typical trash can contents decreased or increased.

Vocabulary

Reduce: to lessen the amount of waste generated and thus waste disposed; source reduction
Reuse: to extend the life of an item by using it again as it is, repairing it, or creating new uses for it
Recycle: a resource recovery method involving the collection and processing of a waste product for use as a raw material in the manufacture of the same or another product (e.g. turning aluminum cans into new aluminum cans or plastic bottles into plastic decking) *A quick note – the recycling logo is also known as “chasing arrows.” Each of the three arrows refers to the recycling process: collection, processing, and manufacturing into a new product.
Compost: a mixture of decomposing organic matter (e.g. food waste, leaves, lawn clippings, etc) under aerobic (presence of oxygen) conditions where organic waste materials are transformed into soil amendments such as humus or mulch. A.k.a. - “Nature’s way of recycling”
Decompose: to break down into basic components
Waste: useless or unwanted materials that are discarded in an appropriate trash receptacle. A.k.a – Trash.
Mobile Environmental Learning Center (MELC)

Land-of-Sky Regional Council, area solid waste officials, NC Cooperative Extension Service agents, and others have designed and built the Mobile Environmental Learning Center which addresses the need for source reduction education, increased participation in the existing recycling programs, and increased awareness of household hazardous waste issues. The center has a wide variety of hands-on and take home educational materials for both children and adults. The hands-on exhibits educate on the issues of waste reduction/reuse/recycle, county specific programs, and HHW.

The Mobile Environmental Learning Center is utilized by four counties through a demographically equal sharing process. The scheduling is maintained by Land-of-Sky. This allows each county to reach an equal percentage of their population within both the "school year tour" and "summer tour."

**MELC FEATURES!!!**

- Exciting Exterior Murals
- "Assignment-Planet Earth" Display (the intro. theme)
- "Life of Litter" Display
- "Environmental Impact" Display
- "Interactive Doors" Display
- "Operation Clean Up" Display (What's Recyclable)
- TV/Video Display
- "Closing The Loop" Display (Products Made from Recycled Materials Display Featuring Elaine (the mannequin))
- "Let It Rot" Display (Composting)
- "Recycling Process" Display
- "Use It Again" Display
- "Hazardous Home" Display

Quiz-boards on:
- Household Hazardous Waste Alternatives, -What Recyclables are made into, -The difference between Precycle, Reduce, Reuse, Recycle, & Buy Recycled.

What's Recyclable in Your County

Teacher Support Materials and Resources

Precycle, Reduce, Reuse, Recycle, & Buy Recycled Definitions

Climate Control

Handicap Access
Curriculum Guide to teaching Recycling and Utilizing the Mobile Environmental Learning Center

**Grade Level Requirements Related to MELC:** Concepts taught in MELC are highlighted in blue – refer to the Educator’s Guide pages for direct reference. Throughout the lessons, teachers can weave the individual’s role in garbage generation: everyone creates trash and therefore has an impact on environmental quality.

**First:**
COMPETENCY GOAL 1: The learner will build an understanding of the needs of living organisms. Teacher relates needs of organisms (natural resources) to needs for CLEAN air, water, soil.

**Second:**
COMPETENCY GOAL 1: The learner will build an understanding of plant and animal life cycles. Teacher can illustrate life cycles of plants and turning back into soil – composting.

COMPETENCY GOAL 3: The learner will build an understanding of changes in
properties. Teachers can illustrate concepts of change in properties with the de-
composition and breakdown of materials, including litter.

**Third:**
COMPETENCY GOAL 2: The learner will build an understanding of soil concepts.
2.04 - Evaluate composting to show how plant and animal material can be broken
down to form soil.

**Fourth:**
COMPETENCY GOAL 4: The learner will build an understanding of technological de-
signs.
4.02 - Observe the many tools that are based on designs found in nature. Landfill-
ing and wasting resources is not a design of resource use based on nature. Nature
reuses everything!
4.05 - Assess the natural resources necessary to construct machines and tools.
Conservation of natural resources is essential to fulfill our tool and machine needs.

**Fifth:**
COMPETENCY GOAL 1: The learner will build an understanding of the interde-
pendence of plants and animals. Everything on Earth is interconnected.

**Sixth:**
COMPETENCY GOAL 1: The learner will build an understanding of the lithosphere.
1.03 - Evaluate ways in which human activities have affected Earth’s pedosphere
and the measures taken to control the impact: land use. Anatomy of Landfill illus-
trates one impact humans make in order to dispose of trash.

**Seventh:**
COMPETENCY GOAL 1: The learner will build an understanding of the atmosphere.
1.04 - Evaluate human impact on the atmosphere. Burning Trash has a negative
impact on air quality.

**Eighth:**
COMPETENCY GOAL 1: The learner will build an understanding of the
hydrosphere.
1.04 - Assess human impact on water quality.
COMPETENCY GOAL 2: The learner will build an understanding of population dy-
namics.
2.01 - Evaluate data related to population growth, along with problems and solu-
tions: Waste disposal.
2.02 - Conclude that some ecosystem resources are finite. Resource Conservation is a concept taught throughout the MELC.
2.04 - Analyze practices that affect the use, availability, and management of natural resources: Land use, Urban growth. Recycling improves the availability of resources also a method to manage natural resources.

9-12:
COMPETENCY GOAL 1: The learner will build an understanding of lithospheric materials, processes, changes, and uses with concerns for good stewardship.

1.03 Assess the importance of the economic development of earth’s finite rock, mineral, fossil fuel and other natural resources to society and our daily lives:
   - Availability.
   - Geographic distribution.
   - Wise use.
   - Conservation.
   - Recycling.

1.04 Analyze the importance of soils:
   - Soil use and conservation.

COMPETENCY GOAL 4: The learner will build an understanding of the hydrosphere and its interactions and influences on the lithosphere, the atmosphere, and environmental quality.

4.02 Evaluate water beneath the earth’s surface:
   - Storage and movement.
   - Environmental impact of a growing human population.
   - Impact of building and development.
   - Causes of natural and manmade contamination.

COMPETENCY GOAL 5: The learner will build an understanding of the dynamics and composition of the atmosphere and its local and global processes influencing climate and air quality.

5.07 Analyze the effects of human activity on the environment and the influence of issues on weather and climate.

COMPETENCY GOAL 7: The learner will build an understanding of
alternative choices facing human societies in their stewardship of the earth.

7.01 Analyze the relationship between the potential of technology to improve the quality of life and the possible causes of stress on the environment.
7.02 Analyze the interdependence of Earth’s natural resources and systems, including land, air, and water, with the need to support human activity and reduce environmental impacts.
7.03 Assess how society weighs the choices of economic progress, population growth and environmental stewardship and selects a balanced responsible course of action.
Additional Lessons

The following lessons pertain to information taught in the workshop, and we feel they may be of further use to you in your classroom. You can add more lessons to this notebook as you find ones you like!
Can We Make It Go Away
(From The Curry School of Education, University of Virginia)

GRADE LEVELS: 4-6

SUBJECT AREAS: science, math

CONCEPT: We can never make something into nothing.

