Environmental Problem Solvers

Developed by: *Sarah Alessio Shea*

Subjects: Science, Environment, Ecology
Estimated Time: 10 sessions over 2-4 weeks
Grade Level: 6-8

About This Lesson Plan:

The Environmental Problem Solvers Curriculum will educate middle school students about regional environmental issues and show them practical applications for how to make an impact on regional environmental issues. Students will learn about household toxins, watersheds and water quality, and waste management. They will utilize this information to develop tools and projects that help the local environment such as installing rain barrels or recycling signage at their school. They will take their knowledge and present their projects to their classmates.

About Pennsylvania Resources Council:

PRC is Pennsylvania's oldest grassroots environmental organization. Since 1939 we have worked to protect the Commonwealth's resources for future generations through environmental education, recycling and waste diversion programs, anti-litter campaigns and much more. Navigate the pages below to find more about PRC's history and current projects and programs.

Pro Tips:

This lesson plan invites students to look closely at how small steps at home can make a global environmental impact. Consider using elements of this lesson plan to help your students investigate similar issues and find new ways to engage in your community. What environmental issues are especially pressing in your community? What community partners might be help your students with their research? Who might be willing to help your students showcase their work and spread the word about their insights?

These materials were developed as part of the Share & Spread Connected Learning Collection, organized by The Sprout Fund with the generous support of the MacArthur Foundation.

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Lesson Plan

Lesson 1 (Intro to Unit: Regional Environmental Issues)

Students will be introduced to local/regional environmental issues and how people can make positive impacts. Teachers can choose from a variety of issues to focus on.

Examples:

- **Discuss Earth Awareness.** Create a KWL chart on ways to make our planet better and cleaner. Ask students to what topic they would like to learn more about (air pollution, humans and the environment, recycling, water supply, etc)
- Protecting Our Planet: http://www.discoveryeducation.com/teachers/free-lesson-plans/protecting-our-planet.cfm

Lesson 2-7 (Background Knowledge)

Students will learn background information on Natural Resources, Recycling, Composting, Watersheds, and Environmental Health or whichever topics the teacher chooses. Through these lessons, students will get a grasp on the value of conserving our natural resources and ways they can make changes in their lives to improve the quality of their environment.

Hands-on activities include:

- Waste Audit of specific classrooms, cafeteria, etc.
- Watershed Extension Activities
- Materials from EWG on Greener School Cleaning Supplies: Research and Guide

Lesson 8-9 (Final Project)

With the final project students will take the background knowledge gained from previous lesson and utilize this to develop a project to make a positive impact on a local environmental issue. This could be through implementing a program such as recycling or composting in a classroom or schoolwide, or creating an education campaign for students on non toxic products, and more.

The teacher will review topics discussed and ask students to imagine and generate some project ideas based on these topics (see attached document for examples). Once a list of ideas have been generated, the instructor will guide students to pick which topic/idea they are most interested in. Students will be grouped together with students with shared project interests.

The teacher will give students a work day to develop their project ideas and sketch out a plan for what they will do, how they will do it, and why (ie what is the need for their project).

Each group will get review time with the teacher to fine tune their project ideas.

Students will receive a selected number of class periods to work on their project. Teacher feedback will be key throughout to ensure students are on the right track and have needed materials (computer access, hard supplies, etc) to complete their idea.

Lesson 10 (Final Project Presentations)

Students will present their final project/idea/campaign to their fellow classmates over the course of one to two class periods. Students will be responsible for explaining to their classmates why they chose the project/idea they did, what impact the project could have on their community or school, and how it will positively impact the environment. After each presentation, students in the classroom will give a written response highlighting what they think were the strengths and the weaknesses of each presentation (See Student Presentation Feedback Form for example). These will be collected by the teacher and reviewed with all students on the final day.

Standards, Knowledge, Skills, and Understandings

Content Standards

- Next Generation Science Standards
    - MS-ESS3 Earth and Human Activity
    - ESS3.A: Natural Resources
    - ESS3.C: Human Impacts on Earth Systems
    - MS-ESS2-4 Earth's Systems

Standards for each lesson:

- **Lesson 1 (Introduction):**
    - 4.5.8.A Explain how Best Management Practices (BMP) can be used to mitigate environmental problems.
    - 4.5.8.C Describe how humans can reduce pollution.
- **Lesson 2 (Natural Resources):**
    - 4.3.7.A Explain how products are derived from natural resources.
- **Lesson 3 (Landfills and Solid Waste)**
    - 3.4.7.B2 Explain how decisions to develop and use technologies may be influenced by environmental and economic concerns.
- **Lesson 4-5 (Recycling & Composting)**
    - 4.1.6.D Explain the costs and benefits of recycling in controlling resource use.
- **Lesson 6 (Watersheds)**
    - 4.2.6.C Identify natural and human-made factors that affect water quality.
    - 4.2.7.A Explain how water enters, moves through, and leaves a watershed.
    - 4.2.7.B Explain the primary functions of a wetland within a watershed.
- **Lesson 7 (Environmental Health)**
    - 4.3.7 A Identify environmental health issue
    - 10.1.6 C Analyze nutritional concepts that impact health.
    - 10.1.6 E Identify health problems that can occur throughout life and describe ways to prevent them.
    - 10.2.6 A Explain the relationship between personal health practices and individual well-being.
    - 10.2.6 B Explain the relationship between health-related information and consumer choices.
    - 10.2.6 D Describe and apply the steps of a decision-making process to health and safety issues.
    - 10.2.6 E Analyze environmental factors that impact health

Understandings

- **Overarching Understandings**
    - Students can make an impact on local and regional environmental issues by starting in their schools and own communities.
- **Related Misconceptions**
    - Students may believe that one person cannot make a difference. This curriculum's goal is to show them that one person can make a lasting sustainable difference or change in their school or community through promoting positive environmental change

Topical Understandings

- Lesson one (Introduction): Students will be introduced to national environmental issue to engage them in how local people can make an impact on larger scale issues.
- Lesson two (Natural Resources): Students will be able to identify the five basic categories of natural resources and how they are used in everyday lift.
- Lesson three (Landfills and Solid Waste): Students will identify the four parts of the waste streams, identify parts of a landfill and problems caused by them. Students will be able to do a home audit of their waste as take home assignment.
- Lesson Four/Five (Recycling & Composting): Students will learn about "Closing the Loop" and the importance of completing the recycling process. Students will also be able to identify materials that can be easily composted as well as how the system of composting works.
- Lesson Six (Watersheds): Students will be able to identify the parts of the hydrologic cycle, define "watershed", and have an awareness of how human behavior impacts the quality and quantity of water.
- Lesson Seven (Environmental Health): Students will understand the links between the environment, personal behavior and human health/cancer. Students will be able to list some of the environmental hazards presented by personal care products, cleaning products, lawn and garden care products, second-hand smoke, the production of electricity, and industrial pollutants.

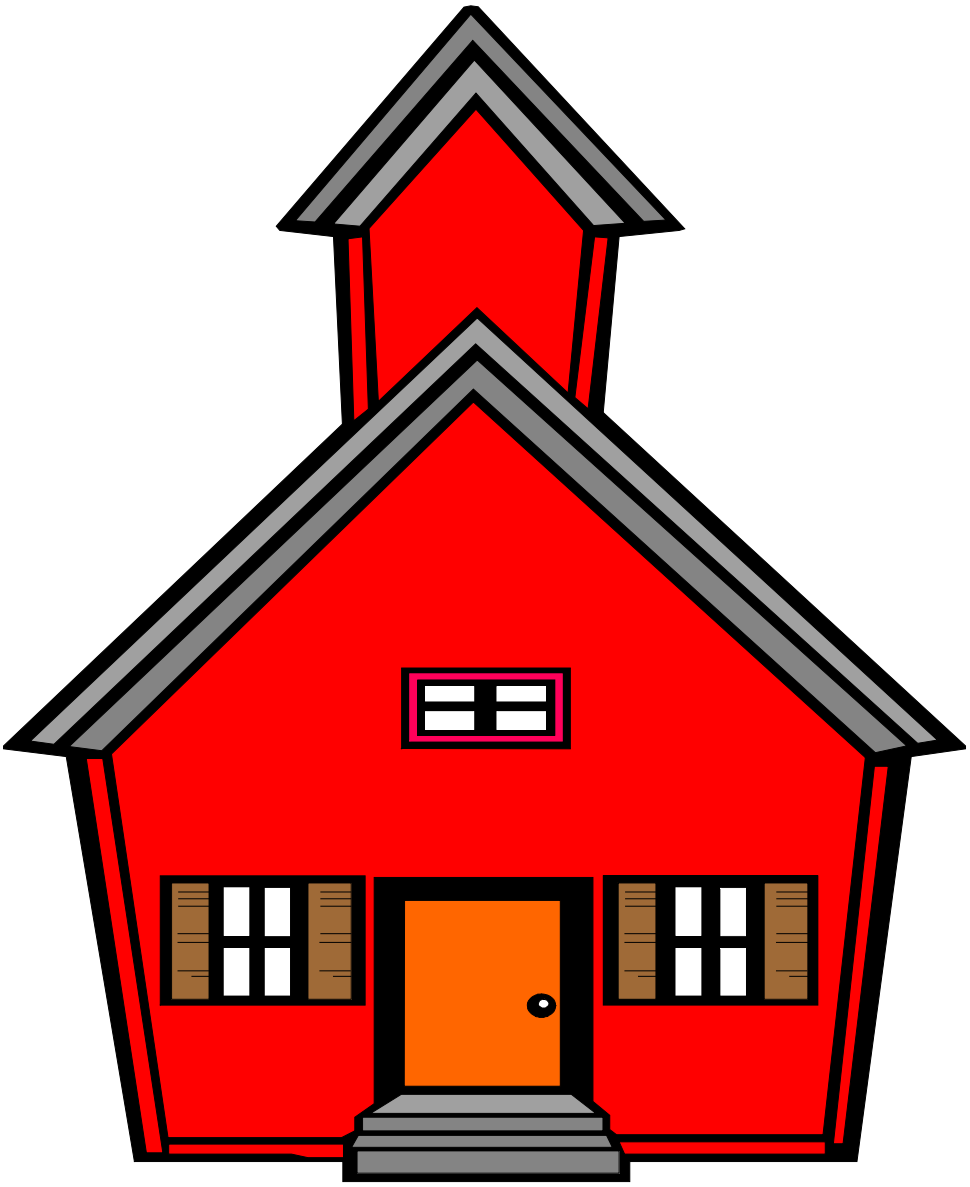
Knowledge

- Utilizing knowledge gained in the initial lessons, students will know some of the environmental issues facing the region today.

Skills

- Students will be able to Take their knowledge gain and develop a tool/campaign to help tackle a local environmental issue in their school or community.

SCHOOL AUDIT PREP



AUDIT PREP BACKGROUND

The Audit Prep lesson provides students with the opportunity to synthesize what they have learned about recycling and waste reduction in the previous lessons. At this time, the students will move into the problem-solving phase of the program. They will begin this process to plan the school audit and think about the information needed in order to have a better understanding of the school's current waste management practices.

Looking at a map of the school may help students to think about all the different kinds of sites at the school. Thought should be given to the various sites to be included in the audit to develop an accurate picture of the types of waste being produced by the school.

If you choose to do a more technical audit with your students Option B provides some suggestions of how you might go about this. This option entails selecting several audit sites where labeled boxes would be placed so that materials that would otherwise go into the school's waste stream can be separated, collected daily, weighed and quantified by the students.

The data collected at the various sites can be used to create charts and/or graphs that can greatly enhance the school proposal. For further ideas on how to organize a more in depth audit you might want to obtain a copy of the "Waste Reduction Handbook" listed in the reference section of this lesson.

LESSON 5 - PREPARING THE SCHOOL AUDIT

Subject:
Science, Social Studies

Lesson Overview:
By now, the students have begun to develop an awareness of waste management practices in the community at large and of ways that waste can be reduced or recycled. In this lesson they will begin the process of investigating waste management practices at the school. They can use the information gathered to engage in creative problem solving and to write a waste reduction proposal for the school.

PA State Standards:
Science and Technology
3.2.7D Know and use the technological design process to solve problems.

- Define all aspects of the problem, necessary information and questions that must be answered.

Content Objectives:
The students will synthesize and apply their knowledge of waste issues by selecting three key questions to be addressed in the school audit.

Materials: (Items in **bold** are included in the Student Workbook)
Student Workbooks (one per student)
School Audit Worksheets
Teacher Survey
Student Survey
pens or pencils
map or blueprint of the school building (if obtainable)

Option B:
12-15 boxes (copy paper boxes work well for this)
Magic markers

Procedure:

Prior Knowledge:

1) Ask students what they know about the school's waste stream and what sorts of waste products they think the school might produce. (You can list these on the board.)

2) Ask students if they are aware of any recycling or other waste reduction practices being implemented in the school (e.g. recycling of paper, cardboard boxes, and/or bi-metal cans from the cafeteria).

Vocabulary:

Note: Due to the small number of vocabulary words in this lesson there is no vocabulary list in the Student Workbook for this lesson

audit - To thoroughly examine or evaluate a problem.

proposal - An idea or a plan submitted for acceptance or rejection.

source reduction- To lessen the quantity of materials in the waste stream by recycling, reusing or composting.

Lesson:

Option A

1) Write the vocabulary words and definitions on the board and instruct the students to refer to them as necessary during the lesson.

2) Divide class into groups of four or five students. They will work with this same group throughout sessions four and five. Provide students with the following information:

   Tell them that in the next session they are going to be walking around the school and participating in a waste audit with their group. The purpose of the audit is to collect information about how waste is currently being handled at the school and what materials are to be found in the school's waste stream. This information will be used in the process of writing the proposal to be submitted to the school administration and other relevant personnel.

   Each group will be visiting a couple of sites at the school to collect information about current waste practices. During this session your group will be given time to discuss and prepare for the audit. Each group should come up with at least three or four questions that they think should be answered in the course of the audit. Tell them to write these questions on a piece of scrap paper.

3) You might want to walk around to each group to see how they're doing and assist them in this process. Listed below are suggested audit questions: ***(Allow students about 10 minutes for this step.)***

   a) Waste materials found at site?

   b) What amount of material? Approximate amount (i.e., one-half paper, one-fourth plastic bottles, one-fourth miscellaneous trash etc).

c) Is there evidence of any source reduction at the site?
(i.e., recycling bins, box for paper used on one side only etc.)

d) Could any of these materials be recycled, reused or composted?

4) Have a representative from each of the groups share the group's questions with the class. Write the questions on the board and have the class identify any duplicates and eliminate them. Ask students to vote and choose the four questions they think are most relevant to the audit.
(**Allow another 10 minutes for this process.)**
Note: If the students have difficulty in coming up with all the appropriate questions you can supply them with some of the questions from the list above.

5) Discuss with the students the sites to be included in the audit. It is suggested that a variety of different sites be visited including regular classrooms, the cafeteria (highly recommended), as well as any special sites such as labs, shops, the art room, school office etc.

6) Have them write their questions along the top row of the blank **Audit Worksheet** in their **Student Workbook** and the sites they have selected along the left hand side.

7) Facilitator will contact the principal and office staff to inform them of the date and time that the audit will take place.

Option B (This will entail a more extensive audit, and will take more time to complete.)

1) Write the vocabulary words and definitions on the board and discuss with the students.

2) Divide class into groups of four or five students. They will work with this same group throughout sessions five and six. Each group will be assigned to an audit site and will be given a set of three boxes to be labeled and placed at the site. Students will be responsible to pick up materials collected daily.

3) Discuss with the students the sites to be included in the audit. It is suggested that a variety of different sites be included such as regular classrooms, as well as any special sites such as labs, shops, the art room, school office etc.

4) It is recommended that materials be collected from the chosen sites for at least two to three days in order to get a truly representative sample. These materials can then be emptied into three large plastic garbage

bags in the classroom labeled similarly: **Paper**, **Other Recyclables** and **Non-Recyclables**.

5) At the end of the audit each of these bags will be weighed either by taking them to the nurse's office to be weighed on the scale there, or by bringing a bathroom scale into the classroom.

Both Option A & B:

1) Instruct students to look over **Student surveys** in their **Student Workbooks** and explain that each student should administer the survey to one other student in the school, other than their classmates. If possible students from a variety of different grade levels should be surveyed.

2) Select students to administer surveys to the teachers using the **Teacher survey** from their **Student Workbook.** If there are enough teachers in the school, all of the students can participate in the teacher survey or you can assign 2 or 3 students to survey one teacher.

3) If possible the students should administer the survey to the teachers in person. If that's not possible students can make a copy of the survey and leave it in the teacher's mailbox to be collected at a later time.

Assessment:

Check students' **Audit worksheets** to identify key questions to be addressed in the school audit.

Student Survey

1) Does your family recycle at home? ___ Yes ___ No

2) Do you think that it's important for your school to recycle?
___ Yes ___ No
Why or why not?

3) Which of these materials do you think can be recycled in your community?

___ Aluminum ___ Plastic ___ Paper ___ Glass

4) Which of these materials do you think it is most important for the school to recycle? _____

5) If there was a recycling program at your school would you participate?

___ Yes ___ No

6) Have you ever seen a compost pile? ___ Yes ___ No

Do you think it would make sense for your school to compost their yard waste to be used on the school grounds as a fertilizer?

___ Yes ___ No

Teacher Survey

1) Have you previously participated in a school wide recycling program?

___ Yes ___ No

2) Was it successful? Why or why not?

_____

_____

3) What materials do you think should be included in a recycling program at your school?

___ Aluminum ___ Plastic ___ Paper ___ Glass

4) Would you be willing to participate in such a program?

___ Yes ___ No

5) Would you be willing to involve your class (or one of your classes) in helping the school's Green Team organize and run a recycling program at your school?

___ Yes ___ No

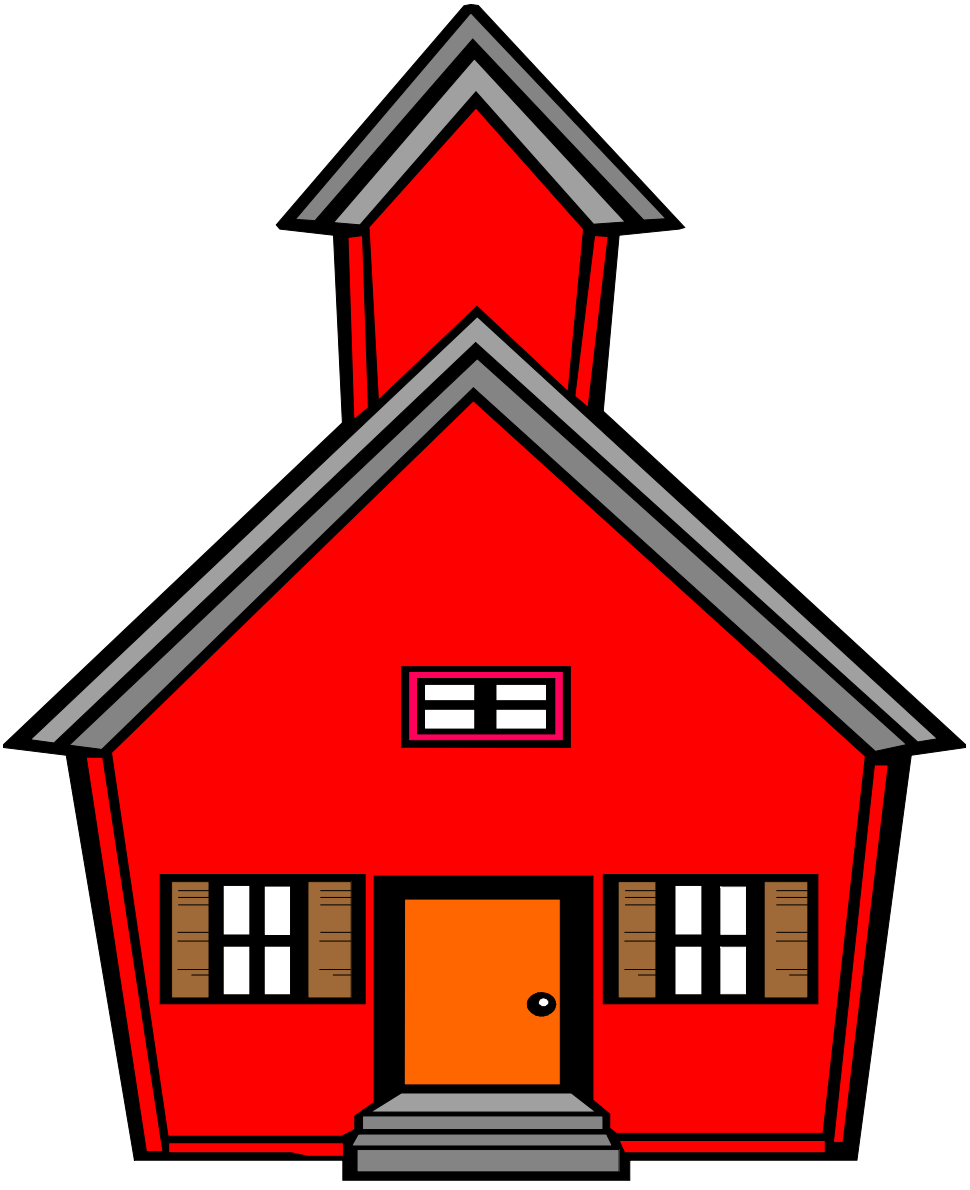
6) Would you be in favor of a composting program at your school for the composting of yard waste to be used on the school grounds as mulch?

___ Yes ___ No

School Audit Worksheet

SITE				

SCHOOL AUDIT



SCHOOL AUDIT BACKGROUND

Often, schools must pay for their waste removal. By practicing source reduction, it may be possible for the school to save money, which could be used for other programs. Waste consultants are sometimes hired to help schools and businesses reduce the amount of waste they generate. Often waste consultants are paid a certain percentage of the savings they help their client generate. (This is an example of a job opportunity in the environmental field.)

As the students participate in the school audit encourage them to use keen observation skills and to be as exact as possible in their descriptions of what they see. Noting that they saw some “plastic” in the trash at their site is not as useful an observation as “plastic milk bottle”. The second more detailed observation will be much more useful in terms of identifying recyclable materials.

It would be helpful for students to speak with the supervisors at the sites that they visit during the audit. This will enable them to get a better idea of the range of materials generated over time, not just the “snapshot” of the waste stream at the time of the audit. Encourage the students to answer the questions on their audit worksheets in as much detail as possible.

LESSON 6 - PERFORMING THE SCHOOL AUDIT

Subject:
Environmental Science, Social Studies

Lesson Overview:
Students will work in groups and conduct the school audit that was planned in the previous lesson. A teacher or facilitator will accompany one group at a time to their designated audit sites. At the end of the session, each group will report its findings to the class and the information will be recorded in the students' **Student Workbooks**.

PA State Standards:
Science and Technology
3.2.7B Apply process knowledge to make and interpret observations.
3.2.7D Know and use the technological design process to solve problems.

Environment and Ecology
4.3.7B Identify how human actions affect the health of the environment

Content Objective:
The students will demonstrate the ability to synthesize their knowledge of waste issues by completing the school audit worksheet.

Materials: (Items in **bold** are included in the Student Workbook.)
Student Workbooks (one per student)
School Audit Worksheets
Teacher Survey
Student Survey
School Audit Brainstorm
pens or pencils
map or blueprint of the school building (if possible)
Option A:
11"X17" paper for making posters (one sheet per student)
magic markers, crayons etc.

Procedure:

Prior Knowledge:
Ask students to try to predict what they will find during the course of the audit. At the end of the lesson you can discuss with them how accurate their predictions were.

Vocabulary:
(same as previous lesson)

Lesson:

The facilitator should arrange to have another adult available for this lesson to remain with students in the classroom while he/she accompanies students conducting the audit.

1) Have students break into their groups (same as Lesson 5).

2) Assign two or three sites to each group, depending on how many sites are being included in the audit.

3) Pass out paper for posters and art supplies. Tell students that while other groups are out visiting their assigned audit sites they will make posters to promote the 3R's to be posted around the school. (These posters should reflect some of the information that students have studied during the course of the Resource Conservation Program.)

4) Take one group at a time to their designated audit sites. Remind the students not to be disruptive when going into classrooms and areas where other students are working.

5) Ask one of the students to be the spokesperson for the group. Instruct them to get the teacher's permission before coming into a classroom and to explain that their class is conducting a waste audit of the school. Make arrangements for a representative from the group to come back later if the teacher does not wish to be disturbed at that time.

6) Allow students about five minutes per site. Students should fill in their **School Audit worksheets** at each site. Remind students to work efficiently so that all groups can have an opportunity to participate in the audit.

7) At the end of the period draw a replica of the audit worksheet on the board and fill in the information gathered by each group. Have students copy the data gathered into their **Student Workbooks**.

Option B

1) The class has been gathering materials for several days and will now begin to measure and quantify their data.

2) The bags of materials collected in the audit can now be weighed either by taking them to the nurse's office to be weighed on the scale, or by bringing a bathroom scale into the classroom.

3) The easiest way to weigh the materials is to weigh one of the students first and then weigh them holding the bag of materials and subtract their weight. You can have the class do this as a math exercise if you wish.

4) Weighing the materials collected and dividing by the number of sites will give you an average figure for the amount of material generated per site.

5) This average can then be used to generate an approximation of the material produced by the whole school weekly. Multiply your average by the number of rooms in the school and then again by five (the # of days in the school week) to approximate the amount of each type of material generated weekly.

6) This information can be used to generate graphs representing the various materials collected. This will make a nice addition to the school proposal.

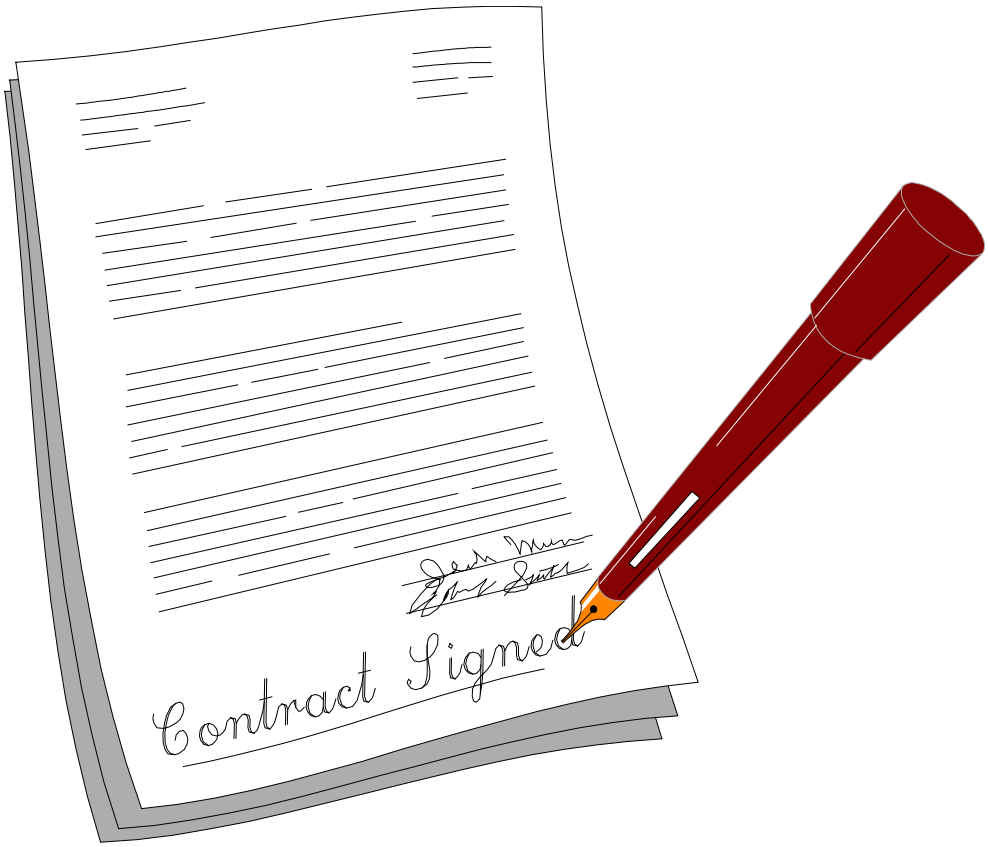
Reflection:

Have students write in their **Student Workbooks** what they learned about their school's waste practices as a result of the audit.

Assessment:.

The completed **School Audit Worksheet** can be checked for completeness for **Option A,** and for **Option B** the graphs generated by the students can be assessed.

PROPOSAL WRITING



LESSON 7 - FORMATTING A PROPOSAL

The main lesson consists of determining a way to reduce the waste stream at the school, and determining the content of a proposal letter needed to implement a resource conservation program. The first extension activity consists of actually writing the proposal. The extension is strongly recommended, especially if the students are interested in implementing the waste reduction plan. The second extension activity focuses on the campaigning that would be necessary if the plan were to be implemented.

Subject:
Science, Language Arts

Rationale:
Students can often influence school policy. It is important for young people to understand that they can make a difference and to show them how to do so. A proposal is a formal letter explaining what changes need to be made, how the changes will happen, who they will effect, the costs and benefits, etc. If students gather the information and write a comprehensive proposal, their voices are much more likely to be heard.

PA State Standards:
Environment and Ecology
4.3.7A Identify environmental health issues.
4.8.7C Explain how human activities may affect local, regional and national environments.
4.8.7D Explain the importance of maintaining the natural resources at the local, state and regional level.

Science and Technology
3.2.7B Apply process knowledge to make and interpret observations.

Content Objectives:
Students will use the results of the **School Audit** to determine which materials in the school's waste stream could be reduced, as well as methods for reduction, by completing the **Strategy Guidelines** handout.

Working in groups, students will identify the information to be included in the final proposal by completing the **Proposal Guidelines**.

Materials: (items in **bold** are included in the Student Workbook)
Student Workbooks (one per student)
Strategy Guidelines
Proposal Guidelines
completed **Audit Forms** (Session 6)

Procedure:

Vocabulary:

coordinator- A person who can design and carry out a plan

feasible- Capable of being done or carried out; possible.

proposal - An idea or plan submitted for approval or rejection.

source reduction – Decreasing the amount of material in the waste stream.

waste stream- The flow of waste from generation, through separation and collection, to final disposal.

Lesson:

1) Instruct students to review the vocabulary words for Lesson 6 and answer any questions they may have.

2) Explain to the students that they will be analyzing the results of the school audit to determine what material(s) in the waste stream they are going to address in their proposal. They will then decide on a strategy for how to divert or reduce the amount of that material and will write a proposal to the school on how this strategy might be implemented.

3) Instruct students to look over the **Strategy Guidelines** in their **Student Workbooks** and fill in the answers during the class discussion.

4) Ask students the following questions. Record the answers on the board, as students record answers in the **Strategy Guidelines**.

a) "During the school audit, what material was thrown out the most?" In most schools, PAPER will be the most abundant material. If not, just complete the proposal with respect to the most abundant material. "What types of paper were thrown away?"

b) "What methods could be used to reduce the amount of paper (or other material) that gets thrown in the garbage?"

Answers may include: Limit the amount of paper teachers get, use both sides of paper when possible, collect used paper for future use, write on Palm Pilots instead of paper, increase computer use, etc. Students should be encouraged to be as creative as possible.

c) "Which of the methods listed in Question #2 is the most feasible?" "Why?"

5) Break students up into their groups. Pass out the **Proposal Guidelines** to each group (1 per group). Instruct groups to fill in the answers.

6) When groups are finished, have one volunteer from each group share his or her group's answers with the class.

Assessment: Students should hand in **Strategy Guidelines** and **Proposal Guidelines.**

Note - The extension activities for Lesson Seven are closely related to the main lesson, and therefore have been included with the main lesson rather than in Appendix A, where the other extension activities are found.

Extension Activity A

Title:
Writing a Proposal

Subject:
Environmental Science, Social Studies, Language Arts

Lesson Overview:
In order to start an in-school resource conservation program, students needs to first obtain permission from an administrator of the school.

PA State Objectives:
Science and Technology
3.2.7D Know and use the technological design process to solve problems

Environment and Ecology
4.8.7B Explain how human activities may affect local, regional or national environments.
4.8.7D Explain the importance of maintaining the natural resources at the local, regional and national levels.

Content Objectives:
Students will write a proposal letter to a school administrator expressing their desire to implement their proposed solution for resource conservation in their school.

Materials: (Items in **bold** are included in the Student Workbook.)
Completed **Strategy Guidelines** and **Proposal Guidelines**

Writing a Proposal handout
Student Workbooks
Pencils
Erasers
Letter Paper

Procedure:

Vocabulary:
NONE

Lesson:
1) Break students into groups or have each student work independently.

2) Students should read over **Writing a Proposal.** Then using the completed handouts **Strategy Guidelines** and **Proposal Guidelines**, students should write their own proposal in their notebooks.

Assessment: Each student or group should hand in their completed written proposals in their **Student Workbooks**.

Extension Activity B

At this point, if the students want to implement the plan, they should decide on one proposal, type it up, sign it and deliver it to the appropriate person. The teacher could type the proposal if necessary. If this takes place and the proposal is accepted, the following extension can be completed. Also, the students and teacher must plan time to carry out the solution. PRC may be available for technical support.

Title:
Implementation

Subject:
Environmental Science, Social Studies, Language Arts

Lesson Overview:
In order to start an in-school resource conservation program, students need to first determine each element of the program and the program design, as well as assign tasks.

PA State Objectives:
Science and Technology
3.2.7D Know and use the technological design process to solve problems

Environment and Ecology

4.8.7B Explain how human activities may affect local, regional or national environments.

4.8.7D Explain the importance of maintaining the natural resources at the local, regional and national levels.

Content Objectives:

Students will implement their proposed solution for resource conservation in their school by following steps that they determine themselves.

Materials:

Completed proposal letters

Student Workbooks

Pencils

Procedure:

Lesson:

1) Using the Proposal that the students have agreed to submit, have groups of students write down the steps that are necessary to complete the project in their **Student Workbooks**. Steps will vary from project to project. Think critically about the plan and try to be very detailed about the steps. Steps to consider include:
   a) Collecting materials
   b) Volunteering time
   c) Acquiring a space
   d) Assigning people jobs
   e) Decorating materials
   f) Campaigning in the school (advertising the program)

2) Have each group read their steps and create one final list of steps on the board.

3) Students should determine which duties they want to be responsible for, and volunteers should be picked to complete each duty.

4) Students should carry out their responsibilities.

Assessment:

The completed solution will serve as an assessment.

FINAL PROJECT

LESSON 8 - FINAL PROJECT

There are various activities that can be used for final projects. The projects are entertaining activities that will reinforce the information that was discussed in at least one of the seven sessions. Directions for each option are included, but some will require more preparation and materials than others. PRC will be happy to facilitate the final project and also to attend extra preparation sessions if the project requires, but cannot guarantee specific date availability.

It is recommended that the students be given the opportunity to choose which project they would like to undertake through a vote or class discussion. The students are also welcome to develop their own final project. If the students choose to design their own project, PRC would like a copy of the information to offer to other schools participating in the program.

Project Title: **FASHION SHOW**

Project Length: 45 minutes

Prep Days: At least 2 class periods

Staffing: Director, 14+ characters, 2 adults

Materials: Script, signage, clothing, music - all provided by PRC

Comments: This is a student-produced assembly featuring a “Buy-Recycled”

Fashion Show. Students will play the role of the “models” as well as emcees for the show. The number of parts can be increased or decreased depending on the class size, and the length of the show can be changed accordingly.

The students can determine who the audience will be. Some classes choose to perform only for other classes in their grade level; others may choose to conduct a whole school assembly. Parents can be invited to attend if they are interested.

This activity is recommended for all classes.

Project Title: **RECYCLED INVENTION FAIR**

Project Length: 1 to 2 class periods

Prep Days: 1 class

Staffing: teacher, facilitator

Materials: used materials, glue, tape, etc.

Comments: Students will be given the opportunity to “invent” new products out

of used materials. They should be encouraged to be as creative as

possible when they “invent”. Students should also write a couple of

paragraphs explaining what their invention is, what materials they used and how they put it together. Projects should be displayed somewhere in the school, and other classes or parents should be invited to visit the displays.

This activity is recommended for all classes.

Project Title: **DEBATES**

Project Length: 2 class periods

Prep Days: 2 class periods

Staffing: Teacher, Facilitator

Materials: Debate topics, books, library access

Comments: Students will debate in small groups on topics that will be provided, or they can determine their own topics. Students will be responsible for their own research, and knowing the topic in depth.
There should be approximately 3 or 4 class periods designated for research. The debates should take place in class.

This activity is recommended for middle to high school students.

Project Title: **RECYCLING OLYMPICS**

Project Length: 45 minutes

Prep Days: None

Staffing: 1 facilitator/teacher per 20 students

Materials: activity materials provided by PRC

Comments: An exciting and educational event in which kids compete in a variety of relays and races that use recyclable or recycled materials. Events include 2-liter bottle bowling, milk jug volleyball, and the recycling relay. Prizes for winning teams are provided.

This activity is recommended for elementary schools and middle schools.

Project Title: **EDIBLE LANDFILL**

Project Length: 1 class period

Prep Days: 1 class period

Staffing: Teacher, Facilitator

Materials:

3 - 9 in. Graham cracker pie crusts (pre-made)
One gallon ice cream (Rocky Road works well) or
5 - 16 oz. cans pudding
Gummy Life Savers (to simulate the tires)
Lg. Pkg. Oreos (generic)
1 pkg. Twizzler licorice (to simulate leachate and methane collection pipes)
1 pkg. fruit roll-ups
32 oz. container whipped topping (Cool Whip)

Commentary: Crush oreos, and if using ice cream, allow to soften for 15-20 min. Place a layer of fruit roll-up in the bottom of the crust. Lay a piece of licorice on top of the fruit roll-up. Then begin layering in other ingredients. Use alternating layers of ice cream or pudding, then a layer of crushed oreos until the pie shell is full and then cover with cool whip and insert licorice into completed landfill.

This activity uses some of the children's favorite snacks to teach about landfills. The graham cracker crust represents the layer of clay lining the landfill and the fruit roll-up represents the plastic layer. The Twizzler lying on top of the fruit roll-up represents the pipes that collect the leachate. The ice cream or pudding symbolizes the layers of garbage, and the crushed oreos represent the layers of soil. The final layer of whipped topping represents the plastic cap used to seal the landfill once full. The licorice inserted vertically through the top represents the pipes for the collection of methane.

Each "edible landfill" feeds about 8 students. This activity is recommended for elementary and middle school classes.

Project Title: **STUDENT LED LESSONS**

Project Length: 1 class period

Prep Days: 2 class periods

Staffing: Teacher, Facilitator

Materials: Paper

Comments: Students will be given the opportunity to play the role of teacher.

They will create their own ten-minute lesson on one or more of the topics that were discussed during the seven sessions. Each group of students will then present their lesson to another class in their grade that has not participated in the program, or to younger classes. The lessons should include information, visual aids, and an activity or handout.

This activity is recommended for middle and high school classes.

Project Title: **RESOURCE CONSERVATION GAMES**

Project Length: 1 to 2 class periods

Prep Days: None

Staffing: Teacher and Facilitator

Materials: Markers, pens, pencils, rulers, tape, construction paper, poster board, other art supplies.

Comments: Groups of students will be responsible for creating a board game

or other type of game that focuses on Resource Conservation, using art supplies and their knowledge about the environment. After games are completed, one class period should be designated for trading and playing them.

This activity is recommended for all classes.

Project Title: **MURALS**

Project Length: 3 to 5 class periods

Prep Days: 2 to 3 class periods

Staffing: Teacher and Facilitator

Materials: Paint, tape, butcher paper

Comments: Students will design and draw a mural focusing on the environment to hang in the school. The mural will be drawn on a large stretch of butcher paper and will require planning and careful thought.

This activity is recommended for all classes.

APPENDIXES

APPENDIX A

The following activities are extension and lab activities, which should be done after the original lesson if time allows.

LESSON 1 – Extension Activity

Title:
Natural Resources Matching Game

Subject:
Environmental Science, Science, Social Studies

Lesson Overview:
Everyone uses resources to wash, feed, clothe and house themselves daily and to stay warm in the winter and cool in the summer. This lesson addresses the renewability and non-renewability of resources.

PA State Standards

Science & Technology
3.5.7 B Recognize earth resources and how they affect everyday life.

Environment & Ecology
4.2.7 A Know that raw materials come from natural resources.

Content Objectives:
Students will be able to identify the five basic categories of natural resources and how they are used everyday as they participate in the Natural Resources Matching Game

Vocabulary:

natural resources- Materials existing in nature which humans and other living things rely on for food, clothing, shelter, and other needs.

non-renewable- Resources that once used are not easily replaced.

renewable- Resources that can be replaced in a reasonable period of time.

raw materials- Substances extracted from natural resources and used in manufacturing processes.

Materials:

Pictures of Natural Resources (from Lesson One)
"Natural Resources Background Information" handout
"Natural Resources Matching Game – Directions" handout
1 Set of yellow "Natural Resource" cards
1 Set of purple "Product" cards
(The "Natural Resource" and "Product" cards can be printed out from the **RCP Graphics CD**, cut out and laminated)

Procedure:

1) Ask the students what they had or will have for lunch today. List the items on the board.

2) Ask them where these items come from. For example:
   a. Chicken sandwich –
      i. Chicken → animal
      ii. Bread → wheat → plant
      iii. Oven → steel → iron ore → rocks and minerals

3) Explain to the students that everything in the world we live in comes from the five natural resources:
   a. Plants and Trees
   b. Water
   c. Air
   d. Animals
   e. Rocks, Minerals and Fossil Fuels

4) Show pictures of the natural resources and have students list some ways they are used.

5) Discuss the difference between renewable and non-renewable resources. **Renewable resources** are materials that can, if managed properly, be replaced by natural or human actions in a relatively short period of time. Trees, crops and livestock for example are considered renewable. **Non-renewable resources** are materials that exist in limited amounts and cannot easily or quickly be replaced (hundreds of thousands or millions of years). Examples of non-renewable resources are rocks and minerals, petroleum and other fossil fuels.

6) Explain to the students that they will be playing the Natural Resources Matching Game.

7) Pass around the Natural Resource Background Information Sheet for the students to review.

8) Go over the directions with the students.

9) Divide into teams of 4-5 students. Begin play (see “Natural Resources Matching Game – Directions” Handout)

Assessment: Observe the students as they are playing.

Natural Resources Matching Game

Directions

- Divide class into teams of 4-5 students and tell them to pick a "nature" name (some suggestions: The Plant People, The Tree People, The Water Wizards, The Wind Warriors, The Animals, The Rock Hounds, The Recyclers, The Conservers etc.)
- Write the team names on the board
- Distribute the Product cards evenly amongst the teams (if there are a couple of leftover cards put them aside with the matching Natural Resource Cards)
- Appoint a team captain for each team who will be the spokesperson for the group but should consult with his/her teammates before answering.
- Explain to the students that you are going to select one "Natural Resource" card at a time from the pile and hold it up. If their team thinks they have a matching "Product" card the team captain should hold up his/her hand to be called on.
- When a team gets the correct answer collect their card and mark a point for the team next to their name on the board.
- Once all the cards have been played the team with the most points is the winner. If there is a tie you can ask a tie-breaking question related to the lesson on Natural Resources to decide the winner.

Some suggested tie-breaking questions

1) Name two natural resources and what they can be used for.
   1. ***(accept any of the following: air, water, rocks and minerals, plants or animals and their various uses)***
   2.

2) What is the difference between a renewable and non-renewable natural resource? (accept student's answers if they convey the basic ideas articulated below)
   Renewable resources - are materials that can, if managed properly, be replenished through natural or human processes. (For example trees, crops and livestock are considered renewable)

<u>Non-renewable resources</u> - are materials that exist in fixed amounts and cannot easily or quickly be replenished.

Natural Resources Matching Game

Background Information

All of the products that we use every day are made from natural resources. Natural resources are the following materials as they are found in nature:

Plants and Trees
Animals
Water
Air
Rocks, Minerals and Fossil Fuels.

Natural resources are turned into raw materials and then used to make products. Here are some examples:

Animals (natural resource), such as cows, are used to obtain leather (raw material). The leather is then turned into jackets, shoes or furniture (products).

Rocks (natural resource), such as iron ore, are used to make steel (raw material). The steel is then turned into refrigerators, cars, etc. (products).

Fossil Fuels (natural resource), such as oil, are used to make plastic (raw material). The plastic is then turned into soda bottles, toys, cups, etc. (products).

Renewable resources are those resources which can be replenished in a relatively short time by human action or natural processes. These include plants and trees, animals, water and air. If managed carefully these resources can last indefinitely.

Rock, minerals and fossil fuels, on the other hand are **non-renewable**. They take hundreds of thousands or millions of years to be replaced by natural processes. Some examples of fossil fuels are coal, natural gas and petroleum. Fossil fuels are not only used for energy, but they are also used to make plastics and cosmetic products.

By practicing the 3R's – Reduce, Reuse, Recycle-- we can conserve these precious resources so that there will be an adequate supply for future generations.

LESSON 2 – Extension Activity

The following activity is an extension activity, which should be done after the original lesson if time allows.

Lab Activity:

Title:
Building A Mini-Landfill
Adapted from Bottle Biology

Subject:
Science

Rationale:
Groundwater is a very important resource. Water absorbed by the ground will eventually reach lakes, streams, rivers, and our drinking water. Landfills must be constructed to keep any contaminated water from getting to the groundwater supply.

Content Objectives:
The students will demonstrate their knowledge of landfill design by creating mini-landfills in bottles and recording their observations in their Student Workbooks.

Materials:
Each group will need:
PART I

2-Liter clear plastic soda bottle	Food Coloring
Scissors	Water
Rubber Band	Cup with holes for rainwater
Cheesecloth or Screen	or spray bottle

Container of "Trash" (candy wrapper, paper, rubber band, plastic, cardboard pieces)

PART II
modeling clay
straw

Procedure:

Vocabulary: None

Lesson:

Part I

1) Students should work in their pre-determined groups.
2) Distribute a set of materials to each group of students. Have students cut bottles in half. Using the small piece of either cheesecloth or screen, and the rubber band, place the "filter" over the end of the top half of the bottle.
3) Insert the top half, turned upside down, into the bottom half. The top half now represents the dump or landfill while the bottom half represents groundwater. Have students add food coloring to the trash container, then place into "dump" (upper section of the bottle container.)
4) Pour or spray water over the "dump" and observe what happens to the groundwater.
5) Clean out the groundwater and the dump. Save the trash container for Part II.

Reflection:

Students should note three observations about their "dumps" in their Student Workbooks.

Part II

1) Explain that the landfill now needs a plastic and clay liner and a leachate pipe in order to keep the groundwater from becoming contaminated. (This is what distinguishes a landfill from a dump.)
2) Have each group place a layer of clay followed by a plastic liner along the bottom of the "landfill." Each group should spend 10 minutes discussing where a hole with a straw could be placed to allow leachate to be piped out without leaking into the groundwater.
3) Groups should then insert the straw through the hole in the determined position to see if it really works. (Have the trash container from Part I catch the "leachate".)
4) After 15 minutes of designing and testing, have each group demonstrate their landfill design to see which ones work effectively.

Reflection:

Ask students to write which group's model they thought worked best and why, in their Student Workbooks.

Assessment:

The teacher needs to observe each group's model and note student input in design and development of the landfill. Collect the Student Workbooks and check for three observations and which model they thought worked best.

LESSON 3 – Extension Activity

Title:
Environmental Shopping

Subject:
Environmental Science, Social Studies

Rationale:
A smart environmental shopper will take into account recycled or recyclable content when choosing a product. Another factor to consider is the amount of packaging the product contains. A product that is in a bag, a plastic wrapper, a cardboard box and has tape around it creates much more waste than the same product that comes in only a cardboard box. Packaging is used to make a product more attractive to a consumer, but if a consumer is concerned with reducing the amount of solid waste they create, the product with less packaging is better for the environment.

PA State Standards:
4.2.7B Examine the renewability of resources.
4.2.7D Describe role of recycling and waste management.
4.8.7C Explain how human activities may affect local, regional and national environments.

Content Objectives:
By comparing similar products and their packaging and by completing the **Packaging Materials** handout students will come to understand that packaging creates waste and that the choices they make as a consumer will affect the solid waste problem.

Materials:
Packaging Materials handout
Pen/Pencil
Large chip bag
Small chip bags
Student Workbooks

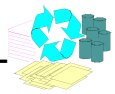
Procedure:

Vocabulary:
reduce- To choose products that use fewer natural resources in order to conserve.

Lesson:
1) Tell students that between one-third and one-half of all solid waste is packaging.

2) Have students brainstorm for a few minutes to list examples of products they have bought with packaging. Ask students:
"What products come with packaging?"
Write some answers on the board.
3) Pass out Packaging Handout to each student. Students should read and complete the handout.
4) Have students share some of their answers. Go over all questions as a class.

Assessment:
Collect **Packaging Materials** handout from students.

PACKAGING HANDOUT 

1. List five items that come in packages. For each item, tell what the package is made of and why it is needed.

_____

_____

_____

_____

_____

_____

2. From the list in the previous question, were any parts of the packages not needed? If so, list the item and why it is not needed.

_____

_____

_____

3. List three items that do not come in packages. For each item, tell why a package is not needed.

_____

_____

_____

_____

4. Look at the following list of packaging materials. Beside each one, list an item that is packaged in it.

Glass

_____

Paper or Cardboard

_____

Steel

_____

Aluminum

_____

Wood

_____

Clear Plastic (PETE)

_____

Plastic Wrap

_____

Opaque plastic (HDPE)

_____

Hot drink cups (Styrofoam)

_____

5. Look at the list of materials in Question #4. Which of the materials do you think are easiest to recycle? Which are hardest to recycle? Which packaging can be reused? Which packaging has only a single use and is not readily recyclable?

_____

_____

_____

_____

_____

_____

6. Look at the materials in Question #4. Which would take up the most space in a landfill?

_____

_____

_____

7. Can you conclude anything from answering these questions about packaging? Which packaging would you choose and why?

_____

_____

_____

_____

LESSON 4 –Extension Activity

Note: Preparation for this activity will take three to four days.

Title:
Magnificent Micro-Critters

Subject:
Science

Rationale:
The real workhorses in a compost pile are the millions of microorganisms that decompose the materials in the pile. This lab will give students the opportunity to see some of these fascinating creatures firsthand.

PA State Standards:
Environment and Ecology
4.2.7C Explain biological diversity

Content Objectives:
Students will explore the diverse organisms that inhabit a compost pile by studying them under the microscope and drawing or writing about them in their Student Workbooks.

Materials:

petri dishes	wide mouth jar	egg yolk
water	cheesecloth	microscope slide
tablespoon of soil	eyedropper	microscope

Procedure:

Vocabulary:
same as main lesson

Lesson:
Preparation: Create "soil water" by filling a wide mouthed jar with clean tap water. Allow it to sit unopened for 24 hours. Explain that this soil water contains the same microorganisms found in soil and compost.
Place a tablespoonful of "soil water" in a baby food jar and add a little bit of hard boiled egg yolk, shake, cover. Place in a dark spot at room temperature for 2-3 days. (The egg yolk enriches the soil water allowing the microorganisms to multiply and become easier to see)

1) Using an eyedropper, place a drop of the enriched soil water on a slide and allow students to take turns viewing it under the microscope.
2) Encourage students to draw or describe what they see, or let them

simply observe the phenomena. (Note: trying to draw microorganisms suspended in water may be difficult or frustrating for the students. Students can just look at the slides and draw from memory.)

3) Have students compare their drawings with the illustration of organisms in compost from the previous lesson for identification purposes.

Adapted from: *The Wonderful World of Wigglers* by Julia Hand. 1995. Vermont, Common Roots Press.

Assessment:

Students will record at least three or four microorganisms in their Student Workbooks.

Lesson 4 – Extension Activity

Title:
Compost in a Bottle

Subject:
Environmental Science

Rationale: A lot of the materials that we discard every day could be turned into a useful resource for our gardens. This activity will give students the opportunity to witness this fascinating process on a small scale.

PA State Standards:
Environment and Ecology
4.2.7D Describe the role of recycling and waste management.

Content Objectives:
Students will learn the decomposition rates of various organic materials by creating a mini compost bin and recording observations for two to three weeks.

Materials:
2-liter plastic bottles with lids (one per student)
compostable materials (grass clippings, leaves, vegetable scraps, egg shells etc.)
magnifying glasses (one for each group)
scissors (one pair for each group)
roll of packing tape

Procedure:

Prior Knowledge:
Ask students:
"What kinds of materials can be composted?" (They should have a list to refer to in their notebooks from the main compost lesson.)

Vocabulary:
same as main lesson

Lesson:
1) Break students up into their work groups.
2) Pass out materials to each group.
3) Instruct students to cut off tops of bottles about one fourth from the top. Set aside tops for later.
4) Instruct students to put a handful or two of each of the compostable materials into the bottom section of the bottles (Mini-composters.)

5) If using the worms, add one handful to each mini-composter.
6) Have students place top section of bottle back on mini-composter, upside down and secure them with a piece of packing tape around the outside. Poke holes in the bottles for air flow. Leave caps on bottles to keep foreign matter out of them.
7) Every few days for the next two to three weeks, have students look at their mini-composters and record observations in their Student Workbooks. Students should note which materials decompose first.

Assessment : Evaluate Student Workbooks to check for accuracy of student observations of the composting process.

APPENDIX B
Recommended Resources & References

LESSON 1

Recommended Resources:

Cheney, Glen Allen. Mineral Resources. New York: F. Watts, 1985.

Mattson, Mark T. Scholastic Environmental Atlas of the United States. New York: Scholastic, 1993.

Winckler, Suzanne. Our Endangered Planet: Soil. Minneapolis, MN: Lerner Publishing, 1994.

Let's Reduce and Recycle: Curriculum for Solid Waste Awareness US Environmental Protection Agency (EPA/530-SW-90-005).

References:

Anderson, Kathy, Ed. Environmental Action Waste Reduction, Teacher Resource Guide. Menlow Park: Dale Seymour Publications, 1998.

LESSON 2

Recommended Resources:

Kowalski, Kathiann M. Hazardous Waste Sites. Minneapolis, MN: Lerner Publishing Co., 1996.

Pringle, Lawrence. Throwing Things Away. New York: Thomas Y Crowell, 1986.

Robinson, Fay. Too Much Trash. Chicago: Children's Press, 1995.

Tesar, Jenny. The Waste Crisis. New York: Facts on File, 1991.

References:

Anderson, Kathy, Ed. Environmental Action Waste Reduction, Teacher Resource Guide. Menlow Park: Dale Seymour Publications, 1998.

Arts, Henry W., Ed. Dictionary of Ecology and Environmental Science. New York: Henry Holt Pubs., 1993.

Braus, Judy, Ed. Pollution: Problems and Solutions. New York: Learning Triangle Press, 1998.
Ingram, Mrill. Bottle Biology. Iowa: Kendall/Hunt Publishing Company, 1993.

LESSON 3

Recommended Resources:

Becker, Ruth, Ed. 1998 Buyer's Guide to Recycled Products. Newtown Square, PA: Pennsylvania Resources Council, 1998.
Comprehensive listings of products made from recycled materials, including manufacturer, seller, recycled content. Categories include household and commercial products.

Greenblat, Rodney Alan. Aunt Ippy's Museum of Junk. New York: Harper-Collins, 1991.
A brother and sister visit their ecology-minded Aunt Ippy and her world famous Museum of Junk.

Lee, Sally. The Throwaway Society. New York: Franklin Watts, 1988.

Parker, Steve. Waste, Recycling and Reuse. Austin, TX: Raintree Steck-Vaugh, 1998.

Silverstein, Alvin. Recycling, Meeting the Challenge of the Waste Crisis. New York: G. P. Putnam, 1992.

Computer File:
US EPA, Office of Solid Waste and Emergency Response. Let's Reduce, Reuse and Recycle. Washington, DC: US Environmental Protection Agency, 2000.
A collection of games, activities, publications, resources, and a screen saver for students and teachers on how to reduce, reuse, recycle and properly manage waste.

References:

Anderson, Kathy, Ed. Environmental Action Waste Reduction, Teacher Resource Guide. Menlow Park: Dale Seymour Publications, 1998.

Arts, Henry W., Ed. Dictionary of Ecology and Environmental Science. New York: Henry Holt Pub., 1993.

Racich, Michelle, Ed. Waste In Place. Stamford: Keep America Beautiful, 1997.

LESSON 4

Recommended Resources:

Blashfield, Jean F. and Wallace B. Black. Recycling. Chicago: Children's Press, 1991.

Foster, Joanna. Cartons, Cans and Orange Peels. New York: Clarion Books, 1991.

References:

Ball, Jeff and Kourik, Robert. Easy Composting. San Ramon, CA: Ortho Books 1992.

Baron, Monique V. The School Yard Ecology Handbook. Rutgers University. 1999.

Bradley, Fern Marshall and Barbara W. Ellis. Rodale's All New Encyclopedia of Organic Gardening. Emmaus, PA: Rodale Press, 1992.

LESSON 5

References:

Anderson, Kathy, Ed. Environmental Action Waste Reduction, Teacher Resource Guide. Menlow Park: Dale Seymour Publications, c 1998.

LESSON 6

References:

Anderson, Kathy, Ed. Environmental Action Waste Reduction, Teacher Resource Guide. Menlow Park: Dale Seymour Publications, c 1998.

LESSON 7

Recommended Resources:

Kimeldorf, Martin. Exciting Writing, Successful Speaking: Activities to Make Language Come Alive. Minneapolis, MN: Free Spirit Pub. c1994.

Zeman, Anne and Kate Kelly. Everything You Need to Know about English Homework. New York: Scholastic Reference, c1995.

References:

Anderson, Kathy, Ed. Environmental Action Waste Reduction, Teacher Resource Guide. Menlow Park: Dale Seymour Publications, c1998.

NATURAL RESOURCES

NATURAL RESOURCES BACKGROUND

Natural Resources are the materials as they exist in nature from which we extract the raw materials that we use as fuel, building materials, fabrics, food etc. The list of these resources is very extensive; however, there are five basic categories of resources which are depicted in the illustrations accompanying the lesson. They are as follows: **Plants, Animals, Air, Water and Minerals & Fossil fuels.**

These resources can be further categorized as being renewable or non-renewable. **Renewable resources** are materials that can, if managed properly, be replenished through natural or human processes. For example, trees, crops and livestock are considered renewable. **Non-renewable resources** are materials that exist in fixed amounts and cannot easily or quickly be replenished. (Hundreds of thousands or millions of years would be needed.) Examples of non-renewable resources are metals, minerals, petroleum and other fossil fuels.

Due to our technological advancement in this country, the abundance of natural resources and their relative ease of extraction, many people are unaware of the negative impacts resource extraction has had on the environment.

Some of the advantages of **conserving** our natural resources are as follows:

1) To protect our **limited supply** of resources for future generations.
2) To preserve the **quality of life**. People everywhere need access to basic resources such as clean air, clean water, healthy soil and adequate mineral resources.
3) To ensure **habitat** for other species. Our actions affect other species. (i.e. logging has severely impacted spotted owl habitat)

There are a variety of ways in which we can conserve natural resources. Some experts estimate that as much as 50-70% of the solid wastes that are currently being landfilled or incinerated can be recycled or composted.

LESSON 1 - WHAT ARE NATURAL RESOURCES?

Subject: Science, Environmental Education, Social Studies

Lesson Overview:
Natural resources are defined as materials existing in nature which humans and other living things rely on for food, clothing, shelter and other needs. Although there is an abundance of natural resources in the United States, there is not an unlimited supply. Sustainable practices ensure that the needs of the present population are reasonably provided for without negatively impacting on future generations. A distinction is made in this lesson between renewable and non-renewable resources.

PA State Standards:
Science and Technology
3.5.7 B Recognize earth resources and how they affect everyday life.

Environment & Ecology
4.2.7 A Know that raw materials come from natural resources.

Content Objective:
Students will be able to identify the five basic categories of natural resources and how they are used everyday by completing a guided notes handout.

Materials: (Items in **bold** are included in the **Student Workbook.**)
Student Workbook (one per student)
Graphics of the five categories of Natural Resources
Natural Resources Kit (coal, refined oil, crude oil etc.)

Procedure:

Prior Knowledge:
Ask students if they know what natural resources are and if they can name some examples of them. Write examples on the board.

Vocabulary:
conserve- To save natural resources for future use.

fossil fuels - A fuel (i.e., coal, oil, or natural gas) that is formed in the earth from plant or animal remains. Fossil fuels are used to produce gasoline, petroleum and plastics.

habitat- The place where an animal or human lives.

natural resources- Materials existing in nature which humans and other living things rely on for food, clothing, shelter, and other needs.

non-renewable- Resources that once used are not easily replaced.

raw materials- Substances extracted from natural resources and used in manufacturing processes

renewable- Resources that can be replaced in a reasonable period of time.

sustainability – Reasonably provide for the needs of the present population without negatively impacting on future generations.

Lesson:

1) Ask students to open their **Student Workbooks** to Lesson One, instruct them to read over the vocabulary words and answer any questions they may have. Suggest that they refer to them throughout the lesson as necessary.

2) Show examples of various resources from the **Natural Resource Kit** (coal, crude and refined oil, laminated pictures and etc.) and have students name the resource represented. Facilitator will write them on the board as students name them (**plants, animals, water, air, minerals and fossil fuels**).

3) Divide students into groups of four or five. Using the categories listed on the board have students make a list of examples of these resources and some of the ways they are used everyday, (i.e., trees – lumber, paper, food, etc.).

4) They can compile these lists in their **Student Workbooks** in the section titled **Brain Storm** found in the guided notes for this lesson.

5) Discuss the difference between renewable and non-renewable resources. **Renewable resources** are materials that can, if managed properly, be replaced by natural or human actions in a relatively short period of time. Trees, crops and livestock, for example, are considered renewable. **Non-renewable resources** are materials that exist in limited amounts and cannot easily or quickly be replaced (hundreds of thousands or millions of years). Examples of non-renewable resources are metals, minerals, petroleum and other fossil fuels.

6) Ask students: “Why do we need to conserve?” Some of the reasons that we might consider **conserving** natural resources are:

   a) To protect our **limited supply** of resources for future generations.

b) To preserve the **quality of life**. People everywhere need access to basic resources such as clean air, clean water, healthy soil and adequate mineral resources.

c) To ensure **habitat** for other species, as our actions can impact them negatively (i.e., logging has severely impacted spotted owl habitat).

Reflection: Have students make a list in their **Student Workbooks** of some ways they might conserve resources at home or at school.

Assessment: Have students complete the guided notes in the **Student Workbook** and check for correctness.

WHAT ARE NATURAL RESOURCES?

____ _____ are the substances that we extract from natural resources for food, building and manufacturing etc. The five basic categories of natural resources are _____, _____, _____, _____ and minerals & _____ _____.

Materials that can be easily replaced by nature or human actions are called _____ resources. Other resources that exist in limited amounts and may take hundreds of thousands or millions of years to replace are called ___ - _____. Some examples of these difficult to replace resources are _____, _____, _____ and other fossil fuels.

Some advantages to conserving these natural resources are:

1) To protect our limited _____ of them.
2) To preserve our _____ of life.
3) To ensure _____ for other species.

WORD BANK				
plants	**renewable**	**petroleum**	**raw materials**	
fossil fuels	**water**	**air**	**metals**	**animals**
non-renewable	**minerals**	**supply**	**quality**	**habitat**

Brainstorm (with your group)
List the five categories of natural resources below and two or three ways we use each of them in everyday life. (During class discussion you may add any uses to your list shared by other groups.)

I)
a)

b)

c)

II)
a)

b)

c)

III)
a)

b)

c)

IV)
a)

b)

c)

V)
a)

b)

c)

WHAT ARE NATURAL RESOURCES? (Answer Key)

Raw materials are the substances that we extract from natural resources for food, building and manufacturing etc. The five basic categories of natural resources are **plants**, **animals**, **water**, **air** and **minerals** and **fossil fuels**.

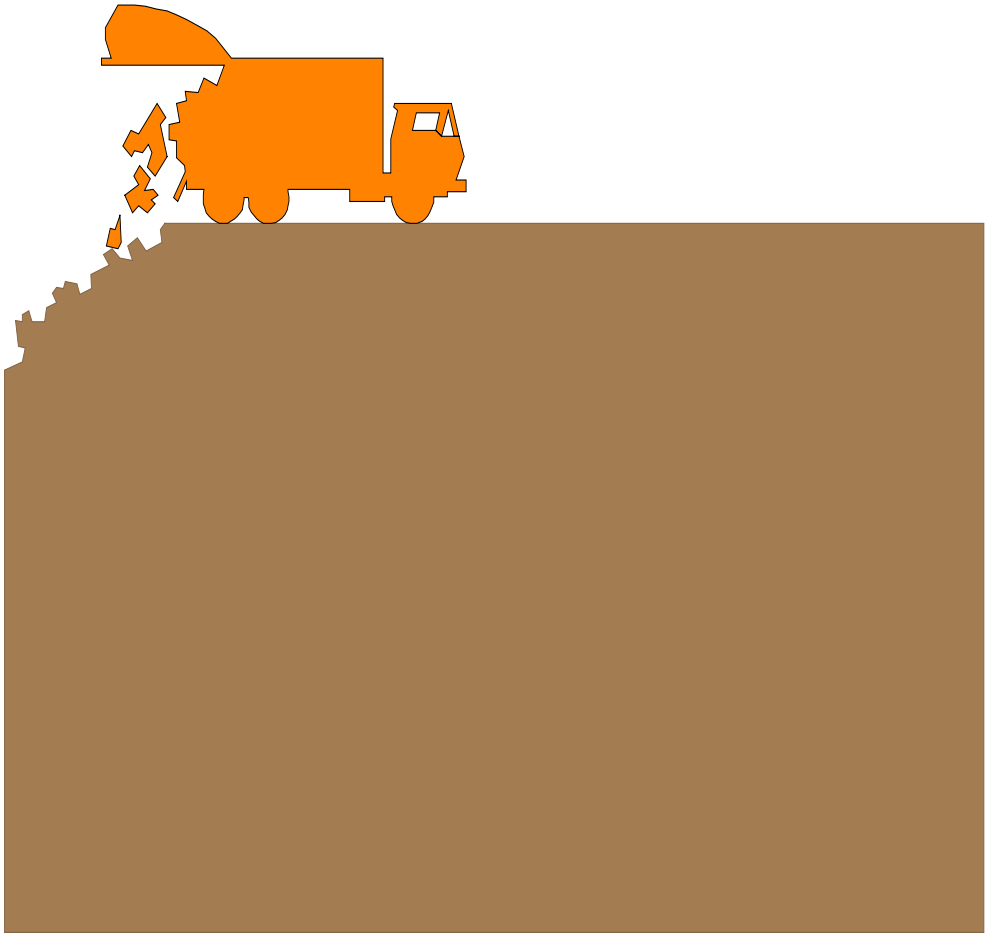
Materials that can be easily replaced by nature or human actions are called **renewable** resources. Other resources that exist in limited amounts and may take hundreds of thousands or millions of years to replace are called **non-renewable**. Some examples of these difficult to replace resources are **metals**, **minerals**, **petroleum** and other fossil fuels.