OBJECTIVE: to help us to realize that we cannot make things go away. They are always there, just in a different form.

MATERIALS:

Experiment #1: apple; pot of moist soil

Experiment #2: 3 steel cans; can opener

Experiment #3: water; powdered lemonade; glass and spoon

Experiment #4: nurses' scale, person

Experiment #5: newspaper; metal tweezers or tongs; bunson burner or matches; metal bucket or other fireproof container; bucket of water

KEYWORDS: solution, compact, dissolve

BACKGROUND: Once something is created, it may change form, size, shape, chemistry, or appearance, but we can never make it go away. We try to make unwanted items such as garbage go away, but we will see that although they may disappear in one form, they will still be there.

PROCEDURE:

Experiment #1:

- Fill a pot or other container with soil, and weigh it.
- Cut 1/2 of an apple and weigh it.
- Bury the apple in the soil (It is gone.)
- Weigh pot with soil and apple.
• **Question:** Did the apple go away? *(No, it is just out of sight.)*

**Experiment #2:**

• Weigh 3 steel cans.

• Cut the tops and bottoms off and then flatten the cans.

• Weigh the cans again.

• **Questions:** Did the cans go away? *(No, they're just smaller.)* Did they lose weight? *(No, they just changed shape.)*

**Experiment #3: Can we make the powdered lemonade disappear?**

• Take a pitcher of water and weigh it.

• Measure out and weigh enough powder to make a pitcher of lemonade.

• Dissolve the powder into the liquid and stir until it disappears.

• Weigh the pitcher of lemonade and compare to the weight of the pitcher of water.

• **Question:** Did the powder go away? *(The powder is gone, but you can see from the increased weight of the lemonade compared with plain water that the ingredients in the powder are still there, but now in a dissolved form.)*

**Experiment #4: If we drink the lemonade, will it disappear?**

• Weigh a person on the nurse's scale.

• Weigh a large empty glass, then fill with lemonade and weigh again.

• Weigh a person, have them drink the glass of lemonade, then weigh them again.

• **Question:** Did the person's weight change? *(Yes, the person is now heavier because the weight of the lemonade has been added to their own weight.)*

**Experiment #5: If we burn something, does it go away?**

• *NOTE: Be very careful when working with a flame. The teacher may want to demonstrate this experiment.*
• Weigh a piece of newspaper.

• Hold the newspaper with tongs or tweezers.

• Outside, or in a well-ventilated place, light the paper and let it burn. Have a bucket of water on hand in case of emergency. Drop the flaming paper into a metal bucket or other fireproof container.

• Collect all of the ash and weigh it.

• **Questions:** Did the paper go away? *(Yes, but not really. The elements in the paper changed form -- some went up in smoke and others stayed behind in the ash.)* Did the weight change? Why? *(The weight decreased because we didn't measure what went up in smoke.)*

**FOLLOW-UP:**

• Discuss the idea of making things go away. Where is away? We can never get rid of anything completely, we can just change it from one form to another.

• Discuss how this relates to cleaning up the environment. For example, we can reduce the need for landfills by incinerating our wastes. But, incineration causes air pollution. When we remove pollutants from the smoke, we clean up the air, but we are still left with the pollutants to get rid of as solid or liquid wastes. Also, the ashes that are left behind must still be safely disposed of.

This lesson can be accessed on the following site:
http://curry.edschool.virginia.edu/class/edis/590s4/Miller/Can_We_Make_It_Go_Away.htm
## Curriculum Correlation Guide for the “Can We Make It Go Away” Activity.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Goal</th>
<th>Objective</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>1.04</td>
<td>1.04 Explain and discuss how humans and other animals can adapt their behavior to live in changing habitats. In Follow Up, discuss how expanding landfills can affect habitats and human living conditions.</td>
</tr>
<tr>
<td>5</td>
<td>1.06</td>
<td>1.06 Explain and evaluate some ways that humans affect ecosystems. Habitat reduction due to development. Pollutants. Increased nutrients. In Follow Up, discuss habitat reduction, pollutants imposed by landfills.</td>
</tr>
<tr>
<td>5</td>
<td>1.07</td>
<td>1.07 Determine how materials are recycled in nature. In Follow Up, discuss how our systems of disposal don’t follow nature’s example, whereas reusing/recycling make more sense in view of natural systems.</td>
</tr>
<tr>
<td>6</td>
<td>1.01</td>
<td>1.01 Identify and create questions and hypotheses that can be answered through scientific investigations.</td>
</tr>
<tr>
<td>6</td>
<td>1.02</td>
<td>1.02 Develop appropriate experimental procedures for: Given questions. Student generated questions.</td>
</tr>
<tr>
<td>6</td>
<td>1.03</td>
<td>1.03 Apply safety procedures in the laboratory and in field studies: Recognize potential hazards. Manipulate materials and equipment. Conduct appropriate procedures.</td>
</tr>
<tr>
<td>6</td>
<td>1.05</td>
<td>1.05 Analyze evidence to: Explain observations. Make inferences and predictions. Develop the relationship between evidence and explanation.</td>
</tr>
<tr>
<td>6</td>
<td>1.08</td>
<td>1.08 Use oral and written language to: Communicate findings. Defend conclusions of scientific investigations.</td>
</tr>
<tr>
<td>6</td>
<td>4.01</td>
<td>4.01a Describe the flow of energy and matter in natural systems: Energy flows through ecosystems in one direction, from the sun through producers to consumers to decomposers. Matter (trash) does not disappear, but can change form.</td>
</tr>
<tr>
<td>6</td>
<td>7.05</td>
<td>7.05 Examine evidence that overpopulation by any species impacts the environment. Draw the correlation between increasing population and expanding landfills.</td>
</tr>
</tbody>
</table>
Solid Waste Lesson Plans
*Adapted from Indian Department of Environmental Management (IDEM)

Grade Level
3-7, can be easily adapted for older grades

Main Ideas
- 80% of generated waste is taken to an underground garbage dump known as a landfill.
- There are different types of landfills depending on the type of waste created, but most household trash is taken to a Municipal Solid Waste Landfill.
- Landfills have many rules and regulations and must be monitored by men and women that work for IDEM.
- Construction of a landfill is a complicated process that involves compliance with regulated standards and the cooperation of many people.

Objectives
To teach students about solid waste and landfills using a combination of information, demonstrations, and a fun food activity.

Materials Needed
1. Pre-made "Garbage pizza"
2. 1 pre-made pie crust per 10 students
3. 4 pudding cups per 10 students
4. 1 bottle of chocolate syrup
5. 1 bag of licorice twists
6. 1 bag of Tootsie Rolls®
7. 1 bag of M&Ms®
8. 1 bag of Oreo® cookies
9. 1 container of green sprinkles

Teacher Preparation
*For use when a teacher is giving the presentation on his or her own*

Overview
This presentation is designed to help students better understand where their trash actually goes when it is taken away. It also explains how landfills are regulated and constructed.