Some advantages to conserving these natural resources are:

1) To protect our limited **supply** of them.
2) To preserve our **quality** of life.
3) To ensure **habitat** for other species.

WORD BANK				
plants	**renewable**	**petroleum**	**raw materials**	
fossil fuels	**water**	**Air**	**metals**	**animals**
non-renewable	**minerals**	**supply**	**quality**	**habitat**

LANDFILLS AND SOLID WASTE



Lesson 2

SOLID WASTE, LANDFILLS, AND WASTE STREAM BACKGROUND

Garbage, trash, waste and refuse are all words to describe the items people discard, collectively referred to as **Municipal Solid Waste** (MSW). MSW consists of waste generated in residential settings (homes) and commercial settings (businesses and schools), as well as industrial non-hazardous waste. MSW is an industry, a science and a factor in human health. We can look at waste from economic, social and cultural viewpoints. It is a vast subject encompassing the fields of science, engineering, economics, mathematics, medicine, health, public policy, history, anthropology and sociology. Waste affects many aspects of our lives. No matter who we are or where we live, we create waste. It is a normal consequence of daily living, and it has been that way for as long as people have populated the planet. From medieval Europeans tossing their refuse out a window to modern waste-to-energy plants, people have taken different views of the waste they generate, depending on their lifestyle and available technology.

Waste is continually created and discarded, which results in a system known as the **waste stream**. The waste stream is the flow of waste from generation, through separation and collection, to final disposal. The waste stream originates with people. People use materials, are involved with creating and using products, and then discard waste. This connection means that people have a direct effect on the amount and type of waste that enters the waste stream by what they buy, what they choose not to buy, what they reuse or recycle, and what they throw away.

The United States leads the world in trash production, and the amount we throw away each year keeps increasing. In 1994, Americans produced 200 million tons of solid waste. That's enough to fill a line of garbage trucks encircling the earth eight times, over half the distance from the earth to the moon. The average person in the US discards about four and a half pounds of trash per day. Combining all household and industrial waste, every American will throw away 600 times his or her average adult weight in a lifetime.

Waste combustion and landfilling are important ways to manage waste that cannot be reused or recycled. Waste combustion at an **incinerator**, or burning of waste, can reduce the bulk of waste and, using waste-to-energy facilities, can generate electricity. Burning solid waste releases harmful air pollutants and leaves behind toxic residue. Materials that are incinerated either burn to ash or meltdown residue. Pros of incineration are that it kills any organisms that could cause disease, it reduces the volume of trash by 70-90%, and energy from the burning can be used as an alternative energy source to produce heat or

electricity. Arguments against incineration are that toxic ash or residues are generated and are very concentrated. Air pollution is caused with heavy metals, and waste-to-energy plants are extremely expensive to build.

Landfilling is the most common form of MSW disposal. Garbage is dumped and covered by a 6 to 8 inch layer of soil. **Sanitary landfills**, in which garbage is covered, were previously known as dumps, which were uncovered pits or piles of trash. The cover of dirt on the landfill helps to prevent odors and litter from escaping into the surrounding area. A landfill contains a **liner** made out of plastic or clay, to keep toxics from passing into the dirt around the landfill. Trash in a landfill is compacted by bulldozers and covered with at least 6 inches of dirt. There are laws that state where landfills can and cannot be built: away from sensitive environments such as streams and rivers to prevent pollution, close to the source of waste to cut transportation costs. Between 65 and 85 percent of solid waste ends up in landfills.

There are several environmental hazards from landfills. There is evidence that toxins from landfills could leak into nearby land and into groundwater. Siting for landfills is difficult because of limited space and concern for public health and safety. Landfills are also very expensive. A 100-acre site with a lifespan of 20 years costs about $87 million. Another problem is that waste does not **decompose** very much in landfills that are built according to federal regulations. The compacted trash is covered with dirt and is kept airtight and dry. This design is intended to keep harmful **methane gas** from escaping into the atmosphere and to prevent **leachate** from seeping out through the liner and contaminating the ground and the water table. The lack of decomposition is why landfills are filling so quickly. A full trash bag or a stack of newspapers takes up the same amount of space decades after it was first compacted.

An alternative to landfilling and incineration includes reducing the amount of waste that goes into the waste stream. Practicing the **3R's (reducing, reusing and recycling)** will accomplish that. **Reducing** involves changing how goods are produced and what we buy to reduce the amount and toxicity of trash. **Reusing** entails either substituting reusable items for disposable ones or finding a way to use something again. **Recycling** involves using recyclable materials in the making of new products as well as buying products with recycled content. The 3R's are practical methods that everyone can practice to reduce the amount of waste that goes to landfills.

LESSON 2 - WHERE DOES OUR SOLID WASTE GO?

Subject:
Science, Environmental Education, Language Arts

Lesson Overview:
Students, families and communities are all responsible for creating solid waste, but little attention is given to waste after it leaves the trash can. Solid waste takes up space when it is disposed of in a landfill. There are also many issues associated with storage and destruction of solid waste that impact on human health and safety.

PA State Standards:
Environment & Ecology
4.3.7B Describe how human actions affect the health of the environment.
4.7.7C Identify a species that became extinct through natural causes and explain how that occurred.
4.8.7.C Explain how human activities may affect local, regional and national environments.
4.2.7D Describe the role of recycling and waste management.

Content Objectives:
Students will be able to identify the four parts of the waste stream and at least three strategies for managing solid waste by completing a guided notes handout and participating in classroom dialogue on that topic.

Students will be able to identify parts of a landfill and three problems caused by landfills by completing the guided notes handout and a landfill diagram.

Materials: (Items in **bold** are included in the **Student Workbook.**)
Landfill diagram
Landfills-What are They Good For? (guided notes)
Home Audit Worksheet
Home Audit Questions
4.5 lb. bag of trash[1]
Pen/Pencil (1 per student)

[1] You can pre-assemble a bag of "clean" trash with mixed materials, some recyclable and non-recyclable materials.
recyclables – glass bottles, aluminum cans, food containers, cardboard, milk jugs, newspaper, office paper.
non-recyclables - plastic wrappers, lids, tissues, paper towels, tape, pens/pencils.

Lesson 2

Procedure:

Review:

Review Lesson 1 – Lesson Objective with the students.

Prior Knowledge:

Ask students what they already know about landfills and how they are constructed.

Vocabulary:

audit – To study or examine something.

decomposition – The decay or breakdown of materials.

groundwater – Water that is contained in rock and soil underground.

incinerator – A device that burns garbage and reduces the overall mass of material, leaving behind ash.

landfill – Site for disposal of solid waste. Landfills are lined with clay and plastic, filled with alternative layers of garbage and dirt, and finally capped with plastic.

leachate – Water that becomes contaminated through contact with toxic materials in a landfill.

methane gas – A very flammable gas produced by decomposing waste in a landfill.

municipal solid waste – Garbage, refuse or trash that is generated at homes, schools and businesses.

3R's – Reduce, Reuse Recycle

reduce (3R's) – To change how goods are produced, what we buy and our use of resources to reduce the amount and toxicity of trash.

reuse (3R's) – The substitution of reusable items for disposable ones or using previously used materials as opposed to new ones.

recycle (3R's) – To create new products out of previously used materials.

waste stream – The flow of waste from generation, through separation and collection, to final disposal.

Lesson 2

Lesson:

1) Instruct students to review the vocabulary words for Lesson 2 and answer any questions they may have. Tell them to refer to the vocabulary list as necessary during the lesson.

2) Show the students a bag of trash weighing 4.5 lbs. and explain that this is the amount of waste the average North American generates in one day and that all these materials were extracted from Natural Resources.

3) Ask them where this goes? (It enters the "waste stream". The "waste stream" is a term used to describe the flow of trash from its creation to final disposal. There are four steps to the waste stream: generation – the production of waste, separation – removing the recyclable materials, collection – trash pick up, and final disposal in a landfill or incinerator.)

4) Discuss the history of waste disposal with the class:

In earlier times trash was dumped in open pits on the outskirts of towns and villages called dumps. The working conditions were extremely unpleasant, there was a continuous foul smell and animals rooted through the open piles of garbage spreading disease.

As materials broke down methane gas was released causing periodic, unexpected explosions in which workers might be hurt or killed. In addition, leachate, or water that had become polluted by contact with materials in the dump, would seep into the soil polluting the groundwater and affecting the health of plants, animals and people in the surrounding area.

5) Ask students: "Do you know how landfills are designed?". Discuss with students their thoughts about how landfills are constructed.

6) Discuss with students guidelines for solid waste disposal in modern sanitary landfills.

In order to protect human health and the health of the environment the US EPA (Environmental Protection Agency) established the following guidelines for disposal of solid wastes in landfills. (Refer to enclosed illustration.)

a) Landfills are lined with clay and plastic liners to prevent contamination of the groundwater.

b) Trash is compacted daily and covered with six inches of soil to reduce odors, keep animals out and to prevent materials in the landfill from littering the surrounding environment.

c) A system of pipes is installed throughout the landfill for the collection of methane gas and another set of pipes to collect leachate. The leachate is pumped into storage tanks for later disposal as a hazardous waste. The methane gas is also collected in storage tanks and can be used for fuel.

d) Wells for the monitoring of the groundwater and gas emissions from the landfill are installed and must be checked for several years after the landfill has closed to ensure that safe levels are maintained.

e) When the landfill reaches capacity it is sealed with a plastic cap to keep materials inside from escaping. It is then covered with a final layer of soil and planted with grass or other vegetation to prevent erosion.

9) Discuss with students environmental impacts of landfills:
   a) limited decomposition – Due to a lack of oxygen and the absence of sunlight materials don't breakdown.

   b) possibility of leachate in groundwater – Pipes in the leachate collection system can crack and leak.

   c) emission of methane gas from leaky pipes (similar to above)

   d) safety issues – large trucks transporting materials 24 hrs/day, 7 days/week; bad odor.

   e) loss of habitat for humans and animals – Farms and forested areas are often disrupted when building a landfill and the land will be unusable for other purposes for a long time.

10) Discuss alternatives to landfills.
   a) **Incineration** – Burning of trash reduces its mass and can be used to produce heat and electricity but does produce air pollution, toxic ash and residue.

   b) **3 Rs** – By practicing source reduction, reusing and recycling we can divert materials from the waste stream and reduce the amount of materials being landfilled or incinerated.

11) Instruct students to complete the handout called **Landfills, What are they Good For?** for homework using the word bank. Introduce the **Home Audit Worksheet** as a second homework assignment.

Home Audit Procedure:

Everyone contributes to the solid waste problem. If individuals are interested in changing their behavior to reduce the amount of solid waste they generate, they first need to know what type and how much solid waste they currently create. The home audit will help students to get a feel for how much solid waste they generate in one day.

a) Go over the **Home Audit** and **Home Audit Questions (in Student Workbook)** with the students during class.

b) Students should take the **Student Workbook** home and record on the **Home Audit Worksheet** every material that they throw out from the time they get home until the time they go to bed.

c) Review the chart that students will use to record information:
   Item/Material
   Quantity of material (approximately)
   Can it be reused or recycled?

d) Remind students to answer the questions on the back of the **Home Audit Worksheet.**

e) Tell the students that during the next session you will discuss the completed **Home Audit** and **Home Audit Questions**.

12) Ask students to see if they can find a product made with recycled content to bring in to share for the next class period.

Lesson 2

LESSON 2

LANDFILL DIAGRAM

Lesson 2

LANDFILLS- WHAT ARE THEY GOOD FOR? 

Solid waste is also known as trash, garbage or refuse. When it's thrown into the trash can, it becomes part of the _____ _____which is the path it follows until its final disposal. There are four parts to the waste stream:

1._____ 2. _____ 3. _____ 4. _____

What do we do with our waste? 65 -85% of our solid waste goes to landfills. One of the differences between a landfill and the older "dump" is that a landfill is covered with 6 inches of _____ every day. This is intended to reduce _____and keep down litter. Clay and plastic _____are installed beneath the landfill to keep toxics from leaking into the groundwater. Pipes are installed throughout the landfill for the collection of _____ gas.

When a landfill is completely filled it is sealed with a plastic cap.

There are 3 major problems associated with landfills.

A. Landfills produce toxic water called _____ that can pollute (contaminate) the groundwater. Polluted groundwater will end up in lakes, streams and rivers, which is where we get our drinking water.
B. There is little _____ in landfills because there is little air, sunlight or moisture let in. This means that the garbage never decays, it stays in its original form. The bag of garbage that goes into the landfill stays in there forever.
C. When a landfill is built, the land is cleared with bulldozers and tractors. This changes acres of _____ in the area, and animals must find other places to live.

WORD BANK

habitat	**soil**	**disposal**
decomposition	**leachate**	**methane**
collection	**odor**	**generation**
waste stream	**liners**	**separation**

Lesson 2

LANDFILLS- WHAT ARE THEY GOOD FOR? (Answer Key) 

Solid waste is also known as trash, garbage or refuse. When it's thrown into the trash can, it becomes part of the **waste stream** which is the path it follows until its final disposal. There are four parts to the waste stream:

1. **generation** 2. **separation** 3. **collection** 4. **disposal**

What do we do with our waste? 65 -85% of our solid waste goes to landfills. One of the differences between a landfill and the older "dump" is that a landfill is covered with 6 inches of **soil** every day. This is intended to reduce **odor** and keep down litter. Clay and plastic **liners** are installed beneath the landfill to keep toxics from leaking into the groundwater. Pipes are installed throughout the landfill for the collection of **methane** gas.

When a landfill is completely filled it is sealed with a plastic cap.

There are 3 major problems associated with landfills.

a. Landfills produce toxic water called **leachate** that can pollute (contaminate) the groundwater. Polluted groundwater will end up in lakes, streams and rivers, which is where we get our drinking water.
b. There is little **decomposition** in landfills because there is little air, sunlight or moisture let in. This means that the garbage never decays, it stays in its original form. The bag of garbage that goes into the landfill stays in there forever.
c. When a landfill is built, the land is cleared with bulldozers and tractors. This changes acres of **habitat** in the area, and animals must find other places to live.

WORD BANK

habitat	**soil**	**disposal**
decomposition	**leachate**	**methane**
collection	**odor**	**generation**
waste stream	**liners**	**separation**

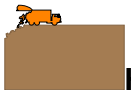
Lesson 2

HOME AUDIT

ACTIVITY SHEET
LESSON TWO

ITEM/MATERIAL	AMOUNT OF MATERIAL	OTHER USES

Lesson 2



Home Audit Questions

1. What material did you throw out the most? (plastic, glass, paper, aluminum, etc.)

   _____

2. Was the material in question #1 recyclable? _____

3. Were any other materials that you discarded (listed on your **Home Audit Worksheet**) recyclable? _____

   If yes, which ones? _____

4. Did you throw out more recyclable or non-recyclable items?

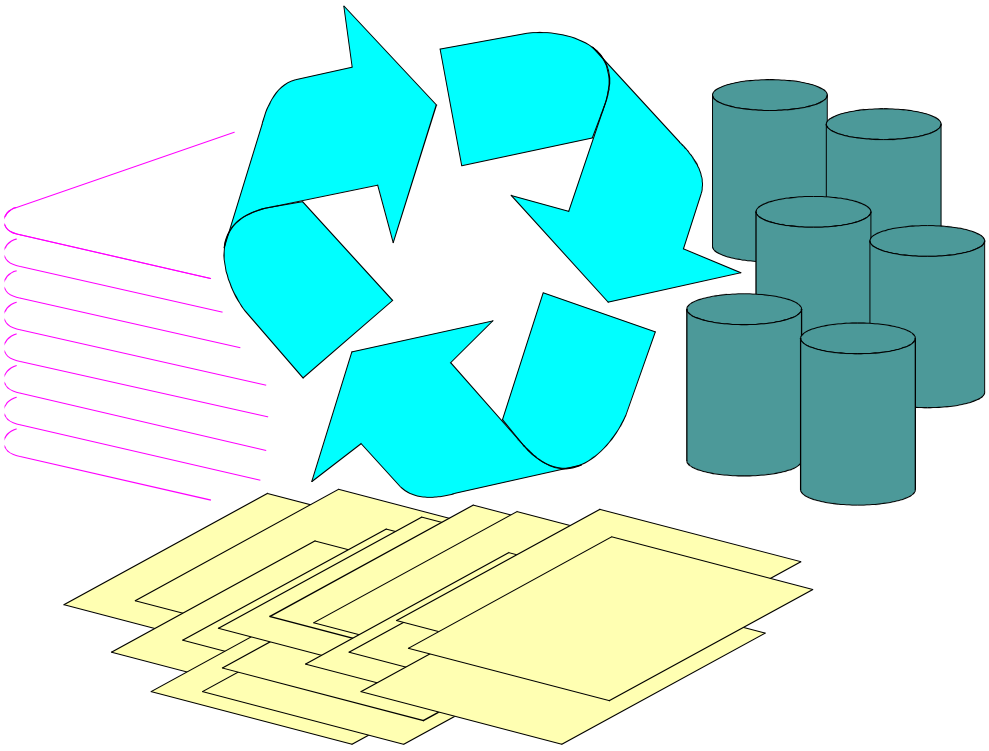
   _____

5. For all the materials on your list, can you think of any other way to use them, in order to keep them out of the trash can? Be specific. List the answers on your **Home Audit Worksheet** next to the item.

6. Describe two ways that trash affects you, your family or your community.

Lesson 2

CLOSING THE LOOP AND BUYING RECYCLED



CLOSING THE LOOP AND BUYING RECYCLED BACKGROUND

Recycling is one method of solid waste management that reduces the amount of waste that would otherwise be burned at waste combustion facilities or buried in landfills. By recycling materials, individuals and societies can extend the value and utility of resources and can improve environmental quality. Materials that can be recycled are called **recyclables**. Recycling is a five part process often referred to as **Closing the Loop**.
Step One: The collection of materials at home.
Step Two: The recyclables are taken to the Materials Recovery Facility (MRF).
Step Three: Glass, plastic and aluminum are separated from one another and baled or bundled and prepared for shipment to factories.
Step Four: Sorted materials are sent to factories to be manufactured into new products.
Step Five: New products are sent to stores where the consumer buys them. Naturally, Step One will follow Step Five and the cycle will continue. If one of these steps fails to happen, the other steps will cease to happen also. For example, if factories don't want bales of recyclables (Step Four), the materials won't be sorted at the MRF (Step Three). If consumers don't purchase recycled products (Step Five), factories will stop making recycled products (Step Four).

Recycled materials can come from two sources, **Pre-Consumer waste** and **Post-consumer waste**. Pre-Consumer waste refers to materials that are left over from manufacturing processes, for example, the remaining paper scraps and trimmings from the paper manufacturing process. Post-consumer waste refers to materials that have been used and collected for recycling such as aluminum cans, glass bottles and newspapers.

Recyclable items are collected in a variety of different ways including curbside pick-up, drop-off centers and deposit/refund programs. Curbside pick-up can involve the collection of separated or **commingled recyclables**. Separated collections means that recyclables are separated in advance by material type such as paper, plastic, glass or aluminum. Commingled collection means that all recyclables are mixed together and sorted by material type at the MRF.

Waste materials taken to MRF's are sorted both manually and mechanically to separate recyclable materials by type and to remove non-recyclable waste. Steel or tin cans can be removed using magnets. Aluminum can be separated by hand or by using eddy currents, which are repelling electrical charges that cause cans to pop up. Glass and plastic are often sorted by hand according to color or plastic resin type. These processes insure that the recovered material is of high quality with minimum contamination. After separation, the materials are crushed,

shredded or baled according to the manufacturer's needs, material type, and transportation concerns.

It is very important to follow the proper recycling techniques. The following steps should always be taken prior to placing recyclables in the recycling bin:

Rinse all containers. (Food waste could hurt the recycling process.)
Remove lids. (Lids are not made from the same material as the container and may not be recyclable.)
Place your recyclables in the proper container (bin, blue bag, bucket).

If there are non-recyclables mixed in with recyclables, the bag is "**contaminated**". A contaminated bag cannot be recycled and is usually thrown in the garbage at the MRF.

LABELS:

Products are often labeled as "recyclable", "recycled" or both. **Recyclable** means that the product can be recycled. **Recycled** means that the product was made from recycled materials. Many recycled products indicate the percentage of pre-consumer waste and post-consumer waste used in the manufacturing of the product, or both. In addition to the written information, symbols are used. For example, items that have recycled content may have a symbol using light arrows on a dark background. Items that are recyclable often have a symbol using dark or raised arrows without a background. Recyclable plastics are coded with a number inside the chasing arrows symbol to indicate the type of plastic and how it can be recycled. Many communities recycle plastics with a #1 or #2 code. The code #1 refers to polyethylene terephthalate plastic (PETE). **PETE** is commonly used for soft drink bottles. The code #2 refers to high-density polyethylene **(HDPE)** plastic, which is often used for milk jugs and laundry detergent containers.

The generic word for plastic refers to a wide range of materials. This can be confusing since there are 45 basic families of plastics and each can be made with hundreds of variations. Plastics are made from crude oil and natural gas. Basic compounds of carbon, hydrogen, oxygen and nitrogen are extracted and combined to produce plastics. Plastics are extraordinarily diverse. From contact lenses to soft drink bottles to computer consoles to automobile airbags, plastics are a family of materials that, through technology, can be used in many different forms.

More than 15,000 communities now recover some type of plastic for recycling, with residents actively participating in curbside or drop-off recycling programs. These collected items are being used by the recycling industry to make new products such as bottles, office supplies, carpeting, jackets and even hiking boots.

Without a market for recyclable materials, these materials are only being collected, not recycled. Only those recycling activities that are economically and commercially viable create reliable markets for recycled materials. Items that

have established markets and are most commonly recycled are aluminum, steel or tin, paper, glass and plastics. Those materials can be made into new containers or various other products. Many new products have been brought to the market because of recycling technology. Some of these products include synthetic lumber made from recycled plastic, fleece jackets made from recycled plastic bottles, and numerous types of paper products made from recycled paper and cardboard.

While a relatively steady supply of recyclable materials exists, markets for such materials are highly variable. This variable market makes it difficult for industries and municipalities to depend on recycling as a steady source of revenue. Numerous businesses and industries have established new markets, expanded the need to utilize recovered products and materials or both, but successful recycling programs depend on consumer demand. For recyclable materials to be made into new products, an industrial demand for the materials and a consumer demand for products made from recycled materials must exist.

BUYING RECYCLED:

For recycling to really work, there must be demand for recycled products. If consumers do not buy the goods, manufacturers will not make them and the materials collected for recycling may wind up in the landfill. As consumers, we have the purchasing power to influence manufacturers to make things from recycled materials. Examples of what recycled materials are turned into are listed below:

Glass- new glass bottles
Aluminum cans- new aluminum cans
Tin and Steel- cars, lawn mowers, steel beams, new cans
Yard and Food Waste- compost for backyard gardens
Paper- newspaper, toilet paper, writing paper, cardboard
Plastic- new bottles, clothing, carpet, track material, playground material, fiberfill, trays

We as consumers make choices about what we buy. We also make choices about how we dispose of the trash we generate.

LESSON 3 - CLOSING THE LOOP AND BUYING RECYCLED

Subject:
Science, Social Studies

Lesson Objective:
Recycling materials extends the value and utility of natural resources and can produce environmental quality by reducing the amount of waste in the waste stream. We refer to recycling as "Closing the Loop", a process consisting of five steps. If one of the five steps does not occur, the loop breaks and recycling does not happen. It is important for students to be aware of how they can play a part in Closing the Loop.

PA State Standards:
Environment and Ecology
4.2.7B Examine the renewability of resources.
D Describe the role of recycling and waste management.
4.6.7B Explain the concepts of cycles.

Science and Technology
3.1.7A Explain the parts of a simple system and their relationship to each other.

Content Objectives:
Students will be able to identify the five steps in *closing the loop* and be able to name the most commonly recycled items in their area.

Materials: (items in **bold** are found in the Student Workbook)
"Complete the Circle" video (To obtain your own copy call 1-800-CALL EDF.)
"Complete the Circle" handout
Student Workbooks
4.5 lb bag of trash (from lesson 2)
Pen or Pencils

Procedure:

Prior Knowledge:
Ask students what they already know about recycling, such as, "What materials are recyclable?".

Vocabulary:
closing the loop- The five steps necessary to recycle.

commingled- When different types of recyclable products are mixed (aluminum, glass and plastic).

contamination- The condition occurring when recyclable materials are mixed with non-recyclables.

HDPE (#2) plastic - One of the two most commonly recycled plastics in the US (for example: milk jugs and laundry detergent containers).

Materials Recovery Facility (MRF)- The place where recyclables are taken to be sorted and separated.

PETE (#1) plastic - One of the two most commonly recycled plastics in the US (for example: soda bottles and juice bottles).

post-consumer waste- Materials that have been previously used by consumers.

pre-consumer waste- Materials that are left over from the production process (for example: scraps of cloth on the factory floor).

recyclable- A product that can be recycled.

recycled- A product that was made from previously used materials.

recycling coordinator- The individual who starts the recycling program and organizes all of the components.

Lesson:

1) Review Lesson #2 and Home Audit Results

2) Pass out **Student Workbooks**.

3) Review the three R's (Reduce, Reuse and Recycle) to introduce Lesson 3. Instruct students to review vocabulary words for Lesson 3 and tell them to refer to them throughout the lesson as necessary.

4) Open up the bag of trash from the previous lesson and have the students help you sort it into two piles, one of **recyclables** and the other **non-recyclables**.
   (Recyclables - glass bottles, aluminum cans, food containers, cardboard, milk jugs, newspaper, office paper. **Non-recyclables** - plastic wrappers, lids, tissues, paper towels, tape, pens/pencils)

5) Discuss with students items that can be recycled in their municipality and list them on the board.

6) Discuss the steps in closing the loop:
   Recyclables are-
   a) Collected, separated and cleaned
   b) Sent to the recycling center
   c) Sorted, baled and sent to factories
   d) Made into new products
   e) Purchased by consumers.

7) Discuss other community efforts to recycle.
   a) yard waste drop off sites
   b) phone book collections
   c) ink jet cartridges
   d) appliances

8) Pass around items with recycled content. Ask to see if any students brought in items that were made from recycled materials.

8) Introduce the concept of closing the loop and stress the importance of buying recycled products

9) Show the “Complete the Circle” video.

10) Instruct the students to complete the “Complete the Circle” handout during the video or for homework.

Reflection:
Have students write down what they learned about recycling from this lesson.

Assessment:
Check “Complete the Circle” handout for accuracy.

"Complete The Circle, How To Buy Recycled"
Video Questions

Directions: As you watch the video, "Complete The Circle, How to Buy Recycled" see if you can discover the answers to the following questions.

1) How do you score a homerun when recycling?

2) Describe how to " complete the circle" or "close the loop." (Hint, think about the baseball bases.)

3) List three benefits of recycling.

4) What does EDF stand for?
   What type of work does the EDF do?

5) How can a consumer identify products and packaging made from recycled materials?

6) Define the term Post-consumer.

7) How can something be recycled, but have no Post-consumer recycled content?

8) If you were choosing between two recycled products, which is the best recycled product to buy?

9) Give three examples of misleading advertising. (Hint- Bologna!)

10) Describe the difference between recyclable and recycled.

11) What does the three arrow recycling symbol mean?

12) What are the three “safe-bets” when looking for packaging with Post-consumer recycled content?

13) How can you cast a vote for packaging with post-consumer recycled content?

"Complete The Circle, How To Buy Recycled"
Answer Key

Directions: As you watch the video, "Complete The Circle, How to Buy Recycled" see if you can discover the answers to the following questions.

1) How do you score a homerun when recycling?
(When we buy products & packaging made with recycled materials we complete the circle or close the loop.)

2) Describe how to " complete the circle or close the loop" recycling. (Hint, think about the baseball bases.)
(1st Buy a recyclable item or packaging., 2nd clean, sort, and collect recyclables, 3rd Resort materials at Materials Recovery Facility and remanufacture recyclables into new products, 4th Buy the product with Post-consumer recycled content.)

3) List three benefits of "Recycling"
(1st Reduce need for landfills , 2nd Saves resources/ energy, 3rd Provides new jobs/ business opportunities)

4) What does EDF stand for and what type of work does this group do?
(*Environmental Defense Fund – Mission to protect the global environment. First accomplishment – banned pesticide DDT)*

5) How can the consumer find products and packaging made from recycled materials.
(*Read label to find "Post-consumer recycled content")*

6) Define the term Post-consumer.
(Anything already used & discarded by a consumer. Necessary step in closing the purchasing loop.)

7) How can something be recycled, but have no Post-consumer recycled content?
(Product is made from pre-consumer factory scraps. Pre-consumer recycled content does not reduce household waste going to the landfill.)

8) If you were choosing between two recycled products, which is the best recycled product to buy?
(Select product with the largest percentage of Post-consumer recycled content.)

9) Give three examples of misleading advertising. (Hint- Bologna!)
(Eco-Safe, Earth-Safe, Environmentally Friendly)

10) Describe the difference between recyclable and recycled.
(Recyclable materials have the potential to be recycled, but do not guarantee that the community actually recycles materials. Recycled materials guarantees product contains a percentage of either pre-consumer or Post-consumer recycled content.)

11) What does the three-arrow recycling symbol mean?
(Symbol is a reminder that a product or its packaging is recyclable.)

12) What are the three "safe-bets" when looking for packaging with Post-consumer recycled content?
(Aluminum with 50% post-consumer recycled content. Glass with 25% post-consumer recycled content. Tin [steel] 12% post-consumer recycled content.)

13) How can you cast a vote for packaging with post-consumer recycled content?
(By choosing to purchase products with packaging made from Post-consumer recycled content.)

Lesson 3

COMPOSTING

COMPOSTING BACKGROUND

Composting is nature's way of recycling. Organic materials, that would otherwise be discarded, are transformed into a usable resource. Using the natural process of decay, organic materials, such as grass clippings, food scraps, and leaves, turn into a nutrient-rich soil material called **compost**. By composting food and yard waste we can reduce the amount of solid waste going to landfills by 25%.

Finished compost can benefit the soil in many ways and is one of the primary **soil amendments** used in **organic farming**. It can benefit the soil by providing a source of plant nutrients, a habitat for **microorganisms**, and by improving drainage and water retention.

The first step in the composting process is to layer **organic materials** into the compost pile. **Decomposition** in a compost pile occurs through the activity of a group of microorganisms, fungi, insects and worms that live in the soil, called **decomposers**. When organic material is collected in a compost pile, bacteria, fungi and other microorganisms start breaking down the material, producing heat, carbon dioxide and water. Next the heat-loving, or **thermophilic**, bacteria move in, and decomposition speeds up. After the thermophilic stage, the pile will begin to cool down and other organisms, such as earthworms, beetles and grubs, will move in to complete the decomposition, turning the pile into rich soil-material.

By controlling the factors of decomposition, the natural decomposition process can be reduced in time from a period of two years to several months. The six essential environmental factors that affect the rate at which a compost pile decomposes are:

1) Food for the microorganisms
2) Particle size of materials being composted
3) Sufficient moisture - water
4) **Aeration**- air
5) Temperature
6) Size of compost pile

Food for microorganisms - When adding materials to the pile, it is important to have a good balance between 'greens' (nitrogen source) and 'browns' (carbon source). Browns are carbon-rich, dry materials which break down slowly, such as dry leaves, straw, sawdust and wood chips. Greens are nitrogen-rich, moist or wet materials, which break down very quickly, such as grass clippings, vegetable scraps, and coffee grounds.

Particle size of materials being composted - The smaller the material is in a compost pile, the faster it will be composted. Smaller particles have more surface area for the decomposers to work on than larger particles.

Sufficient moisture - water - Decomposition will slow down or stop if there is too little or too much water. The material in a compost pile should be as wet as a wrung out sponge.

Air - The decomposers in a compost pile need air to live. Occasionally a compost pile should be aerated by either stirring or turning it.

Temperature - Decomposition occurs between the temperature of 55^{o}F and 155^{o}F. Microorganisms slow down when the temperature is low. They also cannot survive above 155^{o}F. Typically when a compost pile heats up, the temperature will reach 140-150^{o}F. At this temperature the thermophilic microorganisms that are generating the heat will begin to die off, and the compost pile will begin to cool down.

Size of compost pile - Decomposition occurs more rapidly when the compost pile has some volume. An ideal size for a compost pile is a three-foot cube. A compost pile of this size has enough volume to heat up, but is easy to aerate.

LESSON 4 - COMPOSTING

Subject:
Environmental Science, Ecology

Lesson Overview:
Composting is a means by which we can divert organic materials from landfills and turn them into a valuable resource. Food and yard waste comprise about 25% of the waste stream and can easily be composted privately or in municipal composting programs.

PA State Standards:
Environment and Ecology
4.2.7D Describe the role of recycling and waste management.
4.2.10D Explain different management alternatives involved in recycling and solid waste management.
4.2.7C Explain biological diversity.

Content Objectives:
Students will be able to identify types of materials that can be easily composted by filling in a guided note handout.

Students will be able to identify the proper conditions for composting as well as the various organisms involved in decomposition by completing guided notes about composting.

Materials: (Items in **bold** are included in the **Student Workbook.**)
Student Workbooks
Transparencies
Pictures of Decomposers
Overhead projector
Compost guided notes (advanced students)
It's Gotten Rotten Video (advanced students)
Samples of compost at various stages of decomposition
Worm bin (younger students)
Flashlights (younger students)
Clear Plastic Cups (younger students)
Hand-wipes (younger students)

Procedure:

Prior Knowledge:

Ask students if they have ever seen a compost pile. Ask the students if they know what happens in a compost pile.

Vocabulary:

aeration- The process of mixing with air or oxygen.

compost- A nutrient-rich soil formed by decomposition of yard and food wastes

composting- The process of food and yard waste decomposing and turning into a valuable, nutrient-rich soil material**.**

decomposition- The breakdown of organic materials by natural processes.

decomposers – A group of microorganisms, insects and worms that decompose organic matter by breaking it down into a rich soil material.

microorganisms- Any organism too small to be seen with the unaided eye, such as bacteria, fungi etc.

organic farming – Method of farming or gardening that utilizes only natural means to improve soil and plant health. An organic farmer uses no chemical fertilizers or pesticides.

organic matter- Material composed of once living organisms

soil amendment - Substance added to the soil to improve its texture, fertility or water-holding capacity

thermophilic- Heat-loving.

Lesson:

1) Review the previous lesson by reading Lesson 3 – Lesson Overview and reviewing vocabulary.

2) Show pictures of decomposers to the students and ask what the pictures have in common. *They are decomposers*

3) Ask the students what the role of decomposers is in the natural environment. *Cycle nutrients*

4) Show transparency “Nutrient cycle” and explain. – *A seed sprouts in the ground. It takes in nutrients from the soil to aid its growth. The plant continues to mature and grow as it takes in more and more soil nutrients. When the plant’s life comes to an end, it dies and begins to decay. By decaying it releases the nutrients it took from the soil, back into the soil for the next generation of plants.*

5) Ask the students why the decomposers are important to our environment?
   a. *Because the decomposers take decaying material and break it down into nutrients that other plants need to grow.*
   b. *Because it diverts garbage away from the waste stream.*

6) Show transparency “ How much can we compost?”. Ask the students which categories of the pie chart can be composted. *Yard waste, some of the food waste and some of the paper.* Explain that approximately 25% of all the garbage we put into a landfill could be composted!

7) Show transparency “Landfill vs. Composting” and explain each diagram. Have the students explain which system they feel is the best.

8) Explain that composting is nature’s way of recycling. Ask “does any one have a compost pile at home or know of anyone who does?”.

9) Ask the students to tell you how composting happens. Ask them how autumn leaves, food, etc., “recycle” back into soil.

10) Explain that it is the role of the decomposers. Hold up pictures of decomposers again. Explain that by creating an ideal “habitat” for these decomposers they quickly recycle food and yard materials back into a rich soil.

11) Ask the students what organisms need to live. *Food, water, and air*.(Note that most decomposers do not need a lot of light. They seek out places that are dark, like a compost pile.)

12) Make a chart on the board to talk about what materials to put in a compost pile.

Compostable	Non-compostable
egg shells	meat
coffee grounds	dairy products
fruit & vegetable scraps	fatty, oily foods
grass clippings	pet wastes
garden weeds	inorganic materials
sawdust	
rotten fruits & vegetables	
Leaves	
Leftovers	

13) Explain that when you create a compost pile with these compostable materials, you are creating an ideal habitat for the decomposers. They exist in a compost pile because the material in a compost pile is the decomposers' food. They eat the kitchen scraps and yard waste and break them all down into soil.

14) Show organic materials at various stages of decomposition.

15) Advanced Students - Hand out copies of the background information and the "Composting" guided notes . Supplement with the "It's Gotten Rotten" Video.

16) Younger Students - Worm Composting. Explain that earthworms are a very important part of the decomposition process. By eating decomposing materials, they convert it into a rich soil material.

a) Show them the worm bin and explain that the worms eat the newspapers, vegetable and fruit scraps and convert it into a nutrient-rich soil material.

b) Explain that worms need to be handled with care. They don't like light, they don't like to be held, and they need to be kept moist so that they can breathe. Therefore, minimize the amount of time the worms are being handled.

c) Explain that with worms, we have the opportunity to see how the decomposition process works. Worms are translucent. If you hold a light up to the worm you can see their digestive tract. The food travels down through the worm as it turns back into soil. Demonstrate by placing a worm in a plastic cup and shine a flashlight through the bottom of the glass. Remind the students to shine the light in short intervals.

d) Split the class up into groups of 4 or 5 students. Give each group a plastic cup with a worm, a magnifying glass and a flashlight. Have the students observe the worms as you assist them.

e) Collect worms at the end of class and give each student a hand-wipe to clean up.

17) Review notes and/or make sure that all of the vocabulary words have been covered.

Assessment:
Collect **Composting** handout.

COMPOSTING

Finished _____ can benefit the soil in many ways, and is one of the primary soil amendments used in _____ farming.

It benefits the soil by: **1.** providing plants with _____ **2.** providing habitats for _____, and **3.** improving drainage and _____ retention.

The first step in the composting process is layering _____ materials into the compost _____. Then microorganisms move into the pile from the _____, and begin breaking down the material.

As the microorganisms do their work, three things are released: heat, _____ _____, and water. The thermophilic, or _____-_____ bacteria move in and decomposition occurs very rapidly, as temperatures in the pile reach as high as _____. This phase usually lasts about two to three weeks. As the pile cools, other organisms such as insects, mites and _____ move in to complete the _____ of materials. During the composting process, the pile will reduce in size by as much as _____.

The five environmental factors essential for decomposition to occur are:

1. _____ 2. sufficient _____ 3. _____ size of materials being composted 4. _____ of the compost pile 5. food for the _____

WORD BANK				
	Pile	**micro-organisms**	**particle**	**nutrients**
compost	**Moisture**	**worms**	**soil**	**150°F**
65%	**heat-loving**	**carbon dioxide**	**organic**	**size**
organic	**Aeration**	**breakdown**	**water**	**micro-organisms**

COMPOSTING to Reduce the Waste Stream

Finished **compost** can benefit the soil in many ways, and is one of the primary soil amendments used in **organic** farming.

It benefits the soil by: **1.** providing plants with **nutrients** **2.** providing habitats for **micro-organisms**, and **3.** improving drainage and **water** retention.

The first step in the composting process is layering **organic** materials into the compost **pile**. Then microorganisms move into the pile from the **soil**, and begin breaking down the material.

As the microorganisms do their work, three things are released: heat, **carbon dioxide,** and water. The thermophilic, or **heat-loving** bacteria move in and decomposition occurs very rapidly, as temperatures in the pile reach as high as **150°**. This phase usually lasts about two to three weeks. As the pile cools, other organisms such as insects, mites and **worms** move in to complete the **breakdown** of the materials. During the composting process, the pile will reduce in size by as much as **65%.**

The five environmental factors essential for decomposition to occur are:

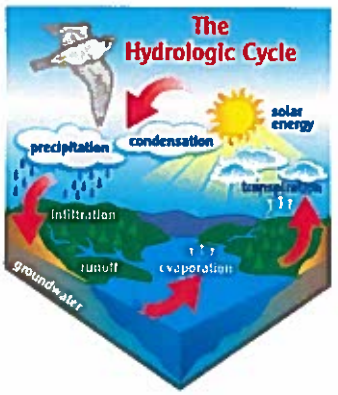
1. **Aeration** 2. sufficient **moisture** 3. size of materials being composted

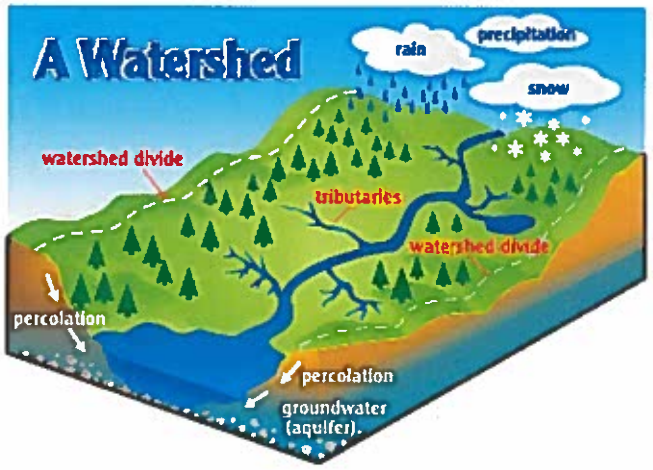
4. **size** of the compost pile 5. food for the **micro-organisms.**

WORD BANK				
	pile	**micro-organisms**	**particle**	**nutrients**
compost	**moisture**	**worms**	**soil**	**150°F**
65%	**heat-loving**	**carbon dioxide**	**organic**	**size**
organic	**aeration**	**breakdown**	**water**	**micro-organisms**

WATERSHED AWARENESS

EDUCATOR'S GUIDE





Pennsylvania Resources Council, Inc.

"Working to protect the environment since 1939

Funding provided by:

The Dominion Foundation

Watershed Awareness Program

The Pennsylvania Resources Council
and
Allegheny County Conservation District

The Pennsylvania Resources Council (PRC), in partnership with the Allegheny County Conservation District, is pleased to offer a watershed education program, designed to inspire and inform middle school students about watershed protection, to teachers in Allegheny County. PRC, founded in 1939, is committed to the preservation of our natural resources, protection of the environment and to the promotion of sound conservation practices.

PRC's Environmental Education Programs have engaged, inspired and educated local students in fourth through ninth grades on pertinent and timely topics for ten years.

The Watershed Awareness Program

Water is life and nowhere is the wonder and awe inspiring vitality of water more abundant than in the Three Rivers bioregion.

This two-session, hands-on, in-classroom program will familiarize students with their watershed, watershed basics and human impact on the watershed.

Students will learn watershed basics including the effects of human behavior and activities upon the watershed, sources of contamination, and ways to become good watershed stewards. Students and their families will be encouraged to work together to improve the health of their local watershed.

PA Academic Standards are addressed in the curriculum.

Funded by a Department of Environmental Protection Environmental Education Grant

Watershed Awareness

Water issues abound nationally and globally but before these can be addressed effectively it is imperative that citizens understand not only what it means to live in a watershed but also local watershed issues and how their local watershed is impacted by human behavior.

Local and regional watershed problems addressed in the curriculum include:

- Polluted urban runoff
- Abandoned mine drainage
- Combined sewer overflow
- Flooding
- Impervious surface
- Residential contaminants
  - Lawn and garden products and practices
  - Household cleaners/products
  - Car care
- Transportation
- Agriculture (pesticides, fertilizer, silt, manure)
- Construction
- Storm drains
- Industry
- Landfills
- Conservation

Watershed education can prepare and empower the citizens of the Commonwealth to make wise decisions and to take positive action. An environmentally literate public will understand watershed basics, point and nonpoint sources of pollution and will possess the knowledge and tools needed for promoting watershed protection.

The watershed education curriculum draws the connection between how people live on the land and the impacts of that behavior on the watershed. We seek to affect change by influencing the way that people think and feel about the land, the watershed and their relationship with the natural environment. When attitudes change behavior changes. An awareness of the watershed, water cycle and the inter-connectedness of the natural world will lead students to examine solutions aimed at reducing non-point source pollution.

Through education and understanding, a new relationship with the environment is possible.

Program Overview:

Water is a precious natural resource that we all must conserve and protect. There are many ways that we impact the watershed. Students, families, schools and businesses are all responsible for creating non-point source pollution. Understanding the water cycle, the watershed and local water issues is critical to preserving this vital resource. It is important that students, and by extension, their families, understand how human behavior affects the quality of our water.

Content Objective:

Students will understand that clean water is a precious resource, essential for healthy bodies and healthy ecosystems. They will be able to identify the parts of the hydrologic cycle, identify the locations and sources of Earth's water, define "watershed" and explain the role of a watershed. They will be able to list the various uses of water, how these uses can affect the watershed and where water goes after use. Students will have an awareness of how human behavior impacts the quality and quantity of water. Students will be able to identify sources of contamination, explain point and non-point source pollution and effective ways to protect and conserve water. Students will have a basic understanding of their local watershed and will understand their roles as environmental stewards.

Students who complete the program will:

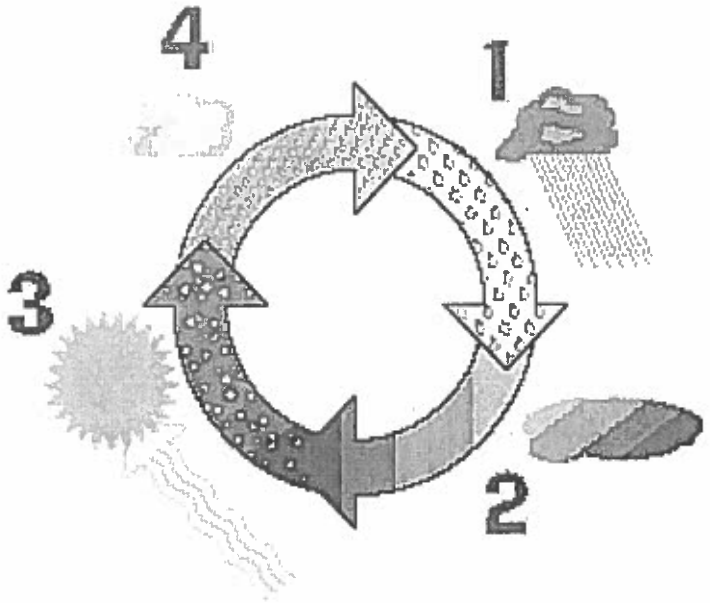
- Understand that clean water is a precious resource, essential for healthy bodies and healthy ecosystems.
- Be able to identify the parts of the hydrologic cycle
- Identify the locations and sources of Earth's water
- Define "watershed" and explain the role of a watershed
- Be able to list the various uses of water, how these uses can affect the watershed and where water goes after use
- Have an awareness of how human behavior impacts the quality and quantity of water
- Be able to identify sources of contamination
- Explain point and non-point source pollution and effective ways to protect and conserve water
- Have a basic understanding of their local watershed
- Understand their roles as environmental stewards
- Possess empowerment, problem-solving and practical application skills
- Understand that not only can we identify environmental problems; we can find solutions and take action in our own lives to reduce human impact on the watershed.

PA State Standards for Environment and Ecology addressed in the curriculum include:

- 4.1 Watersheds and Wetlands
- 4.2 Renewable and Nonrenewable Resources
- 4.3 Environmental Health
- 4.6 Ecosystems and Their Interactions
- 4.8 Humans and the Environment

Lesson 1

THE HYDROLOGIC CYCLE



Between earth and earth's atmosphere, the amount of water remains constant; there is never a drop more, never a drop less. This is a story of circular infinity, of a planet birthing itself.

LINDA HOGAN, Northern Lights, Autumn 1990

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Of all our planet's activities--geological movements, the reproduction and decay of biota, and even the disruptive propensities of certain species (elephants and humans come to mind)--no force is greater than the hydrologic cycle.

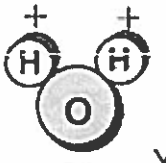
RICHARD BANGS and CHRISTIAN KALLEN, Rivergods, 1985

Background

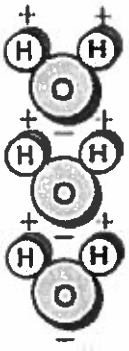
Water Properties

What are the physical and chemical properties of water that make it so unique and necessary for living things? When you look at water, taste and smell it - well, what could be more boring? Pure water is virtually colorless and has no taste or smell. But the hidden qualities of water make it a most interesting subject.

Water's Chemical Properties



You probably know water's chemical description is H_2O. As the diagram to the left shows, that is one atom of oxygen bound to two atoms of hydrogen. The hydrogen atoms are "attached" to one side of the oxygen atom, resulting in a water molecule having a positive charge on the side where the hydrogen atoms are and a negative charge on the other side, where the oxygen atom is. Since opposite electrical charges attract, water molecules tend to attract each other, making water kind of "sticky." As the right-side diagram shows, the side with the hydrogen atoms (positive charge) attracts the oxygen side (negative charge) of a different water molecule. (If the water molecule here looks familiar, remember that everyone's favorite mouse is mostly water, too).



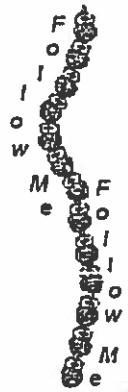
All these water molecules attracting each other mean they tend to clump together. This is why water drops are, in fact, drops! If it wasn't for some of Earth's forces, such as gravity, a drop of water would be ball shaped -- a perfect sphere. Even if it doesn't form a perfect sphere on Earth, we should be happy water is sticky.

- Water is called the "universal solvent" because it dissolves more substances than any other liquid. This means that wherever water goes, either through the ground or through our bodies, it takes along valuable chemicals, minerals, and nutrients.

Pure water has a neutral pH of 7, which is neither acidic nor basic.

Water's Physical Properties

- Water is unique in that it is the only natural substance that is found in all three states -- liquid, solid (ice), and gas (steam) -- at the temperatures normally found on Earth. Earth's water is constantly interacting, changing, and in movement.
- Water freezes at 32° Fahrenheit (F) and boils at 212° F (at sea level, but 186.4° at 14,000 feet). In fact, water's freezing and boiling points are the baseline with which temperature is measured: 0° on the Celsius scale is water's freezing point, and 100° is water's boiling point. Water is unusual in that the solid form, ice, is less dense than the liquid form, which is why ice floats.
- Water has a high specific heat index. This means that water can absorb a lot of heat before it begins to get hot. This is why water is valuable to industries and in your car's radiator as a coolant. The high specific heat index of water also helps regulate the rate at which air changes temperature, which is why the temperature change between seasons is gradual rather than sudden, especially near the oceans.
- Water has a very high surface tension. In other words, water is sticky and elastic, and tends to clump together in drops rather than spread out in a thin film. Surface tension is responsible for capillary action, which allows water (and its dissolved substances) to move through the roots of plants and through the tiny blood vessels in our bodies.



Even if you've never heard of capillary action, it is still important in your life. Capillary action is important for moving water (and all of the things that are dissolved in it) around. It **is defined as the movement of water within the spaces of a porous material due to the forces of adhesion, cohesion, and surface tension.**

Capillary action occurs because water is sticky -- water molecules stick to each other and to other substances, such as glass, cloth, organic tissues, and soil. Dip a paper towel into a glass of water and the water will "climb" onto the paper

towel. In fact, it will keep going up the towel until the pull of gravity is too much for it to overcome.

This is more important than you think. Consider:

- When you spill your glass of BubblyBerryPowerGo (which is, of course, mostly water) on the kitchen table you rush to get a paper towel to wipe it up before your parents see it. First, you can thank surface tension, which keeps the liquid in a nice puddle on the table, instead of a thin film of sugary goo that spreads out onto the floor. When you put the paper towel onto your mess the liquid attaches itself to the paper fibers.
- Plants and trees couldn't thrive without capillary action. Plants put down roots into the soil which are capable of carrying water from the soil up into the plant. Water, which contains dissolved nutrients, gets inside the roots and starts climbing up the plant tissue. As water molecule #1 starts climbing, it pulls along water molecule #2, which, of course, is dragging water molecule #3, and so on.

 One common experiment to demonstrate capillary action is to place a stalk of celery in a glass of water that has been colored with food coloring (you might want to use a piece of celery that has begun to whither, as it is in need of a quick drink). This effect happens because, in plants, water molecules move through narrow tubes that are called capillaries.

- Here's a quick rundown of some of water's properties:
  - Weight: 62.416 pounds per cubic foot at 32°F
  - Weight: 61.998 pounds per cubic foot at 100°F
  - Weight: 8.33 pounds/gallon, 0.036 pounds/cubic inch
  - Density: 1 gram per cubic centimeter (cc) at 39.2°F, 0.95865 gram per cc at 212°F

http://ga.water.usgs.gov/edu/waterproperties.html

Lesson One
Hydrologic Cycle
Water Properties, Locations and Uses

Content Objective:
Students will understand that clean water is a precious resource, essential for healthy bodies and healthy ecosystems. They will be able to identify the parts of the hydrologic cycle, identify the locations and sources of Earth's water, define "watershed" and explain the role of a watershed. They will be able to list the various uses of water, how these uses can affect the watershed and where water goes after use. Students will have an awareness of how human behavior impacts the quality and quantity of water. Students will be able to identify sources of contamination, explain point and non-point source pollution and effective ways to protect and conserve water. Students will have a basic understanding of their local watershed and will understand their roles as environmental stewards.

Materials:
1 liter measuring cup
1 cup measuring cup
Drinking glass
Measuring spoons
Eyedropper
Inflatable Earth ball
EnviroScape
Stream of Knowledge trifold
Student Guides
Take-home Water Wisdom handouts

Procedure:
Prior Knowledge:
Ask students questions to assess prior water knowledge.

Vocabulary:
The instructor can review vocabulary quickly; however the vocabulary will be covered in the lesson.

Water Cycle Vocabulary

aquifer: underground spaces where water is stored and through which it moves slowly under the influence of gravity

condensation: the process by which a vapor becomes a liquid

contaminant: any substance that when added to water (or another substance) makes it impure

ecosystem: a biological community (community of organisms) and its environment functioning as an ecological unit

environmental stewards: caretakers of the earth

evaporation: the process by which liquid turns into vapor (usually as a result of the application of heat energy)

groundwater: water that is found underground in cracks and spaces in the soil, sand and rocks and that moves under the influence of gravity

habitat: the place where an animal or human lives

impervious (surface): Impermeable: unable to penetrate. Impervious surface: a material, such as asphalt, covers the soil and does not allow water to penetrate into soil layers below. Prevents infiltration.

infiltration: the downward movement of water into the soil

natural resource: a substance that exists in nature that we can use for food, building, manufacturing, etc

precipitation: water falling to Earth in the form of rain, snow, sleet or hail

recharge: to replenish or refill groundwater supplies with rain or snowmelt

runoff: Rainfall or snowmelt that flows over the land surface without soaking into the soil, or over impervious surfaces (like parking lots) to lower elevations

surface water: water on the surface of the land, including lakes, streams, rivers, ponds, and runoff

transpiration: the process by which the surface of a plant gives off internal fluids as a vapor, usually from the leaves

water cycle: the paths water takes through its various states (liquid, vapor, solid) as it moves throughout the ocean, atmosphere, ground, rivers, etc.

Lesson 1:

- Hold up the Earth ball
  - Ask students what they notice about the Earth at first glance
    - (Answer: Mostly water)
- Discuss uses of water –using Earth ball as a "talking stick"
  - Toss Earth ball to students as they name some of the many uses of water (Ans: bathing, cooking, drinking, cleaning, manufacturing, agriculture, aquaculture, energy production, transportation, recreation, etc)
  - 75% of the water used in the home is used in the bathroom.
  - Explain that water also provides habitat to many aquatic species and supports wildlife and wildlife habitats.
    - Stress the importance of water to all life. Life cannot exist without it.
- Identify the locations and sources of Earth's water
  - Surface water

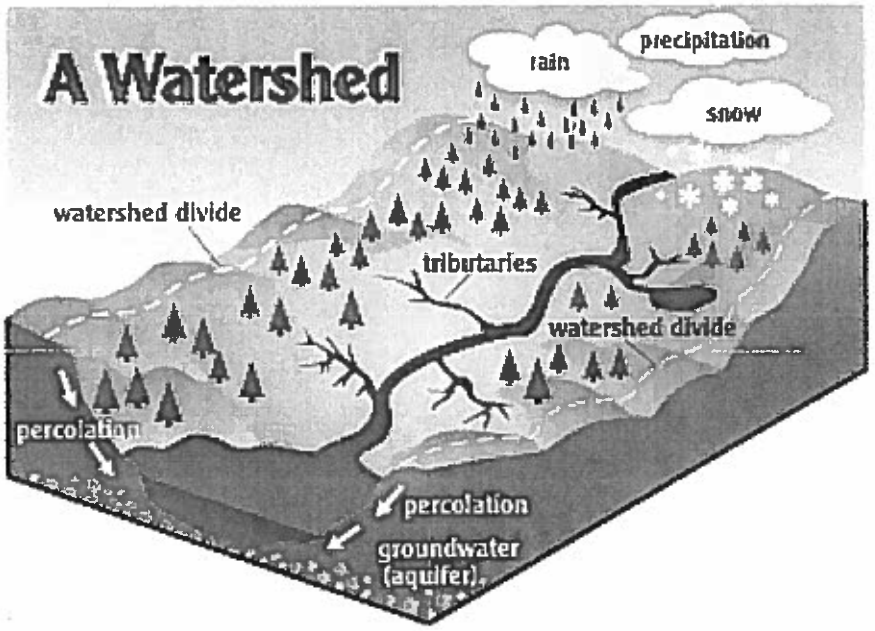
        - Fresh water
            - Rivers, lakes, streams, wetlands
            - Frozen water: polar ice caps, glaciers, mountain tops,
        - Salt water
            - Oceans
    - Groundwater
        - Soil water
        - Aquifers
        - Springs
    - Water vapor
- Usable water demonstration
    - Demonstrate using a one-liter container, two smaller clear containers, an eyedropper and a bowl the relatively small percentage of Earth's water that is easily accessible, surface water
        1. Show the class a liter of water and tell them that it represents all of the water on Earth.
        2. Ask where most of the water on Earth is located. Pour 30 ml of the water into a smaller clear container. This represents Earth's fresh water-about 3% of the total. Put salt into the remaining 970 ml to simulate water found in oceans, unsuitable for human consumption.
        3. Ask students what is located at the Earth's poles. Almost 80% of Earth's fresh water is frozen in ice caps and glaciers. Pour 6 ml of fresh water into a smaller clear container. Tell them that the water remaining in the larger fresh water vessel represents frozen water. The water in the smaller vessel (about 0.6 percent of the total) represents non-frozen fresh water. Only about 1.5 ml of this water is surface water, the rest is underground.
        4. Use an eyedropper to remove a single drop of water. Release this one drop into a bowl or saucer. This represents clean, fresh water that is not polluted or otherwise unavailable for use, about 0.00003 percent of the total.
        5. Discuss the results of the activity. Explain that this small percentage represents a large volume of water; however we do need to conserve and protect it
- Water's unique properties and behavior
    - Water as the universal solvent
        - Water is the liquid most capable of dissolving other substances
        - For this reason it can carry nutrients to plants(a good thing) or dissolve and carry pollutants form streets, parking lots, etc. into our waterways(a bad thing)
    - Occurs in three forms (liquid, solid, gas)
    - Surface tension
        - Water is sticky and elastic, and tends to clump together in drops rather than spread out in a thin film.
        - Surface tension is responsible for capillary action, which allows water (and its dissolved substances) to move through the roots of plants and through the tiny blood vessels in our bodies.
    - Water freezes at 32° Fahrenheit (F) and boils at 212° F (at sea level, but 186.4° at 14,000 feet). In fact, water's freezing and boiling points are the baseline with which temperature is measured:

        - 0° on the Celsius scale is water's freezing point
        - 100° is water's boiling point.
    - Water is unusual in that the solid form, ice, is less dense than the liquid form, which is why ice floats.
- Introduce Stream of Knowledge - a tri-fold interactive model depicting a woodland stream ecosystem and the water cycle

- Ask the students where they think that water comes from.
    - Explain that the same water that was here millions of years ago is still being recycled. In fact, long ago dinosaurs may have drunk the water that they will drink today.
    - As you discuss the **water cycle** use the Stream of Knowledge as a tool and ask the students to complete their blank water cycle worksheet.
    - Explain that water circulates continuously and that as it does it changes form from water to vapor to solid.
    - Using the tri-fold, point out that the three main parts of the water cycle are **precipitation, condensation** and **evaporation.** Explain that heat energy (Sun) causes the surface water to evaporate.
    - Explain how water also re-enters the atmosphere through the process of **transpiration** from plants.
    - Explain the process of precipitation recharging the groundwater by **infiltration** and that aquifers recharge the rivers and streams. Explain that precipitation also flows into streams and rivers as surface **runoff.**

Lesson 2

THE WATERSHED



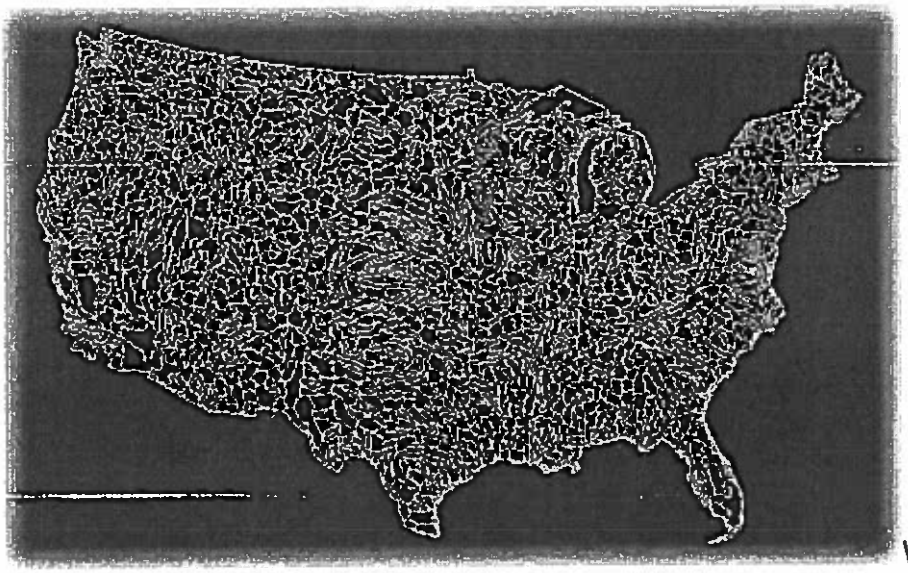
Watershed: Water what ?

The area of land that drains into streams, lakes, estuaries or other bodies of water are known as watersheds. They are also known as drainage basins or catchments. As precipitation falls to the ground, the water is pulled downhill by gravity, which causes it to flow over the landscape or infiltrate through the soil into the groundwater. Topography - the hills, valleys, and other features that define the landscape - determine the boundaries of watersheds.

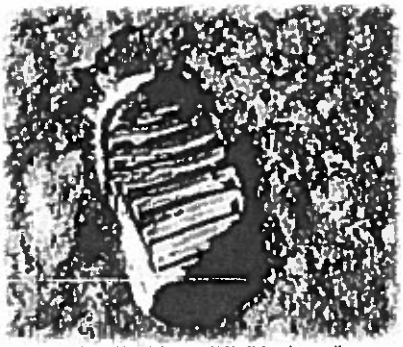
Every stream, regardless of its size, has a watershed. Smaller watersheds are contained within larger watersheds. For example, The Streets Run Watershed in southwestern Pennsylvania is part of the Monongahela River Watershed, which in turn is part of the Ohio River Watershed, which is part of the Mississippi River Watershed. **No matter where you live, you live within a watershed. Just as you have a home and school address, you also have a watershed address.**

Background:

What is a watershed?