Materials Needed
*The following items should be gathered before beginning the presentation:
Lesson & Activities

A.  Introduction

*When a person says that the garbage truck took the garbage away just think, where really is "AWAY?" Does it disappear, or do we put it somewhere?*

Out of 100% total garbage waste, only 20% is either incinerated (burned), composted (made into material that is used to enrich the soil), or recycled (made into other usable material). This is a combined percentage. The other 80% of generated waste is put into landfills.

Activity # 1

Garbage Pizza

*A demonstration for the entire class.*

**Purpose:** To show students what's in a landfill using percentages, math, and fun props.

**Materials:** Pre-made "Garbage pizza", Waste Category Percentage Sheet: "What's in My Trash Can".

**Instructions:**

Ask the students to think about what makes up our garbage while revealing to them the categories of trash that are most common (glass, metal, hazardous waste, etc.). Have them rank the materials from most to least abundant and then reveal to them the true percentages using the pre-cut pizza pieces that correspond.

**Discussion/ Follow-up:** Discuss with these students how the actual percentages
compare to what they had guessed. Also be sure to note how much of the waste stream is recyclable.

B. Solid Waste Landfills

- After our trash is taken away, it is driven to a landfill or a waste transfer station.
- A landfill is an underground garbage dump for which specific rules and regulations are written.
- There are two main types of landfills. One type is called a solid waste landfill. Solid waste includes garbage, construction debris, commercial refuse, sludge from water supply or waste treatment plants, or air pollution control facilities, and other discarded materials.
- Some examples of solid waste that go into a typical municipal landfill are paper, yard waste (trimmings, leaves, etc.), metals, food, glass, wood, plastics, and other miscellaneous items. Biodegradable materials may decompose over many years, while non-degradable materials, such as glass and most plastics, remain at the site.

C. Hazardous Waste Disposal

- The second main landfill type is for Hazardous Wastes.
- Hazardous Waste is any type of solid, liquid, or gas that is harmful to the environment or to humans. Most hazardous waste comes from manufacturers who use chemicals to create their products. This leftover material can be hazardous and must be disposed of in a proper manner. Only specifically designed and permitted landfills may take Hazardous Waste, as it can be toxic, corrosive, or explosive.

D. Environmental Monitoring/Regulating and Career opportunities

- The two main tools that IDEM uses to safeguard the public from improper waste disposal are permitting and inspecting landfills.

- Before IDEM will allow (give a permit) someone to build a landfill there are many different things that must be checked out by IDEM's technical experts and scientists. First of all, the landfill operators must be trained and certified so they may begin using their landfill. Secondly, the landfill must be constructed correctly. Finally, once the landfill is in place and begins to function, IDEM then has to inspect it to make sure that it is being run properly.

Many people who work at IDEM have jobs related to this. A few of them are as follows:
1. **Permit Writer/Manager** – Review landfill applications for correct information and try to gather all of the information the State needs to make its decision on the siting of the landfill. They get information from IDEM staff who read the application, talk to the person who wants to build the landfill, talk to neighbors who live close to the landfill site and hold a public hearing. Then, the permit manager writes the permit from all the information that was gathered. Sometimes permit managers have to go to court to tell the judge how they made their decision. Permit managers talk to a lot of people about the landfill to help them make the decision about the proper and protective construction of the landfill, they write up the decision and then they help explain the decision in the form of a permit.

2. **Geologist** – Look at the ground where the landfill is to be placed to make sure the landfill is constructed in such a way that the lakes and streams and underground water are protected. Since landfills are built like giant ziploc bags and we don't want them to leak, landfill operators must install monitoring wells around the landfill to check if it is leaking. Geologists review the installation of monitoring wells for proper placement and construction to be sure that contaminants are not leaking from the landfill.

3. **Engineer** – Review the plans to build a landfill (construction designs) to make sure that rules are followed such as having proper liners installed with the proper type and thickness and leachate (drainage liquid) collections system design so that waste materials cannot escape and possibly leak into groundwater or streams.

4. **Chemist** – Help review the permits for landfills. They look at test results of the wastes to see what is going into the landfill. They look at test results of the groundwater underneath the landfill to see if anything is leaking from the landfill and contaminating the groundwater. Chemists look at if the samples are taken correctly, they look to see if the laboratory tested the samples correctly, and then they help interpret the results to make sure that the landfill is operating correctly.

5. **Inspector** – Make sure that the rules are being obeyed and the landfill is operating properly. Some of the things that inspectors look for are:

   - Are the right wastes (allowable) being placed into the landfill? (Different wastes are placed into different types of landfills)
   - Are only solids being placed in the landfill? (Liquids should not be placed into landfills.)
   - Are wastes being managed properly, covered, not blowing around, etc.? (This will keep down the rodent, insect and bird problems at the landfill)
   - Is the liner being installed properly? (As the landfill is used, it is divided into
cells and each cell is lined and sealed.

- Are the filled areas of the landfill closed and covered with clay and soil and is that cover vegetated to prevent erosion?
- Is access to the site being controlled?
- Are the wells around the landfill being tested to check if the landfill is leaking into the ground and groundwater?
- Checking compliance with specific permit issues.

E. Construction of a Landfill

Note: Use handouts/transparencies on landfill construction

As you can see, many people are involved in the process of correctly constructing a solid waste landfill. This is because from bottom to top, there are many steps involved in creating a working landfill.

You can think of a landfill's design as a big sandwich, with lots of layers.

**Solid Waste Landfills** - Starting from the bottom, 3 feet of clay and a plastic liner (in combination are called a composite liner) are used to reduce seepage of contaminated fluids (leachate) into the soil and groundwater. Next you will find the leachate collection pipes that collect liquids from the garbage in the landfill. Then 12 inches of sand or gravel is added so that the leachate can drain into the pipes. After this, a first layer of 8-10 foot deep compacted garbage is added, and at the end of each day, 6 inches of soil, shredded tires, compost, sludge, or wood chips is added to prevent the landfill from giving off really bad odors. More soil is added between each additional layer of garbage until the landfill becomes full. Once the landfill is full, the top must be covered with a 12 inch drainage layer to vent off the methane gas that is naturally produced through the decomposition of garbage. Next, 24 inches of soil is added, and then a plastic liner is placed on top to cap it off. Then another 12 inches of gravel or sand is added (this is to allow water to drain through). And then a final 24 inches of a protective layer, which consists of soil and vegetation (grass, etc.).