When looking at the location of rivers and the amount of streamflow in rivers, the key concept is the river's "watershed". What is a watershed? Easy, if you are standing on ground right now, just look down. You're standing, and everyone is standing, in a watershed. A watershed is the area of land where all of the water that falls in it and drains off of it goes into the same place. Watersheds can be as small as a footprint or large enough to encompass all the land that drains water into rivers that drain into Chesapeake Bay, where it enters the Atlantic Ocean. This map shows one set of watersheds in the continental United States; these are known as National 8-digit hydrologic units (watersheds).

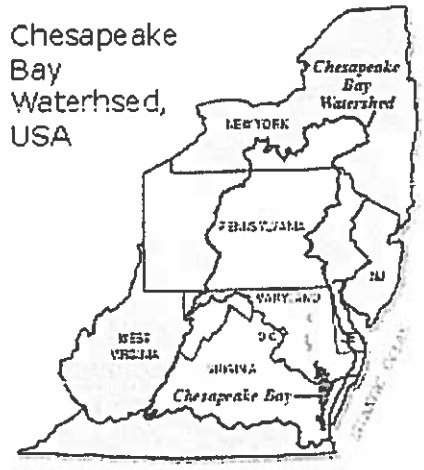


Footprint on the Moon - if it did rain on the Moon, then this footprint would be a watershed. (Credit: NASA)

A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel. The word watershed is sometimes used interchangeably with drainage basin or catchment. Ridges and hills that separate two watersheds are called the drainage divide. The watershed consists

of surface water--lakes, streams, reservoirs, and wetlands--and all the underlying ground water. Larger watersheds contain many smaller watersheds. It all depends on the outflow point; all of the land that drains water to the outflow point is the watershed for that outflow location. Watersheds are important because the streamflow and the water quality of a river are affected by things, human-induced or not, happening in the land area "above" the river-outflow point

A watershed is a precipitation collector



Most of the precipitation that falls within the drainage area of a stream's monitoring site collects in the stream and eventually flows by the monitoring site. Many factors, some listed below, determine how much of the streamflow will flow by the monitoring site. Imagine that the whole basin is covered with a big (and strong) plastic sheet. Then if it rained one inch, all of that rain would fall on the plastic, run downslope into gulleys and small creeks and then drain into main stream. Ignoring evaporation and any other losses, and using a 1-square mile example watershed, then all of the approximately 17,378,560 gallons of water that fell (you can use our interactive rainfall calculator to find out how many gallons of water fall during a storm) as rainfall would eventually flow by the watershed-outflow point.

Not all precipitation that falls in a watershed flows out

To picture a watershed as a plastic-covered area of land that collects precipitation is overly simplistic and not at all like a real-world watershed. A career could be built on trying to model a watershed water budget (correlating water coming into a watershed to water leaving a watershed). There are many factors that determine how much water flows in a stream (these factors are universal in nature and not particular to a single stream):

- Precipitation: The greatest factor controlling streamflow, by far, is the amount of precipitiation that falls in the watershed as rain or snow. However, not all precipitation that falls in a watershed flows out, and a

stream will often continue to flow where there is no direct runoff from recent precipitation.

- Infiltration: When rain falls on dry ground, some of the water soaks in, or infiltrates the soil. Some water that infiltrates will remain in the shallow soil layer, where it will gradually move downhill, through the soil, and eventually enters the stream by seepage into the stream bank. Some of the water may infiltrate much deeper, recharging ground-water aquifers. Water may travel long distances or remain in storage for long periods before returning to the surface. The amount of water that will soak in over time depends on several characteristics of the watershed:
    -
    - Soil characteristics: In Georgia, clayey and rockey soils of the northern areas absorb less water at a slower rate than sandy soils, such as in Georgia's Coastal Plain. Soils absorbing less water results in more runoff overland into streams.
    - Soil saturation: Like a wet sponge, soil already saturated from previous rainfall can't absorb much more ... thus more rainfall will become surface runoff.
    - Land cover: Some land covers have a great impact on infiltration and rainfall runoff. Impervious surfaces, such as parking lots, roads, and developments, act as a "fast lane" for rainfall - right into storm drains that drain directly into streams. Flooding becomes more prevalent as the area of impervious surfaces increase.
    - Slope of the land: Water falling on steeply-sloped land runs off more quickly than water falling on flat land.
- Evaporation: Water from rainfall returns to the atmosphere largely through evaporation. The amount of evaporation depends on temperature, solar radiation, wind, atmospheric pressure, and other factors.
- Transpiration: The root systems of plants absorb water from the surrounding soil in various amounts. Most of this water moves through the plant and escapes into the atmosphere through the leaves. Transpiration is controlled by the same factors as evaporation, and by the characteristics and density of the vegetation. Vegetation slows runoff and allows water to seep into the ground.
- Storage: Reservoirs store water and increase the amount of water that evaporates and infiltrates. The storage and release of water in reservoirs can have a significant effect on the streamflow patterns of the river below the dam.
- Water use by people: Uses of a stream might range from a few homeowners and businesses pumping small amounts of water to irrigate their lawns to large amounts of water withdrawals for irrigation, industries, mining, and to supply populations with drinking water.

http://ga.water.usgs.gov/edu/watershed.html

Q: How important is ground water?

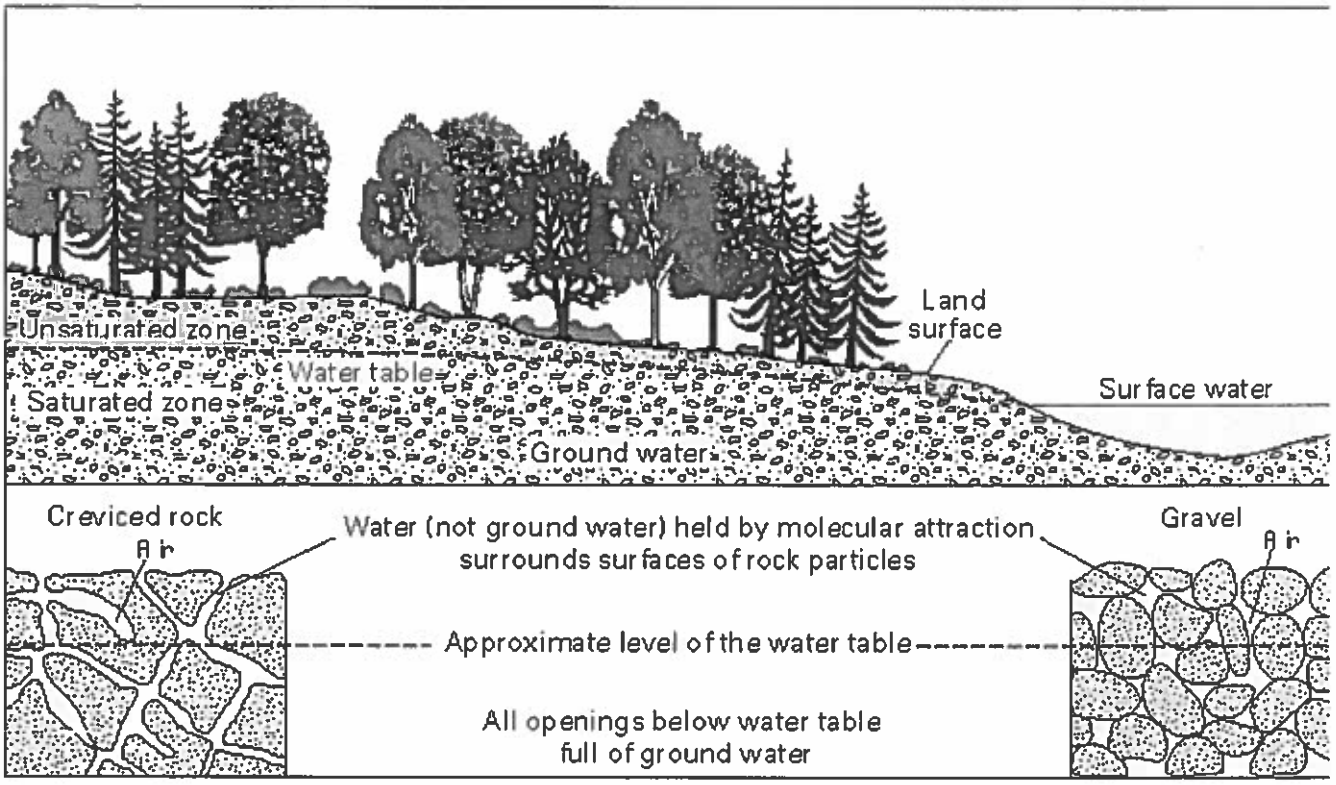
A: Ground water, which is in aquifers below the surface of the Earth, is one of the Nation's most important natural resources. Ground water is the source of about 37 percent of the water that county and city water departments supply to households and businesses (public supply). It provides drinking water for more than 90 percent of the rural population who do not get their water delivered to them from a county/city water department or private water company. Even some major cities, such as San Antonio, Texas, rely solely on ground water for all their needs. About 42 percent of the water used for irrigation comes from ground water. Withdrawals of ground water are expected to rise as the population increases and available sites for surface reservoirs become more limited.

Ground-water aquifers

One of our most valuable resources is the water beneath our feet - something you can't see and may not even know is there! As you may have read, most of the void spaces in the rocks below the water table are filled with water. But rocks have different porosity and permeability characteristics, which means that water does not move around the same way in all rocks.

When a water-bearing rock readily transmits water to wells and springs, it is called an aquifer. Wells can be drilled into the aquifers and water can be pumped out. Precipitation eventually adds water (recharge) into the porous rock of the aquifer. The rate of recharge is not the same for all aquifers, though, and that must be considered when pumping water from a well. Pumping too much water too fast draws down the water in the aquifer and eventually causes a well to yield less and less water and even run dry. In fact, pumping your well too fast can even cause your neighbor's well to run dry if you both are pumping from the same aquifer.

In the diagram below, you can see how the ground below the water table (the blue area) is saturated with water. The "unsaturated zone" above the water table (the greenish area) still contains water (after all, plants' roots live in this area), but it is not totally saturated with water. You can see this in the two drawings at the bottom of the diagram, which show a close-up of how water is stored in between underground rock particles.



Sometimes the porous rock layers become tilted in the earth. There might be a confining layer of less porous rock both above and below the porous layer. This is an example of a confined aquifer. In this case, the rocks surrounding the aquifer confines the pressure in the porous rock and its water. If a well is drilled into this "pressurized" aquifer, the internal pressure might (depending on the ability of the rock to transport water) be enough to push the water up the well and up to the surface without the aid of a pump, sometimes completely out of the well. This type of well is called artesian. The pressure of water from an artesian well can be quite dramatic.

Here's a little experiment to show you how artesian pressure works. Fill a plastic baggie with water, put a straw in through the opening, tape the opening around the straw closed, DON'T point the straw towards your teacher, and then squeeze the baggie. Artesian water is pushed out through the straw.

Some information on this page is from *Waller, Roger M., Ground Water and the Rural Homeowner, Pamphlet, U.S. Geolgoical Survey, 1982*

Lesson 2
The Watershed

Content Objective:
Students will be able to define "watershed" and explain the role of a watershed. They will be able to list the various uses of water, how these uses can affect the watershed and where water goes after use. Students will have an awareness of how human behavior impacts the quality and quantity of water. Students will be able to identify sources of contamination, explain point and non-point source pollution and effective ways to protect and conserve water. Students will have a basic understanding of their local watershed and will understand their roles as environmental stewards.

Materials:
EnviroScape 3-D watershed model

Procedure:
Prior Knowledge:
Ask students questions to assess prior watershed knowledge.

Watershed Vocabulary:

Aquifer: underground spaces where water is stored and through which it moves slowly under the influence of gravity

Collection site: a stream, lake, reservoir, or other body of water fed by water drained from a watershed

Combined Sewer Overflow (CSO): in urban and suburban areas, runoff from roads, parking lots, and rooftops is often channeled into storm sewer pipes that combine with human sewage. During storms, human waste and storm water can overload the system, resulting in an overflow of water and untreated sewage into creeks and rivers. This is called Combined Sewage Overflow (CSO). It occurs most often in townships and municipalities with aging sewage systems.

Conservation: the use of water-saving methods to reduce the amount of water that we use

Contaminant: any substance that when added to water (or another substance) makes it impure

Ecosystem: a biological community and its environment functioning as a unit

Environmental stewards: caretakers of the earth

Groundwater: water that is found underground in cracks and spaces in the soil, sand and rocks and that moves under the influence of gravity

Habitat: the place where an animal or human lives

Headwaters, headwater stream: A small creek or stream that begins in the highest elevations of a watershed.

Impervious (surface): prevents water from entering soil directly

Infiltration: the downward movement of water into the soil

Non-point source pollution: pollution that originates over a widespread region from a variety of sources rather than a single point or location

Point source pollution: pollution that originates at a specific point or location, such as a factory or sewage plant (end-of-pipe sources)

Recharge: to replenish or refill groundwater supplies with rain or snowmelt

Runoff: rainfall or snowmelt that flows over the land surface without soaking into the soil or that flows over impervious surfaces (like parking lots)

Surface water: water on the surface of the land, including lakes, streams, rivers, ponds and runoff

Sewage treatment facility: facility that treats water to remove contaminants so that it can be safely used

Tributary: a smaller channel of water that drains into a larger body of running water: a creek that empties into a stream; a stream that empties into a river.

Watershed: the land area from which surface runoff drains into a stream, channel, lake, reservoir or other body of water (collection site)

Lesson 2:

- Explain what a watershed is
    - the land area from which surface runoff drains into a common stream, channel, lake, reservoir or other body of water (collection site)
    - Defined by elevation
- Discuss the local watershed
    - Streets Run? Plum Creek? Yough? Mon? Allegheny? Ohio? Etc
        - Where does it originate?
        - Where does it go?
        - Local watershed issues
            - Impermeable surfaces
            - Flooding
            - AMD
            - Nonpoint Source Pollution (NPS)
            - Point Source Pollution
            - Combined Sewer Overflow (CSO)
            - Aquatic life

- Introduce the EnviroScape 3-D watershed model
- Review the various uses of water and how these uses can affect the watershed
    - Contamination
    - Aquatic life
- Identify sources of contamination
    - Residential
        - Lawn and garden
        - Household cleaners
        - Pharmaceuticals
        - Car care
        - Sewage
    - Timber harvesting
    - Transportation
    - Agriculture
        - Pesticides
        - Fertilizer
        - Silt
        - Manure
    - Construction/Urban runoff
    - Storm drains
    - Industry
    - Abandoned Mine Drainage- (resource extraction)
    - Landfills
- List best management practices to protect and conserve water.
- Introduce the rain barrel model
    - Rain barrels help to alleviate flooding
    - Method of water conservation

Distribute Take-Home materials.

- **Parent/Guardian will sign and return signed portion to the classroom teacher**

Administer Post -test

Extension Activity

Water Purification by Evaporation and Condensation

http://www.epa.gov/safewater/kids/activity_grades_4-8_waterpurification.html

GRADE LEVEL: 4 – 7

BACKGROUND:

The following demonstration illustrates how the water cycle helps to purify water. The key terms are evaporation and condensation. Evaporation is defined as the process through which a liquid becomes a vapor. Condensation is the process through which a vapor becomes a liquid, and is the opposite of evaporation. In the case of water, the main mechanisms for evaporation and condensation are heating and cooling, respectively.

MATERIALS NEEDED:

- 4 cups of dirt or sand a dozen stones,
- 2 quarts of water a large glass bowl with tall sides (mixing bowl),
- a short glass,
- clear plastic wrap, and
- a sunny day.

PROCEDURE:

Mix the dirt (or sand) and water in a large bowl. Stand a clean and empty short glass in the center of the bowl. Place the bowl outside in the sun. Cover the bowl with the plastic wrap and weigh down the edges with the remaining rocks. Place one rock on the plastic wrap directly over the cup. Allow the bowl to remain in the sun for several hours. Look in the cup (it should contain some relatively clean water free of mud). Look in the bowl (it should contain the dried dirt).

FOLLOW-UP QUESTIONS:

1. What are the two processes responsible for purifying the water? (Evaporation and Condensation)
2. Where else do you see condensation? (Cold drink outside on a hot day)
3. How does this process work on Earth?
4. What is the plastic wrap? (Our atmosphere)
5. What is the condensation? (Clouds and rain)
6. What would happen if the plastic wrap was dirty? (Air pollution)

VARIATIONS:

Add food coloring to water to demonstrate that this process does not remove all pollutants. This may be done simultaneously with the procedure above.

Extension Activity

Non-point Source Pollution

http://www.epa.gov/safewater/kids/activity_grades_4-8_nonpoint_pollution.htm

GRADE LEVEL: 4 – 7

BACKGROUND:

This activity is designed to demonstrate to students what an average storm drain collects during a rainfall event and how the water from storm drains can impact the water quality and aquatic environments of local streams, rivers, and bays.

MATERIALS NEEDED:

- "Waterway"
- Aquarium
- Rectangular Water Box
- Watering Can
- Spray Bottle
- "Pollutants"
- Green Food Coloring (pesticides/fertilizer)
- Vegetable Oil (motor oil)
- Soil/Sand/Pebbles (erosion)
- Grass Clippings (or Shredded Paper) and Twigs
- Cafeteria Waste and Trash

PREPARATION:

Fill the aquarium half-way with water and place it on an accessible area where it can be easily viewed by the students. Cut a hole in the bottom of the box and place the box on top of the aquarium. The box represents the storm drain and the aquarium represents the waterway that the storm water mixes into after entering the storm drain. Leave the sides of the aquarium uncovered so that the students can view its contents.

PROCEDURE:

1. Introduce this activity with a discussion of storm drains and storm drain systems and their purposes. Discuss where the water and objects that float down into a storm drain go. Have students list all of the things that they can think of that might enter a storm drain during a rain storm.
2. Assign a group of students to each pollutant. Discuss each pollutant,

including its use or origin and how it could enter the storm drain.

3. Have each group of students place their pollutant into the storm drain. Use the watering can to create rain to wash the pollutant into the waterway. While washing each pollutant into the waterway, review the pollutant and its use or origin. Discuss the following questions: How does the pollutant damage the environment? Do the people who are responsible for the pollutant want to damage the environment? Why did they do what they did? How can this type of pollution be stopped?
4. After adding all of the pollutants, examine the contents of the waterway. Discuss how the waterway has changed and how viewing this change makes the students feel.

FOLLOW-UP QUESTIONS:

1. What types of the pollution are natural?
2. What types of pollution are added by people living in the local communities?
3. How can we remove the pollution from the water?
4. What could be done to stop pollutants from entering storm drains?

VARIATIONS:

Have the groups of students responsible for the pollution think of ways to remove the pollution from the aquarium. Try some of the removal methods. Which pollutants were easy to remove? Which were difficult to remove?

Extension Activity

Role of Plants in Water Filtration

http://www.epa.gov/safewater/kids/activity_grades_4-8_plantsinwaterfiltration.html

GRADE LEVEL: 4 – 7

BACKGROUND:

Experiments can be done to show how a plume of dissolved materials can move through soil and enter a groundwater aquifer. But soil and plants have something of a dual role in this process. Depending on whether materials are dissolved or suspended in the water, soils and plant roots can remove some or all of this material as the water moves down through soil. Most suspended materials will adhere to the soil. These may then be broken down and used as food by the plants. Dissolved nutrients, such as nitrogen or phosphorus, chemically bond with some types of soil particles. They are then taken up by plants, thus removing them from the soil before they can enter an aquifer. For the plants, these elements are food, for an aquifer, they are pollution. Not all materials are absorbed by plants and not all water pollutants are food for plants. However, sediments from eroding soil, nutrients in human and animal wastes, and some components of household wastewater ("graywater") are excellent plant nutrients. Plants also use different nutrients at different rates, so that the amount of material they take up will depend on how much is dissolved in the water and how fast the water moves through. This experiment is a very simplified way to show whether plants will take up certain kinds of materials from water moving relatively quickly through their root systems.

OBJECTIVE:

To understand the role of plants in filtering the water moving through a watershed.

MATERIALS NEEDED:

- Six potted plants, with pots roughly six to eight inches in diameter, and holes in the bottom. These plants need to be moderately dry, as if they had not been watered for a couple days. Plants with saturated soil will not absorb water, and very dry plants will absorb it all.
- Six clear containers, such as cups, which will support the plants and allow drainage to be viewed. You will need separate plants and cups for each of the materials in the water.
- Soil from outside (anywhere). The best soil is loamy, with smaller particles than sand.
- Unsweetened powdered drink mix, preferably grape or cherry for color.

- Vegetable oil.
- One or two different household cleaners (such as Comet/Ajax and Dish or Laundry soap). One should be liquid and the other powder.

PREPARATION:

Set up the potted plants, each in its own cup. Slowly pour six to eight ounces of clean water through the pot, and check the percolation rate through the pot. Loosen or tighten the soil so that water percolates at about one ounce per minute. The rate should be fast enough to prevent long waiting periods, but slow enough not to carry very much soil through the pot.

PROCEDURE:

1. Place the potted plants into the top of their cups. Pour clean water slowly through one of the pots and watch it percolate through the bottom of the pot. The water should look as clean as what was poured.
2. Add a gram or so of soil to 6-8 ounces of water and stir so that the soil is well suspended and distributed in the water. Pour slowly into another flower pot. The water percolating through should look *much* cleaner than the dirty water poured.
3. Add about one ounce of vegetable oil to 6-8 ounces of water, stir (they won't mix completely) and pour into a third pot. See if the vegetable oil percolates through or is caught up by the plant roots.
4. Add some powdered drink mix to 6-8 oz. of water and pour through a fourth pot. See if the water percolating through retains the color.
5. Add some powdered cleanser to 6-8 oz. of water and pour through a fifth pot. Is the cleanser retained in the soil?
6. Add some liquid soap to the water (an ounce or so in 6-8 oz. water). Does the soap percolate through the soil?
7. Using the "contaminated" plants, pour some clean water at the same rate through each one (simulating a rain shower). Is more of the "pollutant" rinsed away from the soil by the clean water?

FOLLOW-UP QUESTIONS:

1. In what ways can plants and soil benefit drinking water quality?
2. We saw plants and soil remove some types of impurities from water. How might the plants remove larger quantities?
3. Can plants and soil remove any type of impurity from water?
4. What other organisms in the soil-plant system might aid the uptake of water pollutants?
5. What is the role of rainwater moving through contaminated soil?

Post-Test
Watershed Awareness Program

Directions: Read each question carefully and then answer to the best of your ability.
Note: You will not be graded on this exercise.

1) What percentage (%) of the Earth is covered with water?

_____

2) A watershed is always named (Circle one)
   a. After the body of water that the watershed drains into
   b. After the person who discovered it
   c. For the state that most of the watershed's land is in

3) Groundwater is: (circle one)

   a. water that lies on top of the ground
   b. water that has become polluted with soil
   c. water that is found underground in cracks and spaces in the soil, sand and rock

4) An area of land from which water drains into a common (the same) stream, lake, river or other body of water is known as: (circle one)

   a. a watershed
   b. the water cycle
   c. a riparian buffer zone

5) The water that the majority of southwestern Pennsylvanians use in their homes comes from where? (circle one)

   a. cisterns
   b. lakes
   c. rivers
   d. wells

6) The biggest water pollution problem facing North America today is:(circle one)

a. Point Source Pollution
b. Pet waste
c. Nonpoint Source Pollution
d. Litter

7) Name two ways that we can be environmental stewards and protect the quality of our water.

1._____

2._____

8) Name two sources of pollution that come from our homes and/or yards.

1._____
2._____

9) Name two things that you can do to conserve (save) water?

1._____
2._____

10) Name five ways that humans use water.

1._____
2._____
3._____
4._____
5._____

11) What watershed do you live in?

_____

Name of school: _____ Grade_____

Thank you!

Post-Test Answer Key
Watershed Awareness Program

Directions: Read each question carefully and then answer to the best of your ability.
Note: You will not be graded on this exercise.

1) What percentage (%) of the Earth is covered with water?

_____**75%**_____

2) A watershed is always named (Circle one)
   a. **After the body of water that the watershed drains into**
   b. After the person who discovered it
   c. For the state that most of the watershed's land is in

3) Groundwater is: (circle one)

   a. water that lies on top of the ground
   b. water that has become polluted with soil
   c. **water that is found underground in cracks and spaces in the soil, sand and rock**

4) An area of land from which water drains into a common (the same)stream, lake, river or other body of water is known as: (circle one)

   a. **a watershed**
   b. the water cycle
   c. a riparian buffer zone

5) The water that the majority of southwestern Pennsylvanians use in their homes comes from where? (circle one)

   a. cisterns
   b. lakes
   c. **rivers**
   d. wells

(Over)

6) The biggest water pollution problem facing North America today is:(circle one)

a. Point Source Pollution
b. Pet waste
c. **Nonpoint Source Pollution**
d. Litter

7) Name two ways that we can be environmental stewards and protect the quality of our water.

1. **Do not litter**
2. **Do not put anything in the storm drain**

8) Name two sources of pollution that come from our homes and/or yards.

1. **Pet Waste**
2. **Pesticides**

9) Name two things that you can do to conserve (save) warter..

1. **Take shorter showers**
2. **Don't let the water run when not in use**

10) Name five ways that humans use water.

1. **Bathing**
2. **Swimming**
3. **Energy production**
4. **Cooking**
5. **Putting out fires**

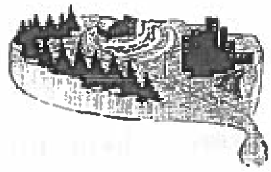
11) What watershed do you live in?

_____

Name of school: _____ Grade_____

Thank you!

We ALL Live in a WATERSHED



Watershed Do's and Don'ts

What is a "Watershed"?

- **<u>Answer</u>: The land area from which water drains into a stream, channel, lake, reservoir or other body of water is a watershed**
    - Watersheds are named after the body of water that the land drains into.
    - In Southwestern PA most of us live in the Allegheny River Watershed, the Monongahela River Watershed and/or the Ohio River Watershed.

How does MY behavior impact the watershed?

- **<u>Answer</u>: Many sources of pollution start in your own backyard!**
    - The health of our rivers and streams is closely linked to activities undertaken in our homes, yards, schools, and businesses.
    - Lawn care, gardening practices, car care, pet waste, paving, and the use and disposal of toxic household chemical products all contribute to nonpoint source pollution (NPS) and affect the water quality in our rivers and streams.

Water is life!

Your student has participated in a Watershed Awareness Program sponsored by the Pennsylvania Resources Council. **It is important that students AND their families work together too protect the watershed.**

***Please read the watershed awareness materials that your student has brought home and <u>SIGN, CUT, AND RETURN</u> the "tear-off" portion at the bottom of this page indicating that you have read the information.**

✂- -

I have read the attached Watershed Awareness materials that my student brought home.

Signature of Parent/Guardian________________________**Date**____________

Watershed "Dos"

Lawn and Garden

- Use natural, non-toxic pesticides and fertilizers in the lawn and garden
- Use mulch in the garden to keep moisture in and weeds out
- Control soil erosion by planting a ground cover and/or native plants
- Seed bare soil and cover it with mulch ASAP to minimize erosion
- Compost grass clippings and leaves.
- Keep fallen leaves out of the ditch or street gutter
- Clean up pet waste to keep nutrients and bacteria out of the waterways
- If using salt on sidewalks, steps, or driveways use it sparingly
- Direct downspouts away from paved surfaces toward an absorbent area (lawn or garden)
- Clean up spilled brake fluid, oil, grease and antifreeze immediately. You can use kitty litter to absorb it.

Car Care

- Wash your car on the lawn or in a grass or gravel area so that the water can percolate into the soil. The ground filters it before it reaches the river or stream
- Take used motor oil to a service station that recycles it.
- Take used batteries and oil filters to participating service stations for recycling.
- Check your car every couple of months for leaks in the oil, fuel, brake, and cooling systems.
- Carpool or use public transportation whenever possible

PRC Pennsylvania Resources Council, Inc.
"Working to protect the environment since 1939."

Household Products

- Use non-phosphate laundry detergents and non-toxic cleaning products.
- Instead of fabric softener use baking soda in the final rinse.
- Use latex paint instead of oil-based paint whenever possible.
- Practice the 3 "R's" (Reduce, Reuse, Recycle).

Watershed Don'ts

Lawn and Garden

- NEVER use pesticides if it looks like rain.
- Never allow leaves and grass clippings to wash into roadways where they will reach storm drains.

Household Chemicals

- Don't Pour It Down the Drain!
  - Anything you pour down your drain or flush down your toilet will enter your community's sewer system or streams.
- Don't Put It in the Trash!
  - As rain and snow pass through the landfill, the water can become contaminated by hazardous products and eventually carry them into the groundwater and surface water.
- Don't Dump It on the Ground!
  - Hazardous wastes dumped on or buried in the ground can contaminate the soil and leach down into the groundwater or be carried into a nearby river or stream by runoff during rainstorms.

Household Hazardous Waste

- Never dump HHW down storm sewers or in the backyard
- Never burn or bury HHW
- Never place HHW in the trash

Litter

- Don't be a litterbug!

Car Care

- Never pour motor oil or anti-freeze in the storm drain

Become an Ambassador for the Watershed

Receive a certificate proclaiming you to be an
"Ambassador for the Watershed"

Students are invited to act as "Ambassadors for the Watershed". Please review this list of actions that students and families can take that can contribute to improved water quality and healthier watersheds:

- Use green cleaning products
- Keep your yard free of pet waste to keep nutrients and bacteria out of the waterways
- Pick up litter and pledge not to litter
- Recycle
- Reduce your use of lawn pesticides and chemical fertilizers
- Practice organic lawn and garden care
- Compost grass clippings and leaves
- Check your car regularly for leaks
- Wash your car on a grassy or gravel area
- Install a rain garden or rain barrel

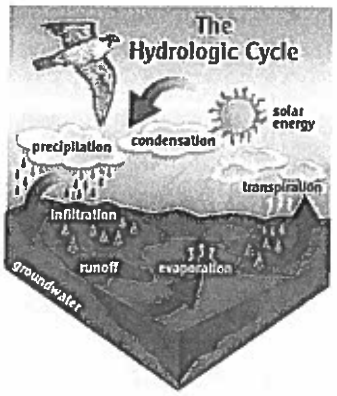
As "Ambassadors" you will share watershed protection information with your family. From there pick one watershed protection action that you can take with your family. This will extend watershed and water quality improvement beyond the classroom while helping your local environment and watershed. We encourage you to add one action monthly.

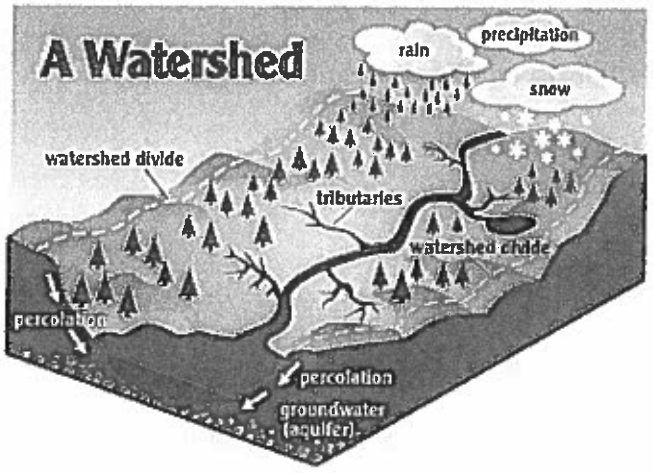
Students who complete the in-school Watershed Awareness Program and pledge to take watershed protection action will be awarded a certificate proclaiming you to be an "Ambassador for the Watershed" and "Environmental Steward". This certificate will be awarded to students who:

- Complete the Watershed Awareness 2-session program
- Return a form signed by an adult at home stating that the information was shared with the family
- Pledge to take action to protect the watershed.

WATERSHED AWARENESS

STUDENT GUIDE





Presented by:

Pennsylvania Resources Council, Inc.

"Working to protect the environment since 1939

Water Facts

(Source: United States EPA - Office of Water)

Facts About Water

The most common substance found on earth is water.

Water is the only substance found naturally in three forms: solid, liquid, and gas.

The amount of water is constant and recycled throughout time; actually, it is possible to drink water that was part of the dinosaur era.

Eighty percent of the earth's surface is water.

Ninety-seven percent of the earth's water is saltwater in oceans. Of the 3% that is freshwater, only 1% is available for drinking - the other 2% is frozen.

Water serves as nature's thermometer, helping to regulate the earth's temperature.

Water freezes at 32 degrees Fahrenheit, 0 degrees Celsius.

Water boils at 212 degrees Fahrenheit, 100 degrees Celsius.

Forty trillion gallons of water a day are carried in the atmosphere across the USA.

An acre of corn gives off 4,000 gallons of water per day in evaporation.

It would take 1.1 trillion gallons of water to cover one square mile with one foot of water.

One gallon of water weighs 8.34 pounds

A person can live without water for approximately one week.

A clothes washer uses about 50 gallons of water.

It takes 12 to 20 gallons of water to run an automatic dishwasher for one cycle.

About 25 - 50 gallons are needed for a tub bath.

You can refill an 8 oz. glass of water approximately 15,000 times for the same cost as a six pack of soda pop. And, water has no sugar or caffeine.

A single quart of motor oil can pollute 250,000 gallons of water in our rivers and lakes.

How much water does it take to grow a hamburger?

Pretty much everything we eat needs water to either grow or create. This water is either supplied by nature as precipitation or added by man during the growing/production process. You can't tell by the size or texture of a food how much water was actually used to produce the food item. To grow that hamburger, for example, it takes water to grow the vegetation the cow eats, water for the cow to drink, water for processing the meat, maybe even water for a cow bath! It all adds up.

Almonds: 12 gallons
Chicken: 400 gallons
French Fries: 6 gallons
Hamburger: 1,300 gallons
Lettuce: 6 gallons
Milk: 65 gallons
Rice : 35 gallons
Tomatoes: 3 gallons
Watermelon: 100 gallons
1 Egg: 120 gallons
Loaf of bread: 150 gallons
1 Car: 65,000 gallons

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http://ga2.er.usgs.gov/edu/sc1action.cfm

LESSON ONE: Water Cycle Vocabulary

aquifer: underground spaces where water is stored and through which it moves slowly under the influence of gravity

condensation: the process by which a vapor becomes a liquid

contaminant: any substance that when added to water (or another substance) makes it impure

ecosystem: a biological community (community of organisms) and its environment functioning as an ecological unit

environmental stewards: caretakers of the earth

evaporation: the process by which liquid turns into vapor (usually as a result of the application of heat energy)

groundwater: water that is found underground in cracks and spaces in the soil, sand and rocks and that moves under the influence of gravity

habitat: the place where an animal or human lives

impervious (surface): Impermeable: unable to penetrate. Impervious surface: a material, such as asphalt, covers the soil and does not allow water to penetrate into soil layers below. Prevents infiltration.

infiltration: the downward movement of water into the soil

natural resource: a substance that exists in nature that we can use for food, building, manufacturing, etc

precipitation: water falling to Earth in the form of rain, snow, sleet or hail

recharge: to replenish or refill groundwater supplies with rain or snowmelt

runoff: Rainfall or snowmelt that flows over the land surface without soaking into the soil, or over impervious surfaces (like parking lots) to lower elevations

surface water: water on the surface of the land , including lakes, streams, rivers, ponds, and runoff

transpiration: the process by which the surface of a plant gives off internal fluids as a vapor, usually from the leaves

water cycle: the paths water takes through its various states (liquid, vapor, solid) as it moves throughout the ocean, atmosphere, ground, rivers, etc.

The Water in YOU ! (Check this out !!)

Think of what you need to survive, really just survive. Food? Water? Air? MTV?

Naturally, I'm going to concentrate on water here. Water is of major importance to all living things; in some organisms, up to 90 percent of their body weight comes from water.

Up to 60 percent of the human body is water.

The brain is composed of 70 percent water.

The lungs are nearly 90 percent water.

About 83 percent of our blood is water, which helps digest our food, transport waste, and control body temperature.

Each day humans must replace 2.4 litres of water, some through drinking and the rest taken by the body from the foods eaten.

There just wouldn't be any you, me, or Fido the dog without the existence of an ample liquid water supply on Earth. The unique qualities and properties of water are what make it so important and basic to life. The cells in our bodies are full of water. The excellent ability of water to dissolve so many substances allows our cells to use valuable nutrients, minerals, and chemicals in biological processes.

Water's "stickiness" (from surface tension) plays a part in our body's ability to transport these materials all through ourselves. The carbohydrates and proteins that our bodies use as food are metabolized and transported by water in the bloodstream. No less important is the ability of water to transport waste material out of our bodies.

Thirstin's Word Scramble Game

Put the letters in the right order to complete the sentence:

All living things need _____ (tawer) to live.

When water evaporates, it travels into the air and becomes part of a _____. (dlocu)

Less than 1% of all the water on the earth is _____ (sefrh) water.

We _____ (ikrdn) water in the liquid form.

Check for leaks and save hundreds of _____ (allogns) of water a day.

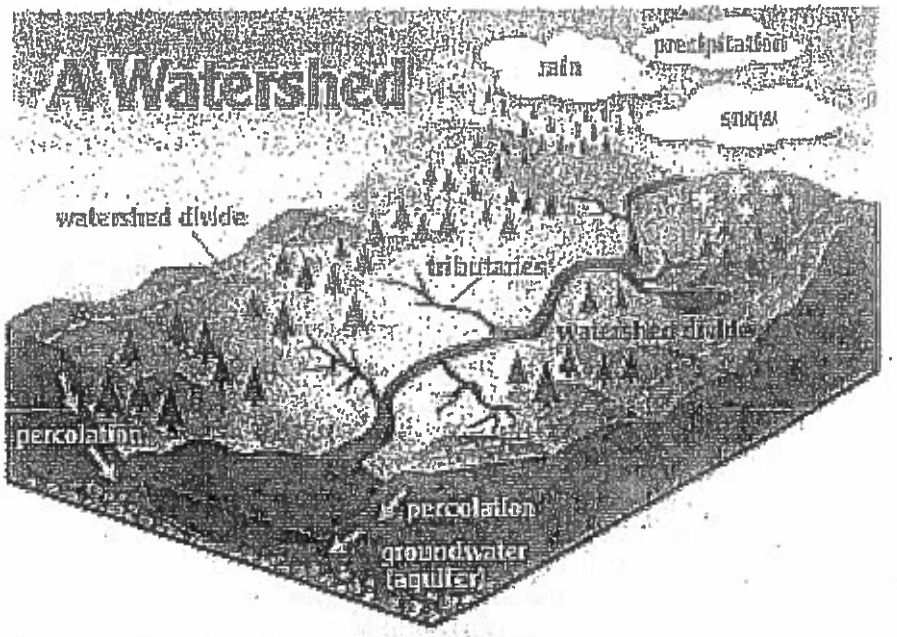
You'll save water by taking a quick _____ (howser).

Wash bikes and cars with a _____ (kecbut) and sponge instead of a running hose.

Ask your _____ (mfaiyl) to look for ways to save water.

Lesson 2

THE WATERSHED



Watershed: Water what ?

The area of land that drains into streams, lakes, estuaries or other bodies of water are known as watersheds. They are also known as drainage basins or catchments. As precipitation falls to the ground, the water is pulled downhill by gravity, which causes it to flow over the landscape or infiltrate through the soil into the groundwater. Topography - the hills, valleys, and other features that define the landscape - determine the boundaries of watersheds.

Every stream, regardless of its size, has a watershed. Smaller watersheds are contained within larger watersheds. For example, The Streets Run Watershed in southwestern Pennsylvania is part of the Monongahela River Watershed, which in turn is part of the Ohio River Watershed, which is part of the Mississippi River Watershed. **No matter where you live, you live within a watershed. Just as you have a home and school address, you also have a watershed address.**

Watershed Vocabulary

Aquifer: underground spaces where water is stored and through which it moves slowly under the influence of gravity

Collection site: a stream, lake, or other body of water fed by water drained from a watershed

Combined Sewer Overflow (CSO): in urban and suburban areas, runoff from roads, parking lots, and rooftops is often channeled into storm sewer pipes that combine with human sewage. During storms, human waste and storm water can overload the system, resulting in an overflow of water and untreated sewage into creeks and rivers. It occurs most often in areas with aging sewage systems.

Contaminant: a substance that when added to water (or another substance) makes it impure

Ecosystem: a biological community and its environment functioning as a unit

Environmental stewards: caretakers of the earth

Groundwater: water that is found underground in cracks and spaces in the soil, sand and rocks and that moves under the influence of gravity

Headwaters, headwater stream: A small creek or stream that begins in the highest elevations of a watershed.

Impervious (surface): prevents water from entering soil directly

Infiltration: the downward movement of water into the soil

Non-point source pollution: pollution that originates over a widespread region from a variety of sources rather than a single point or location

Point source pollution: pollution that originates at a specific point or location, such as a factory or sewage plant (end-of-pipe sources)

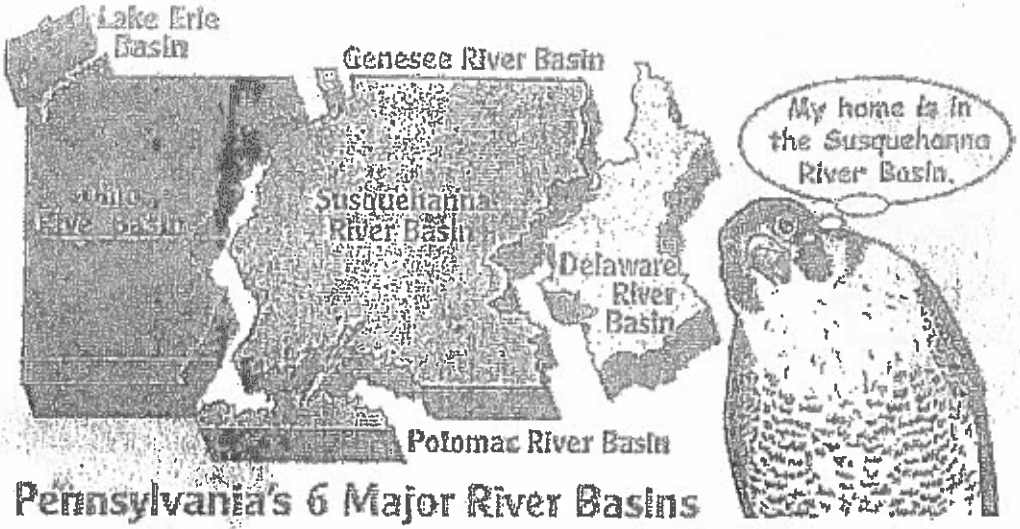
Recharge: to replenish or refill groundwater supplies with rain or snowmelt

Runoff: rainfall or snowmelt that flows over the land surface without soaking into the soil or that flows over impervious surfaces (like parking lots)

Surface water: water on the surface of the land, including lakes, streams, rivers, ponds and runoff

Tributary: a smaller channel of water that drains into a larger body of running water: a creek that empties into a stream; a stream that empties into a river.

Watershed: the land area from which surface runoff drains into a stream, channel, lake, reservoir or other body of water (collection site)



Pennsylvania's 6 Major River Basins

Pennsylvania has over 2000 miles of streams that flow into hundreds of subwatersheds, that flow into 104 different watersheds, that flow into subbasins, which flow into 6 major river basins in Pennsylvania: the Ohio, the Genesee, the Susquehanna, the Delaware, the Erie, and the Potomac. These watersheds are also known as river basins because they are named after major river systems in our state. These river basins or watersheds then eventually drain into larger bodies of water, such as the Chesapeake Bay and Lake Erie. Finally, larger bodies of water like the Chesapeake Bay, flow into the ocean.

Definition

wa.ter.shed \ *n* **1 :** land area from which water drains toward a common watercourse in a natural basin

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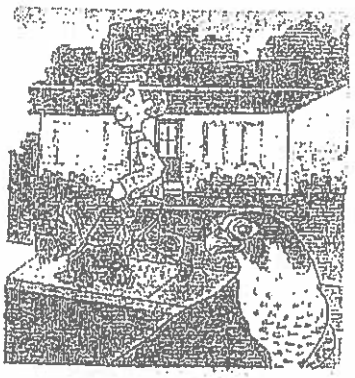
Most of us know our political address; the name of the city, borough, or township where we live. We know the name of our county. And, of course, we know our home state and country.

Less well known to each of us is our **natural** address.

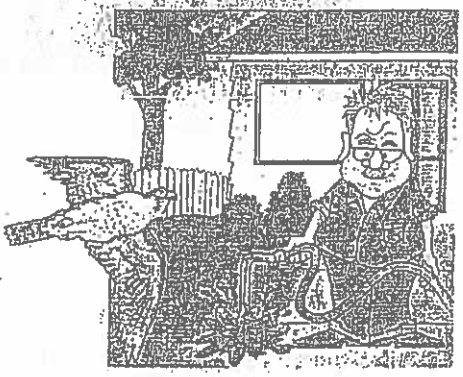
- Do you know the name of your local stream?
- Can you name your home watershed?
- Do you know what larger watershed you live in and where your home stream reaches the sea?

Department of
Environmental Protection

What WE can Do...



It is important to always pick up after our pets. Their waste is very harmful to our streams and rivers. Pet waste has dangerous germs that can make plants, other animals and even people that swim in dirty water sick



Mr Green is watering his grass again. We usually don't think about how much water we use because it seems like we'll always have enough. But that won't be the case if we don't use water wisely. That's why it is very important to conserve what we have. Awareness is the first step in conservation. So next time you take a shower or wash your hands think about how much water you're using and how you can use less!

Here comes a car. Look at all that black smoke coming out the pipe in the back. Did you ever think something in the air like that could pollute the water? Well it can. What goes up must come back down. All that gross smelling smoke that comes out of cars and busses will eventually land on the ground or in a creek, river lake or ocean.

There sure is a lot of litter lying around in the street. Street litter, like plastic bags, cups, and candy wrappers, often gets swept away when it rains into the storm drains and can end up floating in the ocean or washing up on our beaches.
A lot of animals that live in the ocean can mistake this trash for food and get tangled up or sick.

Adapted from
http://www.depweb.state.pa.us/justforkids/site/default.asp?depNav=|

Mr. Greenthumb is washing his car again. Seems harmless to the watershed right? Well, rain and water from hoses when washing the car carries the soap and all the other chemicals in its path to the storm drain. From the storm drain, water flows to the nearest stream – soap, dirt, litter and all!

Hey, there's Greta Greenthumb taking care of her garden. Some plant food, like fertilizer, or bug killers called pesticides can wash into the streams and storm drains when it rains too. These chemicals can take the oxygen out of the water and harm animals, bugs and plants who need it to breathe

Let's walk down by the stream. The water looks a little cloudy. Seems like there is a lot of dirt in there. Did you know that a little bit of dirt in a stream is natural but too much from erosion is bad? Erosion is when dirt slides off a hill or the side of the stream and lands in the water. This dirt can make the water cloudy making it hard for fish to breath or find places to lay their eggs. Dirt can also clog up streams like this and make them disappear all together!

Adapted from http://www.depweb.state.pa.us/justforkids/site/default.asp?depNav=|

BLUE THUMB WORD SEARCH

Most people in North America get their water from a public water utility. Public utilities are companies or government agencies that supply needs such as electricity, gas, or water to the public. Water utilities get their water from rivers, lakes, reservoirs, or underground aquifers. Often, the water must be treated to make it safe to drink.

We reuse the same water over and over and it can become polluted by people and industry. Even deep underground aquifers can be polluted from the surface. For example, many household items, such as car wax, spot remover, or floor polish, should not be poured down the drain nor thrown out in the trash. Even lawn chemicals and other garden toxins used outdoors can contaminate water sources by running off the land into storm drains. And water can end up in lakes and rivers.

Let's take care of our water resources. Use your "Blue Thumb" to conserve water, protect it, and get involved.

(circle each one)

nature	recycle	treatment
drink	pesticide	leaks
toxic	oil	tap
fertilizer	batteries	pollute
paint	contaminate	protect
gasoline	hazardous	safe
clean	wells	water sources

W	E	L	L	S	D	M	P	Q	S	V	F
L	A	B	O	T	P	O	L	L	U	T	E
H	Z	T	R	E	A	T	M	E	N	T	R
C	P	A	E	R	I	C	B	C	U	E	T
O	Y	P	C	R	F	E	N	L	K	D	I
N	A	H	Y	J	S	T	M	E	H	I	L
T	E	A	C	P	Z	O	C	A	L	C	I
A	F	Z	L	K	T	R	U	N	T	I	Z
M	A	A	E	D	O	P	E	R	B	T	E
I	S	R	I	X	X	N	W	G	C	S	R
N	M	D	P	A	I	N	T	S	L	E	V
A	B	O	I	L	C	F	S	M	O	P	S
T	F	U	O	D	R	I	N	K	T	E	S
E	D	S	L	M	O	H	J	L	A	M	R
P	A	T	B	A	T	T	E	R	I	E	S
G	K	U	E	F	N	A	T	U	R	E	L

Watershed Awareness/Rain Barrel Workshop

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DON'T BE A LITTERBUG

PENNSYLVANIA ROADSIDE COUNCIL

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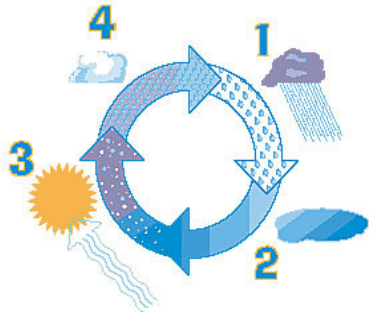
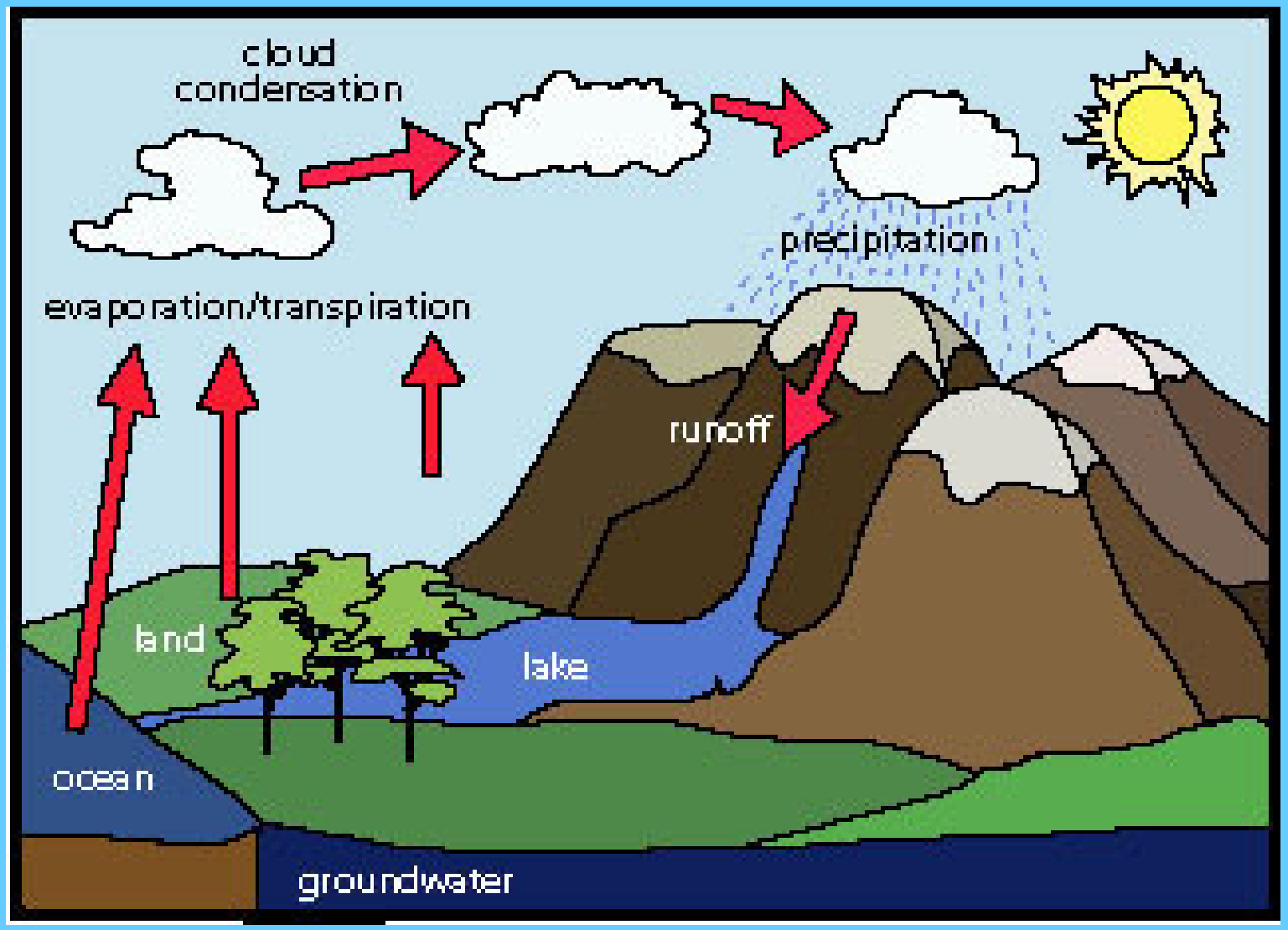


Between Earth and Earth's atmosphere, the amount of water remains constant; there is never a drop more, never a drop less. This is a story of circular infinity, of a planet birthing itself.

LINDA HOGAN, Northern Lights, Autumn 1990

WATER is LIFE

Water Cycle


cloud condensation
precipitation
evaporation/transpiration
runoff
land
lake
ocean
groundwater

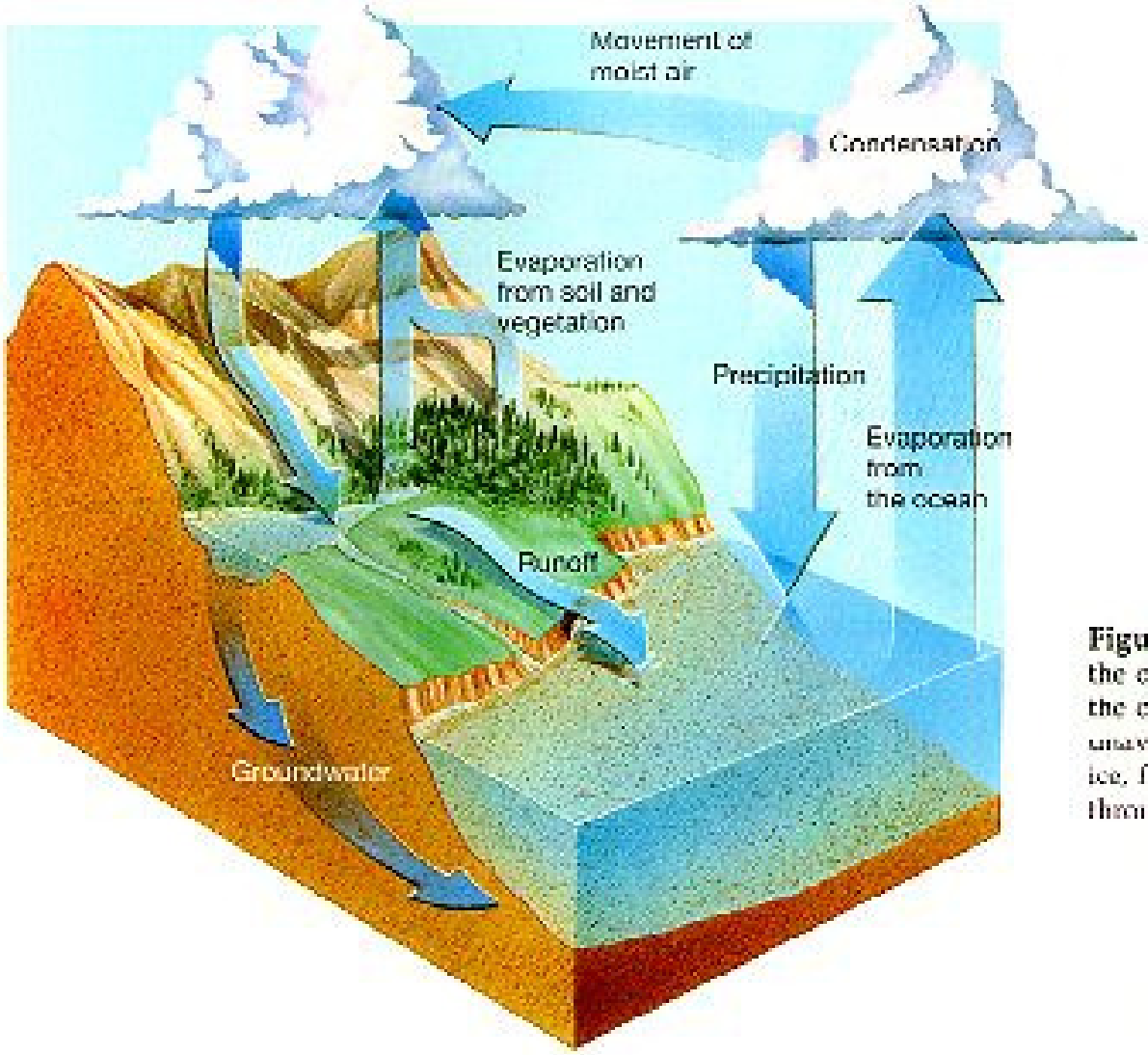
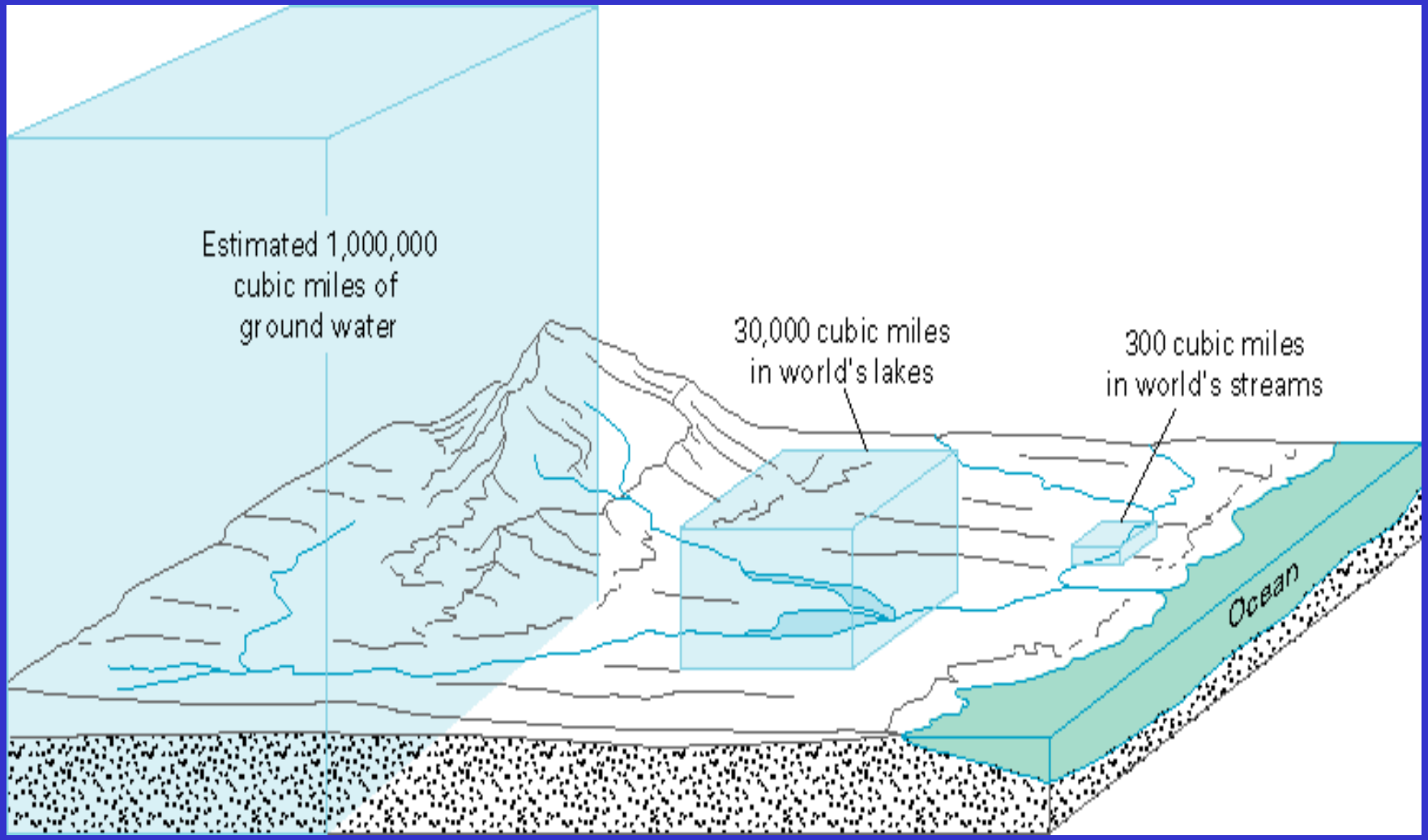
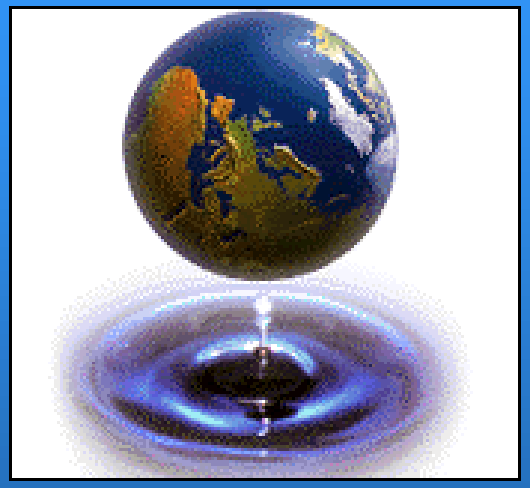


Figure 54–6 The hydrologic cycle. Water cycles from the oceans to the atmosphere to the land and back to the oceans. Although some water molecules are unavailable for thousands of years (locked up in polar ice, for example), all water molecules eventually cycle through the hydrologic cycle.