**Hazardous Waste Landfills** - The basic structure is similar to that of a solid waste landfill, but varies slightly due to the nature of waste disposed of. For instance, all hazardous waste landfills are constructed using double liners (clay and flexible membrane). They also have liquid management systems including leachate collection and removal, leak detection, and surface water collection systems. It is also very important that hazardous waste landfills have extremely strong closure systems after they are full, including flexible membrane caps, gas control, and more.
Activity #2
Edible Landfill...An activity for the entire class

Purpose: To teach students about the composition of a typical landfill by making an edible model.

Materials:
- 1 pre-made pie crust per 10 students
- 4 pudding cups per 10 students
- 1 bottle of chocolate syrup
- 1 bag of licorice twists
- 1 bag of Tootsie Rolls®
- 1 bag of M&Ms®
- 1 bag of Oreo® cookies
- 1 container of green sprinkles

Instructions:
- The pie shell represents the clay-lined hole that begins the process.
- To protect the groundwater, the clay is lined with plastic. Have students cover the crust with chocolate syrup or topping to represent plastic.
- Explain that the leachate ("garbage juice" produced from rain and moisture percolating through in the landfill) accumulates at the bottom of the hole, but can't get through the plastic and clay. Therefore, pipes are placed at the bottom to collect and pump leachate to the surface where it is handled as a Hazardous Waste. Have students place licorice twists horizontally along the bottom to represent the pipes.
- Next, explain to students how decomposing garbage produces methane gas, which must be collected or burned to prevent air pollution and possible explosions. Pipes are placed throughout the landfill to vent the methane to the surface where it can be collected. Set Tootsie Rolls vertically throughout the pie-crust to represent the methane collection pipes.
- Now have the students make the garbage! Combine the pudding with M&Ms and dump it on top of the landfill. The M&M colors usually bleed into the pudding creating a messy-looking garbage dump.
- Now a thick layer or topsoil is placed over the garbage. Have students crunch up Oreo cookies and sprinkle crumbs on top to represent this.
- Remind the students that once a landfill has reached its capacity for garbage, additional measures are taken to "close" the site in a safe manner. Another plastic liner (more chocolate syrup) is placed over the entire area to prevent water leaking into the site and producing excess leachate. Chocolate syrup should now cover the top of the garbage.
- The last part of the landfill is the grass that is placed on top. Have the students put green sprinkles as "landscaping" on top.
Discussion/ Follow-up: After students have constructed their edible landfills, spoon it into bowls and eat! Discuss with them the different parts of the landfill and re-emphasize the different careers at IDEM that work closely with each part.

F. Conclusion: What can we do?

- Everyone can help in the effort to slow the usage of our natural resources simply by becoming aware of the amount of trash being produced and making an attempt to reduce it. Waste reduction slows the depletion of natural resources and reduces pollution associated with the extraction of raw materials and the manufacture of products.
- A few simple ways to go about reducing solid waste are:
  - If you take your lunch to school, make it "garbage free." Take your sandwich and drink in reusable containers. Avoid using throwaway containers.
  - When shopping, take cloth or string bags with you to avoid the need for paper or plastic bags. Before you buy something, notice how the product is packaged. Is all the packaging needed? Can it be reused or recycled? Choose products with little or no packaging or those that have reusable or recyclable packaging. If it will become trash, avoid it.
  - Another way you can help save the Earth is through recycling. Recycling helps keep valuable resources like metal, glass, paper and plastic out of the trash. If recyclable resources are collected properly, they can be made into useful things that we all need and want.

Taking It Further

IDEM's presentations are designed to suit both the environmental scientist with no experience in the classroom and the experienced educator who wants to give his or her students a fresh learning experience.

However, there are a few things that the trained teacher can offer that are not possible to replicate in a short presentation. This section provides that teacher with additional activities that can be used in place of or in addition to the ones in the lesson.

Additional Activity

Biorreactor Landfill
An activity for grades 6-12

Purpose: To extend the concepts introduced in the "Edible Landfill" activity into a productive activity for older children in grades 6-12
**Materials:** paper, writing utensil

**Instructions:** Once the students understand the basics about how a traditional landfill ("dry tomb" landfill) works (anaerobic decomposition, no oxygen present to allow bioreaction to occur), challenge the students to become engineers and design a "bioreactor" or "wet landfill" that utilizes aerobic bioreactions (oxygen is present) to essentially speed up the degradation of the waste.

**Discussion/Follow up:** Have the students present their inventions, one at a time. Have the class vote on the best design and lead discussion on what makes its design the most functional. Use the diagram of a bioreactor to explain to the class what a real design looks like.

This lesson can be accessed on the following site:
http://www.in.gov/idem/enviroed/lessonplans/solidwaste_part1.doc
Lesson Summary: This compost experiment examines three different methods of composting: regular, vermi-, and enhanced. Comparing and contrasting these methods allows for a better understanding of composting processes. This also demonstrates how each method, while similar, may have different end results.

Learning Objectives:
- to learn how to compost
- to increase environmental awareness regarding waste
- to learn about decomposition and nutrient cycling and their role in ecology
- to reduce the organic waste stream and divert waste from the landfill
- to create nutrient-rich soil
- to compare different compost methods

Grades:
Ideally this lesson is geared towards grades 6-12. However, it can be adapted for younger students. For example, some of the measurements such as weight and temperature could be omitted with a focus more on observation of decomposition over a period of weeks, as well as observations of worm behavior.

Competency Goals:
The following student learning objectives are based on the National Science Education Standards from the National Research Council, 1996.
Abilities necessary to do scientific inquiry.
Understanding about scientific inquiry.
Organisms in their environment.
Matter, energy, and organization in living systems.
Behavior of organisms.
Changes in environments
Natural Resources
Science as a human endeavor

Materials:
3 translucent, plastic (Tupperware) compost bins (6x9x17 inches each) with opaque lids, and 1/8 in. holes in sides and bottom (approximately 3 inches apart); Collection bins (any type of air-tight bin with lid); 10 ft of 1 in. chicken-wire (3 ft tall); 4 stakes (3 ft tall); Shredded office paper (bedding); Soil from average environment (i.e. not an extreme environment such as a construction site or farm); Soil thermometer; Air thermometer; Compostable materials (see list on page 50); Red worms- amount depends on amount of compostable materials (estimates vary, but
a good rule of thumb is one pound of worms for every pound of food waste per week.); Compost Maker concentrate; Hanging scale; Webbing or rope; Trowel; Data sheets; Pebbles.