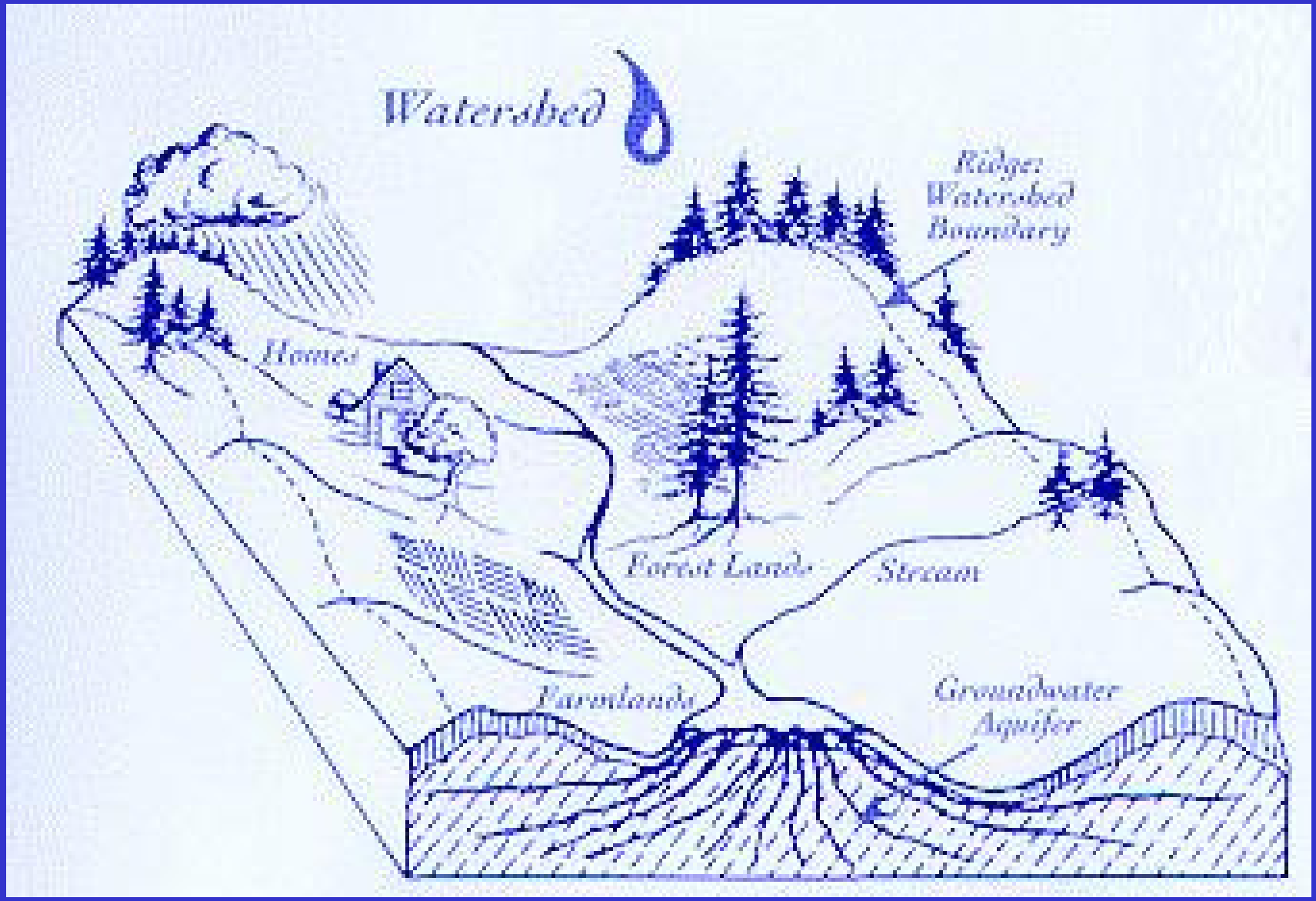
Fresh Water in Storage



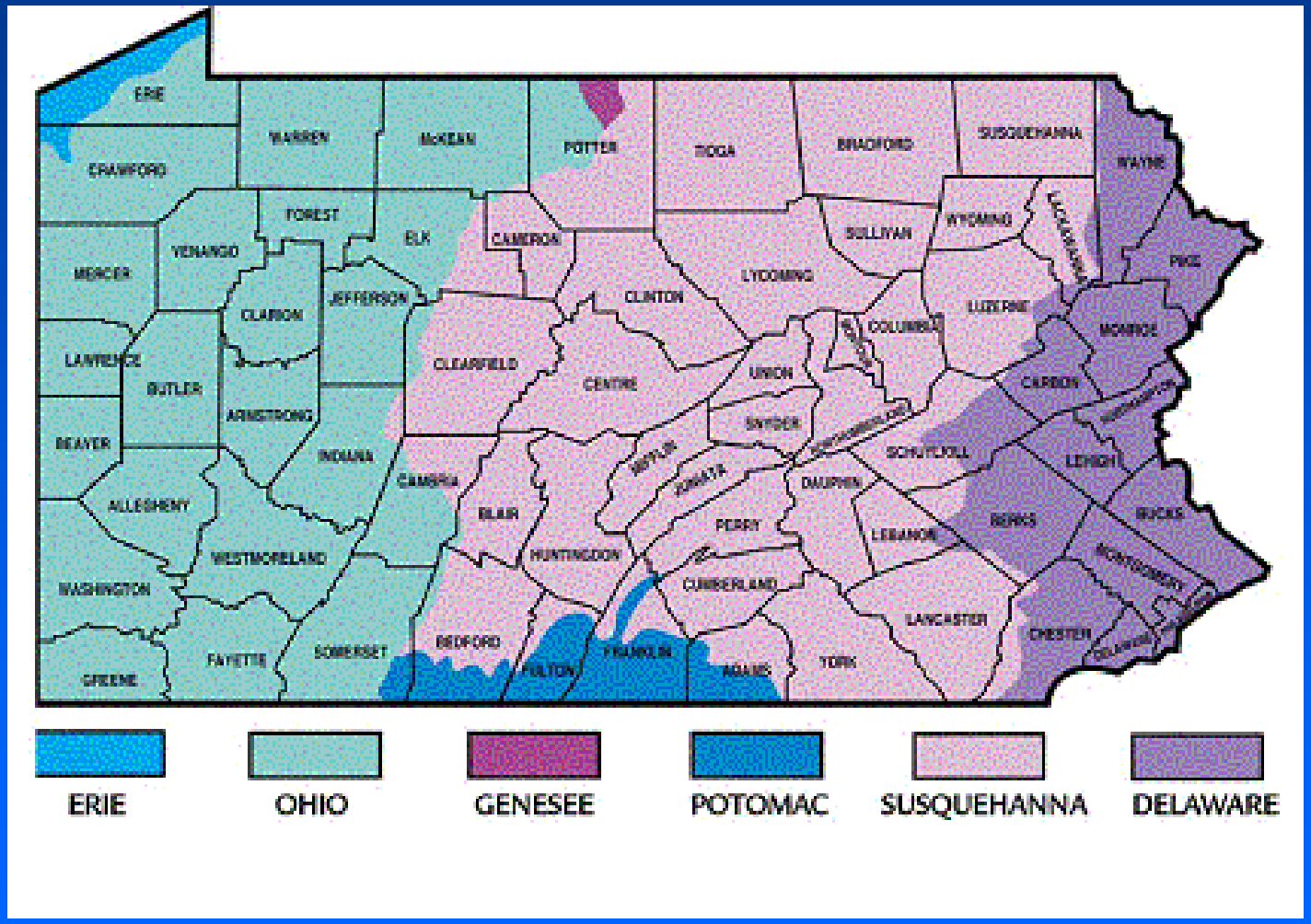
What exactly is a “Watershed”?



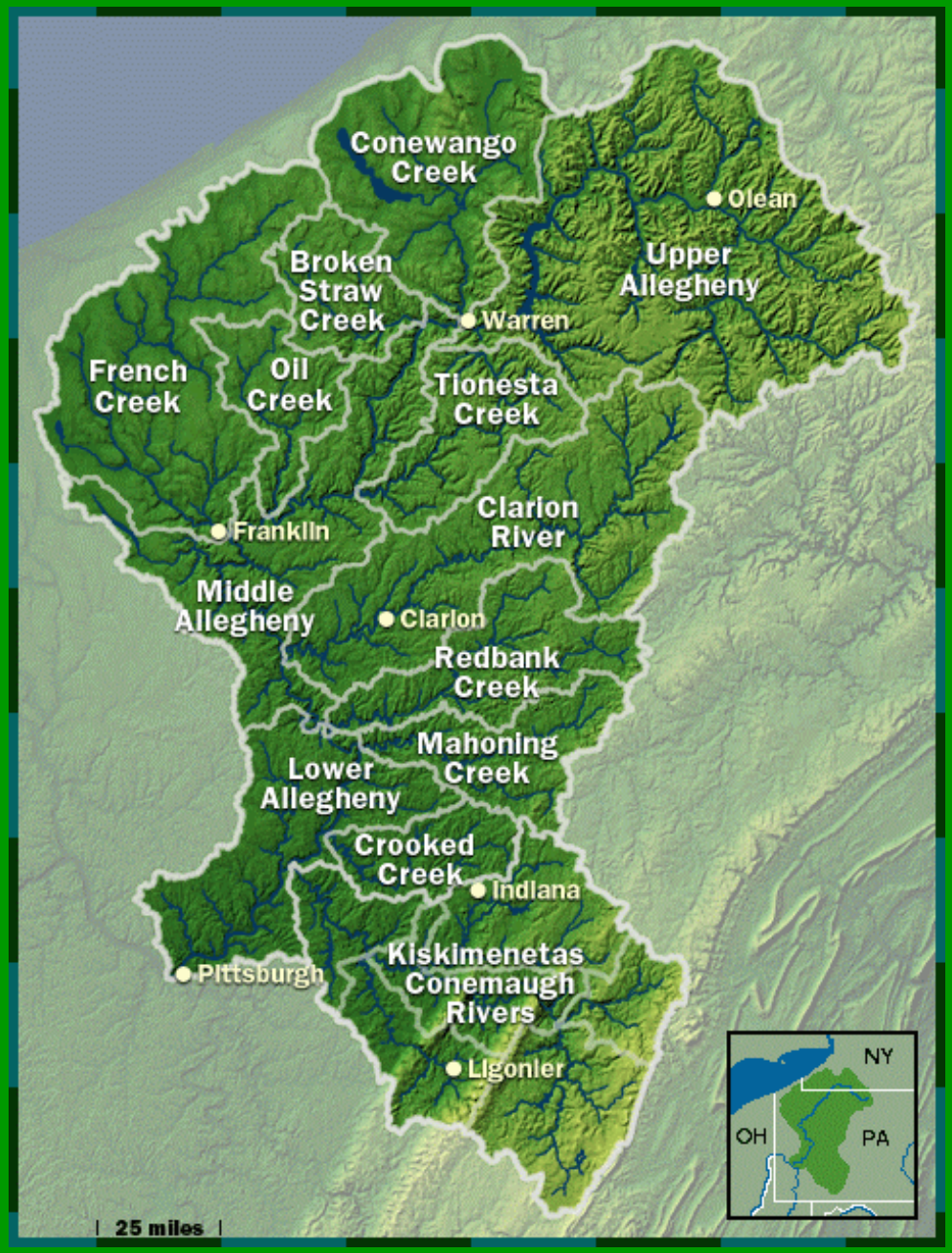
Watershed: **the land area from which surface runoff drains into a stream, channel, lake, reservoir or other body of water (collection site)**


Watershed
Ridge
Watershed
Boundary
Homes
Forest Lands
Stream
Farmlands
Groundwater
Aquifer

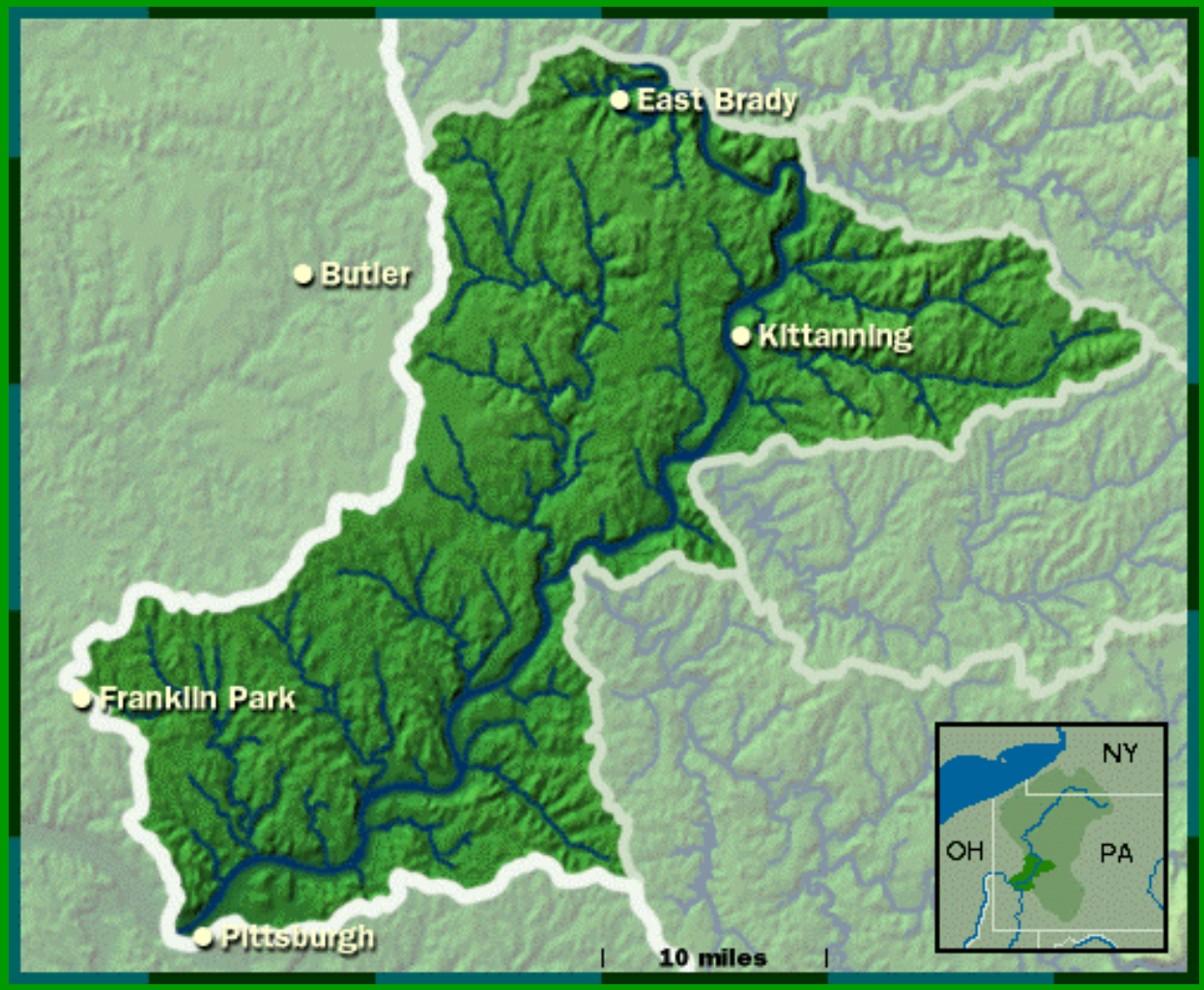
PA's 6 Major Watersheds




Pittsburgh
N
Monessen
Connellsville
Uniontown
Youghiogheny
Lower
Monongahela
Morgantown
Upper Monongahela
Fairmont
Clarksburg
West
Fork
Cheat
Tygart
Valley
OH
PA
MD
WV
VA
25 miles


Conewango Creek
Olean
Broken Straw Creek
Upper Allegheny
Warren
French Creek
Oil Creek
Tionesta Creek
Clarion River
Franklin
Middle Allegheny
Clarion
Redbank Creek
Mahoning Creek
Lower Allegheny
Crooked Creek
Indiana
Kiskimenetas Conemaugh Rivers
Pittsburgh
Ligonier
NY
OH
PA
25 miles

Lower Allegheny



Watershed Units

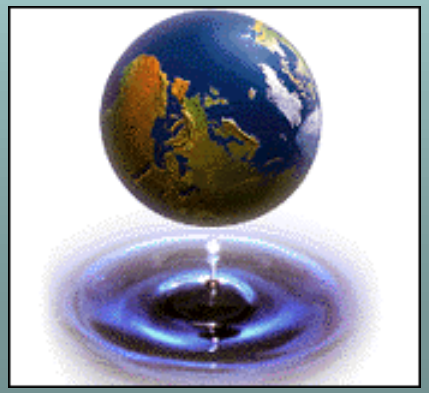
Human Impact on the Watershed

- Point Source
- Nonpoint Source Pollution (NPS)

Sources of Human Impact

Human Impact on the Watershed

- Homes/Yards
- Schools
- Businesses
- Development
- Agriculture
- Mining
- Construction
- Sprawl



Human Impacts on Watersheds

Combined Sewer Overflow (CSO)

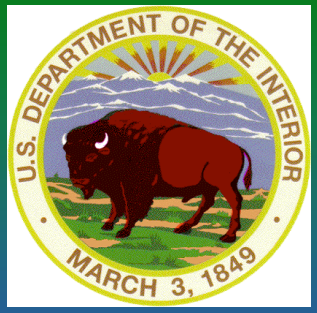
Sewer Overflow

GO “GREEN" AND CLEAN !!

What is “Green” Cleaning?

What is "ENVIRONMENTALLY PREFERABLE" ?

- **"...products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose..."**



- MUST BE BIO-BASED (NO PETROCHEMICALS)
- NO PETRO-DYES IN PRODUCTS (NO BLUES,GREENS,YELLOWS, OR ANY OTHER COLOR unless provided by natural means)
- NO ARTIFICIAL PETRO-PERFUMES (NO...PINES , MINTS , CHERRIES , VANILLAS , LEMONS ... - unless provided through natural means).

"**GREEN**" -or- Environmentally-Preferable Standards

- **Must Not Contain Any Carcinogens, Mutagens, or Teratogens Designated by Federal Law**
- **MUST BE BIODEGRADABLE**
- **Must Not Contain Chlorinated Solvents**
- **Must Not Contain Any Ozone-depleting Compounds, Greenhouse Gases**
- **Must Not Contain Any Substances That Contribute to Photochemical Smog and Poor Indoor Air Quality**
- **Must Not Be Delivered in Aerosol Cans.**

- **Must Not Contain Ingredients Included on the "Chesapeake Bay Program's Toxics of Concern List" .**
- **Must Not Be Toxic to Humans or Aquatic Life**
- **Must Not Contain Endocrine Modifiers, Alkyl Phenyl Ethoxylates, Dibutyl Phthalate, or Heavy Metals**
- **Must Not Contain More than 0.5 Percent by Weight of Phosphorous**
- **Must Not Contain Persistent or Bioaccumulative Substances**

NEW YORK STATE MANDATES "GREEN CLEANING"

On January 10th, 2005, New York State George Pataki announced in his 2005 State-of-the-State Address that he signed an Executive Order mandating state agencies and authorities to use ONLY non-toxic cleaning supplies, and that legislation is currently being created for a similar mandate concerning ALL New York State schools.

Homemade Non-toxic Cleaners

- Basic ingredients include:
  - Water
  - Baking soda
  - White distilled vinegar
  - Liquid soap
- All purpose cleaners, glass cleaners, stain removers, oven cleaner, drain cleaner, floors, polishes, toilet bowl cleaner, etc, etc.

Lawn and Garden

American Lawns…

- Cover more than **30 Million Acres**
- Use up to **10 X more chemical pesticides** per acre than farmers use on crops
- **2001 EPA figures** estimate
  - **US homeowners bought 102,000,000 .lbs** of the active ingredients used in lawn and garden pesticides at a **cost of over $2 billion**

Chemical pesticides and fertilizers contaminate surface and groundwater.

- Lawn pesticides and fertilizers can contaminate surface and groundwater.
- This diminishes the quality of our drinking water as well as the quality of aquatic habitats and health of aquatic life forms.
- Many fish and aquatic insect species are highly sensitive to fertilizers and pesticides.

Household pesticides are poisoning city creeks

- Pyrethroids is a class of insecticides found in household sprays and lawn care products. These findings have caught the attention of EPA, which is now in the process of reregistering these insecticides.

Researchers suspect that pyrethroids bind to small bits of dirt that wash off lawns and into nearby streams.

Wisconsin researcher says frog deformities increase with use of fertilizers

In the Garden/On the Lawn

- Use natural, non-toxic pesticides and fertilizers in the lawn and garden
- NEVER use pesticides if it looks like rain
- Use mulch in the garden to keep moisture in and weeds out
- Control soil erosion by planting a ground cover and/or native
- Compost grass clippings and leaves. Never allow them to wash into roadways where they will reach storm drains.

Car Care

Car Care

- Clean up spilled brake fluid, oil, grease and antifreeze immediately . You can use kitty litter to absorb it
- Wash your car on the lawn or in a grass or gravel area so that the water can percolate into the soil. The ground filters it before it reaches the river or stream.

CAR CARE

- Fact: One quart of motor oil can pollute 250,000 gallons of water in our rivers and lakes.
- Take used motor oil to a service station that recycles it
- Anti-freeze can be recycled. Take it to a service station that does so.

CAR CARE

- Take used batteries and oil filters to participating service stations for recycling.

- Check your car every couple of months for leaks in the oil, fuel, brake and cooling systems

What is HHW or Household Hazardous Waste?


HHW is…

HHW is…

- Six categories: cleaning products, auto maintenance, hobby products, personal care, lawn and garden care
- Found in the kitchen, basement, garage, and workshop
- Look for precautionary words like Poison, Danger, Warning, Caution, Toxic, etc.

Latex Paint

- **NOT a hazardous waste**
- **As long as paint is completely dry, it can be thrown out in regular garbage**
- **Using kitty litter or paint hardener**

HHW and the Environment

Improper disposal of HHW can:

- **Kill living organisms in a lake or river**
- **Destroy wildlife and vegetation**
- **Cause major reproductive complications in wildlife**
- **Limit the overall ability of an ecosystem to survive**

What can you do?

- Buy only what you need
- Use less toxic alternatives
- Give away unused portions to friends
- Bring HHW to an HHW collection event
- Take responsibility for what you buy

How Do You Dispose of the Polluting Materials Used in Your Home?

The way you dispose of products you and your family use at home can contaminate your community's ground water

Motor oil, pesticides, left-over paints or paint cans, mothballs, flea collars, weedkillers, household cleaners, and medicines can be harmful to ground water and to the environment in general.

The average American disposes of approximately one pound of this type of waste each year. Multiply that by the number of people in your community. It adds up to a lot of toxic material going in to the groundwater.

Don't Pour It Down the Drain!

Anything you pour down your drain or flush down your toilet will enter your community's sewer system.

Don't Put It in the Trash!

As rain and snow pass through the landfill, the water can become contaminated by hazardous products and eventually carry them into the ground water and surface water.

Don't Dump It on the Ground!

Hazardous wastes dumped on or buried in the ground can contaminate the soil and leach down into the ground water or be carried into a nearby river or stream by runoff during rainstorms.

What You Should NOT Do

- **Never leave products within reach of children and animals**
- **Never allow children to handle or dispose of HHW**
- **Never dump HHW down storm sewers or in the backyard**
- **Never burn or bury HHW**
- **Never place HHW in the trash**
- **Never reuse containers for other purposes**
- **Never mix products unless instructed to do so by the label directions**

Do Use and Dispose of Harmful Materials Properly!

Use less of such products. Whenever possible, substitute a nonhazardous product. Buy only as much as you need.

Use non-phosphate laundry detergents and non-toxic cleaning products

Instead of fabric softener use baking soda in the final rinse

Use latex paint instead of oil-based paint whenever possible

RECYCLE!

Making cans from recycled aluminum products produces 96% less air and water pollution than making them from raw materials(bauxite).

Manufacturing recycled paper produces 55% less air and water pollution than manufacturing paper from virgin wood(trees).

Recycling just one aluminum can saves enough energy to run a television for three hours.

Each ton of recycled paper can save 17 trees, 380 gallons of oil, three cubic yards of landfill space, 4,000 kilowatts of energy and 7,000 gallons of water!

Don’t be a litterbug!

Litter gets washed into the storm sewer and ends up in the lakes, streams , rivers and wetlands.

Impervious Surface

Forested Wetland

Impervious Surface

The pervious pavement at the Chicago Center for Green Technology lets water seep into the ground instead of heading into the sewer drain. (Photo by Shawn Allee)


SWTA

Replacing impervious surfaces like sidewalks and driveways with permeable areas allows more water to infiltrate into the ground.

Permeable Paving Systems

What is a rain barrel?

- **A rain barrel is a system that collects and stores rain water from your roof that would otherwise be lost to runoff and diverted to storm drains, streams and rivers.**
- **A rain barrel is relatively simple and inexpensive to construct and can sit conveniently under any residential gutter down spout.**

Elevating the Rain Barrel

The rain barrel is designed to take advantage of gravity. Water will flow from the vinyl hose when the hose is below the barrel. Therefore, place the barrel on cinder blocks or a sturdy wooden crate at least 15 inches from the ground.

55-Gal. Drum Rain Barrel

Rain Barrel Camouflage

To construct your rain barrel you will need:

One 55-gallon food-grade drum (these can be purchased or obtained for free from a beverage plant or dairy)

- 3 1/2ft vinyl hose (3/4" DD x 5/8" ID)
- One 4" diameter atrium grate/screen
- One ½" PVC male adapter (will be attached to bottom of rain barrel)
- One 3" vinyl gutter elbow
- Waterproof sealant (i.e. plumbers goop, silicone sealant, or PVC cement)
- One 3/4" x ½" PVC male adapter (will be attached to end of hose and readily adapted to fit standard garden hose)
- Teflon tape

You will need the following tools:

- Drill with 3/4" bit (or use hole saw to cut 3/4" hole)
- Router, jig saw, or coping saw
- Measuring tape
- Other items as needed

½ Inch Male Adapter

Attaching adapter to bottom of barrel

1. Measure about 1 inch above the bottom of the barrel where the curvature along the bottom rim ends and the barrel side begins to rise toward the top. Using a 3/4" bit (or hole saw), drill a hole through the barrel.
2. Screw the ½" PVC male adapter into this newly drilled hole. The hard PVC threads cut matching grooves into the soft plastic of the barrel.
3. Un-screw the ½" PVC male adapter from the hole. Wrap threads w/teflon tape tightly. Coat the threads of the coupler with waterproof sealant. Screw the coated adapter back into the hole and let it sit and dry for 24 hours.
4. Attach 3 1/2 foot vinyl hose to the PVC male adapter.

Atrium Grate or Screening Device

- **Using the atrium grate as a template for size, mark a circle at the center of the top of the drum (Locating the rainwater inlet in the center of the barrel allows the barrel to be pivoted without changing the position of the down spout).**

- Drill a ½" hole in the inside of the marked circle. Use a router, jig or coping saw to further cut within the marked circle until the hole is large enough to accommodate the atrium grate (the atrium grate is used to filter out large debris). Make sure not to make the hole too big–you want the flange of the atrium grate to fit securely on the top of the barrel without falling in. Placing a scrap piece of fine mesh window screen inside or outside of the grate will provide filtering of finer debris and mosquito control.

Cutting out a notch at top of barrel to hold adapter and hose

Using a ½" bit or saw, cut out a notch at the top of the barrel rim (aligned so that it is above the outlet at the bottom of barrel). The notch should be large enough so that the coupler will firmly snap into place.

By using your rain barrel you'll be :

» **conserving water**

» **reducing the chlorine you put on your garden**

» **saving money with every barrel you catch**

» **helping to reduce CSOs**

OTHER OPTIONS

- Creating a Rain Garden
- Above-Ground Cisterns

Rain Gardens

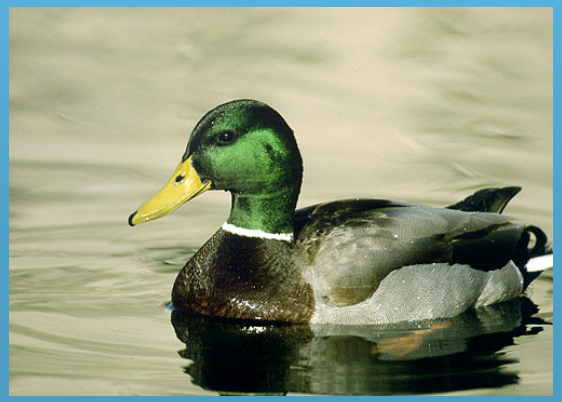
Choosing a Rain Garden Site

Preparing the Site


A LEPIAS INCARNATA
SWAMP MILKWEED

Above-Ground Cisterns

Thank You
for
helping to conserve and protect our watersheds!



LESSON ONE: Awareness - What You Need to Know!!!

Lesson Overview:
Every day we unknowingly use chemicals that might affect our health and the environment. Many common household products, including cleaners, disinfectants, personal care products, and air fresheners contain hazardous chemicals that can contribute to our risk of developing cancer and other health problems. Even the way our electricity is generated can produce toxins in our environment that affect our health.

PA Academic Standards:
4.3.7 A Identify environmental health issue
10.1.6 C Analyze nutritional concepts that impact health.
10.1.6 E Identify health problems that can occur throughout life and describe ways to prevent them.
10.2.6 A Explain the relationship between personal health practices and individual well-being.
10.2.6 B Explain the relationship between health-related information and consumer choices.
10.2.6 D Describe and apply the steps of a decision-making process to health and safety issues.
10.2.6 E Analyze environmental factors that impact health
10.4.6 A Identify and engage in moderate to vigorous physical activities that contribute to physical fitness and health.

Content Objective:
- Students will understand the links between the environment, personal behavior and human health/cancer.
- Students will understand what is needed in order to live healthy lives and the potential health results if these basic needs are compromised.
- Students will be able to list some of the environmental hazards presented by personal care products, cleaning products, lawn and garden care products, second-hand smoke, the production of electricity, and industrial pollutants.
- Students will understand how we are exposed to pollutants, and how harmful chemicals enter the human body.

Presentation Prep
- These activities will take place before the classroom presentation
  - **Pre-test**

- Classroom teacher will administer the Pre-test prior to the presentation of the in-classroom presentation.
- Instruct the students to put only their grade and school name on their pre-test. **They needn't put their name on the test**.
- Explain to the students that this is not a test that will be graded. If they do not know the answer to a question they should simply leave it blank and proceed to the next question.
- Collect pre-tests

- **Have teacher asked students to bring in one personal care product from home for the first day**
- **Possibly have students view – "The Story of Cosmetics" if time allows**

- **Vocabulary**
  - Classroom teacher will pass out the vocabulary, ask children to read over the words and discuss the meanings prior to the classroom presentation

Vocabulary

Benzene: Benzene is a widely used chemical formed from both natural processes and human activities. People are mostly exposed to it through gasoline, car exhaust and from smoking cigarettes or breathing second-hand smoke. Exposure to benzene, especially in the workplace, may cause cancer in animals and humans, including leukemia. You can reduce your exposure by limiting contact with gasoline and cigarette smoke

Cancer - a group of diseases where cells grow abnormally, invade surrounding tissues, and metastasize (spread) to other sites in the body. Cancer has multiple causes, including genetic and environmental factors.

Carcinogen – Any substance or process known to cause cancer

Diethanolamine (DEA) – A suspected carcinogen widely used in shampoo, more hazardous if the product also contains Bronopol

Dioxin – a group of highly toxic chemicals created by industrial processes that use chlorine, such as in making paper or in the incineration of PVC plastics

Endocrine Disruptors – Chemicals that disrupt the body's hormonal balance

Environment - all physical, biologic, chemical and social factors in the world surrounding an individual. In other words, environment represents everything outside the body that impacts health.

Exposure - an individual coming into contact with a disease-causing substance or agent in a way that can produce disease. The route of exposure is the pathway by which a chemical enters the body.

Formaldehyde - Formaldehyde is a nearly colorless gas with a pungent, irritating odor with vapors that are flammable and explosive. It is among the 25 most abundantly produced chemicals in the world and is used in the manufacture of plastics, resins, and urea-formaldehyde foam insulation, in the manufacture of glass mirrors, explosives, artificial silk, and dyes. Formaldehyde is found in construction materials such as plywood adhesives. Formaldehyde also is or has been used in the sugar, rubber, food, petroleum, pharmaceuticals, and textiles industries.

Glycol ethers – Found in nail polish, deodorant, perfumes and other cosmetics, effects include skin, eye, and nose and throat irritations

Heavy Metals: Lead and Mercury - Brain and nervous system toxin, carcinogens, hormone disruptors, found in lead acetate in hair dyes, some urban/suburban soils and old paint

Mercury – A poisonous metallic element used in thermometers, and that is emitted into the air from coal-fired power plants during the production of electricity. It is also used in some mascaras and eyeliners to kill germs and increase shelf life

National Toxicology Program – one of the groups that review and conduct research in order to assess known or possible cancer-causing substances.

Organic Food – Food grown without the use of chemical fertilizers and pesticides

Parabens - Used in deodorants, linked to breast cancer, endocrine disrupting compound, used as a preservative in thousands of cosmetic, food and pharmaceutical products

Personal care products - shampoo, lotions, deodorant, makeup, toothpaste, etc.

Pesticides - a generic term for a pest killer. Pesticides include Insecticides (insect killers), Herbicides (weed killers) Fungicides (fungus killers) Rodenticides (rodent killers) –"cide" means "to kill"

Phthalates – a chemical found in household products, cosmetics, fragrances, deodorants, nail polish, hair products and lotions; Phthalates "hide" behind the term "fragrance"

Polyvinyl Chloride (PVC) – a type of plastic also referred to as vinyl, used in toys, cars, rain wear, and construction materials

Radon – A colorless naturally occurring, radioactive, inert gas formed by radioactive decay of radium atoms in soil or rocks.

Sodium Lauryl Sulfate and Sodium Laureth Sulfate – found in personal care products such as shampoo, have been found to cause "severe epidermal changes "to mouse skin, has not been proven to cause cancer

Toluene - Found in nail polish, can cause liver damage and is irritating to the skin and respiratory tract

Toxin - a poisonous substance that can be harmful or fatal if inhaled, swallowed or absorbed through the skin

World Health Organization - among the groups that review and conduct research in order to assess known or possible cancer-causing substances. http://www.who.int/en/

Materials:

- Personal Care Product examples (safe and unsafe)
- Green Products for students
- Non-toxic Product ingredients

Procedure:

- **Intro**
  - Explain to the students that we will be visiting their classroom three times to explore how many commonly used products, including cleaners, disinfectants, personal care products, and air fresheners, can contribute to our risk of developing cancer and other health problems.

❖ **Prior Knowledge:**

- Ask students to describe their idea of what an environment is. (Ans: *Environment represents everything outside of the body that affects health, development and survival*.)
- Ask the students what they think is needed in order to live a healthy life. (Answers: *Clean air, clean water, healthy food, healthy soil, healthy homes*)
- Ask the students if they have any ideas as to how pollution and/or illness enter our bodies

❖ **Lesson**:

- Ask students why we need clean air? (*Ans: Air provides us with oxygen to breathe*)

- Why do we need clean water? (Ans: *We drink the water from the earth to hydrate us. It is also a habitat for many living creatures, and it needs to remain clean so that the creatures can survive in their habitat. We also need clean water to grow healthy food*)
    - ***Cite the study that found pharmaceuticals in the drinking water in major cities***

- Why do we need clean soil? (Ans: *Soil provides a place for plants and trees to grow. Plants provide us with food, and trees provide us with the oxygen we need to breathe. Without clean soil, plants and .trees could not survive*)

- Why do we need clean food? (Ans: *Food provides us with the nourishment we need to survive. We are what we eat, right? If the food we eat is polluted, then we pollute our bodies; or if our food lacks nutrition, then we are not providing our bodies with the nutrition needed to be healthy*)

  Explain that:
    - Food provides yet another route for toxins to enter the body.
    - Chemicals such as pesticide residues on fruits and vegetables are ingested along with food.
    - Obesity increases the risk of diabetes any many types of cancer

- Explain that if the requirements for healthy living (that we have discussed) are compromised the result can be a range of health problems including (*briefly define characteristics of each*):

- ❖ Cancer
- ❖ Rashes – sensitive skin
- ❖ Respiratory illnesses
- ❖ Learning disabilities –(ex: lead)
- ❖ Hormone imbalance- Explain that endocrine disruptors are chemicals that disrupt the body's hormonal balance. This can interfere with the body's ability to grow, develop, reproduce, and function normally. ***Discuss study done on chemicals found in the bodies of teenage girls.***
    - ***http://www.ewg.org/node/26955*** *- Environmental Working Group study Teen Girls' Body Burden of Hormone-Altering Cosmetics Chemicals: Teens are vulnerable*
    - In fact, the Food and Drug Administration (FDA) has no authority to require testing of personal care product ingredients for safety before they are sold. Instead, FDA states that the manufacturers of these products, with few exceptions, "may use essentially any raw material as a cosmetic ingredient and market the product without an approval from FDA" (FDA 1995).