**Time Required:**
- 1 week prior to start, begin food collection
- 1-2 days to gather materials, build enclosure, and start bins
- Once started, project can be maintained for as long as desired

**Procedure/Activity:**
1. Begin collecting food wastes in collection bins one week before starting experiment.
2. Chose a location for bins, preferably in a place that will not receive direct sunlight. The bins should sit at least 6-12 inches apart.
3. Spread out pebbles in area where bins will sit. This facilitates drainage from bins.
4. Set-up enclosure surrounding area where bins will be, using chicken wire and stakes, primarily in order to prevent pests (such as dogs) and/or people from tampering with piles. The enclosure should be at least 6-12 inches from bins.
5. Put layer of shredded paper on bottom of each bin.
6. Put layer of soil (approximately 2 inches thick) on top of paper.
7. Put layer of food waste (approximately 2 inches thick) on top of soil.
8. Label bins #1-3
9. Add water (enough to make all materials moist, but not dripping wet) to bins #1 and 3.
10. Add enhancer mix (follow directions on box and data sheets) to bin #2.
11. Add appropriate amount of red worms to bin #3, based on how much food wastes will be collected each week.
12. Mix materials in each bin
13. Record appropriate data on datasheet for each bin, every time materials are added. (Use data sheets at the end of this lesson plan)
14. Continue adding materials to each bin (same amount to each bin unless otherwise needed) 1-2 times a week, indefinitely. Add concentrate to bin #2 as directed. Add water to all bins as needed. Continue observing worms (making sure a viable population is still present). For troubleshooting use the Composting Made Easy brochure or other sources from the internet.
15. Anytime between 2-6 months, depending on circumstances, compost should be ‘finished’. The finished compost will be dark, crumbly humus, with an ‘earthy’ smell.

*The picture on page 47 shows the bins in their enclosure. This is not necessary, but does reduce risk of disturbance by both humans and animals.*
Assessments:
1. Define: recyclable, biodegradable, decomposition, compost, nutrient cycling.
   List items that are recyclable and/or biodegradable. Discuss: Are there recycla-
   ble materials that aren't biodegradable? (e.g., aluminum.) Are there biodegrad-
   able materials that aren't recyclable? (e.g. food scraps).
2. Feel, smell, and look at the food scraps, worms, and compost. What words
   would you use to describe these materials? List these words. Do the words have
   positive and/or negative connotations? Why?
3. Explain what is happening to the rotting material. Discuss: What is the natural
   process that breaks biodegradable material into particles that can be used again
   by plants and animals? (decomposition) What organisms assist in this decompo-
   sition process? (fungi, bacteria, earthworms, springtails, mites, etc.) Take a look
   under a microscope to find out what you cannot see with the naked eye. What
   will the rotting material finally become? (humus)
4. Imagine a world where decomposition doesn't take place. Discuss: What would
   happen to organic materials like dead animals, leaves or sewage? Could plants
   and animals survive if decomposition didn't occur? Why or why not? Is decom-
   position important? Why?
5. List items you throw away that are biodegradable. Discuss: How might you and
   your family recycle these materials? What is composting? Why do you think peo-
   ple compost household organic wastes?
6. Which compost method (which bin) composted the most material the fastest
   (based on changes in weight)? Or was there any difference? Why might this be?
   What types of people (ie, farmers, teachers, home gardeners) might use the
   various methods?
7. What are some benefits of composting household food and yard wastes? For ex-
   ample:
8. Doesn't require the purchase of expensive plastic bags often used for disposing
   household and yard wastes.
   • Saves the cost of transporting wastes to, and handling wastes at the landfill
     or incinerator.
   • Reduces pollution from landfill (leachate and methane gas) or incinerator.
   • Creates nutrient-rich humus you can use to improve the texture of your yard
     and garden soil, also continuing nutrient cycling; saves money you might
     spend on mulch.
9. What are some possible problems with composting? What suggestions do you
   have for solving the problems? For example:
   • It's too much work. (Mowing the lawn and washing the car are work, too, but
     we choose to do these activities because they're satisfying - so is compost-
     ing! And composting has a positive impact on the environment, which can
     make us feel good.)
   • You'd have to run outside every time you eat an apple or peel a potato. (Just
place the scraps into a plastic container with a lid. Keep the container in or under the kitchen sink, then take the waste to the compost pile whenever the container is full.)

- There's not enough space. (Share a compost pile with neighbors or other classes, and encourage the school and town to collect and compost yard wastes from people who don't have enough space for a compost pile of their own).

**Follow-Up:** Try growing a few beans or other seeds in pots, some filled with sand and others filled with a mixture of sand and compost. Compare how well the seedlings grow. Discuss the plants' need for nutrients and water. Sand is a poor nutrient source and does not store water. When compost is mixed in, both of these needs are better met. Gardeners can similarly enrich their gardens using compost.

**Citations/References:**
Composting Made Easy. Public Information Office, Environmental Education, City of Richland, WA.
Paydirt in Your Backyard. NCDPPEA.
aggie-horticulture.tamu.edu/extension/compostfacility/les12.htm
aggie-horticulture.tamu.edu/extension/compostfacility/les14.htm
aggie-horticulture.tamu.edu/extension/compostfacility/worm1.htm
benton-franklin.wsu.edu/garden/CWLESSONPLAN.htm
www.cityfarmer.org/compmod.html#module
www.cityfarmer.org/wormgloss82.html#wormgloss

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<th>WHAT CAN YOU COMPOST???</th>
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Compost Pile #1. Control Plot (no additives)

Initial Container Description:

Materials used to start:

Location of Bin:

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<th>Date</th>
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<th>Air Temp. (°F)</th>
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<th>Total weight (lbs) of bin after all today's material (not including water)</th>
<th>Types of material added today</th>
<th>Water added today (oz.)</th>
<th>Observations/Notes</th>
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Compost Pile # 2. "Compost Maker" Additive

Initial Container Description:

Materials used to start:

Location of Bin:

Directions for "Compost Maker": Dissolve 1 tablespoon per gallon of water. Saturate each 6-9" layer of mixed material. Repeat every 10 days to two weeks.

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<th>Date</th>
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<th>Air Temp. (°F)</th>
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<th>Total lbs. of material added to date</th>
<th>Total weight (lbs) of bin after all today's material (not including water)</th>
<th>Types of material added today</th>
<th>Water added today (&quot; as amount of enhancer added)</th>
<th>Observations/Notes</th>
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Compost Pile # 3 Vermiculture

Initial Container Description:

Materials used to start:

Location of Bin:

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<th>Date</th>
<th>Time</th>
<th>Air Temp. (°F)</th>
<th>Temp. (°F)</th>
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<th>Types of material added today</th>
<th>Water added today (oz.)</th>
<th>Observations/Notes</th>
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</table>
OBJECTIVES: The students will
1. calculate pounds of garbage produced by person, family, and city.
2. make a bird feeder out of waste materials.

MATERIALS NEEDED:
Materials for bird feeders (see Procedure section)

PROCEDURE:
This is an activity that focuses attention on the concepts of recycling and "backyard" wildlife management. Urban living concentrates many types of pollutants. One of these is garbage. Tons and tons of waste materials go into incinerators (which pollute the air in most cases) or sanitary landfills (which creates the problem of space needed for such disposal). A great deal of our economy is based on excessive packaging and "throw away" products. This is extremely wasteful of our dwindling natural resources.

In natural ecosystems, raw materials are recycled. Minerals are used over and over again in an endless cycle of becoming plant matter, being eaten by the animals, and decaying into the soil only to be picked up by plants again.

Humankind needs to take a lesson from this ecological process. We will ultimately be forced to recycle because we are rapidly depleting, world wide, the available resources. The resources of our biosphere are limited and ultimately the garbage dumps of today will become the "treasure houses" of tomorrow.

Activity A: Calculating Garbage
Discuss with the students the problem with solid waste. Ask the students to calculate the following:

1) Using the average of 4.1 pounds of waste per person per day, calculate the pounds of waste produced by one single person per year. (4.1 x 352)

2) Calculate the amount of waste produced by your family per day. (number of family members x 4.1)

3) Calculate the pounds of waste per family per week. (answer to #2 x 7)

4) Calculate the pounds of waste per family per year. (answer to #3 x 52)

5) Calculate the pounds of waste for your city (or county) per year. (4.1 x population x 352)

After completing the calculation, have the students discuss what is done with waste materials in their community. Introduce the concept of recycling.
Activity B: Recycle for Birds

As a means of helping them recycle, have the students study the suggestions from the list that follows. Let each student decide which type of bird feeder they would like to make.

1) **Milk carton feeder**: 1 milk carton, 1 paper clip, 2 round head fasteners (or a stapler to staple the top of the milk carton), pocket knife

2) **Detergent bottle feeder**: 1 coat hanger, 1 plastic detergent bottle, pocket knife.

3) **Log feeder**: 4 dead branches (2" thick), 10" long nails (about 4), 1 piece of discarded window screen about 12" x 12", 2 coat hangers, 8 carpet tacks

4) **Onion sock feeder**: 1 onion sock, 1 coat hanger

5) **Coffee can feeder**: 1 coffee can with bottom cut out, 2 plastic lids to fill can, 1 piece of string 2' long

6) **Bleach bottle feeder**: 1 bleach bottle, 1 coat hanger, pocket knife

7) **Pie plate feeder**: 1 large aluminum pie plate, 1 smaller aluminum pie plate, 1 peanut butter jar lid, piece of old broom handle about 8" long, 1 pickle jar lid, 1 roofing nail, 1 coat hanger, 1 eye screw

8) **Peanut butter stick feeder**: 1 dead branch 2-3" thick and about 16" long, 6-8 bottle caps, 6-8 carpet tacks, 1 eye screw

9) **Milk bottle feeder**: 1 plastic gallon milk jug, pocket knife, 1 coat hanger


**SUBMITTED BY**: Doug Ratledge

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**EDUCATION THAT CANNOT WAIT!**

This activity from Great Beginnings in Environmental Education; Field Tested Activities for Teachers

*Compiled by the Tennessee Environmental Education Association*
**Curriculum Correlation Guide for the Garbage To Bird Feeders Activity.**

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<td>1.08 Use oral and written language to: Communicate findings. Defend conclusions of scientific investigations. Describe strengths and weaknesses of claims, arguments, and/or data</td>
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The Commons Game

"Why should I take the long way around? The shortcut across the grass will only be my few footprints!"

**Background:** What's the 'commons problem'?—that individuals may benefit from abuse of common land, air, water, and natural resources, but the environmental costs of the resulting degradation are shared by the community.

When the Earth's population was low, the above problems did not exist because the environment could renew itself. It could replace the clear-cut forest areas and clean the streams and the air by natural recycling. In increasing areas of the world, the limits of natural recycling have been exceeded. **Human restraint is necessary for the environment to recover.**

**Focus Questions:**
How can we call our students' attention to the above problems?
How can we help them to become citizens who care about the environment?

**Objectives:**
To show students the detrimental effects of selfish use of the environment.
To have students understand the benefits of self-restraint without moralizing to them.

**Materials:** (for each group) Tokens, such as poker chips, milk jug lids, or large beans (at least 3 per person in the group). A container to hold the tokens.

**Activity:** The game: divide group into smaller groups of approximately 15 people each. Put 45 tokens in a container for each group. Have the groups sit in a circle with the leaders holding the container of tokens. Give the participants the following rules very carefully. **Allow time for questions and answers because participants will NOT be allowed to talk to each other during the game.** [Note: There will be a second game; instructions below.]

**Rules/Script:**

A. The tokens belong to all of you. They're valuable in that > whenever you collect eight tokens, you are a winner.
B. Everyone may, by choice, take one to three tokens per round.
C. The game is a series of rounds. The round is over when the container is passed all the way around the circle and back to the leader, OR whenever the commons container is empty, whichever comes first.
D. At the end of each round, the leader will add an equal amount of tokens to the amount left in the commons container. The total amount of tokens in the container may not be greater than the original 45.
E. Participants are NOT to discuss the game once it begins.

**Method:** Allow the containers to be passed around the circle(s). If at the end of Round 1, the 'commons' is empty, observe that there are no more tokens to count, and that there can be no replacement. Also observe that there are no winners since no one could have more than three tokens. If the commons container has tokens in it for additional rounds, replace the tokens in equal amounts without discussion, except to let the group know the total number each round. When someone gets eight chips (possible only after 3 rounds), merely observe that 'There is a winner (or winners)." Continue game until commons can is empty. [NOTE: It is possible that the group will understand the principle and will have all winners within a reasonable number of rounds. It is more probably that the commons can will be empty in a short time.]
SECOND GAME: Tell participants that this time, the game will be played with the same rules, but that they will be allowed to talk to each other! Tell them that there is a way for EVERYONE to be a winner. See if a more cooperative strategy can be generated based on self-restraint. Play until all are winners or the 'commons' is depleted.

Conclusion:
1) Develop in a discussion how, in the long run, more can benefit if the individual restrains from taking too much, and what attitude is needed among individual members to achieve the goal of the greatest benefit for all.

2) Make a parallel between the tokens and a forest (or fish in the ocean, or pasture land, a water supply, etc.) Explain how allowing nature a chance to replenish the renewable natural resource would make everyone, including future generations, winners.

3) Point out how some who take more than their share deprive others. Ask for comments about whether communicating with each other in the second game influenced the outcome. Were participants willing to listen to each other and think out the process? Draw analogies to our position as environmentally concerned citizens as being so important in convincing students of the dangers of depletion of resources.

4) End by saying, "I think you know that what we have just experienced is more than a game."

Extension: An analogy can also be made between the run on the chips and the depletion of the Earth's non-renewable resources. Unrestrained use of oil, minerals and metals now will mean earlier exhaustion and lower quality of life for future generations.

The Commons Game is adapted from Thinking Globally and Acting Locally: Environmental Education Teaching Activities; Mann and Stapp, ed. ERIC—Clearinghouse for Science, Mathematics and Environmental Education, The Ohio State University, College of Education, 1200 Chambers Rd., Third Floor, Columbus, Ohio.
### Curriculum Correlation Guide for “The Commons” Activity.

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<td>5 Science 1.06</td>
<td>1: The learner will conduct investigations to build an understanding of the interdependence of plants and animals.</td>
<td>1.06 Explain and evaluate some ways that humans affect ecosystems. Habitat reduction due to development. Pollut- ants. Increased nutrients. Discuss how resource extraction (mining, logging, drilling, etc.) impacts habitats; emissions related to resource extraction.</td>
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<td>5 Science 1.07</td>
<td></td>
<td>1.07 Determine how materials are recycled in nature. Dis- cuss: with over population, the limits of natural recycling have been exceeded in many areas of the world.</td>
</tr>
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<td>5 Science 2.07</td>
<td>2: The learner will make observations and conduct investigations to build an understand- ing of landforms.</td>
<td>2.07 Discuss and analyze how humans influence erosion and deposition in local communities, including school grounds, as a result of: Clearing land. Planting vegetation. Building dams. Discuss how resource extraction also influences erosion.</td>
</tr>
<tr>
<td>6 Science 3.06</td>
<td>3: The learner will build an understanding of the geological cycles, forces, processes, and agents which shape the lithosphere.</td>
<td>3.06 Evaluate ways in which human activities have affected Earth’s pedosphere and the measures taken to control the impact: Vegetative cover. Agriculture. Land use. Nutrient balance. Soil as a vector. Discuss resource extraction as a land use.</td>
</tr>
<tr>
<td>9-12 Biology 5.03</td>
<td>5: The learner will develop an understanding of the ecological relationships among organ- isms.</td>
<td>5.03 Assess human population and its impact on local eco- systems and global environments: Historic and potential changes in population. Factors associated with those changes. Climate change. Resource use. Sustainable prac- tices/stewardship. As part of discussion</td>
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<td>9-12 E/ ES 2.06</td>
<td>2: The learner will build an understanding of lithospheric materials, tectonic processes, and the human and environmental impacts of natural and human-induced changes in the lithosphere.</td>
<td>2.06a Investigate and analyze the importance and impact of the economic development of earth’s finite rock, mineral, soil, fossil fuel and other natural resources to society and our daily lives: As part of discussion</td>
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<td>9-12 E/ ES 2.07</td>
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<td>2.07 Analyze the sources and impacts of society’s use of energy. Renewable and non-renewable sources. The impact of human choices on Earth and its systems. As part of discussion</td>
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Think Before You Toss

Activity E.t
Grades 4 - 6

OBJECTIVES: To offer students alternatives to throwing everything "away."

To generate discussion about renewable, non-renewable, reusable, and recyclable resources

MATERIALS: For each team:
- 5 steel cans labeled compost, household hazardous waste, landfill, recycle, reuse
- A ziploc bag with cardboard strips or popsicle sticks, each one labeled with an item that might be thrown in the trash (see list on following pages for suggestions).

TIME: 20 - 30 minutes

PROCEDURE:
Give each team of four or five students a set of labeled cans and a ziploc bag of "trash." Have them sort the "trash" into the receptacles, discussing their decisions as they sort. Allow 10 - 15 minutes for this part of the activity. At the end of this time, check what each group has in its landfill. Do the groups have similar items? Why or why not?

These labels may be copied, cut out, and glued or taped on steel cans or plastic (not glass) jars.

REUSE      HOUSEHOLD      HAZARDOUS WASTE
RECYCLE    COMPOST       LANDFILL

These labels may be copied onto paper, cut out, and glued on cardboard strips or popsicle sticks. You may wish to color-code the back of each set of strips or sticks to ensure that sets do not get mixed up.
Ideas to use for “trash”.
Copy and cut these words out to use in Ziploc bags as trash.

Half-used spiral notebook
Spoiled hamburger meat
Chicken bones
Bag of cotton T-shirts
Used cat litter
Peach pits
Old business cards
Plastic milk jug
Aluminum soda can
Lamp oil bottle
Broken plastic fork
Steel wool pad
Corn husks
Drain-opener can
Used file folders
Moldy cottage cheese
Worn-out car tires
Broken weed eater
Broken clear drinking glass
Bacon grease
Dried cheese
Juice box
Used disposable diaper
Cereal box
Styrofoam fast-food box
Newspapers
Transistor battery
Spray can of furniture polish
Sock -- hole in toe
Paperback book
Half-used coloring book
Torn poster
Apple core
Leftover macaroni and cheese
Walnut shells
Grass cuttings
Cardboard frozen juice container
Bleach bottle
Rubber band
Brown glass medicine bottle
Egg shells
Potato peelings
Plastic soda bottle
Glass baby food jar
Used cotton swabs
Steel vegetable can
Deflated leather football
Coffee grounds
Paper, printed on one side
Waxed milk carton
Brown glass bottle
Nearly empty pesticide can
Broken watch
Broken lawn mower
2-inch pencil stub
Large box of costume jewelry
Notebooks with old material
Fast food restaurant paper sack
Plastic grocery bag
Computer paper used on one side
Plastic petroleum jelly jar
Paper, written on both sides
Old, broken bicycle
Clock -- alarm doesn't work
Corrugated cardboard box
Brown paper grocery bag
Plastic shampoo bottle
Hamster cage paper and droppings

Cracked plastic soap dispenser
Half-full bottle of cedar oil wood polish
Plastic window cleaner bottle
Small amount of dry oil paint in a can
Aerosol spray starch can
5-year-old English grammar textbook
Lamp without an electric cord
10-year-old computer -- works fine
Green glass drink bottle
Broken washing machine
Cracked ceramic coffee mug
Old lunch box (plastic)
Styrofoam packaging
Broken cassette tape
Shoes that are too small
Doll, slightly worn
Bead necklace with broken clasp
Small amount of wet oil paint in a can
Spilled baking soda
Old jeans-- too small, worn at knees
Banana peel
Cardboard box
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References and Resources

What Goes Around, Comes Around

The Art and Science of Recycling and Composting in the Classroom

PISGAH FOREST INSTITUTE
**Glossary**

**Aeration**
Getting oxygen into the compost by mixing or turning.

**Aerobic**
Requires oxygen. Aerobic conditions in a compost bin are desirable. Aerobic organisms use oxygen to carry out their life functions. Because oxygen is present, the bin will not smell.

**Anaerobic**
Does not require oxygen. Under anaerobic conditions, a compost bin will smell. Anaerobic organisms can grow without the presence of oxygen.

**Bedding**
Materials like newspaper and leaves used as an organic medium for worm composting.

**Browns**
Carbon rich compostable materials. Usually dry as well.

**Cocoon**
Worm eggs or egg cases, they can carry from 2 to 20 worms.

**Compost**
The end result of the composting process or the process itself. Compost is a dark, rich soil conditioner known as humus which has been created through the biological reduction of organic material.

**Composter**
container; usually a bin or box used for composting.

**Compost Tea**
Water in which finished compost has been 'steeped' to concoct a liquid fertilizer for plants.

**Compostable Materials**
Organic materials that will break down in a compost bin.

**(Compost) Critters**
Micro and macro-organisms that live in the soil and help break down organic matter.

**Composting**
The biochemical process which occurs when organic matter is broken down by de-
composer organisms into a nutrient rich soil conditioner called humus.

**Decay**
To rot, break down or decompose.

**Decompose**
To break down into basic components.

**Decomposition**
The process of breaking down organic matter into its basic elements including nutrients needed for plant growth. Decomposition occurs in nature and in controlled environments like compost bins.

**Ecosystem**
A mutually dependent system consisting of plant, animal life and inorganic matter.

**Fertilizer**
A substance (natural or man-made) used to enrich the soil and to provide food for plants.

**Food Scraps**
In the Compost Module, food scraps generally refer to uncooked fruit and vegetable scraps or any compostable food materials.

**Greens**
Nitrogen rich compost materials (usually wet).

**Heap**
An unenclosed compost pile.

**Humus**
Finished compost, formed through the break down of plants and animal matter. Humus retains and slowly releases nutrients to plants.

**Leachate**
Liquid that has been generated by solid waste decomposition and which has extracted, dissolved or suspended materials in it. The leachate from a compost bin or worm bin is full of nutrients and is an excellent liquid fertilizer.

**Leaf Mold**
Decomposed or mostly decomposed leaves.

**Macro-organisms**
Organisms that are visible to the eye.
**Microorganisms**  
Organisms that cannot be seen without magnification.

**Mulch**  
A layer of partially decomposed plant materials placed on top of garden beds and around plants and shrubs.

**Organic Matter**  
Any organic material that is or once was living or was once produced by a living organism.

**Overload**  
To put too much food into a worm bin that can be processed aerobically.

**Red Worm**  
A variety of earthworm suitable for vermicomposting. The Red Wiggler is a red worm.

**Recycle**  
A resource recovery method involving the collection and processing of a waste product for use as a raw material in the manufacture of the same or another product (e.g. turning aluminum cans into new aluminum cans or plastic bottles into plastic decking) *A quick note - the recycling logo is also known as “chasing arrows.” Each of the three arrows refers to the recycling process: collection, processing, and manufacturing into a new product.*

**Reduce**  
To lessen the amount of waste generated and thus waste disposed; source reduction.

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

**Rodent Resistant**  
Compost bins designed or modified in such a way as to deter pests from making a home in the bin.

**Screening**  
To sift out uncomposted matter from humus to create a fine compost.

**Soil**  
Tiny rocks, sand, silt, clay plus decomposers plus organic matter.
Soil Conditioner
Something that enriches the physical condition of soil and increases its organic content.

Vermicompost
To carry out composting with worms or the end product from composting with worms. Vermicompost contains worm castings, broken down organic matter, bedding, worm cocoons, worms and other organisms.

Vermicomposter
A worm bin or person who composes with worms.

Vermicomposting
Composting with worms.

Vermiculture
Worm farming or raising earthworms.

Waste
Useless or unwanted materials that are discarded in an appropriate trash receptacle. A.k.a – Trash.

Worm Bin
A container especially prepared for worms to live in and eat organic garbage. A vermicomposting system.

Worm Castings
Worm manure or worm 'poop'

Wet Garbage
Usually refers to food scraps, grass clippings and garden waste; compostable, organic materials.

*Some terms taken from the Worm Words Glossary for Teachers, from The Compost Module Copyright (C) 1991
Additional Websites

RECYCLING

Aluminum Beverage Cans: The ABCs of Recycling and Curriculum Guides:
http://www.cancentral.com/canc/abc.htm

American Plastics Council www.americanplasticscouncil.org/ (go to Classroom)

America Recycles Day: Find out about ARD and find out about events going on in your area:
http://www.americarecyclesday.org/home.html

Carolina Recycling Association : www.cra-recycle.org/

Crayon Recycle Program: http://crp3.tripod.com

EPA's Office of Solid Waste - Home Page : www.epa.gov/osw/

Earth Day Activities: http://www.planetpals.com/earthday.html


Recycling Activities: http://www.gcrio.edu/elementary/recyclegames.html

***Recycle Guys (Educational Outreach from the Division of Pollution Prevention and Environmental Assistance): www.recycleguys.org

Recycle City: http://bonuslycos.com/bonus/card/recycle_city.html

Recycle It! Craft Projects & Useful Things...: www.makestuff.com/recycle.html


Recycle Video Games: http://recycle-video-games.com/

Recycler's World: http://www.recycle.net/

Welcome to NAPCOR -- The National Association for Plastic Container Resources :
http://www.napcor.com/

ENVIRONMENTAL

100 Green Actions from a "Green Status" School:
http://www.greenschools.ca/seeds/GR100/GR100Hillsb.html

Division of Pollution Prevention and Environmental Assistance –Meet the Recycle Guys:
http://www.p2pays.org/recycleguys


Envirofacts Warehouse Homepage : http://www.epa.gov/enviro/index_java.html

Fat Earth—All things environmental : www.fatearth.net/browse/recycling/education/

MELC's web page: [www.landofsky.org/wastemanagement/MELC/default.htm](http://www.landofsky.org/wastemanagement/MELC/default.htm)

NC DENR Home Page: [http://www.enr.state.nc.us/](http://www.enr.state.nc.us/)

North Carolina Environmental Education: [http://www.ee.enr.state.nc.us/](http://www.ee.enr.state.nc.us/)


United States Environmental Protection Agency: [http://www.epa.gov/kids](http://www.epa.gov/kids)

To order EPA literature **free of charge** (50 maximum allowed at a time) for your students call **1-800-424-9346** and select option 3. The following are recommended resources that are carried in MELC:

- **530-K-98-002** Case of Broken Loop: Activity Guide for Grades 4-6
- **530-K-95-005** Don’t Trash It! Super Fun
- **530-K-99-006** Planet Protectors Create Less Waste in the First Place: A Story about Reuse on Earth
- **530-K-98-001** Follow that Trail!: Activity Guide for Grades K-3


**COMPOSTING**


Carolinas Composting Council: [http://www.cra-recycle.org/cccindex.htm](http://www.cra-recycle.org/cccindex.htm)

Composting for Elementary School Teachers:
[http://www.msstate.edu/dept/geosciences/CT/TIG/WEBSITES/RESEARCH/Mary_Schaefer/](http://www.msstate.edu/dept/geosciences/CT/TIG/WEBSITES/RESEARCH/Mary_Schaefer/)

The Worm Guide: A Vermicomposting Guide for Teachers
[www.ciwmb.ca.gov/Schools/Curriculum/Worms/](http://www.ciwmb.ca.gov/Schools/Curriculum/Worms/)

*And always be sure to check the Pisgah Forest Institute’s Website for information about upcoming workshops, and visit our message board!* 

[www.brevard.edu/pfi](http://www.brevard.edu/pfi)