Display Images of famous cancer survivors and ask what they all have in common
Tell the students that today we are going detail on one specific health problem today - cancer - and where in the environment we are exposed to cancer producing substances.

- ❖ What is cancer:
    - A name for the more than 100 diseases in which cells that are not normal grow and divide rapidly.
    - Cancer cells can develop because of damages to DNA – in cancer cells the damaged DNA is not repaired as it is in normal cells
    - These cells can then group/clump together (tumors) and can destroy the normal cells around the tumor and damage a body's healthy tissues

- ❖ Causes:
    - People can inherit damaged DNA but a person's DNA can also become damaged by exposure to things in the environment
    - Other Causes:
        - Tobacco; Lack of Physical Activity; Sun Exposure; Genetics

- ❖ Environmental Causes:
    - Every day we use products containing chemicals that might affect our health and the environment
    - At least two-thirds of all cancers are thought to have such a cause.
    - Epi genetic change – researcher at duke

- *While exposure to just one contaminant or toxin may not cause serious illness, exposure too many different toxins from various sources over a period of time (multiple hits) is more likely to result in illness.*

<u>On the board list some of the sources of carcinogens in the environment:</u>

- Cigarette smoke – direct and secondhand
- Smokeless tobacco, including chewing tobacco and snuff
- Air pollution
- Pesticides, herbicides
- Many cosmetics and other personal care products
- Many common household products
- Lifestyle factors, including diet and physical activity
- Excessive sunlight exposure

❖ **<u>Exposure/Multiple Hits</u>**

- Explain that the route of exposure is the pathway by which a chemical enters the body.
  - ❖ There are three principal routes of exposure:
    - Via the mouth to the digestive tract (ingestion)
    - Through the skin (absorption) *can also be through the eyes*
    - Through the lungs (inhalation)

- **Five basic steps** progressing from exposure to a toxic substance through development of detectable disease

  - **Exposure.** An individual is exposed to a chemical, biologic, or physical agent that is potentially toxic or carcinogenic. The individual may or may not have knowledge of the presence of the substance.
  - **Entry.** The substance enters the body carried by air, water, food, or soil.
  - **Accumulation.** Over time, enough of the toxin or carcinogen enters the body and accumulates until the quantity is high enough to cause some type of health effect.
  - **Early changes.** The toxin or carcinogen alters some part of the body, often on a microscopic level. A group of cells affected by the toxin now may look or act differently. The person exposed may not have symptoms of disease or any detectable abnormality on routine medical testing at this time.

- **Detectable disease.** The person who has been exposed to the toxin now has developed an actual disease that is detectable by symptoms and/or medical testing.

"Day in the Life: Morning Routine (Personal Care Products)

- Think of what you are coming into contact with everyday
- Take your morning routine/shower/etc

- Activity: Have students take a minute to make a list of all the personal care products they use in a day

Explain that many ingredients in **personal care products** (shampoo, conditioner, lotions, deodorant, makeup, etc.) can harm both the planet and the people who use them

- Go over the Red Flag ingredients on the slide and Pass out the list to the students
- Explain to students that personal care products that contain ingredients such as **parabens, phthalates, toluene, triclosan, diethanolamine, and glycol ether should** be avoided.
- Below is a list of some of the Red Flag Ingredients and where they are typically found: *Have ingredient chart/poster*

  - **Phthalates**
    - Found in household products, cosmetics, fragrances, deodorants, nail polish, hair products and lotions
    - Used to make plastics soft and flexible
    - Endocrine disruptors prevent hormones from functioning normally
    - Have been found to produce cancer of the liver and birth defects in lab animals
    - Phthalates "hide" behind the term "fragrance"
    - *Companies are not required to reveal the ingredients making up fragrance mixtures on the labels of products.*

  - **Sodium Lauryl Sulfate and Sodium Laureth Sulfate**
    - Found in household products, cosmetics, fragrances, deodorants, nail polish, hair products and lotions
    - Has been found to cause "severe epidermal changes" to mouse skin
  - **Toluene**
    - Found in nail polish
    - Can cause liver damage and is irritating to the skin and respiratory tract

- **Diethanolamine (DEA)**
    - Widely used in shampoos
    - A suspected carcinogen
    - Even more hazardous if the product also contains bronopol, a bactericide

- **Parabens**
    - Used as preservatives in thousands of cosmetic, food and pharmaceutical products
    - Found in Breast Cancer Tissue
    - Endocrine disrupting compounds

- **Glycol ethers**
    - Found in nail polish, deodorant, perfumes and other cosmetics
    - Effects include skin, eye, nose and throat irritations

- **Triclosan**
    - A pesticide that is suspected of harming the natural environment and aquatic creatures
    - Found in such products as antibacterial soap, toothpaste, cutting boards, socks and more

ACTIVITY
- Making our own Non-toxic Personal Care product
- Options: Face scrub, deodorant
- Students in groups work together to measure out common ingredients they can find in a grocery store to mix together to make
- Pass out common brands of deodorant and have them look to see that some of them contain Tricolsan, Sodium lauryl Sulfate, etc.
- Talk to students about the need to read labels on all types of products

Distribute samples of "Green" Personal Care Products to get them started

SOAPS

- Tell the students that despite their popularity, antibacterial soaps are not all they're cracked up to be.
    - Studies show that anti-bacterial products are no more effective than normal castile soap in killing infection

- Use of these products can reduce the effectiveness of antibiotics when needed
- Many contain triclosan, a pesticide that is suspected of harming the natural environment and aquatic creatures

Recap & Wrap up:

- Review information and Discuss next session

Continue Day in the Life

-Topics include: Food, Plastics, Sun Exposure, and Cell phones

-Students are to do a Bedroom/Bathroom audit of their products for tomorrow

LESSON TWO: "Day in the Life and Consumer Consciousness"

Lesson Overview:

Now we see our health can be affected by chemicals that we are exposed to. Let's explore other places where we come into contact with such products during our day and discover alternatives to these products and ways to live a healthier lifestyle. In this lesson we will learn how to live healthier and become more conscientious consumers.

PA State Standards:

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10.1.6 C Analyze nutritional concepts that impact health.
10.1.6 E Identify health problems that can occur throughout life and describe ways to prevent them.
10.2.6 A Explain the relationship between personal health practices and individual well-being.
10.2.6 B Explain the relationship between health-related information and consumer choices.
10.2.6 D Describe and apply the steps of a decision-making process to health and safety issues.
10.2.6 E Analyze environmental factors that impact health
10.4.6 A Identify and engage in moderate to vigorous physical activities that contribute to physical fitness and health.

Content Objective:

- Students will understand that there are actions that can be taken and lifestyle choices that can be made that have the potential to greatly reduce ones risk of developing any of a wide range of illnesses, including cancer.
- Students will explore how to avoid various carcinogenic products, the use of less toxic products, healthy eating, and exercise.
- Students will know that they have the power to affect change by contacting legislators, stores and producers of products containing toxic substances.
- Students will be able to be more conscious consumers and learn alternatives to dealing with carcinogens in their daily lives

Materials:

- Post-Test
- True Cost of Food DVD

- Sam Suds DVD
- Audit Review
- Examples of commonly used plastics and alternatives
- Information Packet:
    - Handout- *The Dirty Dozen; 12 Simple Ways to keep Dust and Dirt Out of Our Homes*

Procedure:
Introduction:

Review topics from the first day.
What is Cancer?
What environmental factors can cause Cancer *(air pollution, pesticides, etc)*
What products do we use that contain carcinogens? *(personal care products)*
What can we do? *(use alternative – non toxic personal care products)*

LESSON:

Afternoon/Lunch: Foods and Plastics!

❖ Explain that eating well is one of the most important things we can do to stay healthy and avoid exposure to harmful chemicals.

- Watch "True Cost of Food"

❖ Discuss and Review movie – *What can you do in your daily life to make changes to what you eat? (Farmers Markets, School Lunches, School Garden, Community Supported Agriculture(CSA)organic food, less meat)*

- Eat lots of fruits and vegetables
- Wash all produce before eating or cooking
- Buy organic foods when possible
    - If you cannot buy all organic try to avoid the top ten most contaminated fruits and veggies. Pass Out *Top 12 to Buy Organic Card/Magnet*

- Eat less meat- especially fried, barbecued, smoked and well-done
- Use safe cookware

Food Storage

- Plastics *(Ask students if they know what plastics are made from)*
    - Explain that:

- Plastic is made from petroleum, a non-renewable resource
- Use of plastics in cooking and food storage can carry health risks

- *Show samples of types of plastics known to leach toxic chemicals (polycarbonate, PVC, and styrene)*

- Polyvinyl chloride (PVC) Plastics - #3
  - Soft flexible plastic products that are made with PVC often have a distinct odor, such as vinyl shower curtains.
  - Production of PVC causes air and water pollution
  - Contains chlorine (56% by weight)
  - Explain that it is also important to avoid using materials made with PVC plastic. Many products that we use in our everyday life are made with PVC plastic. You can recognize if a product is made with PVC plastic by looking for the triangle with a number "3" in the middle.

- Show "**Sam Suds"** Video (2 minutes long)

- Polystyrene - #6
  - Used in foam food trays, egg cartons, opaque plastic silverware, disposable plates, cups, take-out containers
  - Styrene can leach directly into the food
  - It is important not to use Styrofoam for cooking or storing containers. Use glass or ceramic containers instead.

- Polycarbonate plastic -#7
  - Explain that polycarbonates are in: Baby bottles and plastic sippy cups and Used in some plastic squeeze bottles, cooking oil and peanut butter jars, detergent and window cleaner bottles
  - Contains Bisphenol A (BPA)
    - Endocrine disruptor
    - Can leach into foods when heated, washed, or exposed to acidic foods
    - No longer allowed in food wrap

      Show recent articles on BP-A: (***http://www.ewg.org/node/20944***) - *Article detailing steps to take to reduce your exposure to Bisphenol-A*

- Do not microwave food in plastic containers. Heat could release harmful substances from the plastic container into your food. The label "microwave safe" on plastic containers only tells us that the container will not melt. If you must microwave, use glass or ceramic dinnerware

AFTERSCHOOL/EVENING: Sun Exposure, Smoking & Cell Phones

❖ ***Sun exposure & Sunscreen:***

- Explain that excessive sun exposure can be harmful to our skin and health. There is a very easy solution to protecting yourself from overexposure to sun- wear sunscreen! Wear at least SPF 15 every time you will be out in the sunshine for longer than 15 minutes.

ACTIVITY: Check label of sunscreen to make sure you do not see any of the "Red Flag" ingredients.

❖ ***Cigarettes***

- Over 4000 chemical compounds are created by burning a cigarette, many of which are toxic and/or carcinogenic. Carbon monoxide, nitrogen oxides, hydrogen cyanide and ammonia are all present in cigarette smoke. Forty-three known carcinogens are in mainstream smoke, side stream smoke, or both.
- The damage a continuing smoker does to their lungs can take up to 20 years before its physical manifestation in lung cancer.

❖ ***Cell phones***

- Electromagnetic fields generated by cell phones may be considered a potential human health risk
- Cell and wireless phones emit electromagnetic radiation that absorption the brain – especially in young children *(Show image of estimated penetration of 5 year old, 10 year olds and adults)*
- Brain of kids don't stop developing until 20s – they are more porous when younger
- Talk about the **TEN PRECAUTIONS** * - see Appendix A for list

❖ ***Cleaning Products***

- Ask students what types of cleaning products they have seen in their homes? Explain that we now know that many conventional cleaning products do more polluting than cleaning
- Explain that:
    - Many common household products, including cleaners, disinfectants, and air fresheners contain hazardous chemicals
    - Conventional cleaning products are a major source of indoor air pollution
        - Loaded with fragrances
        - Ask students what "fragrance" means
        - Volatile Organic Compounds (VOCs)
            - Things like gasoline, paint thinner, paint that evaporate in to the air, contributing to respiratory problems, heart disease and ground-level ozone

❖ ***Non-Toxic household cleaners***

- These alternative products are easy to find, and although they may require a little more elbow grease to be effective cleaners, their proper use will not harm you or the environment:

1. Baking soda- a surface scrubber
2. White vinegar – a disinfectant and germ killer
3. Lemon juice – a disinfectant and germ killer
4. Club soda – stain remover
5. Liquid castile soap – an all purpose surface cleaner

❖ ***Healthy Choices and Alternatives***

- Explain to the students that because we are now informed of how our health can be affected by products and chemicals that we are exposed to everyday, we can use this information to change our behaviors, make informed decisions, and promote healthy choices. By taking these steps, we can minimize our exposure to toxic and cancer-causing products, and better protect our own and our community's health.

❖ ***"Precautionary Principle":***

- The ***Precautionary Principle*** says that we are better safe than sorry. Air on the side of caution when choosing to use chemicals and toxins that are permitted in the world around us. Opt not to use a product when you are unsure of its ingredients or health effects.

❖ ***Beware of Green washing***

- **Green wash** is a term used to describe the practice of companies disingenuously spinning their products and policies as environmentally friendly

ACTIVITY: LABEL GAME

Students will learn which "labels" actually have third party certification and which labels are "green washing"

Label Link

Post Test

- Classroom teacher will administer the Post-test after the in-classroom presentation has been completed.
- Ask the students to put only their grade and school name on their Post-test.
- Explain to the students that this is not a test that will be graded. If they do not know the answer to a question they should simply leave it blank and proceed to the next question.
- Collect Post-tests

Wrap up

- Final Questions
- Distribute Resources

Extension Activities:

- Students will be able to conduct a home/school audit and write a proposal to school administrators outlining their suggestions for making their school a healthier place to learn and grow.
- Students could create a commercial for a non-toxic personal care product explaining why its safer
- Students could work on a letter writing campaign to companies asking that they remove certain toxic chemicals from their products

- **Websites**

University of Pittsburgh Cancer Institute Center for Environmental Oncology
http://www.environmentaloncology.org/

Pennsylvania Resources Council
www.prc.org

Pennsylvania Department of Environmental Protection
http://www.depweb.state.pa.us

Environmental Protection Agency: Your Environment. Your Choice
http://www.epa.gov/epawaste/education/teens/index.htm

Pennsylvania Department of Health: Your Healthy Toolkit
http://www.dsf.health.state.pa.us/health/cwp/browse.asp?a=174&bc=0&c=38816

The Campaign for Safe Cosmetics
http://www.safecosmetics.org/

Skin Deep Cosmetic Safety Database
http://www.cosmeticdatabase.com/index.php?nothanks=1
(a project of the Environmental Working Group: **http://www.ewg.org/**)

Teens Turning Green
http://www.teensturninggreen.org/
(a project of Search for the Cause: **http://www.searchforthecause.org/**)

Agency for Toxic Substances and Disease Registry: **www.atsdr.cdc.gov/toxfaq.html**

Household Product Database: **http://www.householdproducts.nlm.nih.gov/**

Federal Trade Commission: Sorting Out Green Advertising Claims
http://www.ftc.gov/opa/1999/04/green.shtm

The Truth about the Tobacco Industry
http://www.thetruth.com/

National Coalition Against the Misuse of Pesticides
http://www.beyondpesticides.org/

Buy Fresh Buy Local PA
http://www.buylocalpa.org/

Skin Cancer Foundation
http://www.skincancer.org/

American Caner Society
http://www.cancer.org/

Appendix A: 10 Precautions

THE TEN PRECAUTIONS

Given the absence of definitive proof in humans of the carcinogenic effects of electromagnetic fields of cell phones, we cannot speak about the necessity of *preventative* measures (as for tobacco or asbestos). In anticipation of more definitive data covering prolonged periods of observation, the existing data press us to share important prudent and simple measures of *precaution* for cell phone users, as have been variously suggested by several national and international reports. [6, 9, 10, 11, 12]

These measures are also likely to be important for people who are already suffering from cancer and who must avoid any external influence that may contribute to disease progression.

1. Do not allow children to use a cell phone except for emergencies. The developing organs of a fetus or child are the most likely to be sensitive to any possible effects of exposure to electromagnetic fields.

2. While communicating using your cell phone, try to keep the cell phone away from the body as much as possible. The amplitude of the electromagnetic field is one fourth the strength at a distance of two inches and fifty times lower at three feet.

   Whenever possible, use the speaker-phone mode or a wireless Bluetooth headset, which has less than $1/100^{th}$ of the electromagnetic emission of a normal cell phone. Use of a hands-free ear piece attachment may also reduce exposures.

3. Avoid using your cell phone in places, like a bus, where you can passively expose others to your phone's electromagnetic fields.

4. Avoid carrying your cell phone on your body at all times. Do not keep it near your body at night such as under the pillow or on a bedside table, particularly if pregnant. You can also put it on "flight" or "off-line" mode, which stops electromagnetic emissions.

5. If you must carry your cell phone on you, make sure that the keypad is positioned toward your body and the back is positioned toward the outside so that the transmitted electromagnetic fields move away from your rather than through you.

6. Only use your cell phone to establish contact or for conversations lasting a few

minutes as the biological effects are directly related to the duration of exposure. For longer conversations, use a land line with a corded phone, not a cordless phone, which uses electromagnetic emitting technology similar to that of cell phones.

7. Switch sides regularly while communicating on your cell phone to spread out your exposure. Before putting your cell phone to the ear, wait until your correspondent has picked up. This limits the power of the electromagnetic field emitted near your ear and the duration of your exposure.

8. Avoid using your cell phone when the signal is weak or when moving at high speed, such as in a car or train, as this automatically increases power to a maximum as the phone repeatedly attempts to connect to a new relay antenna.

9. When possible, communicate via text messaging rather than making a call, limiting the duration of exposure and the proximity to the body.

10. Choose a device with the lowest SAR possible (SAR = Specific Absorption Rate, which is a measure of the strength of the magnetic field absorbed by the body). SAR ratings of contemporary phones by different manufacturers are available by searching for "sar ratings cell phones" on the internet.

CONCLUSION

The cell phone is a remarkable invention and a breakthrough of great social importance. Our society will no longer do without cell phones. None of the members on the expert committee has stopped or intends to stop using cell telephones. This includes Dr. David Servan-Schreiber, a 16 year survivor of brain cancer. However, we, the users, must all take precautionary measures in view of recent scientific data on the biological effects of cell phone use, especially those who already have cancer.

In addition, manufacturers and service providers must also assume responsibility. It is their responsibility to provide appliances and equipment with the lowest possible risk and to constantly evolve their technology in this direction. They should also encourage consumers to use their devices in a way that is most compatible with preserving their health.

In the early 1980's, the owners of asbestos mines were reduced to bankruptcy as a result of lawsuits brought by the families of deceased exposed workers. A few years later, a key executive of Johns Manville, the most prominent company, drew lessons from the years of struggle of his industry against medical data and the scientists who were drawing attention to the risks of asbestos. He concluded with regret that greater warnings for the public, the establishment of more effective precautions, and *more extensive* medical research "could have saved lives, and probably also shareholders, the industry, and the benefits of its product." [14, 15]

We call on the cell phone companies to provide independent access to records of use so that appropriate studies can be carried out.

Home Audit Worksheet

SITE	TOXINS *Red Flag Ingredients*	Type of Product	Safer Alternative
BATHROOM			
BEDROOM			

List of Red Flag Words To Look For:

Phthalates
- Endocrine disruptors prevent hormones from functioning normally
- Have been found to produce cancer of the liver and birth defects in lab animals
- Phthalates "hide" behind the term "fragrance"
- *Companies are not required to reveal the ingredients making up fragrance mixtures on the labels of products.*

Sodium Lauryl Sulfate and Sodium Laureth Sulfate
- Has been found to cause "severe epidermal changes" to mouse skin

Toluene
- Can cause liver damage and is irritating to the skin and respiratory tract

Diethanolamine (DEA)
- A suspected carcinogen & even more hazardous if the product also contains bronopol, a bactericicde

Parabens
- Found in Breast Cancer Tissue
- Endocrine disrupting compounds

Glycol ethers
- Found in nail polish, deodorant, perfumes and other cosmetics
- Effects include skin, eye, nose and throat irritations

Triclosan
- A pesticide that is suspected of harming the natural environment and aquatic creatures
- Found in antibacterial soap

Non-Toxic Personal Care Product Recipes

Ingredients needed:

- ☐ Sea Salt (included)
- ☐ Ground Nutmeg
- ☐ Milk
- ☐ Lemon Juice
- ☐ Baking Soda (included)
- ☐ Cornstarch (included)
- ☐ Glycerin (included)
- ☐ Olive Oil
- ☐ Dark Brown Sugar

Sea Salt Scrub

Ingredients:
½ cup Fine Sea Salt
4 Tbsp or Vegetable Glycerin
¼ cup Baking Soda
5-6 drops of Essential oil (optional)

Instructions:
Mix all ingredients together in a bowl.
Standing in bath tub, wet hands and apply mixture, (using small circular motion) starting with feet and work upwards towards the neck (do not apply to neck area).
Fill bath tub with warm water and add essential oils.
Relax for at least 15 minutes allowing skin to absorb ingredients.

Acne Remedy

Ingredients:
1 tablespoon ground nutmeg (search you parent's spice cabinet for this)
1 tablespoon milk *(milk works wonderfully to remove redness!)*

Instructions:
Mix the ingredients together and apply to infected area or pimple. Can be washed off after 20 minutes or applied before bed and rinse in the am.

Baking Soda Lemon Exfoliating Cleanser

Ingredients:
Lemon juice
Baking Soda

Instructions:
In a small bowl, add about 2 tbs baking soda. Slowly apply lemon juice. The mixture will foam and fizz. Apply enough juice to make a thin, loose paste. Apply to skin in a circular motion for a minute or 2. Rinse with a warm cloth and water. Smooth, clear skin!

Cornstarch & Glycerin Facial Cleanser

Ingredients:
2 Tbs. cornstarch
2 Tbs. glycerin
1/2 c. water

Instructions:
Mix ingredients until smooth. Heat in a small double boiler pan Heat until thick and clear; it will have the consistency of pudding. Do not boil. Cool completely, Use in place of soap to cleanse your skin.

Olive Oil Face Cleanser Scrub Recipe

Ingredients:
1 tablespoon Olive Oil
2 tablespoons Dark Brown Sugar

Instructions:
Mix ingredients in a bowl. Apply to skin in a circular motion for a minute or 2. Rinse with a warm cloth and water. The cleanser will feel greasy but after you rinse and pat dry, skin will be super silky soft! Also great to remove eye makeup!

Resources:
http://naturalfacialrecipes.homestead.com/
http://www.cranberrylane.com/recipes-body-care.htm

Health and the Environment: The Human Connection

Vocabulary

***Classroom teacher will pass out the vocabulary, ask children to read over the words and discuss the meanings prior to the classroom presentation*

Department of Health And Human Services, Agency for Toxic Substances and Disease Registry (ATSDR): www.atsdr.cdc.gov/toxfaq.html - A United States government agency where you can find out more about toxic substances

Benzene: Benzene is a widely used chemical formed from both natural processes and human activities. People are mostly exposed to it through gasoline, car exhaust and from smoking cigarettes or breathing second-hand smoke. Exposure to benzene, especially in the workplace, may cause cancer in animals and humans, including leukemia. You can reduce your exposure by limiting contact with gasoline and cigarette smoke

Cancer - a group of diseases where cells grow abnormally, invade surrounding tissues, and metastasize (spread) to other sites in the body. Cancer has multiple causes, including genetic and environmental factors.

Carcinogen – Any substance or process known to cause cancer

Diethanolamine (DEA) – A suspected carcinogen widely used in shampoo, more hazardous if the product also contains Bronopol

Dioxin – a group of highly toxic chemicals created by industrial processes that use chlorine, such as in making paper or in the incineration of PVC plastics

Endocrine Disruptors – Chemicals that disrupt the body's hormonal balance

Environment - all physical, biologic, chemical and social factors in the world surrounding an individual. In other words, environment represents everything outside the body that impacts health.

Exposure - an individual coming into contact with a disease-causing substance or agent in a way that can produce disease. The route of exposure is the pathway by which a chemical enters the body.

Formaldehyde - Formaldehyde is a nearly colorless gas with a pungent, irritating odor with vapors that are flammable and explosive. It is among the 25 most abundantly produced chemicals in the world and is used in the manufacture of plastics, resins, and urea-formaldehyde foam insulation, in the manufacture of glass mirrors, explosives, artificial silk, and dyes. Formaldehyde is found in construction materials such as plywood adhesives. Formaldehyde also is or has been used in the sugar, rubber, food, petroleum, pharmaceuticals, and textiles industries.

Glycol ethers – Found in nail polish, deodorant, perfumes and other cosmetics, effects include skin, eye, and nose and throat irritations

Heavy Metals: Lead and Mercury - Brain and nervous system toxin, carcinogens, hormone disruptors, found in lead acetate in hair dyes, some urban/suburban soils and old paint

Mercury – a poisonous metallic element that affects the immune system, alters genetic and enzyme systems, and damages the nervous system; used in thermometers, emitted into the air from coal-fired power plants during the production of electricity; used in some mascaras and eyeliners to kill germs and increase shelf life

National Toxicology Program – one of the groups that review and conduct research in order to assess known or possible cancer-causing substances.

Organic Food – Food grown without the use of chemical fertilizers and pesticides

Parabens - used in deodorants, linked to breast cancer, endocrine disrupting compound, used as a preservative in thousands of cosmetic, food and pharmaceutical products

Personal care products - shampoo, lotions, deodorant, makeup, toothpaste, etc.

Pesticides - a generic term for a pest killer. Pesticides include Insecticides (insect killers), Herbicides (weed killers) Fungicides (fungus killers) Rodenticides (rodent killers) –"cide" means "to kill"

Phthalates – a chemical found in household products, cosmetics, fragrances, deodorants, nail polish, hair products and lotions; Phthalates "hide" behind the term "fragrance"

Polyvinyl Chloride (PVC) – a type of plastic also referred to as vinyl, used in toys, cars, rain wear, and construction materials

Radon – A colorless naturally occurring, radioactive, inert gas formed by radioactive decay of radium atoms in soil or rocks.

Sodium Lauryl Sulfate and Sodium Laureth Sulfate – found in personal care products such as shampoo, have been found to cause "severe epidermal changes "to mouse skin, has not been proven to cause cancer

Toluene - Found in nail polish, can cause liver damage and is irritating to the skin and respiratory tract

Toxin - a poisonous substance that can be harmful or fatal if inhaled, swallowed or absorbed through the skin

World Health Organization - among the groups that review and conduct research in order to assess known or possible cancer-causing substances.

Environmental Oncology Awareness Program
Pre-test

Name of your school:_____
Your Grade Level**:** _____
Date: _____

1) List two things that are needed in order to live a healthy life?
   1. _____
   2. _____

2) Name one way in which a carcinogen (cancer-causing substance) enters the body.
_____

3) The Precautionary Principle says that we are better safe than sorry; choose not to purchase or use a product if we are unsure of its ingredients or health effects. (Circle One)
True False

4) How can we tell if a product contains unhealthy ingredients?
_____

5) What are some sources of carcinogens in the environment?
a. cigarette smoke b. air pollution c. pesticides/herbicides d. all of the above

6) What is the average number of personal care products (i.e. shampoos, lotions, makeup, etc) that the average female teenager uses per day. (Choose One)
a. >5 b. 5-10 d. 10-15 e. 15<

7) What type (or types) of plastic (listed by their number) that you should avoid? (Circle all that apply)
a. #1 b. #3 c. #5 d. #6 e. #7

8) Wearing sunscreen will not protect you from excessive sun exposure.
True False

9) When using your cell phone it is best for your health to: (Circle all that apply)
a. text message b. have the phone to your ear c. use a hands free head set

10) Which of these is actually a real, third party certified, label that denotes eco-friendly products?
a. natural b. hypoallergenic c. green seal d. free range

Environmental Oncology Awareness Program
Post-test

Name of your school:_____
Your Grade Level**:** _____
Date: _____

1) List two things that are needed in order to live a healthy life?
   1. _____
   2. _____

2) Name one way in which a carcinogen (cancer-causing substance) enters the body.
_____

3) The Precautionary Principle says that we are better safe than sorry; choose not to purchase or use a product if we are unsure of its ingredients or health effects. (Circle One)
True False

4) How can we tell if a product contains unhealthy ingredients?
_____

5) What are some sources of carcinogens in the environment?
a. cigarette smoke b. air pollution c. pesticides/herbicides d. all of the above

6) What is the average number of personal care products (i.e. shampoos, lotions, makeup, etc) that the average female teenager uses per day. (Choose One)
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a. text message b. have the phone to your ear c. use a hands free head set

10) Which of these is actually a real, third party certified, label that denotes eco-friendly products?
a. natural b. hypoallergenic c. green seal d. free range

ENVIRONMENTAL HEALTH: THE HUMAN CONNECTION
TEACHER EVALUATION SHEET

Please rate the following questions on a scale of 1 to 6 with 1 being the lowest and 6 being the highest.

Program Review

1. Rate your knowledge of toxins in our environment after this program.

   1._____ 2._____ 3._____ 4._____ 5._____ 6._____

   Please check all that apply:
   _____No additional knowledge
   _____Familiar with terminology, but not concepts
   _____Familiar with terminology and concepts
   _____Very knowledgeable about the subject

2. Rate your students' knowledge of toxins in our environment after this program

   1._____ 2._____ 3._____ 4._____ 5._____ 6._____

   Please check all that apply:
   _____No additional knowledge
   _____Familiar with terminology, but not concepts
   _____Familiar with terminology and concepts
   _____Very knowledgeable about the subject

3. Rate the impact this program had on discussion/activities related to the topic presented.

   1._____ 2._____ 3._____ 4._____ 5._____ 6._____

4. What do you think was the best feature about the program? Please explain_____
_____
_____
_____
_____

6. What aspect of the program would you most like to see changed? Please explain. _____
_____
_____
_____
_____
_____

Date

ANYCOMPANY
100 Main St
USA

To Whom it may Concern,

I am a loyal customer of yours and have been choosing your products for ## of years.

I regret to inform you that your products include ingredients that are known to be harmful to our health and potentially carcinogenic. I cannot and will not purchase your products until this pattern changes.

There are many alternatives to toxic ingredients. I would like to see your company stop using harmful ingredients and instead use safe and non-toxic ingredients.

The decision to substitute safe ingredients for toxic ingredients will ensure the health of your workers, our communities and the environment.

Sincerely,

A Loyal Customer

Example Project Review Sheet

Watershed Awareness

Key points

- Normal daily activities in and around the home, office, school, etc. contribute household chemicals (cleaning products and personal care products), pet waste, automotive fluids, salt, litter, lawn and garden chemicals and more to the water supply.
- Behavioral changes made via education can greatly improve water quality in our rivers and streams
- Rain water harvesting using rain barrels, and storm water management via rain garden installations promote on-site absorption and reduce water pollution from runoff and reduce flooding
- If everyone pitches in, we can go a long way in cleaning up our waterways
- Point and non-point sources pollution

Action/Projects:

- Rain barrel installation at school
- Rain gardens – plan for a possible one on school grounds or in community
- Education around common watershed pollutants

Composting

Key points

- Landfills are associated with many environmental problems
- If everyone were to recycle their recyclables and compost their organic matter (food scraps and yard and garden debris) we could reduce the amount of material we're sending to our landfills by 75%
- Composting reduces solid waste and produces rich, organic soil amendments and fertilizer.
- Composting return organic material and nutrients to the soil where it is a crucial part of soil's composition
- Without 4-7% organic matter in the soil plants (and therefore animals) would not exist

Action/Projects

- Designing own compost bin – worm or backyard
- Plan for setting up a compost bin of either type in a classroom or in school garden

Recycling and Resources Conservation

Key Points

- 3Rs
- Reduce and Reuse first before recycling
- Life cycle of items
- Generation, separation, collection, final disposal

Actions/Project Ideas

- Design an education campaign for school recycling
- Design a recycling program for school
- Larger waste audit of a portion of the school and come up with a plan based on finding
- Create your own recycling bin
- Think of ways your school could conserve resource through reuse over disposable items

Environmental Health

Key Points

- Everyday toxins that harm health of us and the environment
- Key ingredients to avoid
- Food
- Cleaning Products
- Plastic Use

Actions/Project Ideas

- Creating nontoxic products for classmates
- Review of food options at school lunches
- Audit of school's cleaning products

Environmental Problem Solvers – Presentation Feedback

Group:

Project idea:

Strengths:

Weaknesses:

Total Score out of 10:

Why:

Group:

Project idea:

Strengths:

Weaknesses:

Total Score out of 10:

Why: