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AUTHOR Walenta, Brian T., Ed.

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ABSTRACT

In 1989 the Texas Alliance for Science, Technology and Mathematics Education began placing teachers of all levels at industry sites as part of its Texas Teacher Internship Program. In 1995, 15 teachers interned at 11 sites. Each teacher was required to develop a curriculum implementation plan which was to illustrate how they would translate the summer experience into the subsequent year's classroom curricula. This document contains 13 of these curriculum implementation plans and a description of internship activities. Appendices contain intern information list and 1995 evaluation information. (MKR)

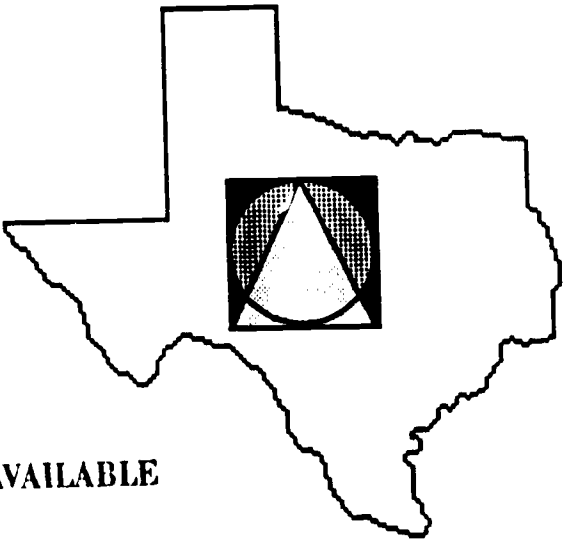
T T I P

Texas Teacher Internship Program

Texas A&M University

Brian T. Walenta, Editor

1995 CURRICULUM IMPLEMENTATION PLANS



Texas Alliance For Science, Technology & Mathematics Education

About the Alliance

The Texas Alliance for Science, Technology and Mathematics Education is a statewide, nonprofit organization whose membership includes representatives from K-12 schools, colleges and universities, businesses and industry, professional and civic organizations, and government agencies. By fostering partnerships between schools and the private sector, the Texas Alliance works to:

- improve student literacy and competency in science, mathematics and technology education; and
- assist teachers in developing curricula with emphasis on "real world" applications and problem-solving skills.

For membership and educational program information, contact:

Texas Alliance for Science, Technology & Mathematics Education
Texas A&M University
EDCI, College of Education
College Station, Texas 77843-4232
PH: 409/845-0825 FAX: 409/845-9663

Dr. Robert K. James, Director
Darryll Brandt, Development Coordinator
Brian Walenta, TTIP and Symposium Coordinator
Dwight Bohlmeyer, BTEP Coordinator
Jeannine Kantz, BTEP Coordinator
Craig Wilson, ARSC Coordinator
, TENET Project
Kristin Hamm, SALISH Project

The Texas Teacher Internship Program is a project of the Texas Alliance for Science, Technology and Mathematics Education, under the direction of Dr. Robert K. James, EDCI, College of Education, Texas A&M University, College Station, TX 77843-4232.

Funding for the project is provided by the participating industries. Publication of the curriculum plans for 1995 was provided by TU Electric located in Dallas, Texas.

TTIP Program Mission

In 1989, the Texas Alliance for Science, Technology and Mathematics Education began placing teachers at industry sites as part of its now-successful program, the Texas Teacher Internship Program (TTIP—formerly Teacher-In-Industry). In the six years of the program, the numbers of both teacher participants and internship sponsors have increased steadily. Since its inception, over 120 teachers have interned at 42 company, university and government agency sites. With each teacher affecting an average of 150 students per year, over 70,000 Texas students have been directly impacted by TTIP to date.

TTIP is a competitive program for science, technology and mathematics teachers who serve as summer interns at industry and university sites in order to experience "real world" applications of the subjects they teach. Teacher interns are mentored by a scientist or engineer, and work on a project(s) for an 8 to 10 week internship period.

The objectives of the program are to:

- Provide teachers with relevant, timely information about science, technology and mathematics applications so they can better prepare students for the future.
- Establish interactive partnerships between industry and teachers—sharing resources and curriculum improvements, and strengthening state and community networks throughout the educational system.
- Increase teachers' awareness of industry expectations and career opportunities to better inform and motivate students regarding careers in science, technology, and mathematics.

In 1995, a total of 15 teachers interned at eleven sites. Each teacher was required to develop a curriculum implementation plan (CIP) which was to illustrate how they would translate the summer experience into the subsequent year's classroom curricula. The Alliance staff provided teachers with suggestions for developing the CIPs during site visits.

We are pleased with the success of the 1995 program and hope that you find the CIPs helpful in planning new activities for your students.

For more information on the Texas Teacher Internship Program, please write or call:

Brian T. Walenta, TTIP Coordinator
or
Robert K. James, Director
c/o Texas Alliance
EDCI, College of Education
Texas A&M University
College Station, TX 77843-4232
PH: 409/845-0825 FAX: 409/845-9663

Acknowledgements

The Texas Alliance for Science, Technology and Mathematics Education would like to thank the program's supporters for providing the opportunity for teachers to experience "real-world" applications of their teaching fields. Many thanks to the industry coordinators and mentors involved with the 1995 Texas Teacher Internship Program.

Advanced Micro Devices, Austin
Allyson Peerman
Renee Craft
Mark Harris

Texas Parks and Wildlife Department, Austin
Bob Murphy
Rufus Stephens
Steven Hall
Linda Kissock
Dave Buzan
Jeff Henson

Brazos Valley Museum of Natural History, College Station
Chuck Thornton

Texas A & M University, College Station

Biochemistry and Biophysics
Ed Funkhouser
Jim Hu
Ryland Young

Ocean Drilling
Lisa Patton

Veterinary Medicine
Jorge Piedrahita

Sea Grant
Shelly DuPuy

University of Texas Medical Branch, Galveston
Peter Bowman
Dr. Raleigh Johnson
Phillip Turk
Dr. Louis Justamente

GeneMedicines, Inc., The Woodlands
Eric Eastman

TU Electric, Dallas
Orlan Ihms

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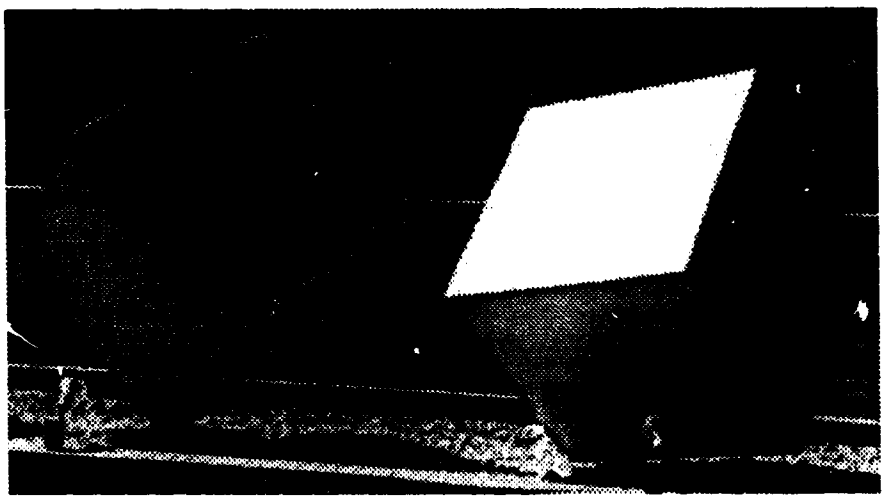
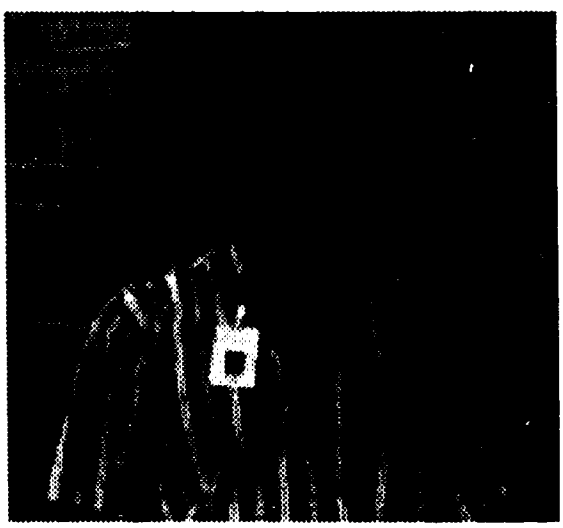
James Roe

Advanced Micro Devices,
Austin Texas



Mark Harris - Mentor
5204 E. Ben White Blvd.
Austin, Texas 78741



James Roe
Del Valle High School
2409 Shapard Lane
Del Valle, Texas 78617

Jilla Khalilolahi

GeneMedicine, Inc., The Woodlands Texas

Eric Eastman - Mentor
8301 New Trail Drive
The Woodlands, Texas 77381-4248

Jilla Khalilolahi
Scarborough High School
4141 Coast Rica
Houston, Texas 77092

Donna Bairrington
National Oceanic and Atmospheric Administration
Flower Gardens, Bryan Texas

NAME:	DONNA BAIRRINGTON
INTERNSHIP:	FLOWER GARDEN BANKS NATIONAL MARINE SANCTUARY
SPONSOR:	SHELLEY DUPUY
SCHOOL:	COLLEGE STATION ISD ROCK PRAIRIE ELEMENTARY
PRIMARY SUBJECT:	FOURTH GRADE: MATH & SCIENCE
ACTIVITIES:	The internship involved several activities that culminated into a final curriculum document. The intern was to review the proposed project and suggest revisions. Identify challenges in bringing the curriculum to the inner city school settings. Identify major topics to be addressed in the curriculum. Identify specialists willing to participate in the projects by doing interviews in the field or laboratory. Work with selected specialists to gain knowledge of science and resource management techniques. Assist in investigating requirements for live remote links between field and classroom. Travel to locations assigned by the Sanctuary Manager to conduct the necessary investigations and confer with specialists participating in the project. Develop a basic curriculum based on the Flower Garden Banks National Marine Sanctuary (FGBNMS). Provide written recommendations for future expansion of the curriculum.
SUMMARY:	The objectives of the sanctuary were the following: 1. increase awareness of the sanctuary program and the site by introducing teachers and students to FGBNMS. 2. Increase cooperation with outside organizations by providing a mechanism for achieving common and compatible goals. 3. Provide teachers and students with skills and opportunities to be wise stewards of the environment by emphasizing the role of the individual in affecting the environment and identifying specific actions which individuals can take to reverse negative trends and/or enhance positive trends. 4. Enhance sanctuary program evaluations by including a mechanism for evaluating the effectiveness of the curriculum. Completion and implementation of the curriculum has immediate and long term implications for sanctuary management. It will address immediate goals of program

awareness and public education. By providing a mechanism for teacher training, it will increase the number of individual students exposed to targeted concepts. Additionally, it will encourage students to take an active role in policy decisions and introduce them to such effort will hopefully create a public informed, interested and active in natural resource issues, which will in turn enhance NOAA's and other agencies' resource management efforts. They will also encourage talented students to pursue careers in science and technology, enhancing the available pool of professionals from which NOAA and other agencies have to choose.

RESOURCES:

Flower Garden Banks National Marine Sanctuary
1716 Briarcrest Dr., Suite 702
Bryan, TX 77802
(409) 847-9296

Adopt -A-Wetland Program, Center for Coastal Studies, Texas A&M University-Corpus Christi.

Texas Parks & Wildlife Department, 4200 Smith School Road, Austin, TX 78744.

Texas Natural Resource Conservation Commission, P.O. Box 13087, Capitol Station, Austin, TX 78711-3087.

Texas General Land Office, 1700 N. Congress Avenue, Austin, TX 78701.

Texas Water Development Board, 1700 N. Congress Avenue, Austin, TX 78711.

CURRICULUM IMPLEMENTATION PLAN

TEACHER: Donna Bairrington

MENTOR: Shelley DuPuy, FGBNMS

GOAL: To teach students about this ecosystem and call the students to action at home to help keep the Flower Garden Banks thriving coral reefs.

OBJECTIVES:

1. Give a sense of ownership of environmental responsibility to fourth grade students.

2. Provide a correlation between the quality of the local environment, and the quality of the regional and global environment, specifically the Gulf of Mexico.

3. To understand the relationship between the watershed, wetlands, and the Flower Garden Banks.

4. Provide hands-on, interactive activities that will empower fourth grade students and encourage them to remain in the field of science in future educational endeavors.

BLACK GOLD

Objectives: Students will be able to: 1) build a model of an oil rig; 2) identify major resources in the Gulf.

Methods: Make a model of an oil platform found in the gulf out of recycled products.

Time: One forty-five minute class period with additional time spent at home.

Materials: For each group: 1 glass jar (empty pickle jar is ideal), 1 glass pipette (clear plastic straw), neutral color modelling clay, clear marbles, 1 bottle soy sauce, and 1 rubber bulb

Key Vocabulary: drilling rig, platform, rig, shale

Careers: geologist, geophysicist, civil engineer, ocean engineer, oceanographer, roustabouts, roughnecks,

Background: The Gulf of Mexico is a valuable commodity for coastal states boardering the Gulf and the nation. It produces about forty percent of the country's commercial fish while the shrimping industry is the most valuable among the nation. Tourism in the region provides billions of dollars. Our nation is heavily dependent upon petroleum. Ninety percent of the nation's oil and gas is produced in the Gulf. It provides government revenues, jobs, boosts the regional economy, and provides other indirect benefits. The government has collected over one-hundred billion from offshore royalties and leases. Currently, the Gulf has more than 4,500 oil and gas production platforms.

The process of making oil occured millions of years ago. Plants and animals in the seas died and sank to the sea floor and rotted. Mud and sand gradually piled on top of these plants and animals. The weight and pressure of the mud and sand turned the remains into oil. The weight and pressure also squeezed the oil upward and outward. Oil may only seep through certain kinds of rock, sandstone and limestone. Thus, much of the oil stays underground. Oil underground can be trapped by salt domes that keep oil from flowing to the surface. Layers of rock that form an arch also trap oil. Geologists looking for oil, therefore, look for oil trapped in beds of sandstone and limestone.

Pictures of models

The search for oil and gas is a lengthy and costly adventure. Technological advances has helped to locate potential resource sites, but as in the earlier days, luck plays a part in it too. Offshore drilling is one of the most costliest industrial projects. An average offshore well could cost as much as three million dollars! Modern day technology has increased the chances of finding oil and gas.

Geophysicists have many technological instruments that help them to locate oil and gas. Magnetometers and gravitometers help geophysicists to identify the type and hardness of the rocks below. Seismograms provide a "picture" of underground formations. This helps the scientists to identify the various layers and how they are arranged. Scien-

tists conduct these experiements from boats that are equipped with high-tech instruments. Airplanes also come in handy. Remote sensing instruments can be mounted on an airplane. These instruments provide data about rock formations. Satellites are another tool that scientists use to gather valuable data from the depths below. Computers can also provide three-dimensional maps, multi-color maps and conduct simulations of the data. These high-tech tools do not guarantee drilling success, however, they diminish the chances of drilling a dry hole.

Offshore drilling companies design rigs and platforms according to the depths of the well and water depth. Environmental forces such as wind, waves, and currents also determine the type of offshore drilling rig. The US leads the world in design of deepwater platforms. One platform in the Gulf is in a water depth of 2,850 feet. Presently, one rig is being designed for a 4,100 foot depth. A rig is the entire oil and gas structure used for drilling. The platform is the structure that supports crew quarters, production facilities, lifeboats, a helideck for helicopter landings, cranes, and offices. The production platform must be self-sufficient. They depend on communication systems to communicate to shore. Equipment and supplies are often brought to the platform by helicopters or boats. The average cost of an offshore rig can easily cost over fifty million dollars and up to one billion for rigs in deeper water.

The structure must be very durable. The depth of the water determines structure design. The platform must be stable enough to weather a hurricane and accommodate heavy equipment. The deck could be as large as two football fields. The legs could be as tall as a fifty story building. Finally, remember that the structure must be transported and assembled at sea!

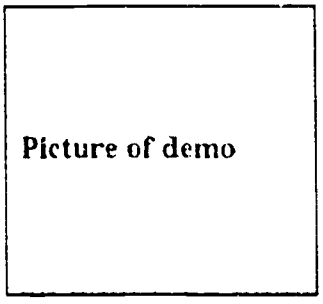
Procedure:

1. Brainstorm uses of oil and gas. Compile a class list. Discuss with the students the process of discovering oil and gas below the surface. Discuss the terms offshore wells, offshore drilling, rigs, and platforms. Using the resource list below, show pictures of oil rigs that are out in the Gulf. Discuss the structure, the weight, the obstacles faced at sea, and different designs of the structure.

2. There are two stages to obtaining oil or gas below the surface. First, a drilling rig which is an exploration rig is set up to drill a test site. The drilling rig floats which allows it to move from place to place. Divide the students into teams. Give each group the following supplies: 1 glass jar (empty pickle jar is ideal), 1 glass pipette (clear plastic straw) (the straw is the tubing string that is set during drilling through which fluids flow to the surface), neutral color modelling clay (the layer of clay at the top/bottom of the model simulates the impermeable rock layers (shale) that trap fluids), clear marbles (marble layer simulates the porous rock (sandstone) that allow fluids such as water, natural gas, and oil to migrate into/through), 1 bottle soy sauce (represents the crude oil production), 1 rubber bulb (represents the pumping unit called a pumpjack that pulls the fluids to the surface). Allow the teams to assemble the oil well. First, layer 1" modelling clay along the bottom of the jar. Make sure it is smooth and sealed against glass wall. This will prevent soy sauce from oozing down the sides of the jar or down the middle. Next, place one layer of marbles on top of the clay. This will prevent the straw from touching the clay bottom. Stand the pipette (or straw) up in the center of the jar and hold with one hand. With the other hand, fill the jar with marbles around the straw within 3-4 inches from the top. Next fill void spaces in marbles with soy sauce leaving a slight gap at the top. Layer about 1" modelling clay along the top ensuring a proper seal around the edges. Be careful, if you press too hard on the top surface, soy sauce will begin to flow.

3. Once the model is ready, allow the students to

conduct an experiment with the model. Squeeze the bulb, then place on the straw. As you slowly let go, the fluid will rise up through the straw. If it doesn't, check the seal around the top clay layer or compact the top clay layer down into the marbles. This demonstrates the suction from the pump (at the surface) pulling low pressure fluids (reservoir) to the surface. Newly drilled wells are usually at high enough pressure that flow is established without mechanical means.



4. The second stage of oil/gas production is the production state. During this phase, an oil platform is brought to the site and oil/gas production begins. Discuss with the students the different approaches to design. For example, the Norwegians have designed and constructed concrete platforms in the North Sea. Brainstorm with the students different types of materials they could use to build a model of an oil rig.

5. Divide the groups into teams or assign the project individually. Have the student or student team build a model of an oil rig from the legs to the platform using recycled products. You may want to add hazards that the student must take into account such as the rig must withstand three left and right motions of the hand when held (simulating strong winds) or the rig must float in water.

6. Allow the student plenty of time to design and build their rig. Display the rigs. You might want to invite an ocean drilling engineer from a local university or an engineer from an oil/gas production company to talk with your students about oil rig designs and critique the rig designs of your students.

Assessment:

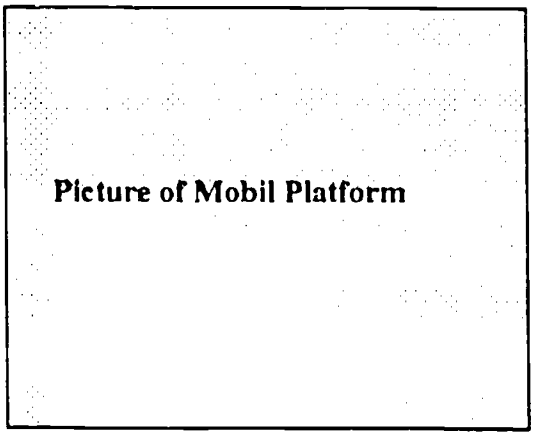
Questions:
1) What depths are you considering when building your model?
2) Can the platform be reused once the well is dry? (The US recycles platforms in order to cut down on costs)
3. How are you going to weigh down your platform? For example, companies tend to fill the legs with water and/or anchor the rig down.

Observations:
1) Are students using the correct terminology such as offshore well, rig, and platform?

Tasks:
1) Write a journal entry from a roustabout (laborer on a rig). What does the roustabout do during the day? What does he/she do for entertainment?

Extensions:

1) Find out how each rig gets its name. For example, each rig is called High Island and given a number such as High Island 389 which is the Mobil platform in the sanctuary. Obtain a map from the Minerals Management Service (MMS) to locate the rigs in the Gulf.
2) Research how an oil company leases areas from MMS or individual states.



Resources:

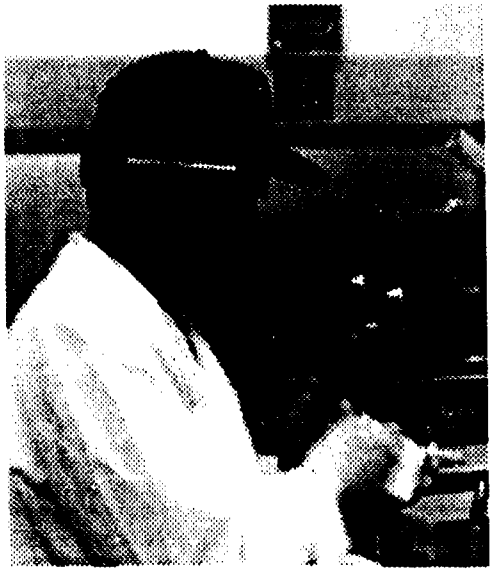
- •Army Corps of Engineers (Protects coastal areas. Issues permits to place structures in offshore waters.), P.O. Box 1229, Galveston, TX 77553-1229
- •Oil by Allan Piper
- •See inside an Oil Rig and Tanker by R.J. Unstead
- •The Living Gulf: A Place to Treasure, Pamphlet, Offshore Operators Committee, P.O. Box 50751, New Orleans, LA 70150
- •The Story of Offshore Oil by Harry Edward Neal.
- •US Department of the Interior/ Minerals Management Service, 1201 Elmwood Park Blvd, New Orleans, LA, 70123 (This federal agency oversees offshore leasing, platform design, equipment safety, training, and certifications.)

(Background information adapted from the pamphlet, The Living Gulf: A Place to Treasure. Oil Rig Model developed by Winnie Schubert at Mobil Oil)

Mark Briles

Texas A&M University Biochemistry, College Station Texas

Dr. Jim Hu - Mentor
Texas A&M University Biochemistry
College Station, Texas 77843



Mark Briles
Bremond High School
P.O. Box 190
Bremond, Texas 76629

NAME: Mark W. Briles

INTERNSHIP: Texas A&M University, Biochemistry/Biophysics

SCHOOL: Bremond High School

PRIMARY SUBJECT: Biology

ACTIVITIES:
* Making Yogurt Utilizing Bacteria
* Making An Acid Indicator
* Testing Conditions Affecting Bacterial Growth

Summary: My internship involved developing and updating an exhisting protocol for separating and purifying a known protein produced by E. Coli bacteria for the purpose of further study of the protein molecule. DNA recombination methods were used prior to my arrival whereby the lab team spliced in a DNA section into a bacterial plasmid which allowed for production of the experimental protein that I then utilized in my own experiment. The bacteria were produced, the cell proteins were made by the bacteria, and the protein of interest was then purified. The purified version was then ready to study with no likelyhood of other cellular proteins distorting the view.

I plan to implement activities that involve the student using bacteria as means of discovery while learning basic Microbiology. Holistically, students should be able to expain what a protein is, how it is produced, induced, obtained in solution, and reasons for purification of a singular protein. The activities provided in this CIP will help students in understanding and explaining why proteins are of such great interest to researchers in fields such as biomedicine and should also demonstrate to the students the types of variables that a microbiologist that works with bacteria might encounter.

CURRICULUM IMPLEMENTATION PLAN

Resources: Texas A&M Biochemistry/Biophysics Department
Dr. Ed Funkhouser, Associate Head of Undergraduate Education, Dr. Jim Hu, Associate Professor

Texas Alliance For Science, Technology and Mathematics Education, TAMU, Dr. Robert K. James, Director, Brian T. Walenta, Project Coordinator.

Basic Microbiology, Sixth Addition, Wesley A. Volk/Margret F. Wheeler, Harper & Row, Publishers, Inc. 1988

The Usborne Book of Experiments, Jane Bingham, EDC Publishing, 10302 E. 55th Place, Tulsa, Oklahoma 74146

Janice Van Cleave's A+ Projects In Biology, John Wiley & Sons, Inc.

CURRICULUM IMPLEMENTATION PLAN

TEACHER: Mark W. Briles

MENTOR: Dr. Jim Hu, TAMU Biochemistry/Biophysics

GOAL: To allow students the opportunity to experience what it would be like to work in a profession that involves biochemistry and microbiology. Students will demonstrate the ability to problem solve utilizing concepts in basic microbiology.

OBJECTIVES:

1. Students will make cell media using sterile technique and explain the importance of maintaining sterility.
2. Students will develop an experimental protocol using a similar experiment which has a known outcome to develop the ability to review and revise.
3. Students will describe the importance of controlling pH when working with organic molecules like proteins, and demonstrate a method used to control pH.
4. Students will demonstrate a basic knowledge of how bacteria can be utilized for protein production and how the process can benefit society.
5. Students will learn to work togather in groups cooperatively performing an ongoing experiment developing and revising their conclusion while demonstrating good organizational and communicational skills.

CURRICULUM IMPLEMENTATION PLAN

ACTIVITY 1: Making Yogurt Utilizing Bacteria/Developing a Protocol
(The Usborne Book Of Science)

Materials:
Large sauce pan, heat source, vacuum seal thermos, large plastic bowl, plain yogurt, long-life milk, spoon, large plate, water, refrigerator, graduated cylinder, one fresh fruit.

Introduction:

If you leave milk in a warm place instead of a refrigerator, bacteria will develop. These bacteria produce lactic acid which turns the milk sour. Here is a way to make yogurt by controlling this process.

Step 1
Heat 250 ml of long-life milk in a saucepan until it starts to boil, Turn off the heat. Now pre-heat a vacuum thermos by filling it with boiling water and then emptying it again.

Step 2
Stir two teaspoons of plain yogurt into the milk, pour the mixture in the thermos for seven hours so the bacteria can make lactic acid.

Step 3
Pour the yogurt into a bowl. Stand the bowl in a basin of cold water and keep stirring the yogurt so that it cools quickly. This will stop the bacteria from making any more lactic acid.

Step 4
Cover the bowl with a plate and put it in the refrigerator. Leave it to thicken for four hours. Now you can eat your yogurt on its own or mixed with fresh fruit.

Critical Thinking:

Organize students into groups. Instruct each group to develop a protocol for making yogurt using the given procedure as a guideline only this time, each group will change a critical step in the original protocol. Each group should turn in the final protocol that explains how they formulated their yogurt. Be sure to produce a yogurt that is sanitary to sample. Compare the yogurts by doing a taste test. See if the students can hypothesize what was done wrong in each group.

Objectives Covered: 1, 2,3,4,5

CURRICULUM IMPLEMENTATION PLAN

ACTIVITY 2: Making An Acid Indicator(Usborne Book Of Science)

Materials:
Red Cabbage, knife, large saucepan, wooden spoon, large screw-top jar, kitchen strainer.

Introduction:

Red cabbage will change color to green in presence of a alkali solution. It will turn pink in the presence of an acid. You can tie this lesson into the use of chemical buffers.

Procedure:

Step 1
Carefully chop the cabbage into small pieces. Put the pieces in the saucepan with enough water to cover them.

Step 2
Bring the water to a boil. Turn off the heat, stir the cabbage mixture and leave it to cool for 30 minutes.

Step 3
Pour the cabbage water through the strainer into the jar. The liquid in the jar is your indicator. Keep it in the refrigerator.

You can then try any of the following ideas(Usborne Book Of Science)or make up variations of your own:

A. Pour some indicator in a glass. Stir in a few drops or some crumbled bits of asprin, yogurt, water, orange squash, sugar, lemonade, flour, or apple juice. Do each separately.

B. Test toothpaste. It should turn green.

C. Soak a handkerchief if a bowl of indicator until it turns pale purple. Dab it dry and squeeze some lemon juice on top(it should be laying on a paper towel). Change paper towels and drop on some bicarbonate of soda(mixed with a little water). Rinse the handkerchief with water and hang to dry. Observe the designs created by the changing of colors.

D. Do the same thing as step C above only use a T-shirt. Soak the final product in alum to make the dye more perminant.

Objectives Covered: 2,3,4,5,

ACTIVITY 3: Testing Conditions That Affect Bacterial Growth
(Janice Van Cleave's A+ Projects In Science)

Materials:

Baby food jars with lids(enough for your groups), dishwashing liquid, water, paper towels, knife, small potato, small sauce pan, stove, unflavored gelatin, distilled water, spoon, beef bouillon cube, cookie sheet, oven, marking pen, masking tape, soap.

Procedure:

Step1
Wash the jars and lids and rinse. Let them drain.

Step 2
Cut a small potato into small sections and boil until they are well done. Save the liquid broth.

Step 3
Sprinkle 7 grams of gelatin onto 250 ml of distilled water, let it stand for two minutes and then stir.

Step 4
Mix potato the broth, the gelatin, and one bouillon cube into a sauce pan and stir over medium heat until the mixture is blended well.

Step 5
Pour the mixture into four jars in equal amounts and quickly secure the lids. Place them on a cookie sheet and bake in the oven for one hour at 250 degrees F.

Step 6
Allow jars to cool. Place the need number of jars for your group into the refrigerator. Keep four jars out for yourself.

Step 7
Open one jar labled "fingertips" and touch the media gently with all four fingers. Secure the lid and wash hands.

Step 8
Rub your fingers across a well-traveled floor and touch the media in the jar labled "floor" gently.

Step 9
Do the same for a jar labled "doorknob." Leave a control well secured.

Step 10
Place the jars in a dark, warm place, such as a closet containing a water heater, for two to four days.

Results:

Control jar should have almost no growth. There should be colonies growing in all other jars.

Additional labs:

1. Try checking to see if temperature affects the growth rate of bacteria. Lable several jars "warm" and "cold" (you will need additional jars). Use the refrigerator for cold and a closet with a heater for the warm.

2. Try light and dark variations.

3. Test different brands of deodorant soaps with contain "antibacterial" ingredients.

Objectives: 1,2,4,5

Tanja Shank

Texas A&M University Biochemistry, College Station Texas

Dr. Ryland Young - Mentor
Texas A&M University Biochemistry
College Station, Texas 77843

Tanja Shank
Pre-Service Teacher
Texas A&M University
Elementary Education

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME:	Tanja M Shank
INTERNSHIP:	Texas A&M University, Biochemistry/Biophysics Department
SCHOOL:	Moorhead Junior High School-Student Teaching
PRIMARY SUBJECTS:	Science I and Science II
ACTIVITIES:	* Graphing bacteria growth * Metric conversion of red blood cells
SUMMARY:	The student will be able to demonstrate proper semi-log, graphing techniques using cell growth versus time to show how the amount of bacteria needed is determined.
RESOURCES:	Texas A&M Biochemistry and Biophysics Department Dr. Ed Funkhauser, Associate Head of Undergraduate Education Dr. Ry Young, Professor of Biochemistry Kay Holtman, PhD. Candidate Texas Alliance for Science, Technology, and Mathematics Education, Texas A&M University Dr. Robert K. James, Director Brian T. Walenta, Project Coordinator Texas Teacher Internship Program CIP Publication, Mark Briles, 1994.

CURRICULUM IMPLEMENTATION PLAN

TEACHER	Tania Shank
Mentor	Kay Holtman
Goal	To familiarize students with math techniques used for science by graphing with semi-log paper and using the metric system.

Objectives.

1. The student will look at actual cell growth data and will determine how much has grown by graphing it on semi-log paper.

2. The student will learn how to convert numbers via the metric system using red blood cell count.

CURRICULUM IMPLEMENTATION PLAN

ACTIVITIES

1 GRAPHING BACTERIA CELL GROWTH

MATERIALS.

Cell growth data, semi-log graph paper, if available-a simple graphics program that the students can check their work on.

A) Have the students research the current "hot" areas that microbiologists are working in (current example: biohazard level 4 virus').

B) Begin by reminding students about how much math is actually used in science and more specifically how it used in this exercise.

C) Teach fundamentals of logarithmic numbers and graphing techniques.

D) Explain that to do research in microbiology, you sometimes have to grow the cells and they will grow logarithmically, hence the connection between knowing logarithms and science.

E) Allow students to work in pairs. Let the students graph all of the cell growth data up to the value of one on the logarithmic axis; time is on the x axis and cell quantity is on the y axis (logarithmic axis). Have them connect their data points by a straight line.

F) First let the students predict at what time the cells will grow to a quantity of 2 and 3.

G) Let the groups come to the board and explain their prediction with data they have graphed.

H) Allow students to check their graphs on a computer if available.

OBJECTIVE COVERED: 1
ELEMENTS COVERED: Teamwork, Problem-solving, Critical thinking, Oral Communication.

ACTIVITIES

2. METRIC CONVERSION OF BLOOD CELLS

MATERIALS

Notebook paper, metric scale, if available-a high power microscope that allows you to see red blood cells

A) Explain the fundamentals of the metric system and scales and allow students to brainstorm on why it is important to know about them. Relate it to the work scientists do, specifically microbiologists.

B) Remind them of the importance of using math in science and explain the use of converting numbers when making solutions. Tell them how microbiologists make blood solutions and need to convert the numbers so they can perform experiments at the microscopic level.

C) If available, let students see the red blood cells under a microscope. Allow the students to make observations about the cells; they are moving, they are small, etc. Tell the students that it would be impossible to count all of the cells. Show them the grid that is used and how they are counted. Tell them that there is a microscope factor which accounts for the rest of the cells.

D) On the board, write the data needed to make a red blood cell solution diluted by calcium saline:

Number of red blood cells (RBC)
Calcium dilution factor = 20
Microscope Factor = 25x10

The formula is:

Number of RBC's x Calcium dilution factor x microscope factor

Or:

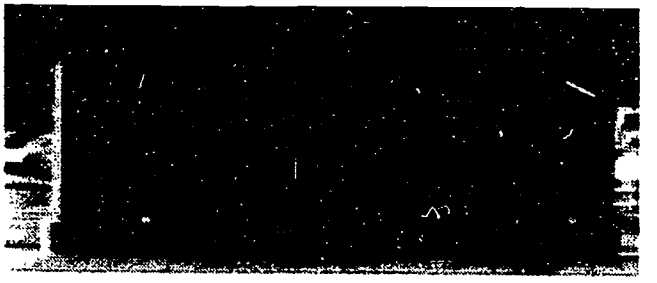
random number x 20 x (25x10)

E) Allow the students to work in groups solving the formula with different red blood cell counts (some common numbers to use are between 300 and 400).

OBJECTIVES COVERED: 2
ELEMENTS COVERED: Oral communication, Problem solving, Teamwork

Linda Ray

Texas A&M University Ocean Drilling, College Station Texas



Lisa Patton - Mentor
Texas A&M University Ocean Drilling
College Station, Texas 77845-9547

Linda Ray
Consolidated High School
701 West Loop S.
College Station, Texas 77840

NAME:	Linda Ray
INTERNSHIP:	Ocean Drilling Program, College Station, Texas
SCHOOL:	College Station ISD
PRIMARY SUBJECT:	Technology: Telecommunication
ACTIVITIES:	• Use hypertext markup language to format text • Save graphics in gif format • Add graphics to hypertext • Add links to hypertext and QuickTime movie • Test hypertext in Netscape software • Download hypertext files and graphics to a web server • Test and revise materials on the Internet
SUMMARY:	The student will be able to demonstrate the developmental steps needed to produce an original document with graphics and links to other documents on the Internet. The student will learn to use the hypertext markup language (html) that is necessary to post documents on the Internet. The student will learn how to save graphics and movies in the proper format so that they can be viewed on the Internet. Graphics, movies, and links to other documents will be added to the student's work The student will learn how to test documents using Netscape before adding them to a web server. Finally, the student will learn how to download files to a server and work with a system administrator to test and revise documents submitted to the Internet.
RESOURCES:	Lisa Patton, Senior Systems Analyst, Ocean Drilling Program Jeff Sauls, WebPage Administrator, Ocean Drilling Program "A Beginner's Guide to HTML", National Center for SuperComputing Applications (pubs@ncsa.uiuc.edu) "HTML Quick Reference", National Center for SuperComputing Applications

CURRICULUM IMPLEMENTATION PLAN

NAME: Linda Ray

MENTOR: Lisa Patton, Ocean Drilling Program, College Station, TX

GOAL: To familiarize teachers and students with the methods and techniques used to produce documents in Hypertext Markup Language format for viewing on the Internet.

OBJECTIVES: Student will be able to:

1. identify the meaning and purpose of HTML tags.
2. open a document with a WWW browser like Netscape to see how it is displayed.
3. make changes to existing documents and view them with Netscape.
4. insert formatting, line and paragraph breaks into documents.
5. save graphics as gif files and insert graphics into documents.
6. add links to the same document and to another document.
7. download hypertext files and graphics to a web server.
8. test and revise materials on the Internet.
9. collaborate with the system administrator to finalize the Internet documents produced.
10. identify careers that are involved in the Internet.

Lesson 1 — Recognize & Use HTML Tags

Materials: Macintosh Computer: System 7.1 or higher

Software: WebWeaver or equivalent
Netscape or equivalent

Lesson 1: Recognizing & Using HTML Tags

Procedures:

Students will open the software, WebWeaver, or SimpleText to keyboard HTML tags into a simple document.

Students will use the built-in features of Web Weaver to mark the document for viewing on the Internet.

Students will open Netscape software, open the document created and test the file created with Web Weaver.

Students will review the function of each tag they have entered into their document.

Objectives Covered: 1, 2

Elements Covered: Written Communication Skills
Technology Skills
Problem-solving Skills

Lesson 2 Formatting the Document

Materials:

Macintosh Computer: System 7.1 or higher

Software: WebWeaver or equivalent
Netscape, Mosaic, or equivalent

Lesson 2: Formatting the Document

Procedures:

Students will open the document, WhySave.html, created in Lesson 1 in, WebWeaver or Simple Text, and make format changes.

- Horizontal Rule
- Unnumbered and Ordered Lists
- Physical style tags: bold, italics and emphasis
- Forced Line Breaks

Students will open Netscape software, open the WhySave.html as amended and test the results.

Objectives Covered:

1, 2, 3, 4

Elements Covered:

Written Communication Skills
Problem-solving Skills
Technology Skills

Lesson 3 Add Graphics to HTML Files

Materials:

Macintosh Computer: System 7.1 or higher

Software: WebWeaver or equivalent
Netscape or equivalent
GraphicConvertor or equivalent

Lesson 3: Add Graphics to HTML Files

Procedures:

Students will save graphics in a format viewable on the World Wide Web by all computers

Use HTML commands to add graphics to a docuent.

Use alignment commands to position the graphics in a specific area of the document.

Save a copy of graphics found on the Internet.

Objectives Covered: 1, 2, 3, 5

Elements Covered:
Written Communication Skills
Problem-solving Skills
Technology Skills

Lesson 4 Using HTML Links

Materials:	Macintosh Computer: System 7.1 or higher Software: WebWeaver or equivalent Netscape or equivalent GraphicConvertor or equivalent
	Lesson 4: Using HTML Links
Procedures:	The students will • Add links to your document so that it will branch to a particular paragraph within the document • Add links to your document so that it will branch to another Internet file. • Add a link that will play a QuickTime movie. • Add a link to an e-mail form.
Objectives Covered:	1, 2, 3, 4, 5, 6
Elements Covered:	Technology Skills Written communication Skills Problem Solving Skills

Lesson 5 Downloading Files to a Web Server

Materials:

Macintosh Computer: System 7.1 or higher

Software: WebWeaver or equivalent
Netscape or equivalent
GraphicConvertor or equivalent

Lesson 5: Downloading Files to a Web Server

Procedures:

The students will

- Check to be sure that all text and graphic files are completed and organized into one folder.
- Setup a meeting and communicate with the web server administrator the plans for your web pages.
- Use a utility program such as Fetch to download the files to a web server.
- Test the files in Netscape after they are on the web server.
- Make revisions, download revisions, and communicate with the administrator when revisions have been made.

Objectives Covered:

6, 7, 8, 9

Elements Covered:

Technology Skills
Written communication Skills
Problem Solving Skills
Critical Thinking Skills
Communication Skills

Lesson 6 Searching the Net for Career Info

Materials:

Macintosh Computer: System 7.1 or higher

Software: WebWeaver or equivalent
Netscape or equivalent
GraphicConvertor or equivalent

Lesson 6: Searching the Net for Career Information

Procedures:

Students will

- Learn to use the Net Search option in Netscape.
- Use Net Search to find a career of interest.
- Use the hyperlinks found in the Net Search to investigate careers.

Objectives Covered:

10

Elements Covered:

Technology Careers
Problem Solving Skills
Critical Thinking Skills

Writing your Own Web Pages

Why Rainforests are Important!

Tutorial by Linda Ray
College Station, Texas

Writing Your Own Web Pages

prepared by Linda Ray
College Station, TX

The Internet is a fabulous way to connect with other places and people around the world. One very exciting way for teachers and students to "get connected" with the Age of Communication is to prepare and publish their own documents on the Internet.

In this series of lessons you will learn to produce a document about **why the rainforests are important** with graphics and links to other documents on the Internet. You will use the hypertext markup language (html) that is necessary to post documents on the Internet.

You will learn how to save graphics and movies in the proper format so that they can be viewed on the Internet. Graphics, movies, and links to other documents will be added to the your work

.

You will learn how to test documents using Netscape, an Internet browser, before adding them to a web server. Finally, you will learn how to download files to a server and work with a system administrator to test and revise documents submitted to the Internet.

After completing this lesson, get together with other people from your school or organization and setup a web site of your own.

Before you begin: Download software

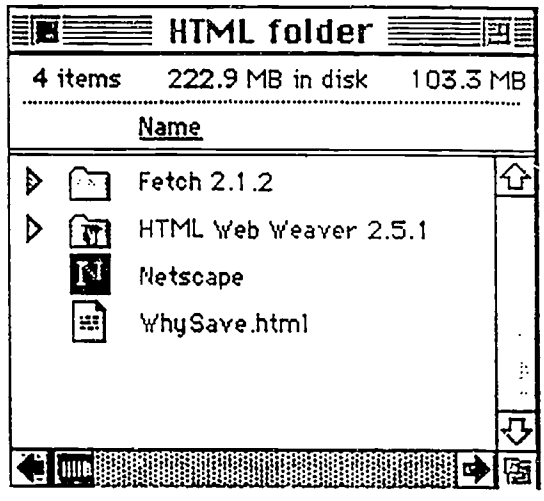
Expand Software and files onto your hard drive:

A number of shareware applications and graphic files have been organized and "stuffed" onto two disks for your use with the lessons that follow. The disks are:

- **WebPage**
- **WebGraphics**

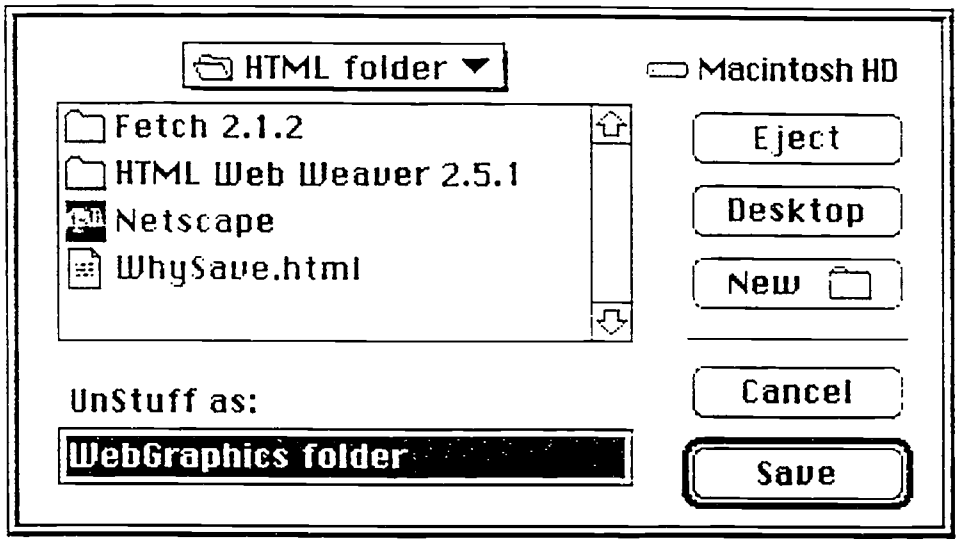
The disks include two self-extracting archive icons. Before you begin the lessons, beginning with the WebPage disk, double-click on the HTML.sea (self-extracting archive) file found on the WebPage disk provided. A folder, **HTML Folder,** will be created on your hard drive as the destination folder.

You should now have the following software and a file in the HTML Folder:



Before you begin: Download software

Double click on the **WebGraphics.sea** icon on the WebGraphics disk and choose the HTML Folder when you are expanding the files.



Open the Web Graphics Folder. use **Edit--Select All** and drag all of the files into the HTML Folder. You may delete the WebGraphics Folder.

You should now have all of the files and applications necessary to create documents for the Internet. Enjoy your learning experience!

Lesson 1: Recognizing & Using HTML Tags

Creating Your First HTML Document

You are about to embark on a journey that will transform you from a mere Internet Surfer of the World Wide Web to an Internet author of your own materials!

Objectives:

After this lesson you will be able to:

- Identify the meaning and purpose of HTML tags.
- Open up a workspace for creating new World Wide Web documents.
- Create a simple World Wide Web document in HTML format using a text editor.
- Open your document within your WWW browser to see how it is displayed.

Introduction:

Hypertext Markup Language is a simple computer language that is read by Internet programs such as Netscape and Mosaic. Each symbol called a "tag" gives the Internet program a command.

Each tag begins and ends with angle brackets i.e. < >.

Each document begins with **<html>** and ends with **</html>**.

The symbol "/" is the command for the end of a tag.

Each World Wide Web document in HTML format has a title that is displayed as the title of the file in the Netscape window. It is recommended that every document have a title.

The tag for a title appears as follows:

<TITLE>Why Save the Rainforest?**</TITLE>**

After the title, the beginning and end of the document should be tagged with a body tag as follows:

<body> **</body>**

Lesson 1: Recognizing & Using HTML Tags

Open WhySave.html.

Any text editor, such as Microsoft Word or Word Perfect, can be used to create Internet documents. The text should be saved in a "text only format."

Specialty software such as HTML WebWeaver can be used to facilitate the insertion of tags into text.

One of the simplest editors to use is SimpleText, which is available on all Macintosh computers. When you use SimpleText, there is no need to save in a special format and the software requires a minimum amount of memory to run.

Try It

Open WhySave.html found on the WebPage disk or HTML Folder using a word processor of your choice. The author recommends that you try SimpleText first and then redo Activity 2 using HTML Web Weaver for comparison.

Adding Tags to Your HTML Document.

Using the information in right column below, add the HTML tags to the WhySave.html file.

```
<HTML>
<HEAD>

<TITLE>Why Save the Rainforest?</TITLE>

</HEAD>

<BODY>

<H2 ALIGN=CENTER>Why rainforests are important!
</H2>

<H3>
<P>Tropical rainforests are by far the richest habitat on
Earth. As many as 30 million species of plants and animals
- more than half of all life forms - live in tropical
```

Try It

End of a paragraph
</P>

Save WhySave.html

rainforests. At least two-thirds of the world's plant species, including many exotic and beautiful flowers, occur in the tropics and subtropics.</P>

<P>As greed continues to destroy rainforests, plant species that might contain medicines to cure AIDS and other diseases are tragically becoming extinct. One species alone - the rosy periwinkle, found only in the tropical forests of Madagascar - is the source of 80 alkaloids used to treat leukemia and Hodgkin's disease.</P>

<P>Rainforests are part of the global weather system. Destroying them alters the hydrological cycle - causing drought, flooding, and soil erosion in areas where such events were previously rare. The cutting of forests also changes the albedo or reflectivity of the earth's surface, which in turn alters wind and ocean current patterns, and changes rainfall distribution.
</P>

<P>The Earth is your home. There aren't any others for sale or rent anywhere in the neighborhood.</P>

<P>The alarms are going off. Better safe than sorry: many changes are already irreversible.</P>

<P>The people and other beings on this planet are your family. It's time to save your own family. It's time to save yourself.</P>

</BODY>
</HTML>

Source for text: "Why Save the Rain Forest," Rainforest Action Network

Rainforest Action Network Web Pages

View this page on the Internet at http://www.igc.apc.org/ran/info_center/whysave.html or **http://www.ran.org/ran**

Lesson 1: Recognizing & Using HTML Tags

Using HTML WebWeaver:

WebWeaver is a utility word processor that allows you to add hypertext markup tags by highlighting a word or group of words and then the tag that needs to be inserted.

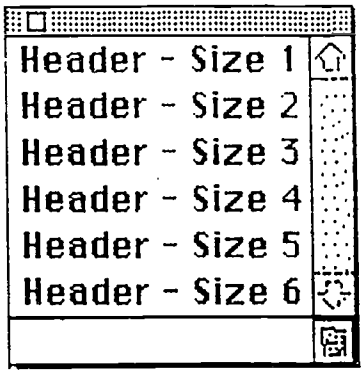
For example, if you type

Why rainforests are important!

Then drag across the text with your mouse and then click on **Header - Size 1** from the Tags menu option. WebWeaver will

HTML Tags:

Address	
Blink	
Block Quote	
Body	
Bold	
Center	
Cite	
Code	
Comment	
Definiton	
Emphasis	
Fixed Width	
Font Size 1	
Font Size 2	
Font Size 3	
Font Size 4	
Font Size 5	
Font Size 6	
Font Size 7	
Head	
Header - Size 1	⌘1
Header - Size 2	⌘2
Header - Size 3	⌘3
Header - Size 4	⌘4
Header - Size 5	⌘5
Header - Size 6	⌘6



insert the tags before and after the text so that you do not have to type the tags in for yourself. The text is formatted on the screen so that you get immediate feedback on the actual size unlike text formatted in html in Simple Text. Its results cannot be viewed until the file is opened in Netscape or Mosaic.

<H1>Why rainforests are important!</H1>

It is really up to you. Some people prefer to type everything in themselves while others find it easier to use WebWeaver.

WebWeaver is a shareware program by Robert C. Best. However, the examination copy may be used for 30 days. The fee for using is currently around $30.

Be sure to check out the HTML WebWeaver folder. It contains excellent tutorial files to make learning to use it a lot easier. Sorry, PC users, it is not available yet.

Lesson 1: Recognizing & Using HTML Tags

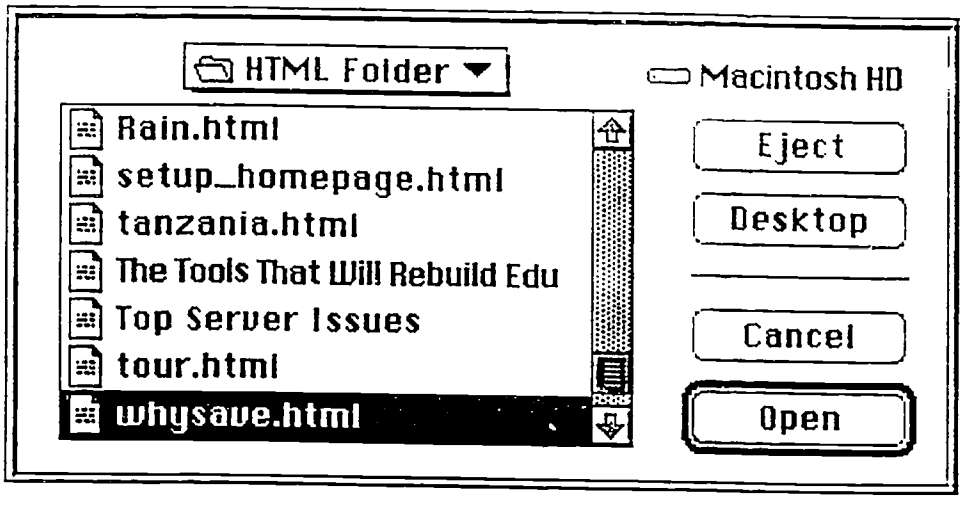
Open Netscape:

If you have a direct Internet connection, you will be able to use the full functionality of Netscape. Netscape is a graphical user interface that allows the user to view all of the features that the Internet has to offer. If you do not yet have an Internet connection, you can use it as a stand alone software package on your Macintosh hard drive.

Once the Netscape program has been expanded onto your hard drive, open it by double-clicking on the Netscape icon.

Try It

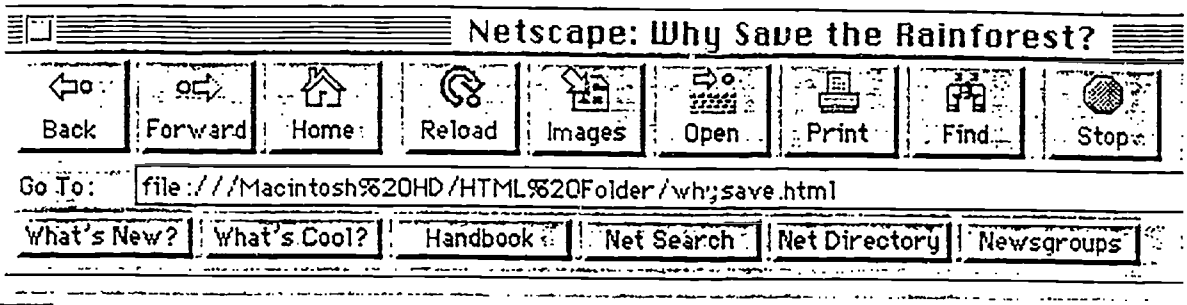
From the File menu at the top of the screen, choose the Open File option. Choose WhySave.html from your HTML Folder.



You should see your document with hidden tags. If you see any mistakes, we will learn how to correct them next.

Netscape Preferences:

Setup Netscape so that it will open WhySave.html as the default file every time that it is opened. This will save you a lot of time as you develop your web pages.



Try It

Options -- Show Location

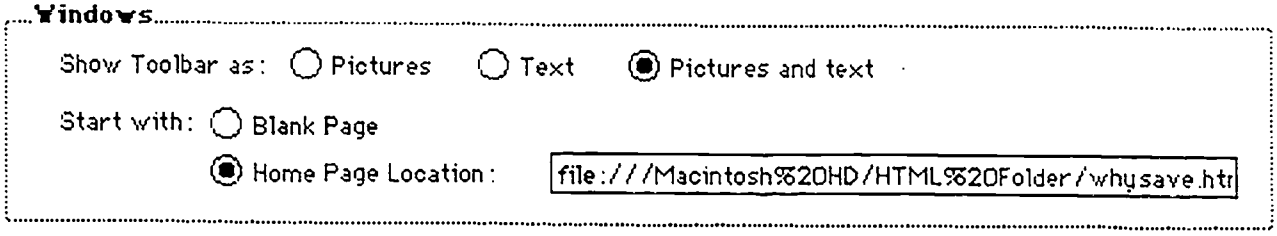
Copy the Location

Options -- Preferences

Check to be sure that your Netscape shows the Go To dialog box as shown above. If it does not, choose **Options -- Show Location** from the menu bar at the top of the screen.

Select the reference to your whysave.html file in the Go To dialog box as shown above. Choose **Edit -- Copy.**

Choose **Options -- Preferences** from the menu bar. In the **Home Page Location** dialog box, paste the reference to your WhySave.html file. Close the dialog box.

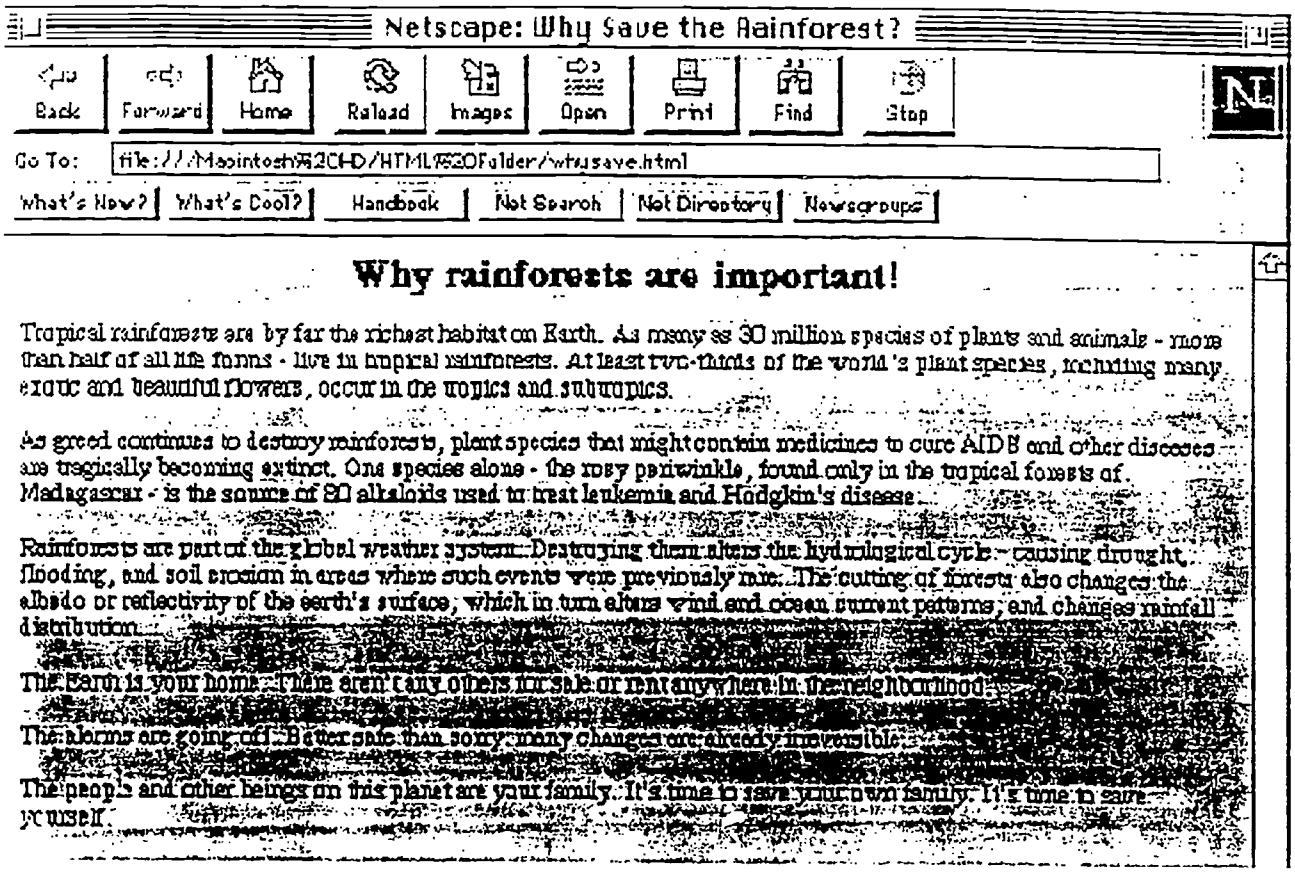


Save Options

Choose **Options -- Save Options.** When you open Netscape again, your WhySave.html should open immediately.

Viewing the document:

When completed, Lesson 1 should appear in Netscape as follows:



Netscape Features:

Notice that the title, "Why Save the Rainforest?", shows up at the top of the Netscape screen.

Notice also that the path to the file, WhySave.html, shows in the Go To dialog box at the top of the screen. Also, the title, "Why Rainforests are Important!", is centered and in a larger font than the rest of the file.

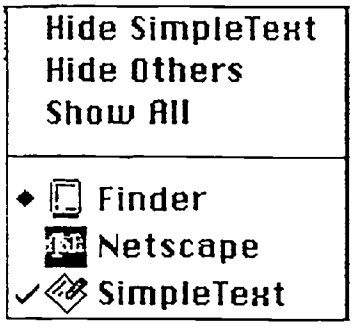
The paragraphs are separated by a blank line because we used the <P> html command.

Making corrections:

On most computers, you should have enough memory to open two files at once. If you do have this option, making corrections and getting immediate feedback is extremely helpful in developing documents for the World Wide Web.

Try It

With Netscape open, pull down the Finder button from the extreme right-top edge of the screen. Choose Finder. Now choose Hide Others.



Open WhySave.html. Make any corrections that you might need to make after viewing the document in Netscape.

Save WhySave.html.

Go through the Finder button and return to Netscape.

Choose the Reload button.

Using Reload Option:

Netscape will reload the file and update the changes that were last made.

Using the Finder button to navigate back and forth, go back to **Simple Text.**

Try It

Type **<H2>** between the title and the first paragraph. Save the file.

Use the Finder button to navigate back to **Netscape.** Click on the Reload button.

Is the body of the WhySave file now in a larger font?

Lesson 1: Reviewing HTML Tags

HTML Commands:

HTML commands are recognized by software like Netscape or Mosaic to indicate where a document should be formatted in a special way.

Some of the HTML commands that were covered in this lesson were as follows:

<html>	**</html>**
<title>	**</title>**
<body>	**</body>**
<P>	**</P>**
<h2 align =center>	**<h2 align =center>**

Text Editors:

A simple text editor may be used to create HTML documents. Some that are widely used are Simple Text, HTML Web Weaver, Microsoft Word or Word Perfect. If Word or Word Perfect are used the format of the file must be saved by using a Text Only or ASCII.

Netscape:

Netscape is a software package that is known as a World Wide Web browser. It allows the user to see pictures, movies and text that are found on the Internet.

File -- Open File:

Netscape has features such as the **File -- Open File** that allow the user to view documents that have been prepared using HTML commands.

Reload button:

Using the Finder button, Simple Text and Netscape may be both be open at one time. Changes made to a document in Simple Text may be saved and then viewed in Netscape by using the **Reload** option in Netscape.

Lesson 2: Formatting the Document

Objectives:

After this lesson you will be able to:

- Open the document. WhySave.html. created in Lesson 1 in WebWeaver or SimpleText and keyboard a few changes.
- Test the results in Netscape.
- Format the document using horizontal rules. lists and boldfacing.
- Review the function of each new tag learned in this lesson.

Introduction:

In this lesson, you will learn the following new HTML features:

- Horizontal Rule
- Unnumbered and Ordered Lists
- Physical style tags: bold. italics and emphasis
- Forced Line Breaks

These features will add more functionality to your WhySave.html document.

Horizontol Rules: <HR>

The **<HR>** tag produces a horizontal line the width of the Netscape window. It adds a visual separation between sections of a document.

After the title and each of the first three paragraphs in WhySave.html, add the tag <HR>.

Lesson 2: Formatting the Document

Change the text size for the body of the text:

Try It

Between the title and the first paragraph, insert the tag <H3>.

Save your changes.

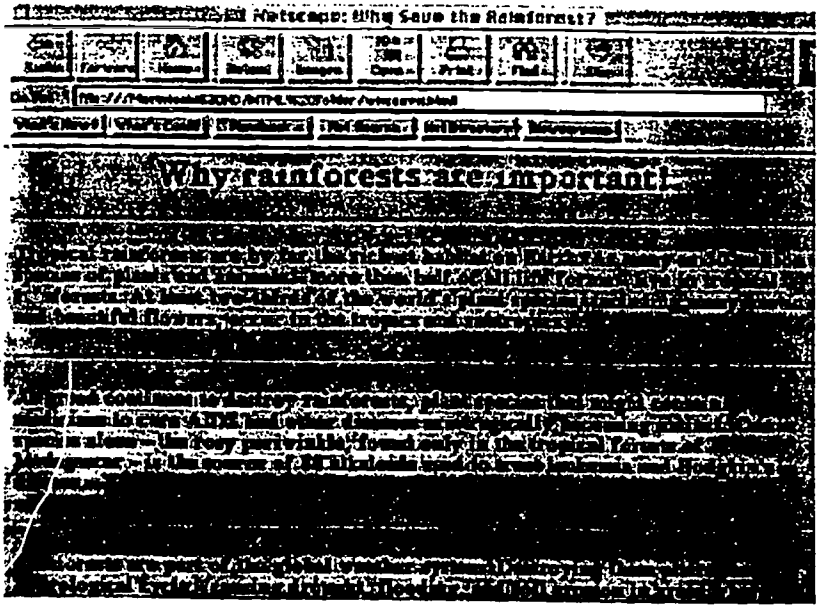
Using the Finder button, go back to Netscape.

If WhySave.html is not already open, choose File -- Open File to open it, now

The file should appear as follows:

Horizontal Rule Lines:

<HR>



Try It

Creating a thicker line:

<HR SIZE=4>

Return to your WhySave.html file. Change all of the the <HR> tags to the following:

<HR SIZE=4> (Larger numbers will produce a thicker line.)

Save the changes. Return to Netscape. Click on the Reload button.

The size of the horizontal rule should be larger now.

Activity 2:

Unnumbered Lists

Creating unnumbered lists in an HTML documents.

To make an unnumbered list.

1. Start with an opening list <UL> tag.
2. Enter the <LI> tag followed by the individual item. (No closing </LI> or <P> tags are needed.)
3. End with a closing list </UL> tag.

Below is an example of a two-item list:

```
<UL>
<LI>Plant Life in the Rainforest
<LI> Animal Life in the Rainforest
</UL>
```

The output is:

- Plant Life in the Rainforest
- Animal Life in the Rainforest

We are going to change the last few paragraphs in WhySave.html to an unnumbered list.

Try It

Make the following changes::

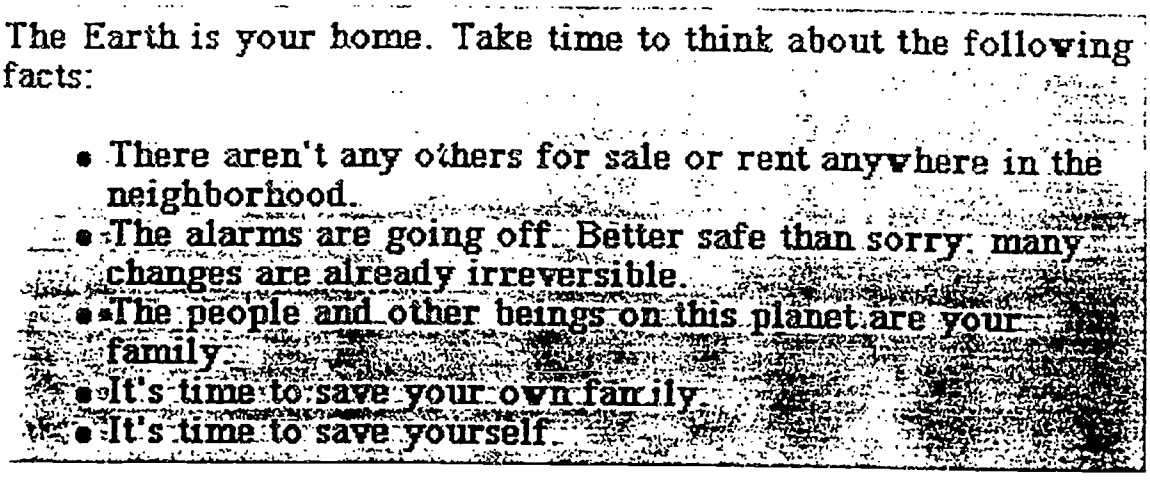
```
<HR SIZE=4>
<P>The Earth is your home. Take time to think about the following facts:
<UL>
<LI>There aren't any others for sale or rent anywhere in  the neighborhood.
<LI>The alarms are going off. Better safe than sorry: many changes are already irreversible.
<LI>The people and other beings on this planet are your family.
<LI>It's time to save your own family.
<LI>It's time to save yourself.
</UL> <HR SIZE=4>
```

Try out the changes:

Save the changes. Return to Netscape. Click on the Reload button.

The changes should appear as follows: The bullets, indentation and word wrap are automatically added with an unnumbered list as well as the line break after each item in the list.

Lists may be nested inside each other. Refer to the "Beginner's Guide to HTML" for more details about HTML lists.



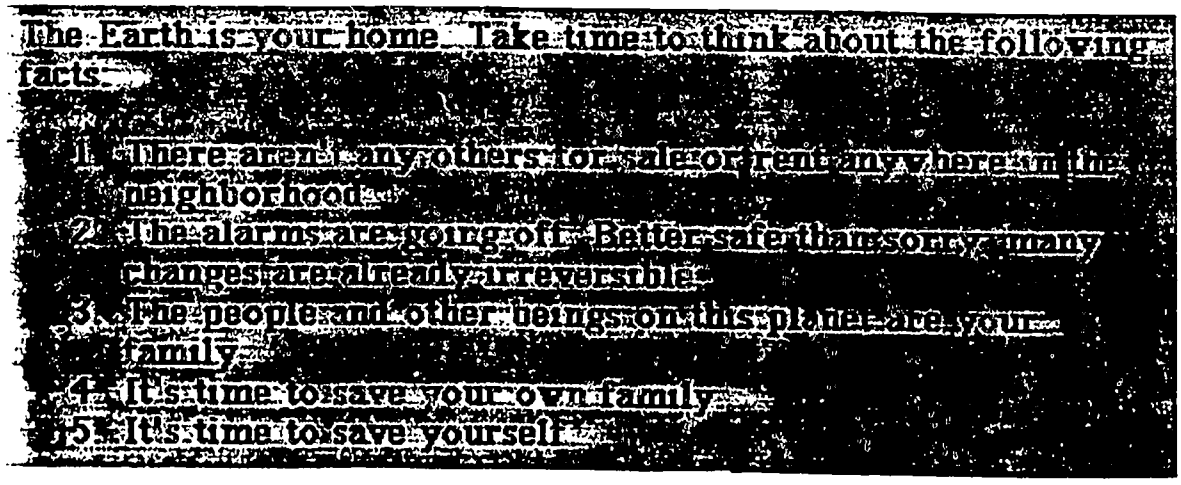
Try It!

Return to your WhySave.html file.

Change the <UL> and </UL> tags to <OL> and </OL>, respectively.

Save your changes and return to Netscape. Reload. Your screen should appear as follows:

Ordered Lists <OL>



Try It

Physical style HTML tags: bold, italics and emphasis

Open WhySave.html, if it is not already open.

In the first paragraph, notice the following phrase:

more than half of all life forms

Before and after the phrase, add the following tags:

<EM>more than half of all life forms</EM>

The text will appear in Netscape with bold, italic formatting.

In the second paragraph, add <B> before the word "AIDS" and </B> after the word.

Add <I> before Hodgkin's disease and </I> after it.

Navigate to Netscape. Open WhySave.html and view your changes.

Emphasis <EM>

Boldface <B>

Italics <I>

Centering

Line Break

Other formatting tags of interest are as follows:

<CENTER> center all text included </CENTER>

**
 produces a line break**

Lesson 2: Summary

HTML Commands:

Some of the HTML commands that were covered in this lesson are as follows:

<UL>	</UL>	Unnumbered List
<LI>	</LI>	List Item
<OL>	</OL>	Ordered List
<HR>		Horizontal Rule
<HR SIZE=4>		HR Size 4
<B>		Boldface font
<I>		Italics
<EM>		Emphasis

Unnumbered List:

To make an unnumbered list,

1. Start with an opening list <UL> tag.
2. Enter the <LI> tag followed by the individual item. (No closing </LI> or <P> tags are needed.)
3. End with a closing list </UL> tag.

Each item in the list is indented and preceded by a bullet. A new line begins with each ordered or unnumbered list item.

Ordered List:

To make an numbered (ordered) list,

1. Start with an opening list <OL> tag.
2. Enter the <LI> tag followed by the individual item. (No closing </LI> or <P> tags are needed.)
3. End with a closing list </OL> tag.

Horizontal Rule:

To make a horizontal line in Netscape,

1. Add <HR> in the text wherever desired.
2. To make the line larger use <HR SIZE=4>, for example.

Lesson 3: Adding Graphics

A Picture is Worth a Thousand Words!

Plain text does not always capture the attention of the reader and get the reader involved in the heart of the matter as quickly as much as do graphics or pictures.

Objectives:

After this lesson you will be able to:

- Save graphics in a format viewable on the World Wide Web by all computers
- Use HTML commands to add graphics to a document.
- Use alignment commands to position the graphic in a specific area of the document.
- Save a copy of graphics found on the Internet.

Introduction:

On the Internet there are several different types of computers and operating systems, i.e. Macintosh, Windows, XWindows, and Sun workstations. When your document is viewed on the Internet, you will probably want everyone to view it without any error messages.

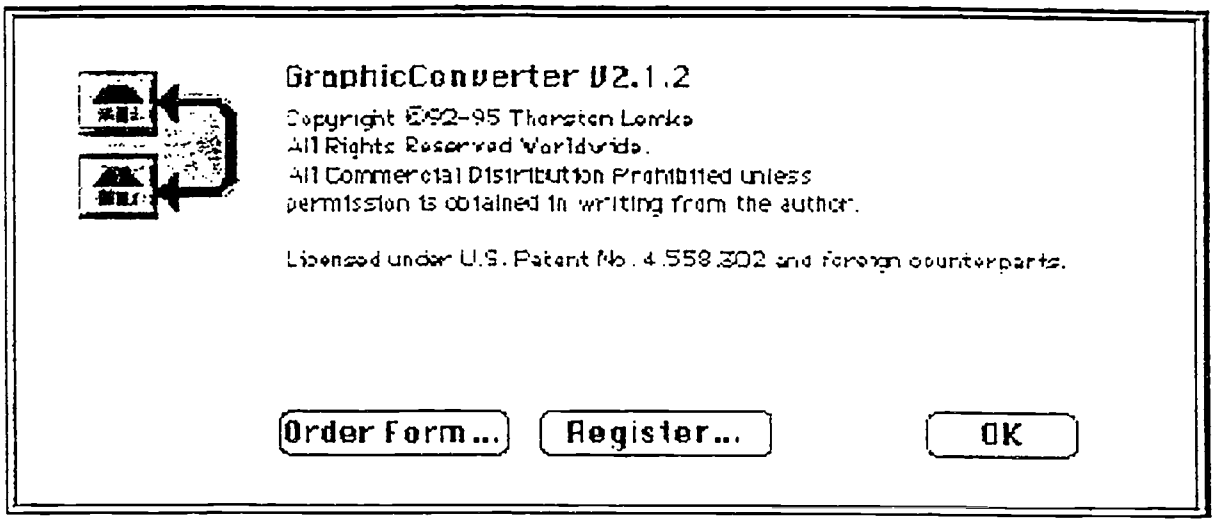
In order for all operating systems to view your document, the graphics that you add need to be in a **gif** format. Your Macintosh will be able to view graphics saved in jpeg format, but other computers will not find it compatible. **Look in the HTML folder for the application, GraphicConverter..**

Note: All of the files from the WebGraphic disk should all be in your HTML Folder to do this lesson.

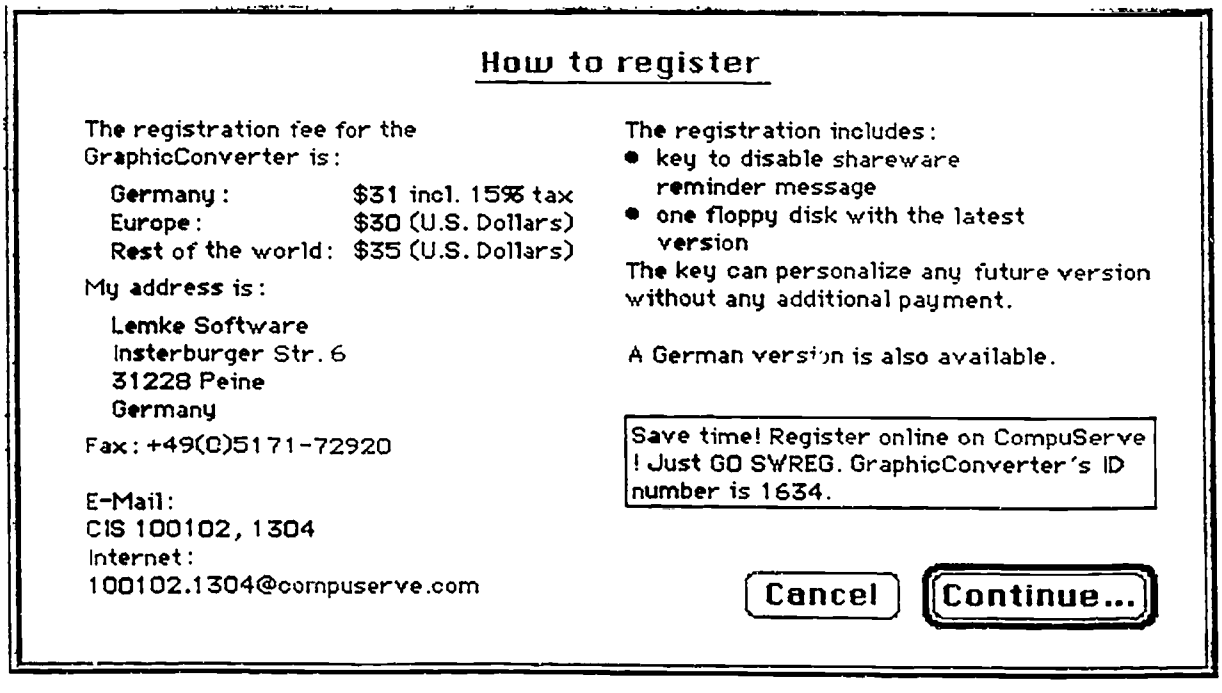
Lesson 3: Adding Graphics

Activity 1: Using the GraphicConverter.

Double-click on the application icon for GraphicConverter to open it.



GraphicConverter is shareware that can be downloaded from the Internet. The fee to register your copy of it is $35.



Try It

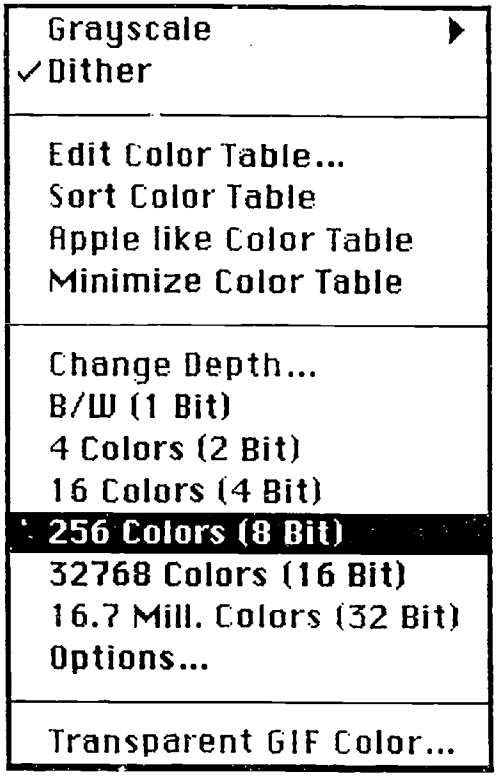
Convert a graphic from jpeg to gif

Click on the **OK** button and GraphicConverter will open.

Choose **File -- Open**. Choose **butterfly.jpg** from your WebGraphics disk.

In order to convert graphics from jpg or jpeg format, the first step is to choose **Pictures -- Colors** from the menu bar.

Choose **Colors -- 256 Colors (8 Bit).**

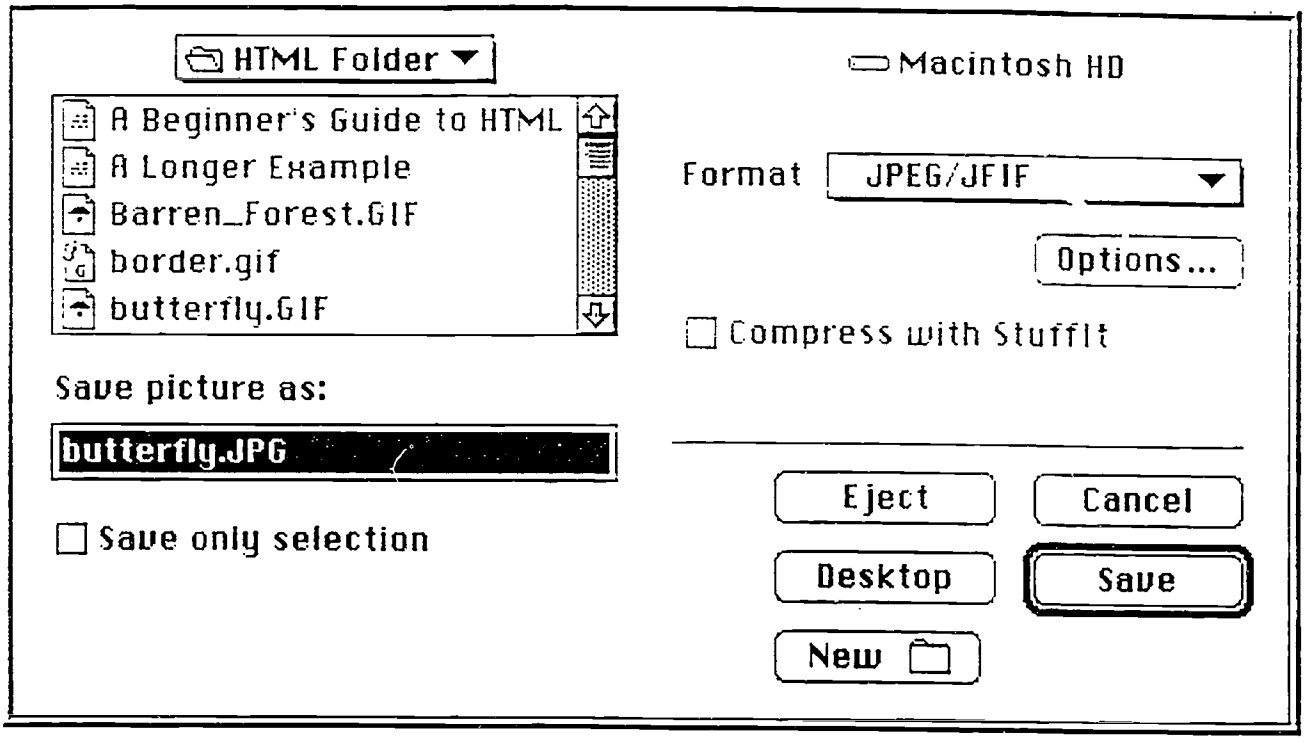


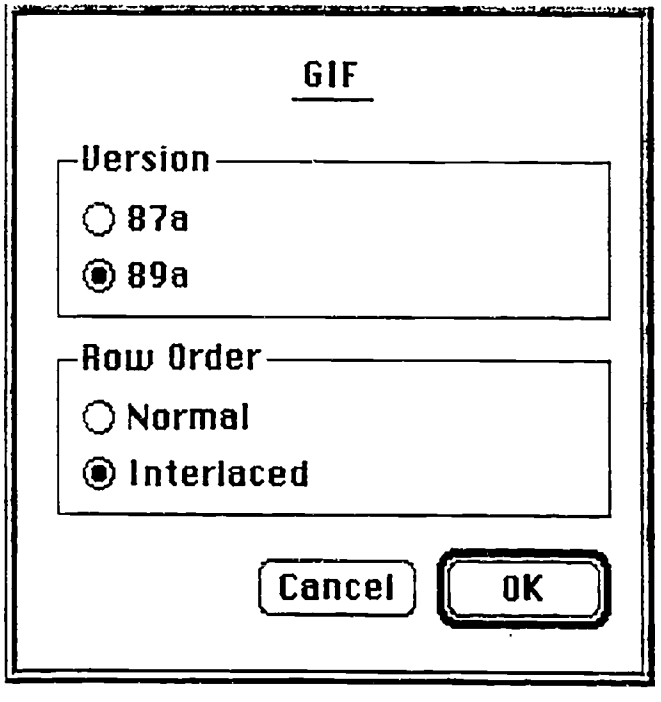
Lesson 3: Adding Graphics

Gif Format

The butterfly graphic may now be saved in gif format.

To do so, choose File -- Save As.





Click on the Format pull-down button. Choose **GIF** from the top of the list.

The file name should now be **butterfly.gif.**

Click on the **Options...** button. Be sure that the option for **Interlaced** is chosen.

When gif-interlaced images are opened on the Internet, they will open gradually and become progressively clearer.

Click on the **OK** button and then on the **SAVE** button.

Try It

Convert a graphic from pict to gif

Choose **File -- Open**. Choose **Rosy Periwinkle** from your HTML Folder or WebGraphics disk. It has been saved in a PICT format which is very common format for Macintosh graphics.

In order to convert graphics from a pict format to gif, choose **File -- Save As** and then choose the **GIF** format from the Format pull-down menu. Click on the **Save** button.

Choose **File -- Quit** to exit GraphicConverter.

HTML Commands to add graphics to a document

To add graphic to a document at the left margin use

<IMG SRC = "file ">

<IMG SRC = "butterfly.gif ">

To center a graphic on a line by itself use:

<CENTER><IMG SRC = "line.gif ">
</CENTER>

To align a graphic at the right margin use

<IMG ALIGN=RIGHT SRC = "border.gif ">

To center a graphic at the right margin within a paragraph use

<P><IMG ALIGN=RIGHT SRC =
"logo.gif ">Text of paragraph </P>

Lesson 3: Adding Graphics

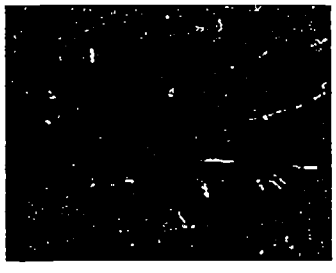
Make the following changes to add graphics to your WhySave.html document:

Try It

 Adds a Blank Line

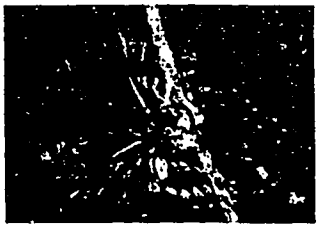
Colorful line replaces the HR

Graphic added to a paragraph



```
<HTML>
<HEAD>
<TITLE>Why Save the Rainforest?</TITLE>
</HEAD>
<BODY>

<IMG ALIGN=RIGHT SRC="info.gif">
<BR>
<H1 ALIGN=CENTER>Why Rainforests are Important!</H1>
<BR>
<CENTER><IMG SRC="fineline.gif"></CENTER>
<BR>

<H3>
<P><IMG ALIGN=LEFT SRC="frog.gif">
Tropical rainforests are by far the richest habitat on Earth. As many as 30 million species of plants and animals - <EM> more than half of all life forms </EM>- live in tropical rainforests. At least two-thirds of the world's plant species, including many exotic and beautiful flowers, occur in the tropics and subtropics.</P>
<BR>
<BR>
<BR>
<CENTER><IMG SRC="fineline.gif"></CENTER>
```

Try It!



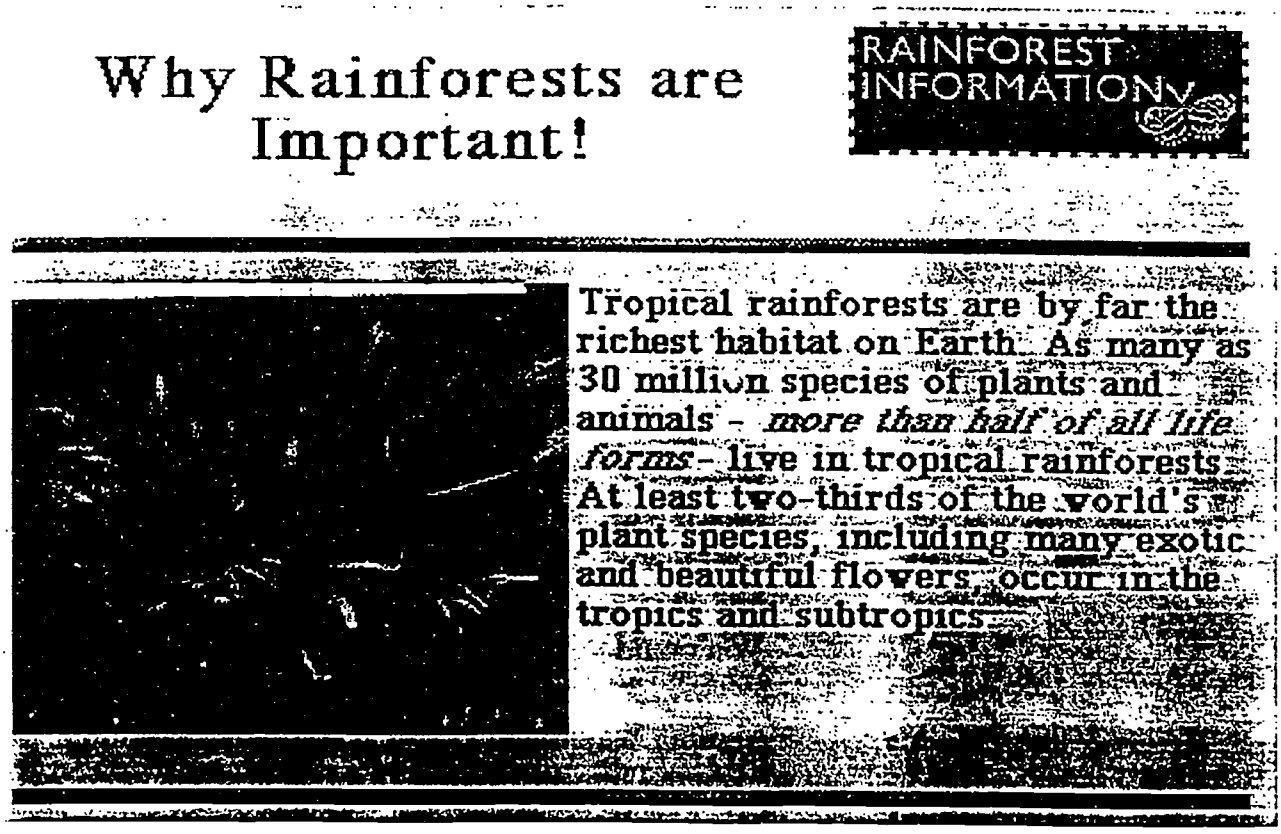
Note: All of the <HR SIZE=4> tags have been changed to <IMG SRC = "fineline.gif">

```
<BR>
<BR>
<BR>
<P><IMG ALIGN=RIGHT SRC="Rosy
Periwinkle.gif">As greed continues to destroy rainforests.
plant species that might contain medicines to cure AIDS and
other diseases are tragically becoming extinct. One species
alone - he rosy periwinkle. found only in the tropical forests of
Madagascar - is the source of 80 alkaloids used to treat leuke-
mia and Hodgkin's disease. </P>
<BR>
<CENTER><IMG SRC="fineline.gif"></CENTER>
<BR>
<P><IMG ALIGN=LEFT SRC=
"barren_forest.gif">Rainforests are part of the global
weather system. Destroying them alters the hydrological
cycle - causing drought, flooding, and soil erosion in areas
where such events were previously rare. The cutting of forests
also changes the albedo or reflectivity of the earth's surface.
which in turn alters wind and ocean current patterns, and
changes rainfall distribution.</P>
<BR>
<CENTER><IMG SRC="fineline.gif"></CENTER>
<BR>
<P><IMG ALIGN=RIGHT SRC="butterfly.gif">
The Earth is your home. Take time to think about the follow-
ing facts:
<OL>
<LI>There aren't any others for sale or rent anywhere in
the neighborhood.
<LI>The alarms are going off. Better safe than sorry: many
changes are already irreversible.
<LI>The people and other beings on this planet are your
family.
<LI>It's time to save your own family.
<LI>It's time to save yourself.
</OL>

<CENTER><IMG SRC="fineline.gif"></CENTER>
<BR> </BODY</HTML>
```

Check HTML Folder

Netscape will look for the graphics in the same folder or directory as your WhySave.html.

Open Netscape and view your WhySave.html file. The changed document should appear as follows:



Experiment on your own!

Experiment with the placement of graphics within your document. You may find many different ways to display text.

Browse through the Internet looking for different ways that graphics have been used to enhance an article.

Lesson 3: Adding Graphics

More about Graphics:

You may wonder how to gather graphics for your web document. There are a number of ways to go about this.

GraphicConverter

- Create your graphics using a software tool such as GraphicConverter. It has a number of paint and draw tools that may be used to create your original graphics. Other software packages like Adobe Photoshop or Adobe Illustrator may be used to develop very fine work. Be sure to save your work and then convert the final copy to a gif format.

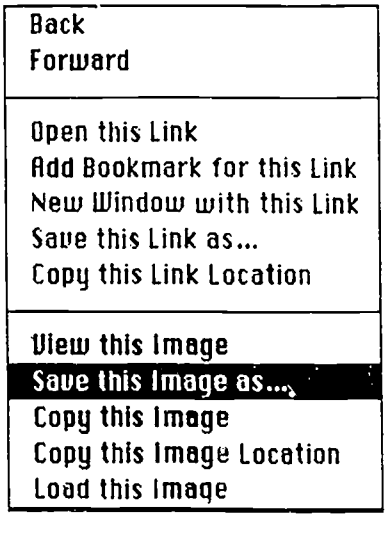
Color Scanner

- Use a full-bed color scanner like the HP ScanJet to scan pictures from books or your own photos. Be sure to watch the size (width and length) of your picture while you are scanning so that the final gif is not too large on a Netscape screen.

QuickTake Camera

- Use an Apple QuickTake camera. If you have the camera, the processing of these pictures is very simple and inexpensive. Just convert them to gif and you will have a pretty good Netscape image. You could even put your picture on the Internet.

Download from the Internet



- Another way to get graphics is to download them from the Internet itself. This is a very easy process. Most of the graphics on the Internet are not copyrighted and downloading them is acceptable.

To download from the Internet:

- Hold your mouse down and click on a graphic.
- When the pop-up menu appears, drag to the option Save this Image as...
- Choose your HTML Folder and save the image onto your hard drive.

Lesson 3: Summary

HTML Commands:

Some of the HTML commands that were covered in this lesson as as follows:

<IMG SRC = butterfly.gif">

<CENTER> <IMG SRC = "fineline.gif"> </CENTER>

<IMG ALIGN=RIGHT SRC = "border.gif">

<P><IMG ALIGN=LEFT SRC = "trees.gif">

Some of the HTML issues concerning graphics:

Save as GIF

•For uniformity and accessibility on the Internet, graphics should be saved in a gif format.

Use GraphicConverter

•A utility program such as GraphicConverter or Gif Converter may be used to convert pict, eps or jpeg files to gif.

Create your Own Graphics

•Graphics may be produced through the use of draw or paint packages such as Adobe Photoshop, a color scanner, or a QuickTake camera. You can download gif and jpeg files from the Internet itself.

Lesson 4: HTML Links

Branching out!

The World Wide Web is famous for its branching features. One minute you can be in Paris looking at the Louve and the next minute be in a virtual tour of the Great Wall just by the click of a button.

HTML Links:

After this lesson you will be able to:

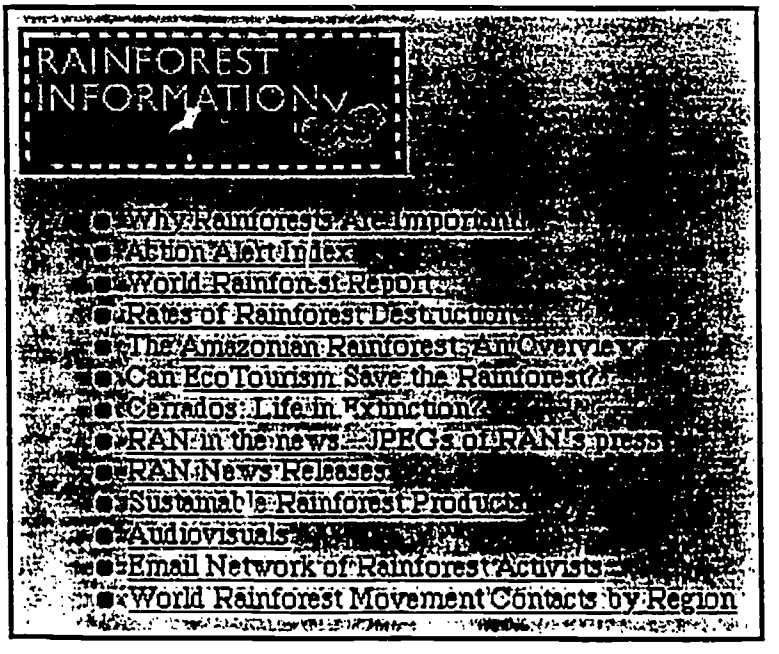
- Add links to your document so that it will branch to a particular paragraph within the document
- Add links to your document so that it will branch to another Internet file.
- Add a link that will play a QuickTime movie.
- Add a link to an e-mail form.

How links work:

Articles or groups of articles are often organized into a table of contents format so that an Internet viewer may see a sequence of articles and choose one by clicking on a name or a picture. For example:

An Unnumbered List with Links

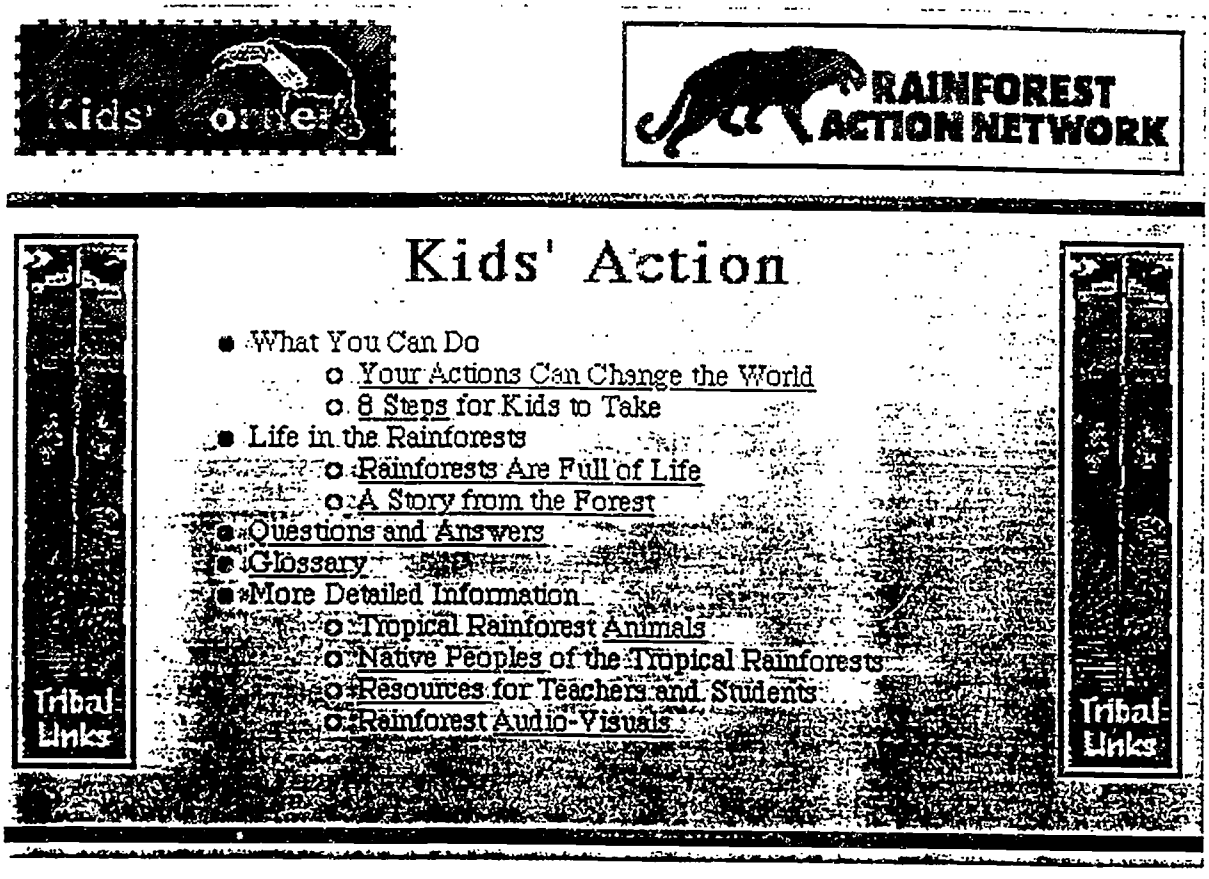
Underlined words represent links to web pages on the Internet:



Lesson 4: HTML Links

HTML Links:

If you were viewing the Kids' Action web page, the text would appear in as many as three colors, i.e. black, purple and blue.



HTML Text Colors:

- Black text has no links associated with it.
- Blue text indicates that a link to a paragraph in the same document or to another document or file on the Internet can be reached by clicking on the text.
- Purple text indicates that the user has already accessed the link at least once.

Lesson 4: HTML Links

Formatting text with links:

To add a link to a document:

1. Begin with <A HREF = "location or file name">
2. Add the words or words on which the user should click. For example, "What You Can Do"
3. End with a </A>.

Here are a few examples:

Example HTML link references:

Links to a text file in the current folder or directory:
<A HREF = "Kids_Action.html">Kids' Actions </A>

Links to a QuickTime movie in the current folder:
<A HREF = "Earth_Rotating.MPG">Earth Video</A>

Links to a file on the Rainforest Action Network web server:
<A HREF = "http://www.ran.org/ran/ index.hmtl"> Information about Rainforests </A>

Links to a file on the TAMU web server:
<A HREF = "http://tam2000.tamu.edu/ jobs.html">TAMU Jobs </A>

Links to an e-mail form:
<A HREF = "mailto:LRay@tenet.edu">Click here to Send E-mail </A>

Links to a paragraph in the current file:
<A HREF = "#Effects">Effects of Deforestation</ A>

Lesson 4: HTML Links

Example HTML link references:

A graphic that is a clickable link to a file:
<A HREF="kids_action/index.html">
<IMG SRC="gifs/kids.gif"></A>

Let's examine the HTML code for the Kid's Action web page:

Kid's Action WebPage:
(See page 30)

Nested Lists with links to html documents:

```
<H1>Kids' Action</H1>
<UL>
        <LI>What You Can Do
        <UL>
                <LI><A HREF="actions.html">Your Actions
Can Change the World</A>
                <LI><A HREF="eight.html">8 Steps</A> for
Kids to Take
        </UL>
        <LI>Life in the Rainforests
        <UL>
                <LI><A HREF="life.html">Rainforests Are
Full of Life</A>
                <LI><A HREF="penan_story.html">
A Story from the Forest</A>
        </UL>
        <LI><A HREF="questions.html">Questions and
Answers</A>
        <LI><A HREF="glossary.html">Glossary</A>
        <LI>More Detailed Information
        <UL>
                <LI>Tropical Rainforest
<A HREF="animals.html">Animals</A>
                <LI><A HREF="native_peoples.html">Native
Peoples</A> of the Tropical Rainforests
                <LI><A
HREF="sources_kids.html">Resources</A> for Teachers and
Students
                <LI>Rainforest
<A HREF="av_classroom.html">Audio-Visuals</A>
        </UL>
</UL>
```

Lesson 4: HTML Links

Activity 1:

Let's add a table of contents with HTML links and some new graphics into paragraphs after the title in the WhySave.html file as follows:

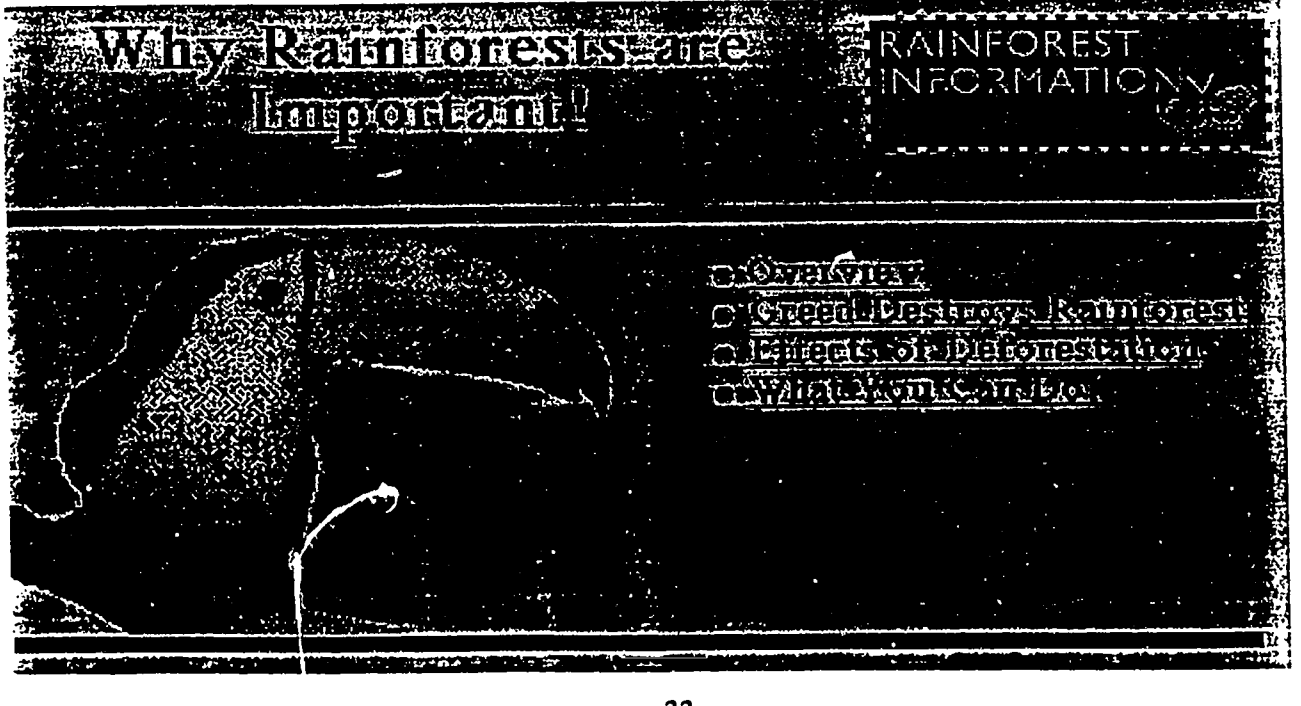
Try It!

```
<H1 ALIGN=CENTER>Why Rainforests are Important!</
H1>
<H3>
<BR  CLEAR=ALL>
<CENTER><IMG SRC="fineline.gif"></CENTER>
<IMG ALIGN=LEFT  SRC = "Toucan.gif">

<UL>
<LI><A HREF = "#Overview">Overview</A>
<LI><A HREF = "#Greed">Greed Destroys Rainforest</A>

<LI><A HREF = "Effects.html">Effects of Deforestation</
A>
<LI><A HREF = "You.html">What You Can Do!</A>
</UL>
<BR CLEAR=ALL>
<CENTER><IMG SRC="fineline.gif"></CENTER>
```

 # -- Links to the current document

No # -- Links to another document

Save your work and open the file in Netscape. The file should appear as follows:



Lesson 4: HTML Links

Adding Overview Link:

You may have noticed that the links do not work yet. Let's add the link in the first paragraph so that the Overview link will work.

Reference links in the same document contain two parts:

1. The link to a specific location.
   <A HREF = "**#Overview**">Overview</A>

2. Definition of the location.
   <A NAME = "**Overview**">

The name in double quotes must be exactly the same. Note that a # is not used in the definition of the location.

Define the location of the link

In your WhySave.html file. you will add the following reference between the table of contents and the first paragraph as follows:

Try It

```
<A NAME="Overview">
<P align=center>Overview</P>
<IMG ALIGN=LEFT SRC="frog.gif">
Tropical rainforests are by far the richest habitat on Earth. As many as 30 million species of plants and animals - <EM> more than half of all life forms </EM>- live in tropical rainforests. At least two-thirds of the world's plant species, including many exotic and beautiful flowers, occur in the tropics and subtropics.</P>
```

Save your work and reload your document in Netscape. Test your link by clicking on the word "Overview" in the table of contents. If there are no errors in your HTML commands, your screen should branch to the first paragraph.

Lesson 4: HTML Links

Now that you have added a link to the first paragraph in WhySave.html, let's add a link from the paragraph back to the table of contents.

This link will be a graphic file, **pagetop.gif.** To create a link using a graphic:

Using a graphic as a link:

1. Include the graphic in a reference statement:
   <A HREF = "#pagetop">
   <IMG SRC= "pagetop.gif">
   </A>

2. Define the location within the table of contents.
   <A NAME = "pagetop">

In your WhySave.html file, add the following reference at the **end of the first paragraph** as follows:

many exotic and beautiful flowers, occur in the tropics and subtropics.**<A HREF="#Pagetop"><IMG SRC="pagetop.gif"></A>**</P>

At the top of the document, define the location of the link as follows:

<H1 ALIGN=CENTER>Why Rainforests are Important!</H1>
<A NAME="Pagetop">
<BR clear=all>
<CENTER><IMG SRC="fineline.gif"></CENTER>

Save your work and try out your links in Netscape.

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Adding a link to the top of the page:

The first paragraph should now appear as follows:

Overview

Tropical rainforests are by far the richest habitat on Earth. As many as 30 million species of plants and animals - *more than half of all life forms* - live in tropical rainforests. At least two-thirds of the world's plant species, including many exotic and beautiful flowers, occur in the tropics and subtropics.

Top of Page

Now you will need to add a link to the other paragraphs in the WhySave.html document. Looking back at what you have done so far, you have added a table of contents with a link to each paragraph as follows:

<UL>
<LI><A HREF = "#Overview">Overview</A>
<A HREF = "#Greed">
<LI><A HREF = "#Greed">Greed Destroys Rainforest</A>
<LI><A HREF = "Effects.html">Effects of Deforestation</A>
<LI><A HREF = "You.html">What You Can Do!</A>
</UL>

Now you need to define the location for the second paragraph. Remember to use the same name in the definition that is used in the HREF command.

Try It

Make the following changes to the second paragraph:

```
<A NAME="Greed">
<P ALIGN=CENTER>Greed Destroys Rainforests</P>
<P>
<IMG ALIGN=RIGHT SRC="Rosy periwinkle.gif">
As greed continues to destroy rainforests, plant species that might contain medicines to cure AIDS and other diseases are tragically becoming extinct.
One species alone - the <EM>rosy periwinkle<EM>, found only in the tropical forests of Madagascar - is the source of 80 alkaloids used to treat leukemia and Hodgkin's disease. <A HREF="#Pagetop"><IMG ALIGN=TOP SRC="pagetop.gif"></A></P>
```

Add a link back to the table of contents:

Make sure that your links to and from this paragraph are working properly.

For the last two paragraphs, you will learn to link from the table of contents to separate documents. To add a link to another document use the following HTML command:

<A HREF = "Effects.html">Deforestation </A>

Note: # symbol is omitted when the link is to a different document.

Try It

Cut the third paragraph from the WhySave.html file, open a new file, and paste the text. Save the new file as **Effects.html** into the HTML Folder. Be sure to save your WhySave.html file.

Lesson 4: HTML Links

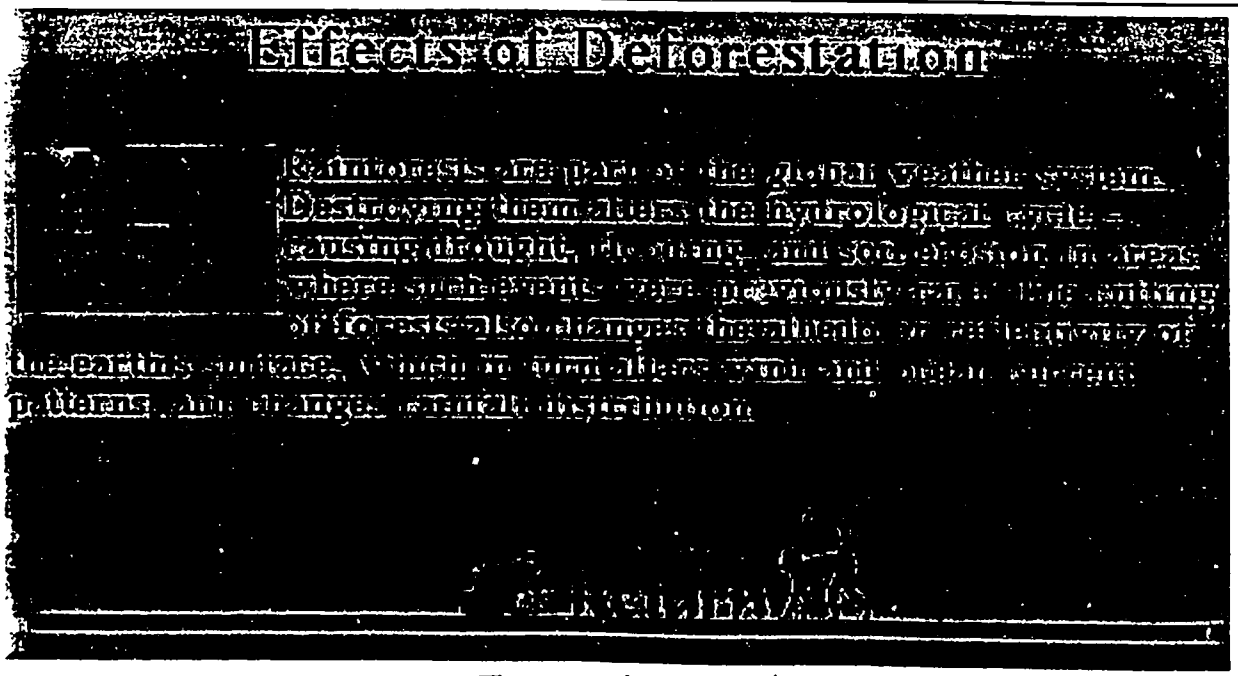
Making a link to a different document:

Try It

Make the changes in effects.html as indicated below:

```
<HTML>
<HEAD>
<TITLE>Effects of Deforestation</TITLE>
</HEAD>
<BODY>
<H1 ALIGN=CENTER>Effects of Deforestation</
H1>
<BR><H3>
<IMG ALIGN=LEFT SRC="barren_forest.gif">
<P>Rainforests are part of the global weather system.
Destroying them alters the hydrological cycle - caus-
ing drought, flooding, and soil erosion in areas where
such events were previously rare. The cutting of for-
ests also changes the albedo or reflectivity of the
earth's surface, which in turn alters wind and ocean
current patterns, and changes rainfall distribution.<P>
<BR>
<CENTER><A HREF="WhySave.html"><IMG
ALIGN=TOP SRC="Return.gif"></A></CEN-
TER>
</BODY></HTML>
```

Add a return to your WhySave.html file:



Lesson 4: HTML Links

Activity 7:

Cut the last paragraph from the WhySave.html file, open a new file, paste and save as **You.html**.

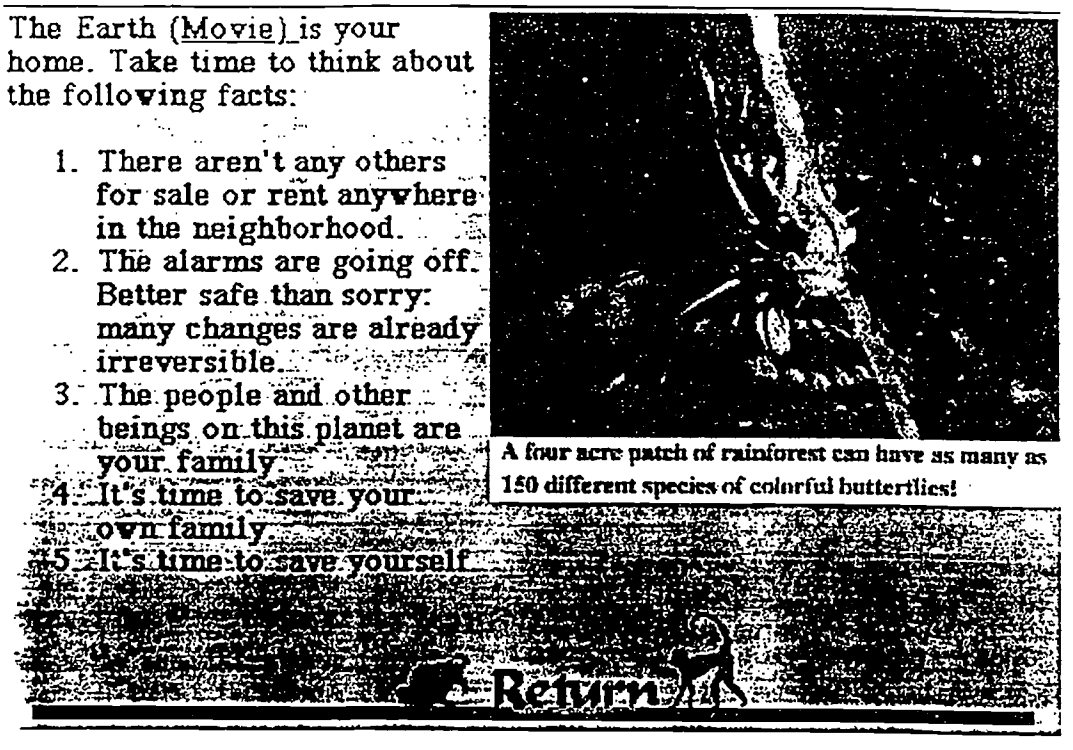
Make the changes indicated in bold below:


```
<HTML>
<HEAD>
<TITLE>What You Can Do!</TITLE>
</HEAD>
<BODY>
<H1 ALIGN=CENTER>What You Can Do!</H1>
<BR>
<BR>
<CENTER><IMG SRC="fineline.gif"></CEN-
TER>
<BR>

<IMG ALIGN=RIGHT SRC="butterfly.gif">

<H3><P>The Earth<A HREF =
"Earth_Rotating.MPG">(Movie) </A> is your
home. Take time to think about the following facts:
<OL>
<LI>There aren't any others for sale or rent anywhere
in the neighborhood.
<LI>The alarms are going off. Better safe than sorry:
many changes are already irreversible.
<LI>The people and other beings on this planet are
your family.
<LI>It's time to save your own family.
<LI>It's time to save yourself.
</OL>
<BR><BR>
<A HREF = "WhySave.html"><CENTER><IMG
SRC = "Return.gif"  border=0></CENTER></A>
<BR CLEAR=ALL>
</BODY>
</HTML>
```

Add a link to a QuickTime movie:

Note: QuickTime 2.0 must be in your Extension Folder and you must have a movie player such as Sparkle to view movies using Netscape.

The You.html should appear as follows:



Movie clips on the Internet:

MPEG Format

For uniformity on the Internet among computer systems, movies should be saved in an MPEG or MPG format.

Sparkle 2.3.3

One utility shareware program designed to save QuickTime movies into MPG format is Sparkle 2.3.3 by Maynard Handley. It can be downloaded from the Internet.

QuickTime 2.0

QuickTime 2.0 must be installed on your hard drive in the Extension Folder in order to view movies. QuickTime 2.0 began to ship with System 7.5 but can be purchased from Apple Computers for use on earlier operating systems.

Lesson 4: HTML Links

Add an e-mail reference:

Your last task in this lesson is to add a reference so that you can receive your accolades about your great web page via the Internet.

To add a reference to receive e-mail:

1. <A HREF = "Mailto:Your e-mail address">
2. Text
3. </A> to end the reference.

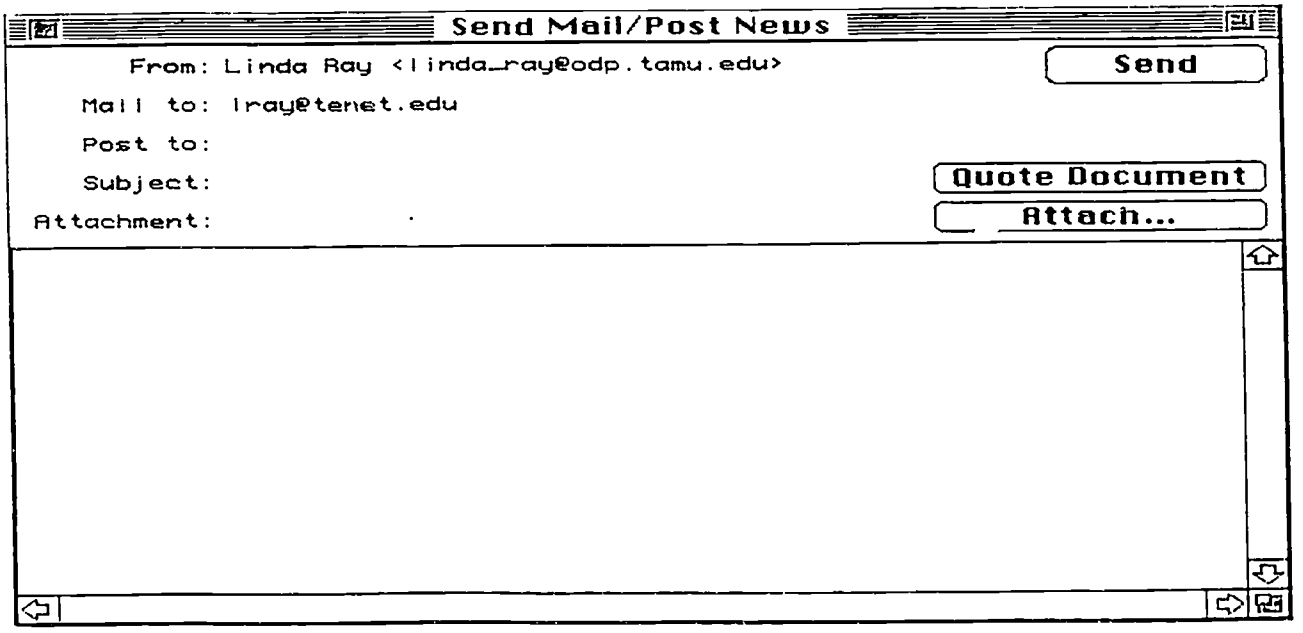
At the end of the WhySave.html file add the following substituting your address and name:

Try It

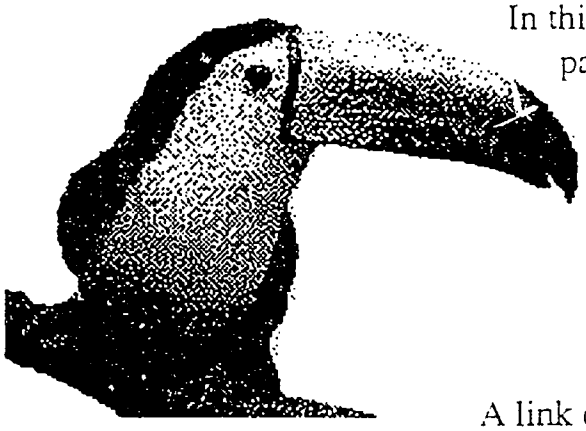
Mailto: Your Internet Address

```
<BR>
<CENTER>WebPage created by Your Name<P>
<A HREF = "mailto:lray@tenet.edu">Send comments
by clicking here</A>
</CENTER>
</BODY></HTML>
```

The following e-mail form is provided by Netscape.



Lesson 4: Summary



In this lesson you have learned to add links to web pages. Links can be but not limited to the following:

- A paragraph within the same document
- Another document or web location
- A QuickTime movie
- An e-mail form

A link consists of three parts:

1. The reference: <A HREF = "file or paragraph">
2. The name that appear in Netscape
3. The ending tag: </A>

Link to a different document:

Example: **<A HREF = "You.html">You are Important! </A>**

A link to the same document has two parts:

Link to the same document:

1. The reference tag: <A HREF = "#Trees"> Learn more about trees</A>
2. The target location: <A NAME = "Trees>

A link may include a clickable graphic or the reference to a movie:

Clickable graphic link:

<A HREF = "WhySave.html"> **<IMG SRC = "Toucan.gif">** </A>

Link to a movie:

<A HREF = "**Earth_Rotating.MPG**">Click here to view a video</A>

A link may be used to open an e-mail form in Netscape.

Link to a mail form:

<A HREF = "**mailto:lray@tenet.edu**"> Send comments</A>

Lesson 5: Getting your Pages onto the Web

Getting on the Web!

The World Wide Web servers are connected all around the world. After you download your files to your organization's web server, thousands of people will have access to your pages.

Objectives:

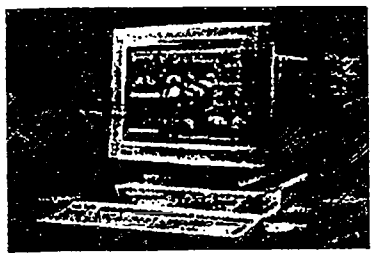
After this lesson you will be able to

- Check to be sure that all text and graphic files are completed and organized into one folder.
- Setup a meeting and communicate with the web server administrator about your plans for the web pages.
- Determine how your pages will link to and be a part of an overall web site for your organization.
- Use a utility program such as **Fetch** to download the files to a web server.
- Test the files in Netscape after they have been downloaded to the web server.
- Make revisions, download revisions, and communicate with the administrator when revisions have been made.

Introduction:

When you finish your graphics and text files, you will want to download them to a web server that is connected to the World Wide Web or Internet.

Web servers are typically Unix workstations that use a different operating system than your Macintosh or PC. Consequently, you will need to transfer your files to



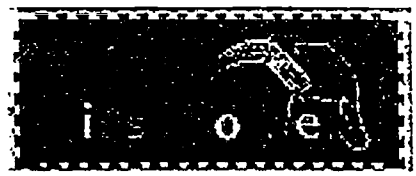
Unix Server

Drop Folder is Password Protected

the Unix web server using a utility program called Fetch.

Before you use Fetch, talk to the web server administrator about your web pages. Your pages may be a part of the larger group of pages that represent your organization.

For example in our rainforest example, a different group of people may have developed the Rainforest Information pages while another group developed the pages for Kids' Corner.



The web server administrator will create a folder or directory for you to use as a droping-off place for your files. You will also be given a password for this folder. You will be able to put files into this folder and to get files from it later.

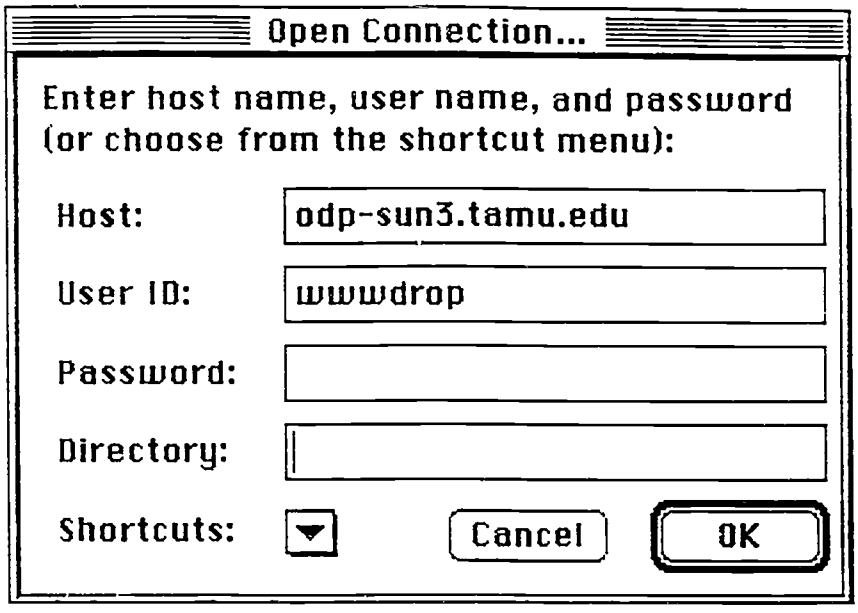
If you have not ever used Fetch, you may find it a very handy way to download files. It may be used to download or transfer files from any FTP site on the Internet.

Let's turn our attention now to the use of Fetch! Unless you are connected to a network or the Internet, you will not be able to open Fetch to see how it operates However, the information may help you when you do become connected.

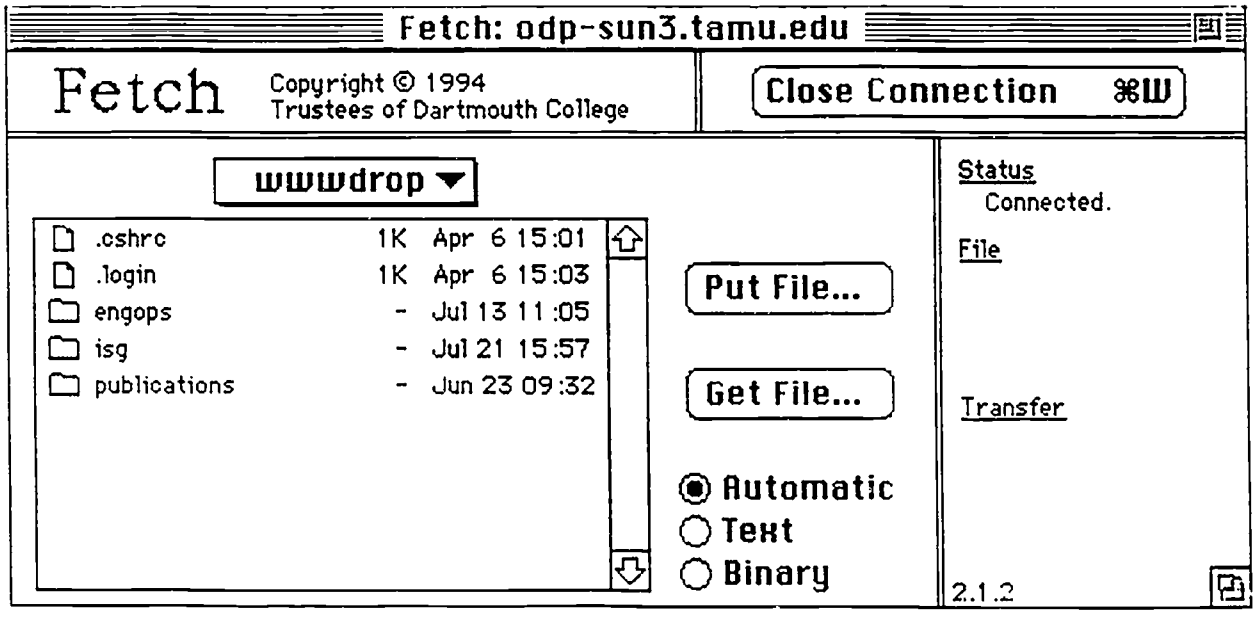
Lesson 5: Downloading Files to a Web Server

Fetch 2.1

When you open the Fetch application, you will see an Open Connection... similar to the one below. You will need to know your Host, User Id and Password in order to proceed.

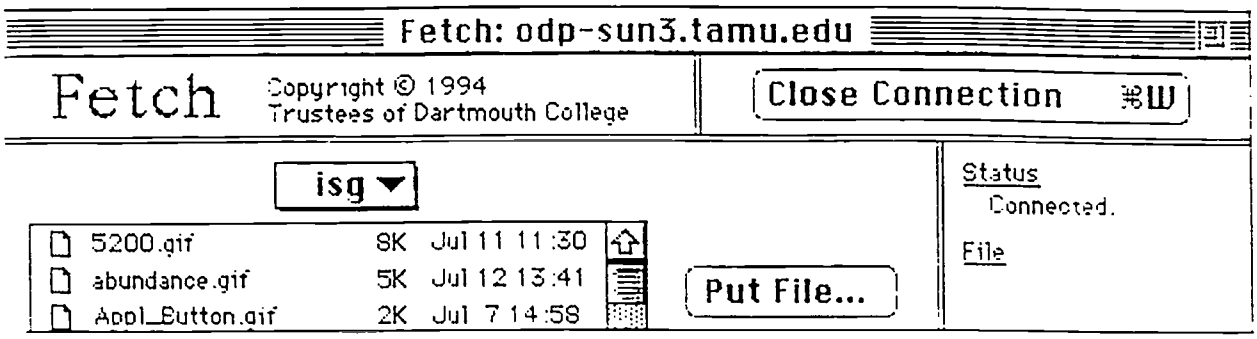


After the connection has been made, you will see the Fetch dialog box as shown below. Double-click on the folder into which you want to place the files.



Put File:

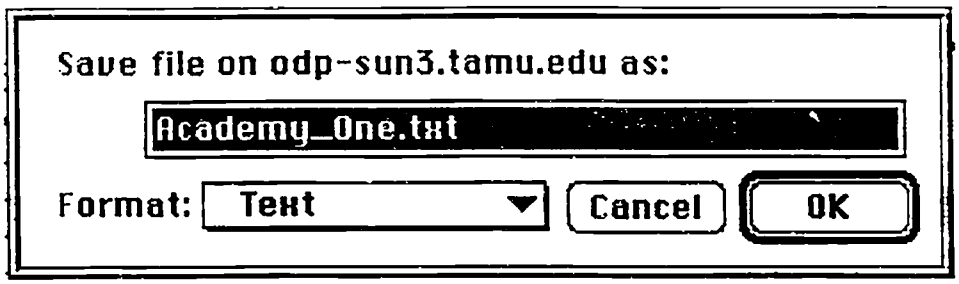
When you want to transfer a file to the drop folder, click on the **Put File** button. Find the file and then choose the format for the file.



A Word of Caution:

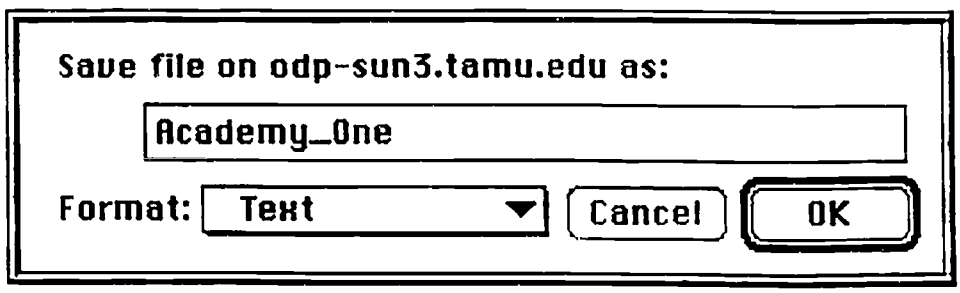
Note: Be very careful when you transfer these files. The names in the your HTML files must be exactly the same as the ones that you are transferring to the web server. Errors will result in Netscape if the file names or formats are not correct.

When you transfer text files, be sure that you remove the extension ".txt" that Fetch adds to the file before choosing Save.



Remove the txt extension added by Fetch:

Then click OK

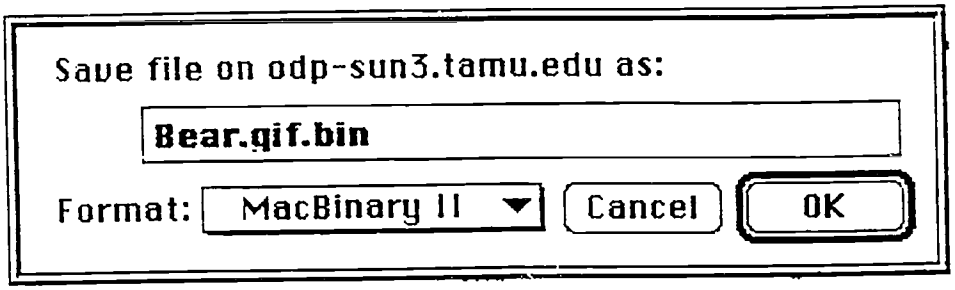


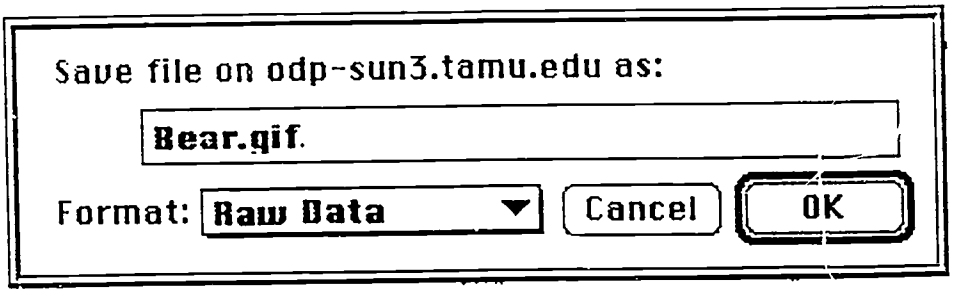
Lesson 5: Downloading Files to a Web Server

Choose Raw Data for Gif files:

When GIF files are added to the drop folder, be sure to choose **Raw Data** as the data type.

Change MacBinary II to Raw Data before clicking OK:





Notify the web server administrator:

Be sure that all of the text (.html) and graphic (gif) files are downloaded to the drop folder. Notify the web server administrator by e-mail that files are ready to be transferred.

Get File Command:

Later, you may lose a file from your hard drive or want to retrieve files from the drop folder. Open Fetch and use the Get File command.

Revisions:

When files are updated for your web page, you will correct them on your hard drive and then transfer the revised files using Fetch.

Lesson 5: Summary

In this lesson you have learned that:

- Files must be transferred to a web server through the use of a utility program such as Fetch.
- In order to use Fetch, you must be connected through a network connection.

Coordinate with web server administrator:

- Unless you are operating a web server yourself, you will need to coordinate your efforts with the web server administrator.

Setup a drop folder:

- A drop folder or directory and a password should be established.

Find out Host, User ID and Password:

- In order to use the drop folder, you must know:

1. Host
2. User ID
3. Password

Check file names:

- Files should be transferred with exactly the same name that is used in your HTML text files. For example, if you have the following reference in your WhySave.html file,

<A HREF = "**Greed.html**">Greed </A>

Accuracy counts:

Greed.html should be transferred exactly that way without the .txt extension added.

- GIF files should be saved as Raw Data.

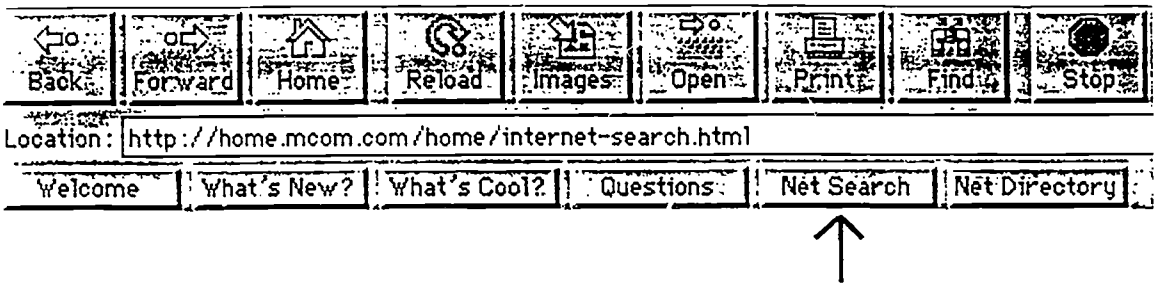
Get File Command:

- The Get File command may be used to retrieve files from the drop folder.

Net Search

By searching the Internet, you can find lots of information about careers. There are even a lot of careers that involve telecommunications and the Internet itself.

Take a little time to use the Net Search feature in Netscape.

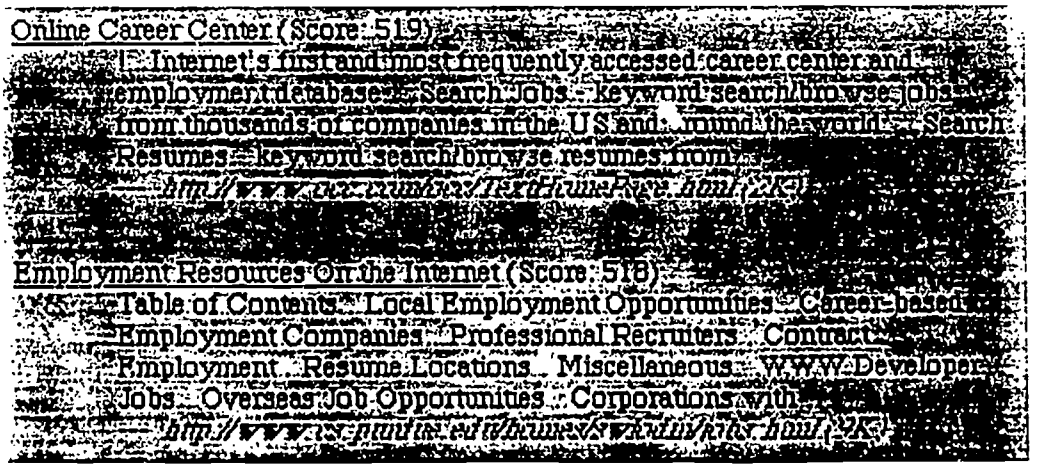


Try It!

Search for **Internet Careers:**

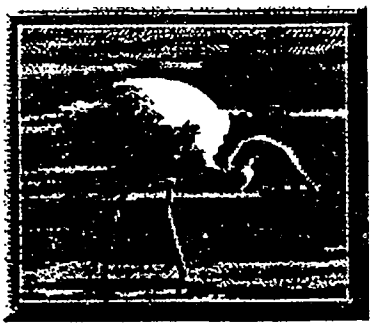
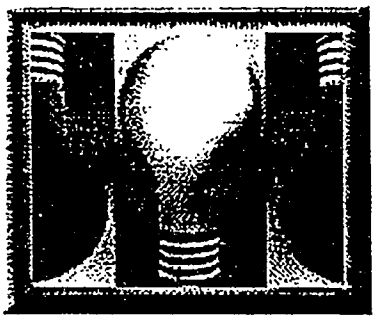
Type in a word or a combination of words in which you are interested in searching. For example, if you want to know more about Internet careers, simple type **Internet careers** and hit Return.

Netscape will go out onto the Internet and gather web sites that relate to that subject as follows:



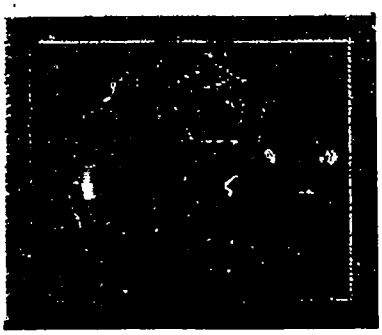
Happy Surfing!!

Sharing the Experience


The Internet is rapidly becomng a major educational resource for teachers and students. It allows us to gain up-to-date information about virtually any subject.

It is also a potentially powerful way to communicate and share our ideas and expertise with the world!



Linda Ray, College Station ISD
LRay@Tenet.edu
Internship: Ocean Drilling Program
College Station, Texas

Lisa Patton, Mentor

Education:Math and Science Education

- 1994-1995 SMART Catalog - Science and Mathematics Advancement and Resources for Teachers catalog, includes professional development resources.
- Adam und der Rechenriese - You can get a playable demo of the german MSDOS-program for 1st grade mathematics on this page. There are some videos of this program on this page too.
- Advanced Computer Tutoring Research - contains information about our research on the ACT Architecture for Cognition. There are links to the software for running cognitive models in ACT and you can read the manual on-line.
- Algebra Group [new] - The list of members and publications of thealgebra group at the LUC.
- Annenberg/CPB Higher Education Project - funders of educational videos, videodiscs and CDROMS for higher education.
- ASPIRE - Alabama's Supercomputing Project to Inspire Research in Education
- **Commercial Mathematics Software Companies@** *(22)*
- **Commercial Mathematics Software Products@** *(4)*
- Computer as Learning Partner - on-going educational research effort at UC Berkeley dedicated to informing and improving middle school science instruction.
- Cornell Math and Science Gateway for Grades 9-12 - Cornell Theory Center Math and Science Gateway for secondary school students and educators provides an easy starting point for locating science and mathematics resources on the web.
- Doug Ingram's Astronomical Teaching Resources - describes some of the Astronomy courses taught at the University of Washington and provides links to the resources used in teaching the classes, such as readings, homeworks, labs, exams, syllabi, study guides, etc. Most files are either linked both as LaTeX and Postscript or as just ASCII.
- E-GEMS: Electronic Games for Education in Math and Science - a collaborative effort by scientists, educators, and professional video game and educational software developers who have come together to do research on and develop teaching materials that integrate video games and computer-based explorations with existing classroom practices. The aim of this research is to increase the proportion of children in Grades 4-8 who enjoy learning, mastering, and using underlying concepts of math and science.
- Eisenhower National Clearinghouse - provides K-12 teachers with a central source of information on mathematics and science curriculum materials and to encourage the adoption and use of such materials in order to support national goals to improve teaching and learning in mathematics and science.
- Explorer Home Page - The Explorer (Alpha) is part of a research and development effort to establish an on time and user friendly means of delivering a full range of information resources to educators and students.
- Family Math - to encourage underrepresented groups to enter careers that use mathematics.
- Franklin Institute Virtual Science Museum [*] - offers visitors a host of resources for science education as well as general information about the museum and its programs.
- Honest Open Logical Debate (HOLD) on math reform - Parents concerned with math curriculum in Palo Alto schools.
- Image Processing for Teaching - A group of people working at the Univeristy of Arizona developing Macintosh software packages devoted to teaching current Science and Math technology to this generation's student.
- Interactive Learning in Calculus and Differential Equations with Applications
- Lawrence Berkeley Laboratory's ELSI Project - Connect to the ELSI pages to see a discussion of basic vs. applied research. Presentation is esp suitable for middle and high school students and teachers.
- Lawrence Hall of Science - LHS is the public science center of the University of California, Berkeley and a leader in teacher education and curriculum development.
- **Magazine** *(1)*
- **Magnet Schools@** *(10)*
- **Math Courses@** *(1)*
- Mathematical Sciences Education Board
- Mathematics Archives - Contains software and other materials which can be used in the teaching of mathematics at the community college, college and university levels. Also contains links to other similar sites.
- Mathematics Experiences Through Image Processing (METIP) - The METIP project is developing digital image processing software to help motivate Jr. High and High School students to learn mathematics.
- MathMagic!
- MATHMOL --K-12 Mathematics and Molecules
- Minority Science & Engineering Program - The MSEP provides academic support for minorities entering science and engineering at the University of Washington. Included at this site are contact names, program description and sample worksheets and tests from our Academic Excellence Workshops.
- Monarch Watch - goals are to further science education, particularly in primary and secondary school systems, to promote conservation of monarch butterflies and to involve thousands of students and adults in a cooperative study of the monarch's fall migration.
- NASA Aerospace Education Services Program - designed to increase awareness and understanding of scientific research and technological development and their place in the world in which we live
- National Space Simulations Project - part of the National Public Telecomputing Network's Academy One program for schools.
- **NCSA Education Group** *(2)*
- **Organizations** *(1)*
- Pennsylvania Governor's School for the Sciences - Come learn about us, our students, and the exciting research projects they are working on!
- Poisson, poisson, poisson, je vous aime!

- Project Discovery
- Project INSITE [new] - A project of the National Science Foundation to constuctivist philosophy and the use of technology in K-12 science education.
- REACH Summer Science Camp - Lots of cool science experiments for kids and teachers as well as many links to other science pages for kids.
- Remote Sensing and GIS Information
- Rural Math Connections Project
- Science and Math Initiatives Database
- Science and Mathematics Education Resources
- **Science Education** *(3)*
- Scope, Sequence, and Coordination of Secondary Science
- Shell Centre for Mathematical Education
- Space Odessy - at Rochester Institute of Technology (RIT)
- The Hub - The Hub is an Internetworked resource for mathematics and science education funded by the Eisenhower Regional Consortia and operated by TERC on behalf of the Regional Alliance for Mathematics and Science Education Reform.
- The Learning Studio - The Exploratorium's multimedia and communications lab, now has "On Line" exhibits, resources for students, teachers and science enthusiasts.
- The Math Teaching Assistant - Various levels of addition, division, subtraction, multiplication, geometry, fractions, percentages,alegebra, and word problems
- The Regional Alliance
- UCI - Science Education Programs (SEP) [*] - Direct links to hundreds of selected K-16 multimedia science gems sorted by subtopic and grade level.
- Index - MATHEMATICS AND SCIENCE EDUCATION

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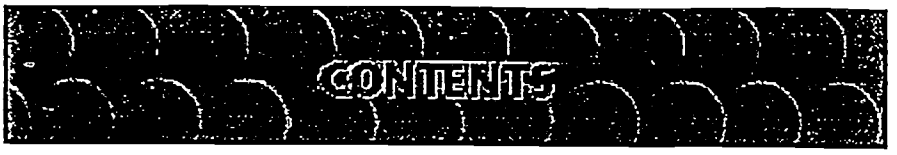
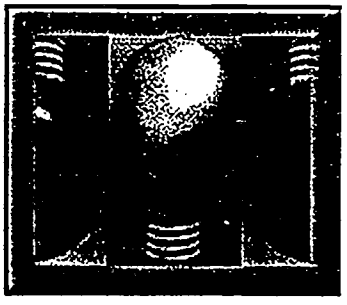
admin@yahoo.com



To learn more about a subject in *Microworlds*, click its button.

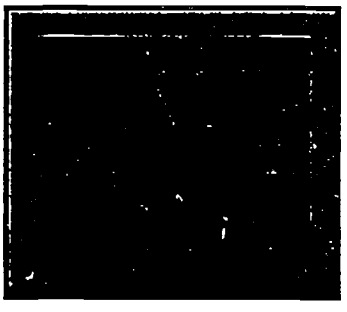


LIGHT CONVERSATION

Publish your ideas in *Microworlds* and communicate with other readers.

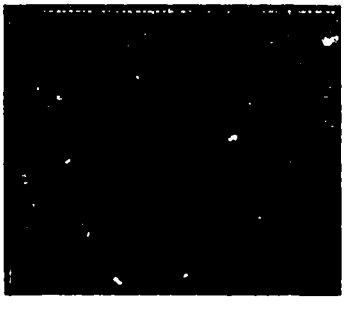
THE ADVANCED LIGHT SOURCE: A TOOL FOR SOLVING THE MYSTERIES OF MATERIALS

Electrons racing at nearly the speed of light? Find out how and why.



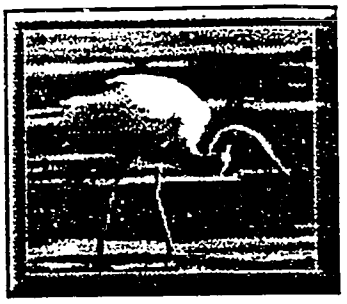
EXPLORING THE MATERIAL WORLD

What is it about a material that makes it hard, brittle, or a good electrical conductor? Powerful new tools like the Advanced Light Source help scientists probe the inner structure of materials.



KEVLAR--THE WONDER MATERIAL

A material so strong it stops bullets! Find out why Kevlar is so strong. And learn how research facilities like the Advanced Light Source can reveal the details of Kevlar's structure.

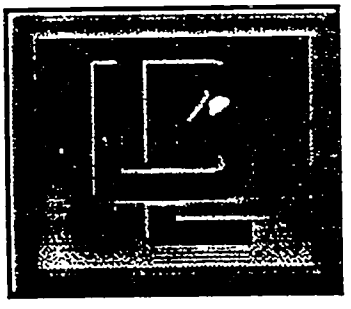


SELENIUM: A WINDOW ON WETLANDS

Wetlands are natural recycling plants, but they are often endangered by the waste people put there. Understanding the complex processes that enable a marsh to clean water, recycle nutrients, and immobilize toxic elements will help us protect these diminishing resources.

ASK A SCIENTIST

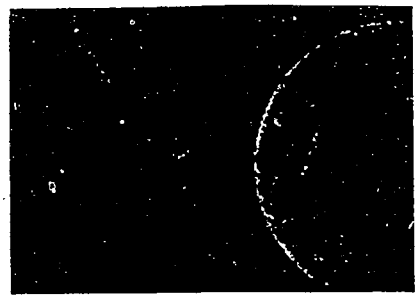
Have a question about what you've seen in *Microworlds?* Just type it on our "Ask a Scientist" page, and get an answer from an LBL scientist.



INFORMATION ABOUT THE PUBLISHERS

Contact us if you have questions about how we put together *Microworlds.*

Return to Page One of *Microworlds*

Project Galileo: Bringing Jupiter to Earth

Welcome to the Project Galileo Home Page. Galileo is currently enroute to Jupiter, with arrival scheduled for December 7, 1995. At that time, Galileo's atmospheric probe will plunge into Jupiter's atmosphere, relaying information on the structure and composition of the solar system's largest planet. The spacecraft's orbiter will then spend two years orbiting the giant planet, studying Jupiter and its moons, and returning a steady stream of images and scientific data.

What's New (July 11, 1995)

Latest News on Galileo

Orbiter Deflection Maneuver Status

Probe Release Status: Probe has been released
Galileo Messenger May 1995 The official Galileo newsletter
Galileo's New Telecommunications Strategy 7/95 Press Release
Latest Science Results:

- Dramatic views of the asteroids Gaspra and Ida (and Ida's moon, Dactyl).
- See the latest pictures from Comet Shoemaker-Levy 9 colliding with Jupiter.
- Take a look at the Earth-Moon flyby images.

Status Report: The monthly spacecraft health report (last updated July 1, 1995)
Trajectory Status: Where is the spacecraft today?

Galileo--Mission to Jupiter

Background material on the mission.

Deep Space Network Pictures Galileo's phone to home.
Galileo Messenger Articles Background articles from Galileo Messenger back issues
Galileo Preparing For Jupiter Arrival Technical paper presented at the last International Astronautical Federation meeting
Mission Overview A brief non-technical look at the mission.
Mission Plan Timelines A technical overview of mission events.
Navigation and Trajectory Info Galileo's road maps to Jupiter and its moons.
Press release archive
Spacecraft Pictures What does the spacecraft look like, anyway?

Frequently Asked Questions

How fast is the probe going when it hits Jupiter's atmosphere? Why doesn't Galileo use solar panels? Answers to these and other questions can be found in Galileo's FAQ. And, if you don't find your question answered, submit your own question (we will post and answer 2-3 each month as recent additions to the FAQ).

Related Home Pages

- Comet SL-9 Home Page
- JPL Home Page
- NASA Home Page
- NASA Spacelink (educational information)
- National Space Science Data Center is a repository for Galileo data, images, and experiment background
- Other JPL Flight Projects
- Planetary Data System: See Welcome to the Planets for info on Galileo and Jupiter.
- Principal Investigator Home Institutions
- STS-34 The shuttle mission that launched Galileo

or questions about content please contact
JPL Public Information Office

Phone: (818) 354-5011
newsdesk@jpl.nasa.gov

Comments and suggestions about this home page may be directed to
askgalileo@gllsvc.jpl.nasa.gov

NASA
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

v

Return to "What's New at *The Electronic School* on the Web"

Tour the World Wide Web with *The Electronic School*

Websurfing for Beginners

Feeling lost in cyberspace? Why not let *The Electronic School* take you on a cruise through the Internet's World Wide Web. We've tailored our ports of call for educators and students. Just click on the hyperlinks underlined in blue. Bon voyage!

- Our tour begins at the U.S. Department of Education in Washington, D.C., where you can find information about the department and its programs, policies, and staff. While you're there, read up on recent legislation and the department's initiatives in areas including technology and school-to-work transition.

- Next, try AskERIC, the Educational Resources Information Center service, housed at Syracuse University. You can search ERIC databases (including abstracts of education magazine articles), retrieve lesson plans, and browse AskERIC's collections.

- Don't forget to stop by the Library of Congress to search online catalogs and databases, view Library of Congress Exhibits (such as "Scrolls from the Dead Sea" and "Rome Reborn: The Vatican Library and Renaissance Culture"), and get up-to-date legislative information from the U.S. Congress.

- Why not take a virtual tour of the White House, where you can say Hi to the First Family and Socks the Cat. After you've signed the guest book and exchanged the proper pleasantries, you can use this site as a jumping-off point to get information from Executive Branch agencies.

- The Decisions of the U.S. Supreme Court are made available on the Internet the same day they are handed down, even before you can read about them in the newspaper. Cornell Law School's Legal Information Institute helps you navigate through them.

- Interested in outer space? You don't have to be an astronomer or an astronaut to get the latest far-out images or Space Shuttle information. NASA Spacelink is specifically tailored for classroom instructional use and provides information, news, images, lesson plans, and software. For up-to-the-minute goings-on in space, check out Today at NASA. And don't forget to visit the Hubble Space Telescope, where you can look at the universe through some pretty incredible corrective eyewear. You can also tour NASA's picture archives of that magnificent celestial fender-bender of the summer of 1994, the Comet Shoemaker-Levy collision with Jupiter. Finally, check out more and even more educational resources from various NASA sources.

- What's the current weather like? How about the latest forecast? Now you can bypass your local TV weatherman and get weather information when you need it. Try MIT's weather forecasts map, which displays current weather conditions for the United States and allows you to click anywhere on the map to get the National Weather Service forecast for that location. What does the weather look like from orbit? To find out, take a look at the current weather satellite images, courtesy of the University of Illinois.

- If you need to catch up on the news, stop by TIME Magazine, where you can read the weekly newsmagazine in full text as soon as it hits the newsstands.

- If you've never visited Paris and strolled through the Louvre art museum, here's your chance. Voila! Le WebLouvre in Paris is an online virtual exhibit where you can view the famous paintings and even take a tour of Paris. If the trans-Atlantic link is slow, try the mirror sites in North Carolina or California instead.

- How far does the Internet reach? Well, let's do some traveling and see for ourselves. First, let's go to

School Section
BRITISH OVERSEAS DEVELOPMENT

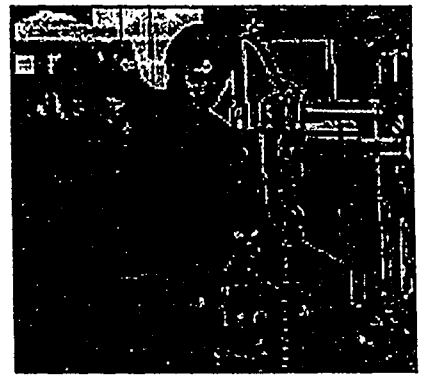
The material that follows has been provided by Overseas Development Administration

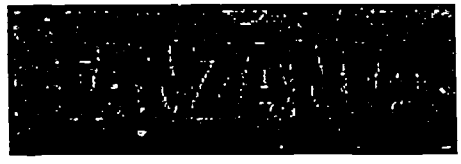
Country file: Tanzania

This fact file looks at Tanzania in east Africa: its climate and landscape, its agriculture and trade, its health and education services, and the 28 million people who live in this mainly rural nation

Left: Eleven-year-old John carefully paints a figurine. John Left home when both his parents were killed in an accident. With nowhere else to go he took a train to the coast and found himself homeless. Now he lives at the St. Albans Centre, a hostel and training centre for young boys, set up in Dar es Salaam with help from the ODA. Photo: ODA.

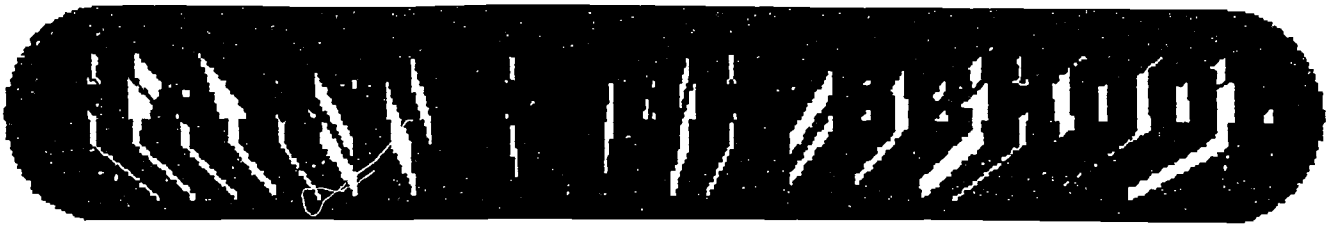
Right: Mechanics upgrade railway machinery. A World Bank-led project is financing the transformation of the Tanzania Railways Corporation (TRC). Work includes improving information and finance systems, as well as repairing old trains and rolling stock. The ODA is providing £9 million towards the costs. Photo: ODA.





As countries go, Tanzania is still quite young. This east African country was formed in 1964 when Tanganyika on the mainland and the islands of Zanzibar joined to form a united republic.
The country is four times the size of Britain, but with 28 million people has around half the population. Many people live in the south or around the country's borders, leaving large open spaces in the interior.
Most adults work on the land, as farmers or agricultural labourers. some farmers are wealthy, but many are poor.
According to one measure - gross national product (GNP) or the amount a country earns and produces every year - Tanzania is one of the poorest countries in the world.
Many roads and railways are in a poor state and the government can't afford large-scale repairs.
Instead, the government is concentrating its efforts on basic services for its people. There are plans to improve schools and health clinics, and agricultural specialists are helping farmers grow more crops. More tourists are visiting Tanzania, attracted by beauty spots such as Mount Kilimanjaro and the country's wildlife - and providing welcome revenue for the country.

- Transport
- Agriculture
- Landscape
- Family life in Dar es Salaam



Welcome to the Wm. S. Hart High School Web Site!!!

 School & History

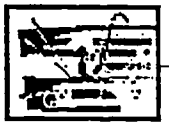
 Sports

 Faculty

 Student Groups

 Academics

 Cool Stuff

 The Arts

 Feedback

Check out the new Alumni Page!!!

HELP

Hart Web Site Maintained by Jesse Christensen

You are the 860th visitor since July 1, 1995

 Top of Page

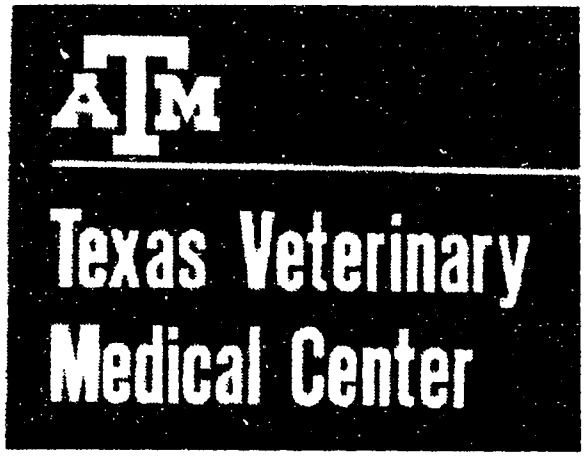
Student Groups

Pages for the groups have not yet been developed.
Hopefully, this will change over the summer.
If you 're willing to help out, please contact us.

- ASB (Associated Student Body)
- NHS (National Honors Society)
- Drama Club
- CSF (California Scholarship Federation)
- Academic Decathlon
- Team Calculus

George Weissenberger

Texas A&M University Veterinary Medicine,
College Station Texas



Dr. Jorge Piedrahita - Mentor
Texas A&M University Veterinary Medicine
College Station, Texas 77843

George Weissenberger
Pre-Service Teacher
Texas A&M University

Name:	George M. Weissenberger
Internship:	Texas A&M University, Veterinary Anatomy and Public Health
School:	Texas A&M University
Primary Subject:	Biology
Activities:	* Calculate the melting temperature for a sequence of DNA using a simpie formula * Determine if one sequence of DNA has a higher or lower bonding energy then another sequence of DNA * Play a little game utilizing these skills
Summary:	The student will have an understanding of how bonding energy works to hold a strand of DNA together. They will understand the process of denaturation and renaturation and how temperature effects these processes. Finally, the students will be given a simple formula by which they can calculate the melting temperature of any segment of DNA
Resources:	DNA Replication, second edition, Arthur Kornberg, W.H. Freeman, 1992.

Curriculum Implementation Plan

STUDENT: George Weissenberger

MENTOR: Dr. Piedrahita, Dept. of Veterinary Anatomy and Public Health, TAMU

GOAL: To help students understand how the double helix structure of DNA is held together and how it can be broken apart and rebonded.

OBJECTIVES:

1. The student will understand the concept of bonding energy.
2. The student will understand the complementary structure of DNA.
3. The student will understand the process of denaturation and renaturation.
4. The student will be able to calculate the melting temperature of various sequences of DNA.

I. The Hunter-Russell Model

A. Introductory Activities

1. Focus (30 sec.)

Today, we will be learning what holds the DNAs double helix structure together and how it can be broken apart and put back together.

2. Goal (30 sec.)

By the end of the period everyone should be able to use a simple formula to determine the melting temperature for a segment of DNA. The melting temperature is the temperature at which DNA begins to break apart when heated.

3. Objectives (1 min.)

On the next test, you will be given several segments of DNA and asked to figure out the melting temperature for them. Also, you will have to determine which ones have a higher and lower bonding energy. You will also have a bonus question will you will be given a temperature and asked to write a DNA sequence which will melt at this temperature.

4. Purpose-Motivation (5 min.)

The ability to break double stranded apart into single stranded DNA, and rebind single strands into double strands is vital to recombinant DNA technology. In real life this process is crucial to the cells functions in replication, transcription and recombination. In crime labs this process is gaining reputation when the breaking and rejoining of DNA is used in PCR. PCR is the process which was used in the O.J. Simpson trial. During this process a single piece of DNA

taken from a blood, skin, hair follicle, saliva, or fingerprint can be heated up until it breaks apart. Since it breaks apart in a mixture of nucleotides, each half remakes a new half making two copies of the DNA instead of one. After it is re-heated and cooled again it doubles to four and so on until after 40 cycles you can have over 1 million copies of the one original piece of DNA. This gives one plenty of DNA to run other tests on it such as gene sequencing to determine the genetic fingerprint of the DNA. Like fingerprints, DNA fingerprints are different for every person.

5. Recalling (3-4 min.)

Do a quick review of DNAs basic structure. Ask a series of questions such as: How many nucleotides are there in DNA? Can someone name all or one of the four nucleotides? Can someone tell me which nucleotides bind to which base? Tell about the sugar-phosphate backbone of DNA.

B. Presenting (20 min.)

Hydrogen Bonds

Note, there are two hydrogen bonds between Thymine and Adenine and three hydrogen bonds between Cytosine and Guanine. These hydrogen bonds are the only attractive forces between the two polynucleotides of the double helix and serve to hold the

structure together.

Bonding Energy

GCGCCCGGCCGGGCCC
CGCGGGCCGGCCCGGG

Because a Guanine-Cytosine base pairing is held together by three hydrogen bonds, it has a higher bonding energy and is harder to break apart.

ATATTTAATATTTAAATTT
TATAAATTATAAATTTAAA

Because an Adenine-Thymine base pairing is held together by only two hydrogen bonds, it has a lower bonding energy and is easier to break apart.

Therefore, a section of DNA with a long strand of G-C base pairs, is stronger then a long section of A-T base pairing. Because of these differences, varying segments of DNA will break apart at different times and temperatures.

Denaturation

Denaturation is the term used to describe the process by which the double helix structure breaks apart when heated at or above, its melting temperature. A strand of DNA which is denatured is no longer double-stranded, but rather is now single-stranded because all the hydrogen bonds between the complementary strands have been broken.

Renaturation

Melting can be reversed even after the two chains have been completely denatured, i.e. separated. When complementary chains are incubated at a temperature below the Tm, they begin to

reassociate and eventually reform the original helix.

Melting Temperature of DNA

The two strands of a DNA helix readily come apart when the hydrogen bonds between its paired bases are disrupted. This can be accomplished by heating a solution of DNA or by adding acid or alkali to ionize its bases. The unwinding of the double helix is called melting because it occurs abruptly at a certain temperature. The melting temperature (Tm) is defined as the temperature at which half of the helical structure is lost.

A simple formula for determining a DNAs melting temperature is:

Tm = (#G + #C x 4 degrees Celsius) + (#A + #T x 2 degrees Celsius)

Sample Problem

5'- CGAATTCGAACACGCA - 3'

Tm = (3+5 x 4) + (6+2 x 2)

= (8 x 4) + (8 x 2)

= (32) + (16)

Tm = 48 degrees Celsius

Thus, the above strand of DNA will begin to break apart from its complementary strand at 48 degrees Celsius.

When DNA is heated up in a process called thermal melting, the DNA's double helix structure begins to break apart or unwind. This unwinding doesn't occur all at once, rather, the DNA begins to unwind in regions high in AT base pairs (remember AT is only bonded by two hydrogen bonds and is therefore a weaker bond) and

proceeds to regions of progressively higher GC content. The more GC bonds a strand of DNA has, the higher its melting temperature will be.

C. Guided Practice (10-15 min.)

For guided practice, it would be good to play some kind of game. You could have teams or just have individual students answer the questions and perhaps give out candy to those who answer correctly. You could write a sequence up on the board and see who can calculate its melting temperature first. Or you could figure up melting temperature for a certain sequence ahead of time. Then you could divide the entire class into two groups and have each student in the group tape a nucleotide to them. So some students in each group would be thymine, adenine, cytosine and guanine. The students themselves will have to figure out what order they have to get in with correct complementary base pairing to form a sequence with their bodies which would melt at the given temperature. This would cause them to have to work together as a group and be fun as they try to organize themselves in the proper order. The first group to put themselves in an order which will melt at the right temperature wins and gets some kind of reward such as candy, leaving class early, or a couple of bonus points on the test.

D. Independent Practice (10-20 min.)

Can make up a worksheet for the students to do which could have questions like the following.

1. Which strand has a higher bonding energy?

Strand 1 or Strand 2

ATATTAGCTTAA	GCGCCTATCCGG
TATAATCGAATT	CGCGGATAGGCC
Strand 1	Strand 2

The correct answer would be Strand 2.

2. Which strand has a lower melting temperature. Strand 1 or Strand 2?

The correct answer would be Strand 1.

3. Calculate the Tm of the following strand.

5' - ATAAGACCTTGGCAG - 3'

The correct answer would be 44 degrees Celsius.

4. You could also give them a temperature and have them create a strand which would melt at this temperature.

E. Evaluation Activities (5-10 min.)

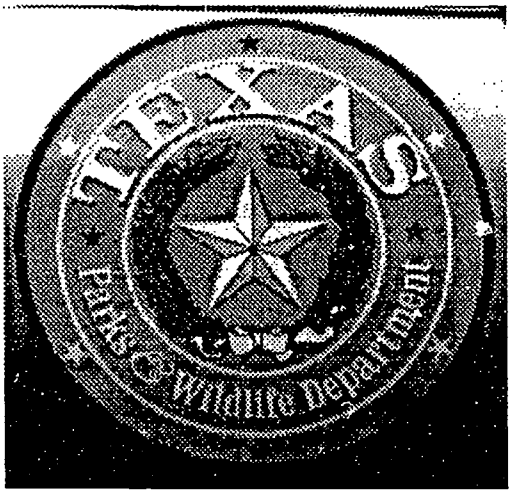
Have the students exchange worksheets for grading. Then have different students come up and answer the questions on the worksheet.

F. Closure (5 min.)

Ask questions to see if the students have an understanding of the different parts of the lesson.

Eleanor Duggar

Texas Parks & Wildlife
Austin Texas



Steve Hall - Mentor
4200 Smith School Road
Austin, Texas 78744

Eleanor Duggar
River Oaks Elementary
14201 Schofield Farms
Austin, Texas 78758

1. Name: Eleanor Duggar

2. Internship: Texas Parks and Wildlife Department Conservation Education

3. School: River Oaks Elementary School
Pflugerville, Texas

4. Primary Subjects: Health Safety, Physical Education, Science

5. Activities: Discussion/large group and cooperative group
Word puzzles
Read and answer comprehension questions
Creativity draw a mobile
Role-play

6. Summary: The student will be able to recognize the safety rules for firearms. The student will use problem solving techniques in settling dilemmas. The student will recognize his/her responsibility in regards to firearms. The student will role-play and therefore speak in front of the class.

7. Resources: Texas Parks and Wildlife Department
Texas Internship Program

Project WILD

Eddie the Eagle Program
NRA

Region XIII

Dept of Health - Texas
Mary Jo Priest

Crosman Airgun News

TEXAS PARKS AND WILDLIFE

PRESENTS

FIREARM SAFETY

CURRICULUM DESIGNED FOR GRADES 4, 5, AND 6, MEETING THE GUIDELINES AS SET FORTH BY HOUSE BILL 44, SEPTEMBER 1, 1995.

The Texas Parks and Wildlife Curriculum is dedicated to the students of the Texas Schools.

Eleanor Duggar
5th grade teacher
Pflugerville ISD

Firearm Safety Curriculum

Day 1

Define accident and discuss what is safety with the students. Collect magazines and newspaper articles on safety or ask the students to collect articles and discuss articles in class. Have students draw a safety web and discuss it. Give out pre-test and letter to parents. allow them to take it home to discuss with parents.

Day 2

Review the test, then present and watch the video. After viewing the video have the student discuss in cooperative groups what they saw. Then write the rules for firearm safety on the board. Pass out the folded paper activity.

Day 3

Review the gun safety rules, introduce role-playing activity. Place the students in cooperative groups to role play the situations. There are 8 situations.

Day 4

Introduce the article about Launi Meili, an Olympic Champion and ask students the answer the questions after reading the article. Pass out a word puzzle for the students to complete.

Day 5

Make a mobile or place students in cooperative groups in order to problem solve the dilemma cards. The give a post test, and after correcting pass out certificates and trigger guard. (or whatever) (same as pre-test)

Objectives:

The student will learn safety rules for gun safety
The student will recognize a potentially dangerous situation with a firearm and will be able to safely defuse the issue.
The students will be aware of different attitudes about guns/firearms
The student will become responsible for their own actions.
The student will accept becoming an active citizen of their society.
The student shall be a good role model.
The student will learn the safety rules.

Day One

Objective:

The students will discuss safety issues. The students will accept responsibility for their own actions.

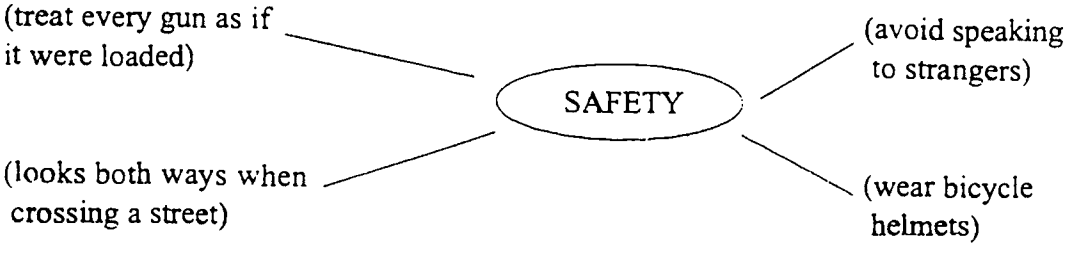
Materials needed:

Newspaper and magazine articles on safety, unlined paper and pencils, pre-test and parental letter.

A. Teachers or students will collect magazine or newspaper articles which demonstrate a responsible attitude toward safety. They might find examples in their health books, or from personal experiences. Discuss the articles with the class, then define accident and safety. (accident is an unplanned (or not thought through) event that might cause injury or damage. Safety is free from damage or danger, secure or trustworthy.)

B. Review with students ways that they are responsibly and safety conscious. Then assign students to draw a safety web.

Example:



C. Discuss with students their safety webs and how they are responsible.

D. Pass out the parent letter and give out pre-test. Tell the students that their parents may help them with the test.

Dear Parent:

Your student will be discussing Firearm Safety as established by the state legislature (House Bill 44) and the National Goals for Education 2000. We will be watching a video, reading, and engaging in activities dealing with how to prevent accidents.

This program educates students about firearm risks and dangerous situations, identifies trusted adults, discusses how to make safe choices, combat negative peer pressure, and resolve conflicts. Students will not receive instruction in the use or handling of guns.

This unit was developed by the Texas Parks and Wildlife Department. It will help your child become aware of safety precaution when they see a firearm.

The school staff hopes that you will work with us to make firearms safe. Please talk with your children about firearm safety just as you would discuss drug and alcohol abuse with them. You may help your child complete the pre-test attached.

Thank you.

Pre-test Firearm Safety

1. What are the two main causes of firearm accidents?

   1.

   2.

2. List the six primary rules for gun safety.

   1.

   2.

   3.

   4.

   5.

   6.

3. What is the most important safe gun-handling rule? (may choose 1 above)

4. Multiple choice: circle the correct answers. If you see a gun, you should

   a. read the owners manual
   b. take it to your parents
   c. share it with a friend
   d. not touch it

5. Responsibility is

   a. the ability to take care of yourself
   b. a duty
   c. accountability, obligation
   d. a favor

6. If you find a gun and can't find your parents or a responsible adult you should call _____.

True or False

7. It's okay to rest your finger on the trigger as long as you don't pull it.

8. You need to treat every gun as if it were loaded.

9. There are gun-safety education programs in all states of the United States.

10. You should always handle a loaded gun.

Day 2

Objective:

The students will learn the rules for firearm safety. The student will recognize a potentially dangerous situation with a firearm and will be abie to safely defuse the issue. The student will recognize trustworthy role models. The students will be aware of different attitudes about gun and firearms. The student will accept responsibility for their own actions. The student will realize the cause and effect relationship for use of guns.

Materials needed:

Pre-test review, video, box activity for each student and map pencils.

A. Review the test and write the 6 safety rules on the board.

Answers:

1. Carelessness and lack of knowledge

2. 1. Don't touch
   2. Leave the area
   3. Tell an adult

   *When your parents and you are ready for you to handle a gun:

   4. Treat every firearm as a loaded firearm
   5. Always keep a gun pointing in a safe direction
   6. Keep your finger off the trigger

3. Always keep a gun pointing in a safe direction

4. d

5. a, b, c, d

6. 911

7. F

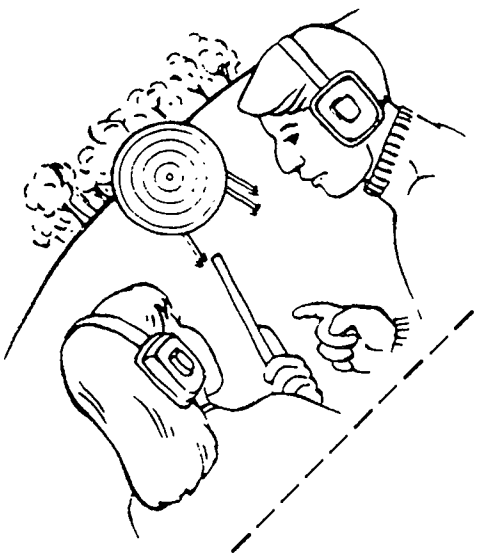
8. T

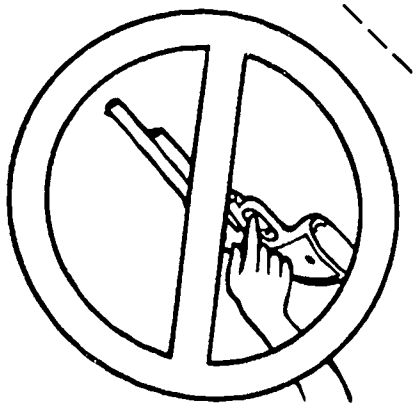
9. T

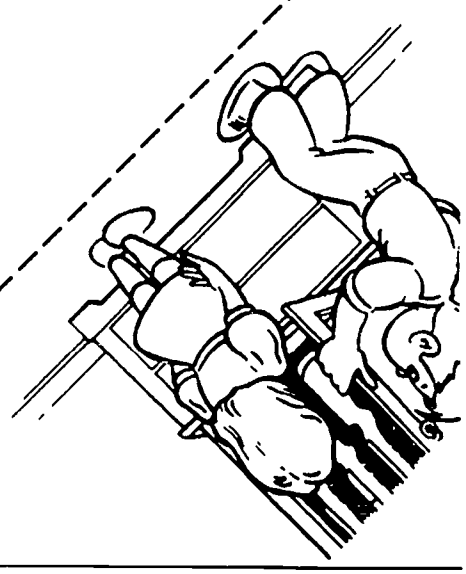
10. F

B. Present the video and watch it. After watching have the students in cooperative groups discuss what they saw. Give each child time to choose a significant fact from the video. Pass out the box activity for the student to complete.

Students, cut on the solid lines and fold on the dotted lines. Color the pictures and write at least 2 safety rules which are being followed. If the safety rules are not being followed, place the not safe symbol over picture Ø. Explain your choice of safety rules.







Day 3

Objective:

The students will work in cooperative groups. The children will recognize a potentially dangerous situation with a gun and will be able to defuse the issue safely. The student will become a good role model for his peers. The student will use effective problem solving techniques.

Materials needed:

Copies of situations for cooperative groups, use a"cup or eraser for a gun"

A. If necessary review the safety rules or ask them to bring out their copies of the rules. The students have at their disposal the six steps necessary for effective problem solving.

1. Define the problem
2. Clarify the choices
3. Look at the good and bad consequences of each choice
4. Make the choice based on the above information
5. Act on the choice
6. Evaluate the choice once it has been executed

B. Place the students in cooperative groups. Next pass out the role playing activity. Then have them share their "role" playing in front of the class. The students watching will discuss how effectively the groups were in their problem-solving techniques and using the safety rules. Reinforce the general gun safety rules. Stop -- Don't touch. Leave the area. Tell an adult. When you and your parents decide you are ready to handle a firearm them: Always treat every firearm as a loaded firearm. Always keep a gun pointed in a safe direction. Keep your finger off the trigger.

Role-Playing Activity

Below are eight general role playing scenarios. Adjust these situations to match the level of your students. You may want to divide a class into small groups, and have each group prepare a brief "skit" based on one of these situations for performance in front of the rest of the class.

After discussing or performing each scenario, reinforce the general gun safety principle: STOP! DON'T TOUCH. LEAVE THE AREA. TELL AN ADULT.

When your parents are ready for you to handle a gun.
TREAT EVERY FIREARM AS A LOADED FIREARM. ALWAYS KEEP A GUN POINTED IN A SAFE DIRECTION. KEEP YOUR FINGER OFF THE TRIGGER.

Someone You Know
Situation #1

Your older brother and several of his friends are at your house. You and your friends walk into the living room and find him showing off your parent's handgun. He is bragging about what a powerful weapon it is and asking if anyone else wants to hold it.

What do you say?

What do you do?

Someone You Know
Situation #2

When your big sister is giving you some money for lunch, a handgun falls out of her purse. She picks it up quickly and starts to put it back in her purse. Then, she reminds you that she works late and sometimes walks to her car after dark. She asks you if you've ever held a handgun and offers to let you hold it. She warns you that it is loaded.

What do you say?

What do you do?

Someone You Know
Situation #3

You are spending time at a friend's house after school. Your friend's parents are still at work. Your friends brings out a handgun and starts to play with it. Your friend spins the cylinder and says, "Let's play Russian Roulette. Unless you're a chicken..."

What do you say?

What do you do?

Someone You Know
Situation #4

You and your cousins are spending the afternoon at your grandparents' house. You are playing in their den and see a gun cabinet. Your cousins dare you to open it.

What do you say?

What do you do?

Someone You Know
Situation #5

You have just seen someone you know with a handgun. You saw this person put the handgun in his backpack.

What are you feeling at the moment you see the gun?

What do you say?

What do you do?

Someone You Know
Situation #6

You and two of your friends see a gun. You want to leave the area and go tell an adult, but your friends want to stay and play with the gun. They tease you because you want to leave.

What do you say?

What do you do?

Someone You Know
Situation #7

You and a friend see a gun while you are playing. Your friend says that he knows touching a gun is dangerous, but he will be careful as he tries to put the gun up on a shelf where his younger sister can't reach it.

What do you say?

What do you do?

Someone You Know
Situation #8

You and your friend see a gun and you say, "Let's leave and tell an adult about this." Your friend says, "Nah, this isn't dangerous. I know how to use one of these."

What do you say?

What do you do?

Day 4

Objective:

The students will learn about shooting as a sport. The student will answer comprehension questions. The students will unscramble the word puzzle and write sentences using the unscrambled words.

Materials needed:

A Launi Meili article for each student, word scramble and pencils.

A. Pass out the article on Launi Meili. Invite the students to read the article then answer the questions.

B. Pass out the unscramble the words puzzle. Ask the students to find the words and use in a complete sentence.

Launi Meili
An Olympic Gold Winner

Launi Meili, winner of a gold medal in shooting for the U.S. at the 1992 Olympics in Barcelona, has signed on with Crosman to promote the safety, responsibility and the fun of airgun shooting.

The vivacious, 29-year old believes that shooting, especially in competition, is a great way to prepare for the challenges of life.

Launi started shooting at age 12 when her father, an avid hunter, taught both his daughters the basics of safe shooting.

"Dad always had hunting guns around and he wanted to be sure that we knew how to handle them safely," says Launi.

"My early shooting was at a gun club near Spokane. Part of the program was to qualify and to earn patches reflecting your ability. I started competing seriously in high school. It was great fun to compete against boys, and to beat them at their own 'manly' sport!"

Launi's parents raised her with a strong desire to excel. She tried swimming and iceskating, but settled in on shooting as her sport. By the time she reached college, she realized that she might achieve the highest levels of shooting, but only if she put everything into it.

Her first major disappointment came in her first Olympics in 1988. She shot a new Olympic record in her first 40 shots, then slid from first to sixth place in the finals.

Although an enthusiastic supporter of the power of positive thinking, this defeat took its toll. For the next two years, Launi says, there was virtually no motivation.

"I could still win," she remembers, "but I could take it or leave it."

Gradually, her confidence came back, and she began to focus on the positive and put the negatives behind her.

Just four years later, her confidence restored, Launi topped the shooting world at the 1992 Olympics with an Olympic record setting performance on the way to a gold medal in Women's Three Position Rifle Shooting. She also finished a very respectable 11th in the Women's Air Rifle Event.

Launi's Crosman duties will fit in nicely with other assignments that put her in touch with the public, extolling the virtues of shooting, especially for young people.

She is designing a high school curriculum project called "Aiming for Bright Minds and Bodies." In this program, sponsored by the NRA, a school or school district can obtain a portable range, airguns from Crosman, and Launi's services to teach teachers basic shooting skills. The teachers then will conduct shooting programs for their students over a two-week period, typically as part of a physical education program. She is just starting to develop this program, but says that word of mouth is already driving demand among teachers across the country.

When asked why she thinks shooting is so good for kids, Launi gives a detailed, thoughtful reply.

"Successful shooting, even at an elementary level, teaches a great deal. It includes:

- Self esteem - A student will quickly see his or her own improvement. It's an easy sport to get started in. You want to get better -- and you can.
- Concentration - You have to learn how to create a perfect "sight picture." That means when the two sights on the gun are perfectly aligned in the center of the target. Learning concentration like this can be transferred to other sports or education situations.
- Responsibility - Every gun must be used safely, It's the first rule of all shooting, including airgun shooting.
- Hand-eye coordination - You have to match the perfect mental sight picture with the picture in your eye as you squeeze the trigger.
- Improved physical abilities - This includes steadiness and breath control.
- Visualization - The conscious sight picture finally must begin to work in your subconscious.
- Trained relaxation - It's impossible to shoot well when tension or stress is present in any part of your body or mind."

It's clear that Launi sees shooting as more than a casual pastime. Her main message, however, it that it's a fun learning activity for anyone, at any level of expertise.

"The same skills learned from shooting can be applied to all kinds of challenges and life-long goal setting," she says.

One of Launi's first assignments for Crosman will be at the Boy Scout Jamboree in Fort A.P. Hill, Virginia this August. There, she will have the chance to visit with hundreds of Scouts and to spread the good word on shooting and Crosman an.

Beyond these initial months, she faces an interesting challenge: what do you do with the rest of your life, if you are on top at age 29, famous, and the holder of one of the world's most prized awards?

"First, I want the educational program to succeed. I want many more kids to have some of the opportunities and rewards that I have enjoyed."

'Second, I'd like to try some 'inspirational' public speaking. I'd like to teach people what I've learned about stress management, goal setting and visualization."

"Someday, I'd like to have a family of my own. Of course, that requires time for dating, and a lot less travel -- a very different lifestyle from my own."

And what will Launi Meili's kids be like?

"Of course I'll teach them to shoot, but they won't have to be Olympic shooters," she says. "I will try to get them to excel at something -- to be as good as they can be. They'll also be diverse and very active and colorful," If so, they'll be a lot like their Mom.

Welcome to Crosman, Launi Meili. We're proud.

Article courtesy of Airgun News: Crosman Corp., N.Y. 1993, and Launi Meil

Unscramble the words and use each in a sentence.

1. ATETRG
2. LYDIIMEMTAE
3. OADLED
4. MAREIRF
5. COUHT
6. SIBLEERSNOP
7. TEYFAS
8. WYTHTRUTORS
9. DUTLA
10. PTOS

Launi Meili - An Olympic Gold Winner answer the questions below

1. Where did Launi grow up?

2. What did she do during her childhood?

3. What was her 1st major disappointment?

4. How would you feel?

5. What occurred in 1992?

6. What are the reasons that Launi thinks that shooting is good for kids

   1.

   2.

   3.

   4.

   5.

   6.

   7.

7. What in your opinion is a champion? Do you know anyone personally who is a champion?

8. What is Launi's next goal?

9. What is one goal you have for this year?

10. What do you need to meet that goal?

A. Answers to questions and word scramble

Launi Meili

1. Spokane, Washington
2. swim, ice-skate and shoot
3. In 1988 she shot a new Olympic record in her first 40 shots, then she slid from first to sixth place.
4. student's answer
5. Launi set a World Record in 1992 Olympic in Women's Three Position Rifle Shooting. She won a gold metal.
6. self-esteem, concentration, responsibility, hand-eye coordination improved physical abilities, visualization and trained relaxation.
7. student's answer
8. She is designing a high school curriculum and wants it to succeed and she wants to try some "inspirational" public speaking.
9. student's answers
10. student's answers

Unscramble the words

1. TARGET
2. IMMEDIATELY
3. LOADED
4. FIREARM
5. TOUCH
6. RESPONSIBILITY
7. SAFETY
8. TRUSTWORTHY
9. ADULT
10. STOP

Day 5

Objectives:

The student will learn rules for gun safety
The student will recognize a potentially dangerous situation with a firearm and will be able to safely defuse the issue.
The students will be aware of different attitudes about guns/firearms
The student will become responsible for their own actions.
The student will accept becoming an active citizen of their society.
The student shall be a good role model.
The student will know what number to call for help in an emergency (911).
The student will realize the cause/effect relationship for use of guns.

Materials needed:

Dilemma cards, paper and pencil for groups.

B. Repeat the firearm safety rules. Discuss with the students the questions below.

What would you do if...

-you saw a friend with a gun at school?
-you saw a gun while playing?
-you saw a police officer with a gun?
-you saw a gun on television?
-you saw a gun locked in a gun cabinet?
-you saw a toy gun in a store?
(You may want to record student responses on chart paper or black board.)

Ask the children to imagine themselves in different settings.

To whom might you go if you see a gun...

-while playing in the park?
-while passing by an open locker or cubbies at school?
-in the hallway of an apartment building?
-among the debris in a vacant lot or alley?
-while riding on the bus to school?

B. Cut apart the "Dilemma Slips." Divide the class into cooperative groups, each group receiving 4 dilemmas or more. Have students decide what to do in each dilemma. They may choose other scenarios than the choices given if you desire. After about eight minutes of discussion among the groups, group members should write down their solution. Then, group representatives should take turns orally reading the dilemmas and solutions.

or

C. Make a mobile

D. Reward each child with a certificate of completion of Firearm Safety Class. Hand out trigger guards.

Dilemma

A deer herd has grown so large during the past ten years that many of the deer appear to be starving. The herd is severely damaging the habitat, eliminating much of the vegetation that the animals use for food or shelter. There is a disagreement within your community as to what course of action is best to take. You are personally opposed to hunting. A limited legal hunt has been proposed in order to reduce the size of the herd in this area. Should you:

•investigate and consider the situation to see what, in your judgment, seems to be the most humane and reasonable solution, including the feasibility of options such as moving some of the deer to other areas, understanding that they still may not survive

•attempt to identify the causes of this population increase and propose action to return the system to a balance;
•organize a protest to bring people opposed to hunting to the recreation area at the time the legal hunt is to begin;
•allow the habitat degradation to continue and the deer the starve
•leave it to the state wildlife agency to work with the land holder to arrive at a solution
•other choices

Dilemma

You have found a young screech owl which you have managed to raise to maturity. You have been told that you cannot keep the owl any longer because keeping it without the proper permit is in violation of state and federal laws.

Should you:
•offer it to your local zoo
•keep it as a pet
•call the fish and wildlife agency and ask their advice
•determine whether it could survive in the wild and, if it appears it could, release it in a suitable area
•other choices

Dilemma

You are walking in the woods and come upon a young fawn. There is no sign of the fawn's mother. Should you:
•leave it where it is and call game warden
•move it to a sheltered area
•take it home
•other choices

Dilemma

You are out in the woods with a friend when you spot a hawk perched on a high limb. Before you realize what is happening, your friend shoots the hawk. An hour later, you are leaving the woods and are approached by a state wildlife officer, who tells you a hawk has been illegally shot and asks if you know anything about it. Should you:
•deny any knowledge of the incident
•admit your friend did it
•make up a story implicating someone else
•say nothing, but call the fish and wildlife office later with an anonymous phone tip
•other choices

Dilemma

You have purchased a beautiful ten acre property in the mountains to build a summer home. One hillside of the property has a beautiful view of the valley and lake below and is your choice for your homesite. However, you discover there is an active bald eagle nest site on that hillside. The bald eagle is sensitive to disturbance around its nest tree and is a protected species. Bald eagles are highly selective in choosing nest sites, and usually return to the same nest year after year.
Should you:
•select a different site on the property to build your home
•sell the property
•chop down the tree and build your home
•other choices

Dilemma

You are on a field trip with your class to the zoo. Although you know that feeding of the animals by zoo visitors is prohibited, some of your friends are feeding marshmallows to the bears. Should you:

•tell them that feeding marshmallows may harm the bears and ask them to stop
•report their behavior to the nearest zoo keeper
•ask the teacher to ask them to stop
•not do anything
•other choices

Dilemma

You are on a picnic with your family and you see another family leaving to go home, without having picked up their own trash. It is clear the other family is going to leave litter all around. Should you:

•move quickly and ask the to pick up the trash before they leave.
•wait for them to leave and pick up the trash for them.
•do nothing
•other choices

Dilemma

You are a youth of 18 involved in a traffic accident while using your father's truck. After returning home and informing your father, you were scolded. Your father then left to examine the damaged truck at the repair shop. Should you:

•Load a bullet into your fathers rifle which was kept unsecured at home
•Leave home and visit your best friend
•Stay home and wait for your father to come home
•Borrow your mom's car and follow your father to the repair shop.
•other choices

Dilemma

You know your birthday is coming up. You are going through your parents closet with your friend. You see a rifle you think might be your birthday present. You:

•Pick it up to show your friend.
•You tell your mom and dad what you found.
•You ask your friend to take it down.
•You don't touch and close the door.
•other choices

Dilemma

Your friend gets a hold of his fathers handgun - improperly stored. He shows it to you. You:

•pick it up
•tell your parents
•leave the house
•call 911
•other choices

Dilemma

Gang member shows you a gun be obtained illegally from a cousin. You would like to be a member of this gang. He is bragging about using it and the power associated with it. You:

•Decide you don't want to be a member of the gang after all.
•Feel like you'd like to talk to an adult.
•Agree with him - say you have used a gun also.
•Borrow your parent's gun to show your friend.
•other choices

Dilemma

You are at home watching T.V. and you hear gun shots on the street outside. What do you do to be safe?

•You move away from the windows and duck under a table.
•Call 911.
•Go outside to see what is happening.
•Call your parents then call your best friend and explain what you are hearing.
•other choices

Dilemma

Your little sister finds a bullet somewhere. You don't know where she got it. She doesn't want to give it to you, but you're afraid that she might get hurt. You:

•Take it away from her.
•Scream at her.
•Run in the house to tell your parents.
•Borrow your dad's gun and put it in to see if it is a good bullet.
•other choices

Dilemma

For your 11th birthday your Uncle Bob gives you a brand-new air rifle. You father and mother think that you are too young for a rifle and put it away in the attic. You:

•Can't get the gun out of your mind and want to shoot it just once.
•Write a thank you letter to Uncle Bob.
•Call the 4-H and the Boy Scouts and see if they have a training program.
•B and C
•other choices

Dilemma

Your brother just came home from college. He has taken a skeet-shooting class. He is very excited about shooting and asks you to shoot it in the backyard with him. You:

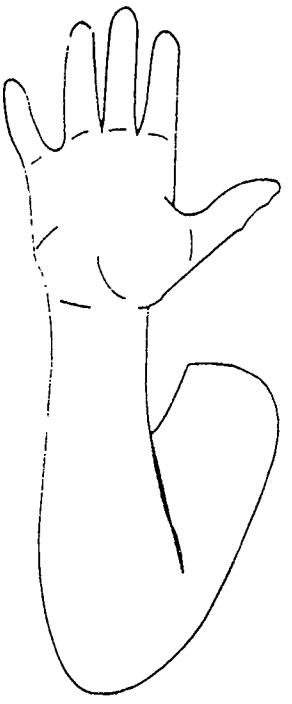
•join him
•tell him you must ask your parents
•listen enthusiatically and then say "No, thank you."
•you ask him if your best friend can join you
•other choices

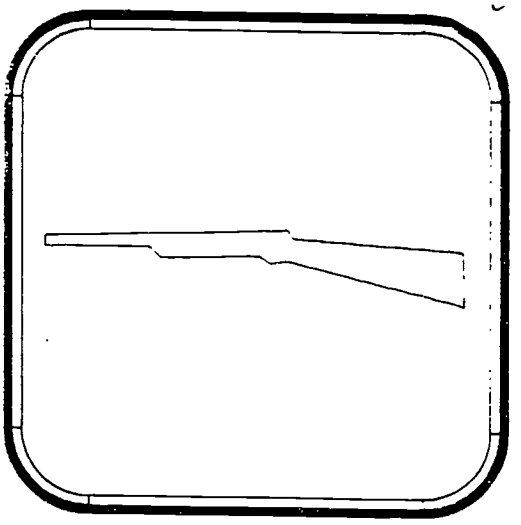
Dilemma

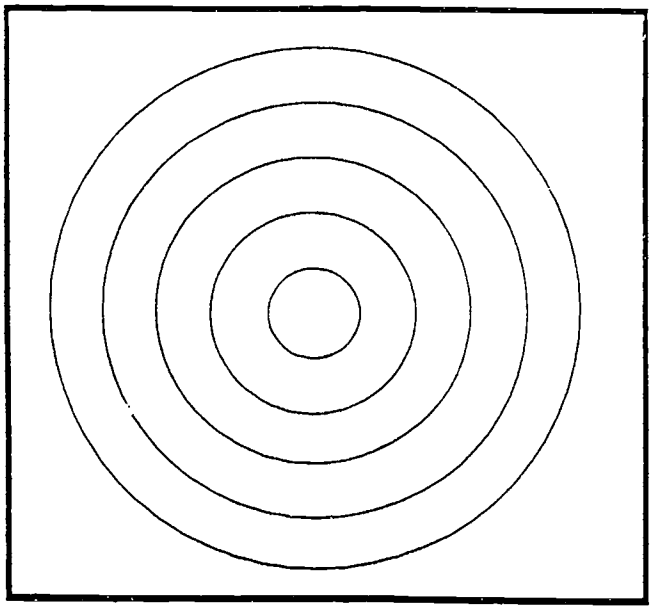
You have been learning to shoot at the target range with your parents. Your favorite Uncle Charlie comes to town and asks you to go done hunting. You have never hunted before. You can't find your parents to ask permission.. You:

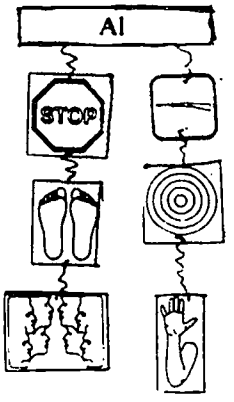
•call the game warden to find out if it's dove season
•borrow your dads rifle and ammunition so you can go
•use your BB gun and join him
•tell Uncle Charlie that you need to get your parents' permission

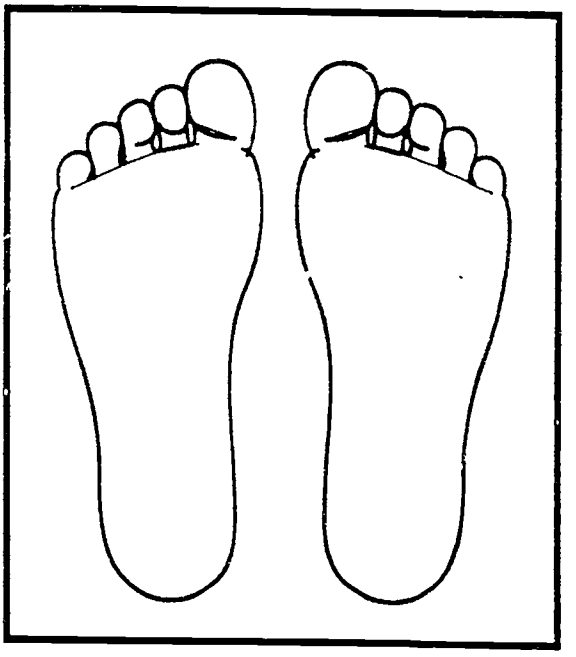
MAKE A MOBILE. YOU MAY CUT OUT THE PICTURES, COLOR ONE SIDE, AND WRITE THE FIREARM SAFETY RULE ON THE BACK. DRAW ANY SHAPE AND WRITE YOUR NAME ON THAT SHAPE. WRITE DOWN ONE WAY THAT YOU ARE RESPONSIBLE. THEN PLACE A HOLE IN EACH SHAPE AND ATTACH THEM WITH STRING.

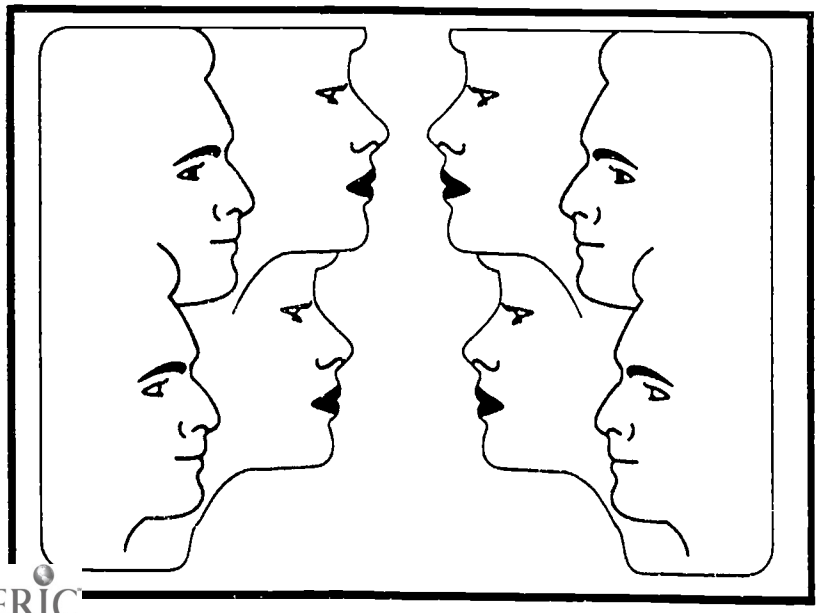


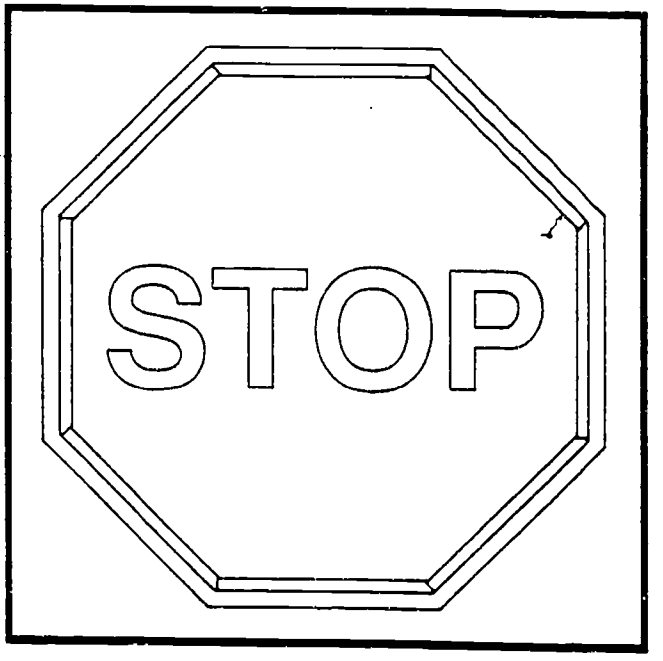












Extension Ideas:

Discuss in class:

What should you do if your friends want to play with a real gun?

Do you know of anyone who has been hurt while playing with a real gun?

What are some of the "pretend" situations that might make you think guns are safe for young children? Discuss the difference between "fantasy" and "reality" on television or when you play. Discuss some safe sand unsafe situations dealing with guns.

Have students share their ideas with each other in cooperative groups. Compile these lists during your whole group discussion.

ACTO is a Spanish word for stories that students make-up and act out to solve a problem involving a gun where someone gets hurt. Then they could use the safety rules and show how the accident could be avoided.

Media - The students will list some of their favorite T.V. shows, movies and video games. Then have the students identify any characters in these programs that use guns to handle conflicts. Then ask how could these characters solve these problems without guns. Then students can work in cooperative groups to answer the question.

Writing Task: Pose several questions to your students. Have them write a paragraph using the knowledge and experiences they have had the past several days.

Art: Have the students create an original poster that shows the safety rules.

Field Trips: Arrange a field trip to your local police department.

Speaker: Ask a law enforcement officer to speak to your class on gun safety.

CERTIFICATE OF COMPLETION

This is to certify that

_____

has completed the Texas Parks and Wildlife Firearm Safety Curriculum

1. Don't touch.
2. Leave the area.
3. Tell an adult.

When your parents are ready for you to handle a gun:

4. Treat every firearm as a loaded firearm.
5. Always keep a gun pointed in a safe direction.
6. Keep your finger off the trigger.

_____

Teacher

_____

Date

Acknowledgements:

Steve Hall - Texas Parks and Wildlife Department
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Larry Hysmith - Texas A&M
Alan Allen - Sportsmen's Conservationists of Texas
Launi Meili - NRA
Eddie Eagle Program - NRA
Crosman Airgun News
Project WILD
Margaret Danforth - Proof-reader
Carolyn Wieruscheske - Proof-reader

Texas Parks and Wildlife Firearm Safety Curriculum for 4, 5 and 6 Grades Evaluation Form

		Yes	No
1.	Did you use the unit?	☐	☐
2.	If you used this program will you do so again?	☐	☐
3.	Did you share this program with other teachers?	☐	☐
4.	What is your overall opinion of the program?	☐	☐

Excellent Very Good Fair Poor

5. Thinking about the 5 lessons, what did you like the most? What did you like the least?

6. What suggestions do you have to improve this program?

7. Number of students who used this material.

8. What were the reactions to this unit by:
   - students
   - parents
   - other teachers or administrators

9. How would you rate your knowledge of guns?

Extensive Fair Some None

Video will be available later through Texas Parks and Wildlife Department

1. Name: Eleanor Duggar

2. Internship: Texas Parks and Wildlife Department Conservation Education

3. School: River Oaks Elementary School
Pflugerville, Texas

4. Primary Subjects: Health Safety, Physical Education, Science

5. Activities: Discussion/large group and cooperative group
Word puzzles
Read and answer comprehension questions
Creativity draw a mobile
Role-play

6. Summary: The student will be able to recognize the safety rules for firearms. The student will use problem solving techniques in settling dilemmas. The student will recognize his/her responsibility in regards to firearms. The student will role-play and therefore speak in front of the class.

7. Resources: Texas Parks and Wildlife Department
Texas Internship Program

Project WILD

Eddie the Eagle Program
NRA

Region XIII

Dept of Health - Texas
Mary Jo Priest

Crosman Airgun News

TEXAS PARKS AND WILDLIFE

PRESENTS

AIR-GUN SHOOTING AND SAFETY

CURRICULUM DESIGNED TO AUGMENT THE AIR-GUN KIT AVAILABLE THROUGH PARKS AND WILDLIFE

Dear Instructor:

Texas Parks and Wildlife is pleased to offer their Air-Gun training unit. This unit will help adults set up an organized shooting sports program for young people. This training unit is designed to augment the training kits (complete with air-guns) available through Parks and Wildlife. The young people will receive hands-on experiences as well as pencil and paper experiences with an emphasis on safety.

The pencil and paper tasks are designed to be educational and valid for the young peoples experiences. They stress gun-safety, knowledge of how a gun works, and the responsibility of gun use.

The activities are set up to use as you, the instructor, desires and in any order. There is also some practical step-by-step advice on how to set up a target range and develop marksmanship.

As you use this program you will gain many rewards, the joy of working with young people, helping to develop life - long skills, and helping young people develop responsible habits for a lifetime. Thank you for your interest.

Sincerely,

Eleanor Duggar
Teacher 5th Grade
Pflugerville ISD

Activity #1 - Safety rule puzzle

Materials: Copy puzzle pieces onto construction paper. Scissors, pens or fine pointed magic markers needed.

Activity #2 - Muzzle velocities

Materials: Copy muzzle velocities onto paper for each student, pen or pencils.

Activity #3 - Design a target or backstop

Materials: Paper, markers, tape, boxes, carpet, newspapers, etc.

Information for instructor about how to set up a shooting range.

Activity #4 - Parts of an airgun

Materials: A copy of the cross word puzzle for each student, pencils and an unloaded airgun.

Activity #5 - Marksmanship

Materials: A shortened broom handle for a practice gun. Go over the 5 main steps of marksmanship with students.

Activity #6 - Test and Certificate

Materials: Test and certificate for each student

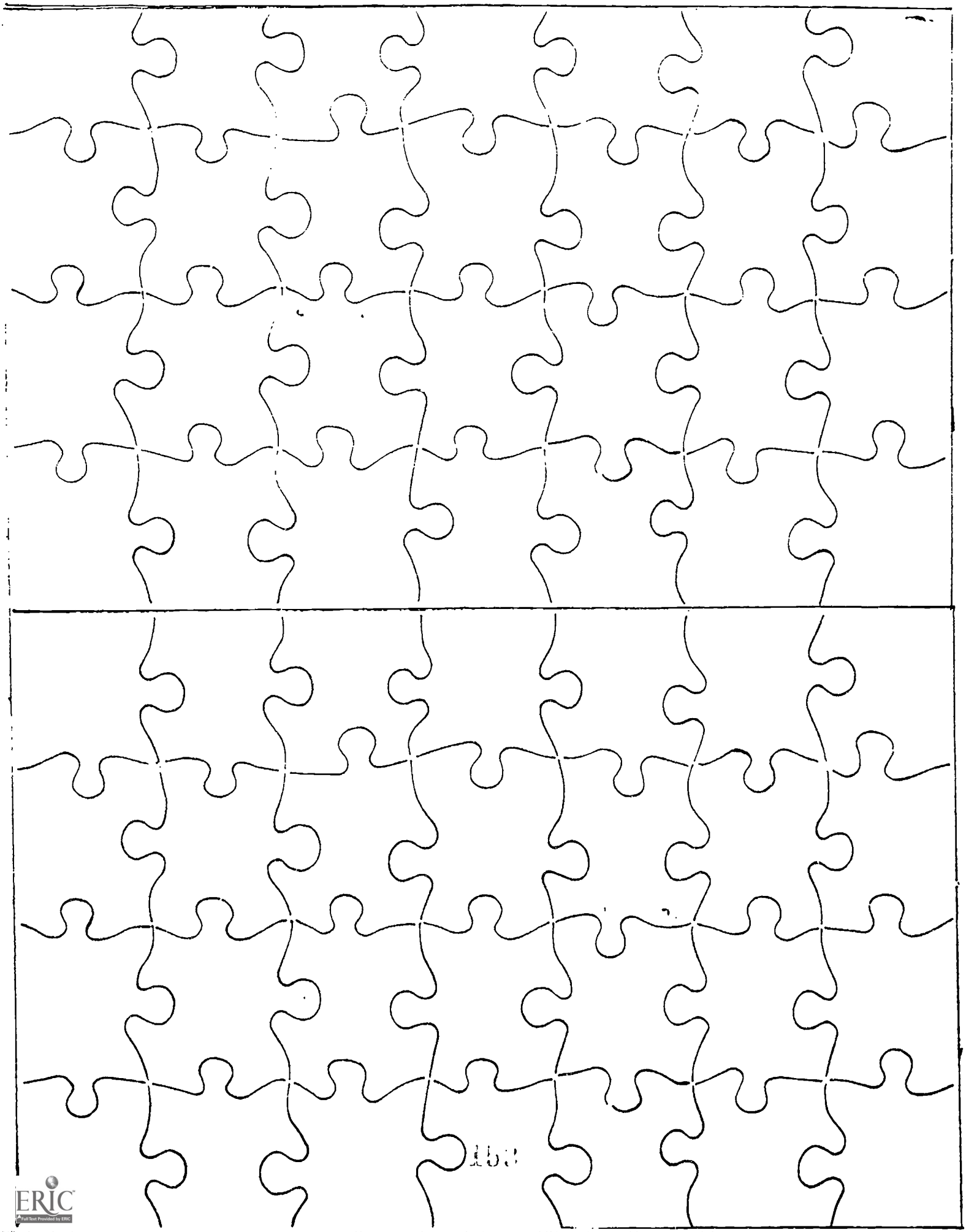
Extended Activities

Activity #1

Review the safety rules with the students and discuss what each rule means. Next, pass out the puzzle. Ask the students to write the rules on the puzzle and cut the pieces apart. Then invite their partners to put the puzzle pieces together.

When handling, using or storing any type of firearm, safety must be your first concern. Gun safety rules must be understood and applied in all situations involving firearms.

1. Treat every gun as if it were loaded.
2. Keep the gun pointed in a safe direction.
3. Keep your finger off the trigger until ready to shoot.
4. Keep the gun unloaded until ready to use.
5. Know how to operate your gun safely.
6. Know that your gun is safe to use.
7. Use the correct ammunition for your gun.
8. Be sure of your target and what is beyond.
9. Never use alcohol or drugs while shooting.
10. Store guns and ammunition apart from each other so they are not accessible to unauthorized people.



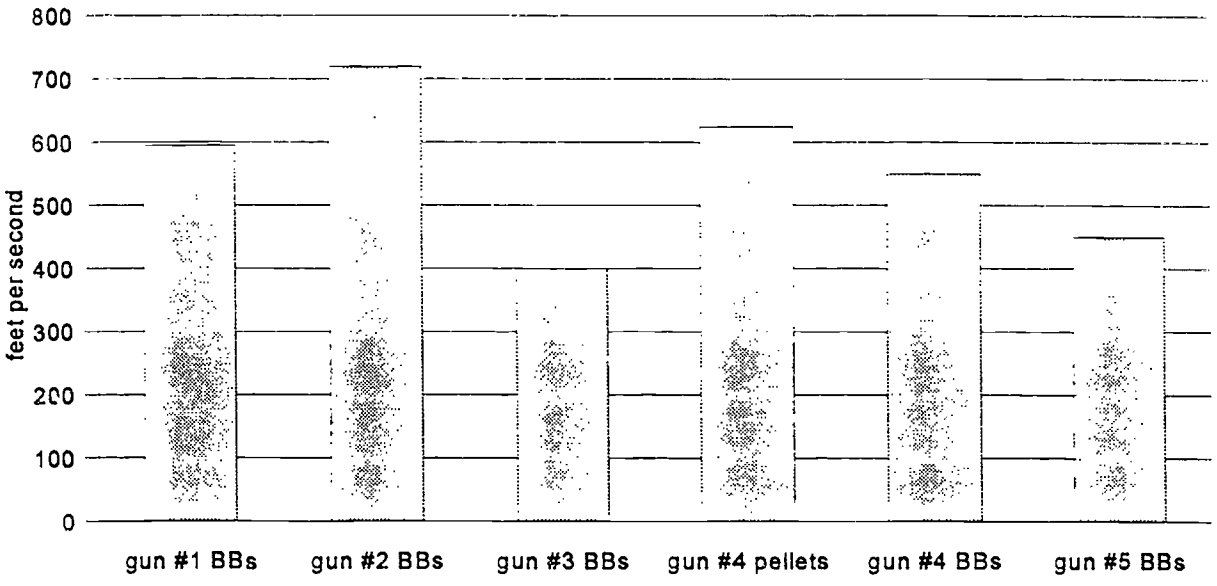
Activity #2 - Muzzle Velocities

Materials: A copy of muzzle velocities sheet for each student, pencils or pens.

Muzzle Velocities Answer Key

1. gun #2
2. gun #3
3. 550 fps.
4. 625 fps.
5. No
6. gun #5
7. 170 fps.
8. 75 fps.
9. pellets usually travel farther
10. chronograph

MUZZLE VELOCITIES



1. Which gun's BBs traveled the greatest feet per second (fps)?

2. Which gun's BBs traveled the least feet per second?

3. How many fps did gun #4 with BBs travel?

4. How many fps did gun #4 with pellets travel?

5 Did any of the BBs or pellets travel at the same velocity?

6. Which gun's BBs traveled at 450 fps?

7. How many more fps did the BBs in gun #2 travel than the BBs in gun #4?

8. How many more fps did the pellets in gun #4 travel than the BBs in gun #4?

9. Using the above information, do BBs or pellets travel farther?

10. How do they measure feet per second?

Activity #3

Have the students design a backstop and target. It may be a silhouette or a unique target. Make sure that the students check what is beyond the target. You might want to copy the information below for the students.

BACKSTOP:

Easy to build or buy for safety

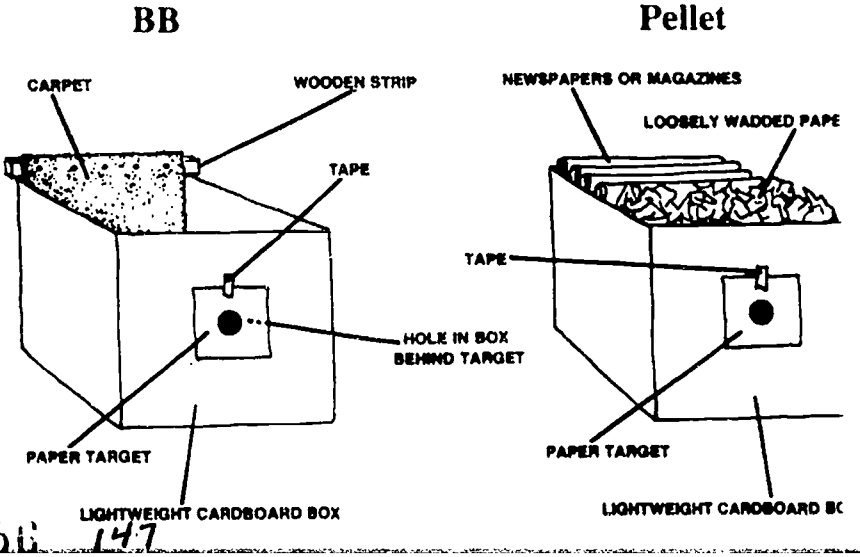
The backstop is the single most important component of any airgun range. Good ones are simple and inexpensive to build or buy.

A corrugated cardboard box filled with crumpled newspapers or magazines is easy to create for BB and pellet shooting. For extra safety, a tarpaulin blanket or piece of carpeting can be hung behind it for indoor or outdoor safety.

Materials inside the backstop should be fairly loose and cardboard must be used in back of target. BBs and pellets could ricochet off tightly packed materials or hard surfaces. Target boards should be cleaned or replaced reguarly as BBs and pellets may become embedded in the board and cause ricochets.

Regardless of the type of backstop, airgun shooters should always use tape to hold targets in place. BBs can ricochet off paper clips, thumb tacks, clothes pins or spring clamps. And, of course, shooting glasses must always be worn when firing an airgun.

Courtesy of - Crosman Airgun News



Air - Gun Shooting Ranges

Air-gun shooting ranges include the garage, basements, backyards, gyms or other open area. The amount of space necessary depends on the type of airguns that will be used. A BB gun requires a 15-foot range while a pellet gun requires about 33 feet.

Safety of shooters, area behind the backstop, and spectators in the area should be of primary concern when determining the size and location of the range. Good lighting or outside light is vital as well as an awareness of other activities that occur in the vicinity.

Indoor airgun ranges should be enclosed on three sides. An alternative is to set up the range in a corner. Any side of the range not enclosed by a wall should have a non-ricochet barricade around it.

Outdoor airgun ranges should use natural barriers such as fences and hedges. The area behind the backstop should be clear for the distance a projectile will carry. Pets should be kept out of the way. The firing line should be marked clearly.

If there is a concern that your shooters may miss the traps, the wall toward which you are firing must be protected. It is wise to cover the plywood with carpet, heavy material or styrofoam. Half or 3/4 inch plywood will stop pellets, where they will flatten out and fall to the floor. Plywood without covering will bounce BB's back toward the shooter.

Pellet and BB traps are designed to absorb the energy of the ammunition. For pellet traps you may cover the face of the trap with cardboard. This prevents spent pellets from being kicked out of the trap. BB traps are designed to absorb the energy and keep it from leaving the trap. Commercial BB traps usually have one or more drapes which stop the BB's and let them fall to the bottom of the trap. Cardboard boxes can be used. At the bottom of the box, lay six or seven layers of cardboard, then fill the box with balls of newspaper. When the box is packed with newspaper balls, tape the lid shut. A large surface is recommended for beginning shooters.

Adult supervision is important at the range to enforce safety procedures. The shooters and spectators should wear protective eyewear, and ear protectors. The range officer should have complete control over the loading and firing of airguns, as well as the hanging and retrieval of targets. It is important for the shooters to know that safety is everyone's responsibility and when you hear "Cease Fire," stop firing immediately.

Activity #4

Introduce the parts of the airgun

Materials needed: A copy of crossword puzzle and question sheets for each student.

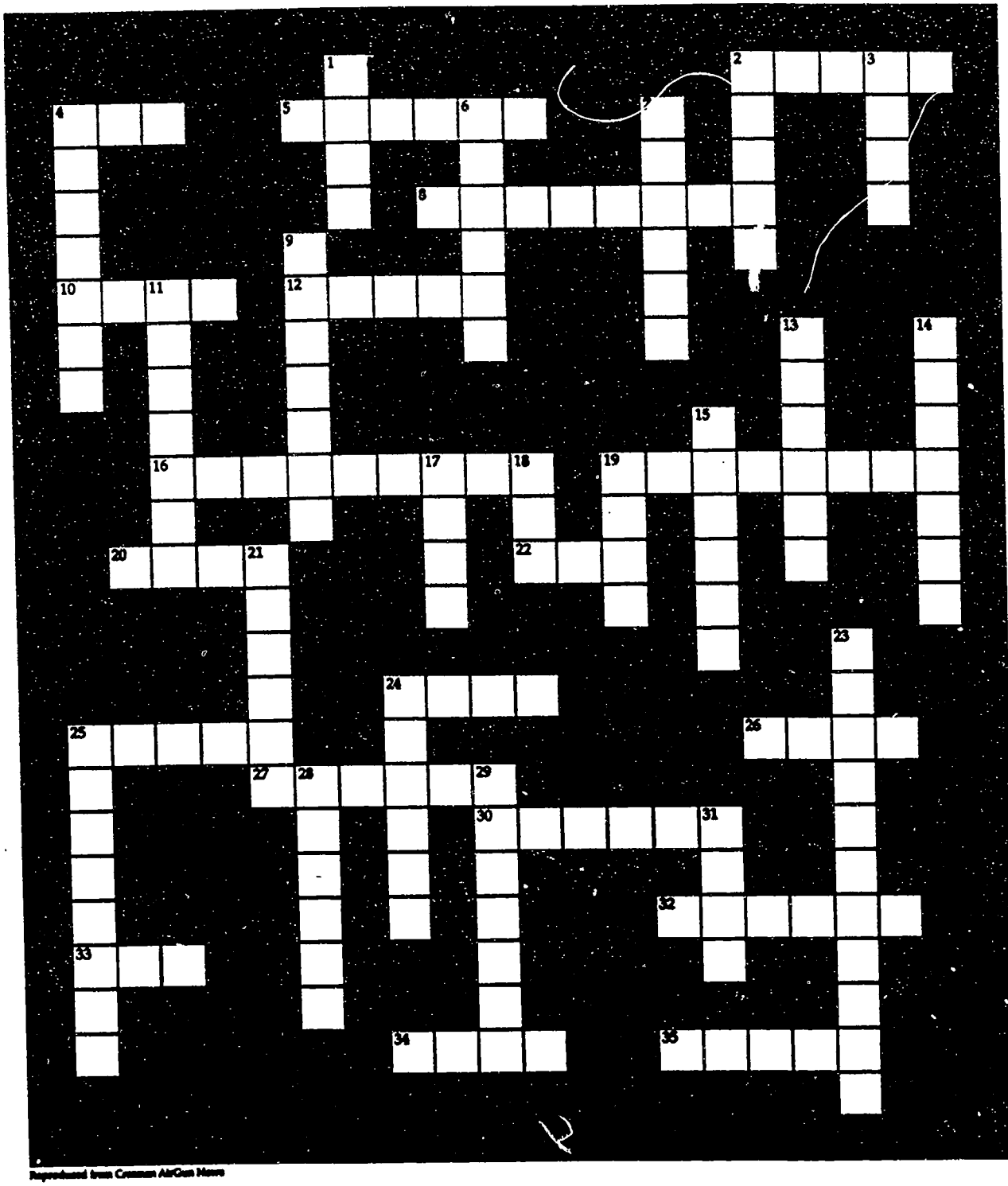
Use an unloaded airgun as an example. Give a brief explanation of the various purposes of each part. Then pass out the cross word puzzle to each student. Here are the answers:

Across

2. Stock 4. CO_2 5. Muzzle 8. Backstop 10. Kick 12. Range 16. Bikathlon 19. Practice 20. Trap 22. Aim 24. Score 25. Rifle 26. Bolt 27. Target 30. Recoil 32. Barrel 34. Bore 35. Plate

Down

1. Butt 2. Scope 3. Comb 4. Chicken 6. Loaded 7. Action 9. Crosman 11. Caliber 13. Pistol 14. Forearm 15. Safety 17. Line 18. NRA 19. Pump 21. Pellet 23. Silhouettes 24. Sights 25. Ricochet 28. Airgun 29. Trigger 31. Load



Reproduced from Common AirGun News

ACROSS

2. The butt, comb & grip are on this part of the rifle.
4. There are pneumatic, spring and _____-powered airguns.
5. The end of a barrel. Always point this in a safe direction.
8. The most important ingredient of an airgun range.
10. Another name for recoil.
12. The location where you shoot.
16. The challenges of off-road bicycling & airgunning are combined in this sport.
19. Shooters do this to improve their score.
20. Safely catches pellets and BBs.
22. You _____ to line up the sights on a target.
24. Total of your points.
25. This type of airgun is held against your shoulder.
26. Located at the top of the receiver/action.
27. You shoot at this.
30. Airguns don't have it.
32. BBs & pellets travel from the receiver to the muzzle through this.
33. The opposite of a miss.
34. The hollow part of the barrel.
35. The butt _____ covers the rearmost part of a rifle stock.

DOWN

1. This part of a rifle fits against your shoulder.
2. A telescopic sight.
3. This is located at the top forward part of the butt stock.
4. The smallest of the silhouette targets.
6. Ready to fire.
7. Another name for the receiver in an air rifle.
9. The world leader in airgun technology. A bikathlon sponsor.
11. Determined by the diameter of a bore.
13. An airgun held in the hand.
14. The front of the stock on an air rifle is called the _____.
15. The most important responsibility of shooters.
17. You shoot from the firing _____.
18. The National Rifle Association.
19. How you increase air pressure in a pneumatic airgun.
21. Soft lead airgun projectile.
23. The metal targets that are profiles of rams, turkeys, pigs and chickens -- you shoot at these only with pellets.
24. What you use to aim an airgun.
25. Never shoot BBs at metallic silhouette targets because they might do this.
28. What you call a rifle or pistol powered by air.
29. You make an airgun fire when you squeeze this.
31. You do this when you put pellets or BBs in an airgun's receiver.

Crossword and Diagram courtesy of Crosman Air-Gun News
Activity #5

Marksmanship entails

1. dominate eye
2. breath control
3. sight alignment
4. follow through
5. body positions
   a. prone
   b. sitting
   c. kneeling
   d. standing
   e. bench

Dominate Eye

The ability to clearly line up the sight with your target is critical. You should use your dominate eye for aiming.

Extend both arms in front of you, put your hands together with a small opening between your hands. Focus on the hole. Keeping both eyes open, look through the opening at an object in the distance.

Then slowly move your hands toward your face, while still looking at the object. Place the back of your hands on your face. The eye that your hands surround is your dominate eye. This is the side of your body on which to shoulder your rifle.

Breath Control

The ability to breath correctly helps to relax you and improve your arm. Take a regular inhale, exhale one half a breath, then shoot. Exhale other half a breath after shooting.

Sight Alignment

The ability to line up the sights with the target means you become a top performance shooter. Imagine looking through a tube. If you line it up with your eye, you can point it anywhere you want. The airgun barrel is the tube, but it is blocked on one end. That's why there are sights.

Line up your eye and the sights on a target. The sights should always appear sharp, the target may be blurry. Poor alignment angles the barrel away from the target.

When the sights are lined up with the target, then smoothly squeeze the trigger. Continue squeezing the trigger for a second or two after the shot is fired this is called follow through.

Follow Through

The ability to flow with the movement helps you to hit your target. Follow through is the act of continuing to maintain breath control, sight picture control and trigger control. This will minimize the possibility of any sudden movement which could change the bullet's path.

Body positions

The prone position is the steadiest of the positions.

1. Body lies facing target and angled slightly to left.
2. Left elbow is extended forward of body.
3. Right knee is bent slightly.
4. Rifle fore-end rests in left hand.
5. Right hand grasps rifle grip.
6. Butt of stock is positioned against shoulder so rifle sights(s) is at eye level.

The sitting position provides support for both elbows.

1. Body sits on ground.
2. Legs are extended from body, with ankles crossed.
3. Elbows rest on legs just in front of knees.
4. Rifle fore-end rests in left hand.
5. Right hand grasps rifle grip.
6. Butt of stock is positioned against shoulder so rifle sight(s) is at eye level.

1. Body sits on heel of right foot.
2. Lower left leg is vertical.
3. Left elbow rests on left knee.
4. Rifle fore-end rests in left hand.
5. Right hand grasps rifle grip.
6. Butt of stock is positioned against shoulder so rifle sight(s) is at eye level.

Arm-Rest standing position allows the shooter a high degree of stability and accuracy.

1. Feet are shoulder width apart.
2. Body weight is distributed equally on both feet.
3. Body bends back away from rifle.
4. Head is erect.
5. Left arm rests on side or hip.
6. Left hand supports the rifle - wrist is straight.
7. Right hand grasps the rifle grip.
8. Butt of stock is positioned against shoulder so rifle sight(s) is at eye level.

Bench rest position allows the shooter the advantage of a stationary rest to support the firearm.

1. Sit in chair with feet in a comfortable position
2. Place elbows on bench rest while aiming firearm
3. Cheek resting on the butt of the rifle
4. Left hand supports the rifle - wrist is straight
5. Right hand grips the stock
6. Butt of stock is positioned against shoulder so rifle sight(s) is at eye level.

Notice that all shooters are wearing eye protection.

TEST

1. T or F - An important attitude about safety comes from the home.

2. T or F - It is not important to follow and understand the 10 rules of shooting safety.

3. T or F - You must keep your right hand off the grip of the firearm until you are ready to shoot.

4. T or F - The firearm and ammunition should be stored separately.

5. T or F - The butt of the gun is the part you pull to fire the firearm.

6. T or F - You may shoot at animals with your air rifle.

7. The 3 most important rules of gun safety are:

   1.
   2.
   3.

8. Choose the most correct answer:

   A. The firearm laws in all states and countries are the same.
   B. The safety of the gun is where the bullet comes out.
   C. A bullet fired at the surface of the water can skip like a flat stone.
   D. All of the above.

9. Choose the most correct answer:

   A. The best safety rule when handling a gun is you, your common sense and your knowledge.
   B. Guns can load and fire themselves.
   C. The safety on a firearm is a mechanical device and it can fail.
   D. None are correct.

10. Fill in the blanks.

    Always _____ the direction the muzzle is _____.

Answers:

1. T
2. F
3. F
4. T
5. F
6. F
7. 1) Treat every gun as if it were loaded
   2) Keep the gun pointed in a safe direction
   3) Keep your finger off the trigger until ready to shoot
8. C
9. C
10. control; pointed

Extended Activities

Write a safety prescription for:

Dr. J.M. Safe
100 Prevention Drive
Hometown, USA 00000

Why do accidents happen?
people who are in a hurry
careless
take chances
do not watch what they are doing

Is this a safe thing to do?
Draw a cartoon about gun-safety

Optical illusion exercises
hallucination
phenomenon of "seeing" what we want to see

Writing Activity: Write the steps in order

a. How do we shoot a gun safely?

b. How to load a gun safely.

CERTIFICATE OF COMPLETION

This is to certify that

_____

has completed the Texas Parks and Wildlife
Air-gun Shooting and Safety Unit

_____ Teacher

_____ Date

Texas Parks and Wildlife Firearm Safety Curriculum for 4, 5 and 6 Grades Evaluation Form

		Yes	No
1.	Did you use the unit?	___	___
2.	If you used this program will you do so again?	☐	☐
3.	Did you share this program with other teachers?	☐	☐
4.	What is your overall opinion of the program?	☐	☐

Excellent Very Good Fair Poor

5. Thinking about the 5 activities, what did you like the most? What did you like the least?

6. What suggestions do you have to improve this program?

7. Number of students who used this material.

8. What were the reactions to this unit by:
   - students
   - parents
   - other teachers or administrators

9. How would you rate your knowledge of guns?

Extensive Fair Some None

Erica Lindstrom

Texas Parks & Wildlife
Brazos Valley Museum of Natural History
Bryan Texas

BRAZOS VALLEY MUSEUM
of NATURAL HISTORY

Jeff Henson - Mentor
3232 Briarcrest Dr.
Bryan, Texas 77802

Erica Lindstrom
Pre-Service Teacher
Texas A&M University
Elementary Education

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Erica Lindstrom

INTERNSHIP: Texas Parks and Wildlife and The Brazos Valley Museum of Natural History

SCHOOL: O'Donnell Middle School (Student Teacher)

PRIMARY SUBJECT: Life Science

ACTIVITIES:
*What is a Food Chain?
*What's Wrong With This Picture?
*Project Food Web.
*Food Pyramids and Biomass.
*Why Do We Care?
*Danger!
*What Are You Going To Do?

SUMMARY: Many students have heard the terms "food chain" and "food web," but frequently they are not aware of the significance and components of these concepts. Environmental concerns often center around the idea of habitats and their importance. However, food chains/webs are the backbone of properly functioning ecosystems. These activities will help students develop a better understanding of food chains, food webs, and their significance. Students will also gain an awareness of the dangers to these delicate food systems. Through activities and studies, students will learn about and create action plans for preserving and protecting these systems.

RESOURCES:
Chuck Thornton
Brazos Valley Museum of Natural History
Curator of Education
3232 Briarcrest Drive
Bryan, Texas 77803
(409) 776-2195

Jeff Hensen
Texas Parks and Wildlife Department
Inland Fisheries Biologist
E. 26 th Street
Bryan, Texas 77803
(409) 822-5067

Aralev, Neil. Dr. Jeffrey Bates. William Hemsley, et.al. Encyclopedia of Science. New York: Shooting Star Press. 1994.

Roa, Michael L. Environmental Science Activities Kit. West Nyack, NY: The Center For Applied Research In Education. 1993.

Project Wild. Colorado: Western Regional Environmental Education Council, 1986.

FUN WITH "FOOD SYSTEMS"!

(PRE-SERVICE) TEACHER: ERICA LINDSTROM
MENTORS: JEFF HENSEN AND CHUCK THORNTON

OBJECTIVES

1. Students will define and appropriately use terms relating to food chains/webs in written and oral communication.

2. Students will understand the significance of abiotic factors (air, water, and sunlight) in food chain/web systems.

3. Students will learn that food chains/webs are cyclical.

4. Students will be aware of the differences between food chains and food webs.

5. Students will work in teams to create food webs of particular habitats/niches.

6. Students will utilize picture blocks to create 3-dimensional models of food pyramids.

7. Students will understand the role numbers play in studying energy transfers and biomass exchange in food pyramids.

8. Students will appreciate the significance of food chains/webs in ecosystems.

9. Students will develop an awareness of some of the dangers to food chains/webs.

10. Students will learn about different careers involved in food chain/web preservation and protection.

11. Students will develop a "Personal Action Plan" for assisting food chain/web preservation.

WHAT IS A FOOD CHAIN?

(Objectives 1, 2,3,4)

Students will listen to and participate in a lecture about food chains. Students will learn about the different levels of food chains, including producers (autotrophs) and consumers (heterotrophs). Students will help create a simple food chain on the board. **Be sure that the abiotic factors (air, water, and sunlight) are included in the chain. For example:

sun/air/water----cattail plant----caterpillar----frog----heron

Once a basic food chain is created, the teacher will ask (if a student has not already brought this to the class's attention) "What happens when the heron dies? Does the food chain stop?" The class will then discuss the process of decomposition and the role of scavengers and decomposers. After discussions about how the food chain is actually a cycle, the class should expand on the previous food chain (add scavengers and decomposers) to complete the cycle. (NOTE: A close-to-home example of a food chain is a "living food chain" system. The classroom may already have such a system. Classroom pets, especially a frog or salamander, could easily represent a simple system. For example, the teacher provides the crickets with plants and grains to eat, and the frog eats the crickets. When the frog dies, bacteria decomposes the frog and breaks it down into fertilizer for soil, in which the plants grow. It's a cycle!)

WHAT'S WRONG WITH THIS PICTURE?

(Objectives 1,4)

After a simple food chain has been created, the teacher will ask "What's wrong with this picture? Do caterpillars eat only cattail leaves? Do frogs only eat caterpillars? (etc.)" The students will be introduced to the concept of a food web. The teacher will discuss how the food web is a more realistic representation of a food system. Students will help expand the existing food chain (on the board) to create a food web. To give students a more tactile and visual representation of the newly created food web, the students will participate in the "Food Web Game." For this game, each child will become an organism or abiotic factor in the web. The students will stand in a circle (be sure that they are mixed up so that the caterpillars aren't right next to the frogs, etc. The goal here is to create a "web."). The teacher will begin by holding the end of a ball of twine or yarn and tossing the ball to the "sun." He/she will then toss the ball (while holding a part of the twine/yarn) to the "air" or "water." The game will progress until all organisms in the web have a piece of the twine/yarn. The resulting web can be placed on the ground at the students feet, preferably in an area where it cannot be disturbed. However, after discussing the resulting web, it may be "destroyed" if necessary. If the web is "destroyed," it is recommended that the teacher have a smaller version of a web (perhaps made on a peg board/weaving board) for future use during these activities. The students will be creating webs of their own and the teacher could also make one of these as a smaller version of a food web.

PROJECT FOOD WEB

(Objectives 1, 5)

The students will be divided into teams and will be given/will determine a particular habitat that they will use in creating their own food web. (For example, the previous scenario was from a wetland. Many other wetland food webs could be created.) In teams (2 or 3 people, preferably) the students will research their area to find organisms that create a food web. Using magazines, drawings, or even just written words, students will create a food web on a paper plate or round piece of cardboard (pizza rounds work well). The students will glue pictures/write names of the organisms and abiotic factors around the circle in a "random" order. Slits will be cut (either by the students or teacher) and yarn will be used to connect the "parts" of the web. (MAKE STUDENTS AWARE OF SAFETY CONSIDERATIONS WHEN USING

SHARP OBJECTS TO CUT SLITS) The yarn will be permanently attached through the slits with tape on the back of the circle. (Please note: Make sure that the yarn is not too tight. It needs to be able to be lifted slightly from the surface for a future discussion. This discussion will demonstrate that when you disturb one connection on the web, you also disturb the others.) (For an example of a completed project, please see the Appendix.) Upon completion, the teams will present their webs to the class. During their presentations, students should discuss the abiotic factors, the producers, and the consumers.

FOOD PYRAMIDS AND BIOMASS

(Objectives 1, 6, 7)

Students will be introduced to a food pyramid, a vertical and pictorial representation of a food chain. The teacher will discuss the significance of both the "pyramid of biomass" and the "pyramid of numbers" food pyramids and the transfer of energy through food systems. The teacher will also define biomass, the total mass (or weight) of organisms. Students will learn about trophic levels and that only approximately 10 percent of the energy of a trophic level is transferred to the next level. After the lecture, students, in teams or individually, will be given blocks with different organisms on each block. (For an example, please see the Appendix.) The students' task will be to create an appropriate 3-dimensional pyramid with the blocks. The teacher will then present the class with questions concerning the structure and significance of the pyramid. The questions should be both number-related and biomass-related, and the answers can be oral or written.

WHY DO WE CARE?

(Objectives 1,3,8)

Why do we care? That question will be posed to the students. As a class or in teams, students will determine reasons for studying food chains/webs. After some time for idea generation, the teacher will discuss the reasons presented by the students. Some of the reasons should include (but are not limited to):

1. It's a cycle. Without this cycle, no organisms would exist!
2. Studying the numbers of animals in these food chains/webs (food pyramid) can provide scientists with valuable information concerning the health of the ecosystem. (For example, if classroom has a "living food chain," students can observe the tank for the number of crickets left at the end of a day (if the frog is fed daily or with a weekly sum at once) to determine if the frog is eating regularly and if there are too many crickets in the tank.)
3. Scientists can look at the levels of the food chains/pyramids to determine the number of consumers that a particular ecosystem can support.

The teacher will then discuss the significance of a stable food chain/web. To visually demonstrate this, students will need the food webs previously created. Each team will use their food webs to "act out" a particular scenario. The teacher will present each group with a story about something that happened in their ecosystem/food web. For example, in a wetland system, some construction work has resulted in the wetland drying up. (The teacher can add that most of the vegetation has died.) The students will then lift up the string(s) on their web that is/are connected to the plants (or water)

on the web. The students will observe all of the other strings that are moved/lifted as a result. The student teams can write down what organisms are affected by each scenario. After all scenarios have been "acted out," the students will present the "worst" scenario (where the most organisms were affected) and the "best" scenario (where the least organisms were affected).

DANGER!

(Objectives 8, 9)

As an introduction to this section, the students will participate in a modified version of Project Wild's "Habitat Lap-Sit." In this activity, students will, once again, become parts of the food chain/web. They will form a circle, each student facing the person in front of him/her. After some instruction, each student will sit on the person's lap behind him/her. Hopefully, the whole circle will be sitting. After someone falls, or even if the whole circle successfully sits, the teacher will reiterate the significance of a stable and balanced food chain/web. The circle represents a balanced web. When someone falls out or is pulled out, an imbalance has occurred. For example, if someone who was an insect falls out, perhaps the population was decreasing due to pesticides or too many of a particular predator. As a result, the whole food chain/web is affected, and in some instances, it completely collapses!

This activity will be followed with a brief overview of some of the many dangers to food chains/webs. After the overview, students will divide into teams (3 or 4 people). These teams will determine a "danger" (such as pesticides, over-hunting, habitat destruction, oil spills, etc.) that they wish to study in-depth. Each team will research their topic, the problems in the food chains/webs it's creating, and solutions people have attempted/are attempting. Each team will write a paper summarizing their findings. After research and writing is complete, student teams will present their issue, using visual aids when desired.

WHAT ARE YOU GOING TO DO?

(Objectives 10, 11)

Now that the students have been familiarized with some of the issues involving food chains/webs, they are prepared for action! First, the class will be visited by a local wildlife rehabilitator. This individual will share with the students his/her responsibilities and goals as a rehabilitator. He/she will discuss the need to leave wild animals in the wild. He/she will discuss the effects on food systems when humans intervene (for the better and worse) with wildlife. Students will also learn how to treat wild animals that may or may not appear to be injured. (Please note: If necessary, the speaker can be videotaped to enable more than one viewing if all students cannot be present.)

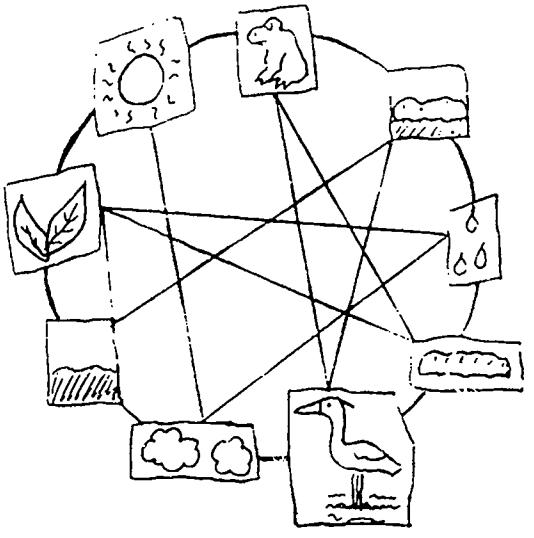
After the visit from the rehabilitator, students will learn about scientists and other individuals who, in some way, help the preservation and protection of food chains/webs. (Note: Many of these careers may also be concerned with habitat preservation.) The teacher will then direct the focus to the students and what they can do to help. The students will brainstorm individually about what they can do to help protect and maintain balanced food systems. The teacher will help the students get started by writing two or three ideas (that the students generate) on the board. From their brainstormed ideas, students will develop "Personal Action Plans" for assisting

food chain/web preservation. These "actions" can range from recycling to putting out extra birdseed in the winter. The students will then create an action plan for the classroom. This action plan will be posted in the classroom and students will be responsible for ensuring that this plan is followed.

APPENDIX

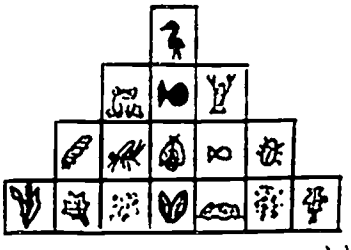
*PROJECT FOOD WEB

Example of completed food web project:



*FOOD PYRAMIDS AND BIOMASS

Examples of organisms for pyramid blocks:
(Note: These blocks can be made of wood, toilet paper rolls, or even film canisters. However, blocks work best.)
(*Also, these "blocks" can be flat squares.)



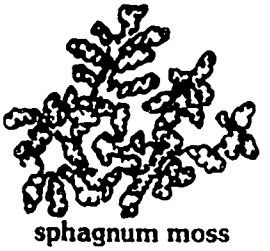
Example of pyramid.

These pictures were taken from the "Explore a Wetland" Copy Cat Page of Ranger Rick's Nature scope: Wading Into Wetlands

rushes

pitcher plant

cattails

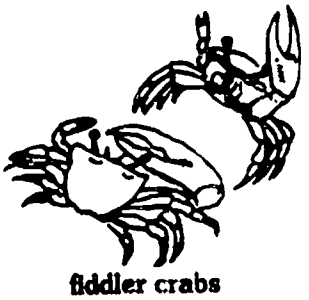


sphagnum moss

dragonfly

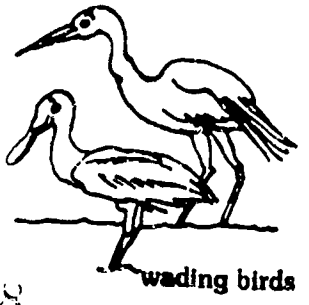
mosquito

snails

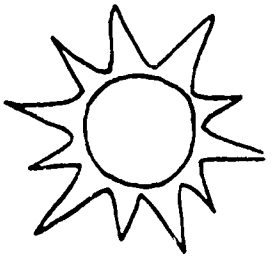


fiddler crabs

frogs



wading birds

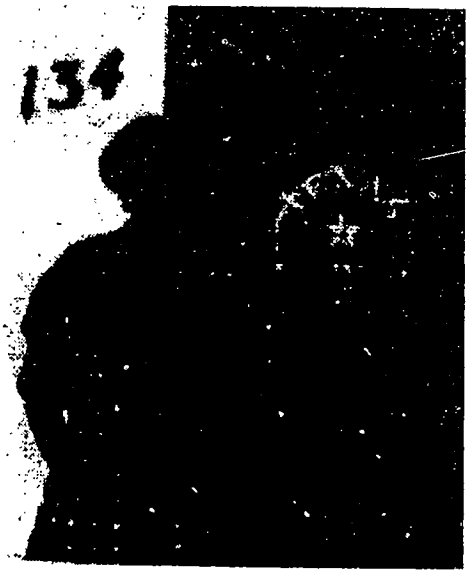


sun

Kathleen McGurk

Texas Parks & Wildlife / RayCo, Inc.
San Antonio Texas

Rufus Stephens - Mentor
134 Braniff
San Antonio, Texas 78216



Kathleen McGurk
Taft High School
11800 FM 471
San Antonio, Texas 78250

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: KATHLEEN McGURK

INTERNSHIP: TEXAS PARKS AND WILDLIFE/RAYCO INC.
OUTDOOR CLASSROOM
SCHOOL: WM. F. TAFT HIGH SCHOOL
SAN ANTONIO, TEXAS 78249

PRIMARY
SUBJECT(S): BIOLOGY/INTERDISCIPLINARY UNIT--FRESHMAN

ACTIVITIES: INDIVIDUAL, AS WELL AS COOPERATIVE GROUPING, WILL RESULT IN VISUAL AND ORAL PRESENTATIONS. WRITTEN ASSIGNMENTS COMPRISE THE PORTFOLIO, INCLUDING RESEARCH OF LOCAL NATIVE/NON NATIVE ORGANISMS, AND SOME OF THE MICROSCOPIC, AQUATIC LIFE INTERRELATIONSHIPS AMONG ORGANISMS AND THEIR ENVIRONMENT WILL BE INVESTIGATED. USE OF LOCAL MEDIA AND OTHER NARRATIVES WILL EMPHASIS THOSE WHO WORK IN NATURE, EG. ENVIRONMENTAL SCIENTISTS, URBAN BIOLOGISTS, AND AUTHORS. USING NATURE, THE AREA OF AN IRREGULAR OBJECT, EG. A LEAF, WILL BE CALCULATED AND CONVERTED TO ANOTHER UNIT OF MEASURE. APPLICATION OF THESE MEASUREMENTS TO ENVIRONMENTAL AND SCIENTIFIC STUDIES WILL BE IMPLIED, AS WELL AS REAL LIFE APPLICATIONS. FOCUSED DESCRIPTIONS WILL BE READ AND WRITTEN BY STUDENTS, AS WELL AS DRAWING AND LISTING OBSERVATIONS FOUND IN NATURE. ENVIRONMENTAL STUDIES, OTHER THAN LOCAL, WILL INCLUDE MICROSCOPIC INVESTIGATION OF POND WATER, AND HISTORICAL ENVIRONMENT IN WISCONSIN, AS TOLD BY ALDO LEOPOLD. THIS ACCOUNT ALSO EMPHASIZES MAN'S IMPACT ON NATURE, AND THE EFFECTS OF GOVERNMENT INTERVENTION.

SUMMARY: USING AN INTERDISCIPLINARY APPROACH, AND AN OUTDOOR SETTING, AS WELL AS GUEST SPEAKERS AND CURRENT EVENTS, STUDENTS MAKE OBSERVATIONS IN NATURE. MEANS OF REPORTING THEIR INFORMATION INCLUDE: A FOCUSED DESCRIPTION; GRAPHING AND CALCULATION OF AREA; WRITTEN REPORT OF THOUGHTS ON PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS; COMPILATION OF LOCAL ORGANISMS THAT WERE RESEARCHED; SKETCHES AND RECORDED OBSERVATIONS SHOWING THE RELATIONSHIP OF AQUATIC MICROORGANISMS.

RESOURCES:

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Miller and Levine. Biology . Englewood Cliffs: Prentice Hall, 1991.

Preston, Richard. The Hot Zone . New York: Random House, 1994.

OTHER CONTACTS

Gardenville
Malcolm Beck
7561 E. Evans Road
San Antonio, Tx. 78266
(210) 651 - 6115

New York Science, Technology,
and Society Education Project
89 Washington Avenue, Room 228
Albany, New York 12234
(518) 486 - 1726

Project Learning Tree
American Forest Foundation
1111 Nineteenth Street, NW
Washinton, DC. 20036
(202) 463 - 2462

Project 2061
Peggy Carnahan
Texas Center for Science and Technology
San Antonio College, Moody L. C #659
1300 San Pedro
San Antonio, TX. 78212
(210) 733 - 2061

Project Wild -- Aquatic Project Wild
5430 Grosvenor Lane
Bethesda, MD. 20814
(301) 493 - 5447

Wisconsin Fast Plant Program
1630 Linden Drive
Madison, Wisconsin 53706 - 1598

take a close look!

OBSERVATIONS IN NATURE

English	**Focused Description**
Mathematics	**Leaf Graph**
History	**Native Organisms**
Biology	**Microscopic Observations of Pond Water**

An introductory unit,
utilizing an outdoor classroom.
Grade 9, Interdiciplinary.
by Kathleen J. McGurk
Taft High School, San Antonio, Tx.
in conjunction with: Texas Alliance,
Texas Parks and Wildlife, Natural Iniatives.
Funded by RayCo, Inc., San Antonio;
Texas Parks and Wildlife Department.

OBSERVATIONS IN NATURE Sample lesson with Math integration

OBJECTIVES: Make observations in nature with an emphasis on only one shape
Measure the area of an irregular object
Practice respect for nature (Take nothing with you from nature, leave only footprints)

MATERIALS: Pen/pencil
One sheet of paper/student with a single shape on it.
Tissue paper and crayon as needed for leaf print. (from teacher)
Graph paper

PROCEDURE:

1. Obtain a single sheet of paper from your instructor. Check to be sure there is a shape on it.
2. Each student, CHOOSE ONE, of the following ways to collect data:
   A. Make a list of objects with your particular shape.
   B. Draw each object having that shape.
   C. Draw a scene and mark the objects having your particular shape.
   D. Describe the objects having the shape.

Note: Your shape may be part of an object, a pattern within an object, the whole object, or a grouping that forms the shape you have. Manmade items are NOT acceptable for this assign.

3. Before returning to the building with your class:
   A. Find a fallen leaf on the ground, trace it, and return it OR:
   B. Make a leaf print of an attached leaf.

   Reminder: Take nothing from nature. Leave only footprints!!
4. If necessary, transfer the outline of the leaf to your graph paper.
5. Count all of the squares, to determine the area of this irregular object. You may record numbers in the squares. Be sure to calculate parts of squares that make a whole square and add to your total. Be as accurate as possible.
6. Include the answers the following on your graph paper:
   * What is the width of each square?
   * What unit of measurement is the used for the area?
   * In a real life situation, what are some other circumstances where I would have to calculate the area of irregular shapes? (The number of square feet of flooring needed for a room.)
   * Why would the area of a leaf be important to know?
   * Why is it important to be observant of nature?
   * How do we influence the effects of nature?

EVALUATION

1. Each student is to collect data choosing one of the methods outlined in Procedure #2. Near the enc of class, another student will rate your data with a / + or - and initial the paper. These will be taken with you to English, and be used for your Focused Description. Record your rating and initials by your name on the roll sheet for a daily grade.
2. By the end of class, you must have an outline of a leaf on your graph paper, so that you may complete the homework assignment.
   BE SURE NOT TO TAKE ANYTHING FROM NATURE!
   The Squares of this irregular object should be counted. Note if your leaf appears singly; in pairs, as an alternate or opposite arrangement; or in a composite and note the arrangement. Follow procedures #3-5 and include answers to procedure #6 on your graph paper. Bring this to the next Biology class to evaluate by doing a class comparison. Unfinished work will be unexcused and incomplete.
3. Your grade for class today begins with a "+" and only lowered if you are not working or if you are bothering others. Teacher discretion is final.

Activities are adapted from "Poet Tree" and "The Shape of Things" found in Project Learning Tree.

OBSERVATIONS IN NATURE PART 2

OBJECTIVES: Evaluate by comparison the correctness of your calculated area
Arrange leaves chronologically from smallest to largest
Correct for miscalculations
Display leaves in some artistic form.
Recalculate the area using familiar shapes and formulas within or outside of the irregular shaped leaf.
Apply this method to a real life situation.

MATERIALS: Completed assignment Ruler Pencil Graph paper, as needed.

PROCEDURE:

1. Chronologically order your drawings from smallest to largest . To do this, each row of students will compare their pictures to others in their row and line up with the next smaller leaf to your right and the next larger leaf to your left. Row after row we will keep arranging smallest to largest until the entire group has the leaves arranged.
2. A further comparison is made by checking if the person's leaf to your right has a smaller area than your leaf's area, and if the persons leaf to your left has a larger area than your leaf's area. The areas should be progressively larger as the leaf size increases. Anyone whose leaf that has an area that is far out of line should have the students to his/her right and left help recalculate the area of the leaf and identify where the error occurred.
3. Re trace your leaf pattern on graph paper. Obtain another sheet from your teacher if you need to.
4. An arrangement of the tissue paper leaf prints or the original outlines can be designed on the wall, bulletin board or window; or saved for another class if this particular group has no one interested in designing.
5. On the second outline of your leaf, mark off as many rectangles and squares as you can. Number these and calculate the area of each. Add these areas together as well as any single whole and partial squares that remain. This is another way of calculating the area of an irregular object.
6. Answer the following questions on your graph paper, and clearly mark the two calculated areas obtained for the leaf:
   A. Which method of calculating the area was faster?
   B. Which method is more accurate; OR were they comparable?
   C. What unit of measure did you use? Now use a formula to convert it to any other unit of measure. You may use texts or ask your math teacher to assist you.

EVALUATION: 5 points for each question.

1. Neatness: Were your drawings legible, and submitted for display?
   Were the answers to questions organized?
   Were the Math calculations easy to follow?
   Were the calculated areas clearly marked?
2. Completeness: Were all drawings present?
   Were all questions answered?
   Were all math calculations shown?
   Were calculated areas completed by both methods?
3. Accuracy: Were your drawings concise and comparable?
   Were your answers and units of measure correctly stated?
   Were math calculations done correctly, using correct formulas?
   Were the calculated areas correct and comparable?

ENGLISH The English portion of this unit will invoive a written, visual and oral presentation of a focused description found in nature. The visual may include photography or videos, various art forms, shape poems or another teacher approved, student initiated idea. The written portion will be worked on in class and will include data observed during a Biology outing of the campus (see sample lesson). The oral presentation will be presented to the class in an outdoor setting unless video equipment or weather warrants the use of the auditorium. The presentations may be individual or small group and must utilize student's visual and/or written portions of the assignment. Evaluations will be made by student groups, and the final written presentation will become a part of the student portfolio for the unit. . The readings included in this unit follow: a selection from the June 1995 Reader's Digest "The Secret World of a Pond" by Michael Pollan and "Giant Water Bug " by Annie Dillard, found in "Elements of Literature " textbook (Holt, Rhinehart and Winston). Additional readings dealing with authors associated with nature include "A Sand County Almanac and Sketches Here and There" by Aldo Leopold, "The Norton Book of Short Stories About Nature, and current media articles from various sources.. Some of these activities are adapted from "Poet Tree" and "The Shape of Things" found in Project Learning Tree. An extension to the unit can be adapted from Project Learning Tree activity entitled "Sounds Around".

HISTORY The History portion of this unit will consist of two parts . The first part is scheduled near the middle of the unit and at the completion of the English presentations. It will begin with the explanation of the assignment and immediately followed with a guest speaker, Rufus Stephens, Urban Biologist, who will provide an introduction to native vegetation. This will familiarize the students with their surroundings. If a speaker is not available, other organizations can serve as excellent references. Some of these may include: the local Audubon society, County Extension Services, horticultural agencies, local gardening groups, botanical gardens, Parks and Recreation Departments, local nurseries, and the public library.

The first portion of the History component of this unit deals with local native organisms and involves student research. The unit begins with Mr. Stephens, who will do a show and tell about native grasses and plants. This will be done in an outdoor setting, utilizing some of the campus' resources. A list of the plants and wildlife will be distributed to the students following the presentation , so that the students will have proper spelling of the terms that they may want to research further. Later, we may ask Mr. Stephens for assistance in scientifically classifying some of the organisms as well as correlating some of the Latin meanings to the characteristics of the organism. A writ ten, oral and visual presentation will be the final products of the unit. The students will choose and vote on the title and location of the visual display The oral presentation will be evaluated by the listeners, probably the students and perhaps the principal, and must incorpoate the visual. The researched information will include native and non native organisms with an emphasis on the following: What was here to attract settlers to Texas?; What, how, and why did they introduce new organisms?; What impact did it have on the environment?. The written portion is part of the student portfolio for the unit.

The second portion of the History component involves a nonnative area and reading pages 6-18 from "A Sand County Almanac and Sketches Here and There", by Aldo Leopold. This may be used at the end of "Observations in Nature"; interjected on a given day when other plans don't work out,(eg. inclement weather on day scheduled for an outdoor outing); or may be used at another time of the year. It is designed to last 1-2 days and parts of it may be done outside of the classroom. An appreciation for the need to regulate hunting and to use precautions to prevent fires and flooding can be appreciated in the lesson, as well. Integrated into the lesson is the growth process of annual rings. An extension of theis lesson can emphasize the impact of logging expedtions on the natural environment. The extension utilizes "Dating Game" from a book entitled "Nature Puzzlers" by Lawrence E. Hillman. "Tree Cookies" from Project Learning Tree can also be incorporated into this portion of the unit.

Local Wildlife

Choose 3 categories from the left column and 3 categories from the right column:

Grasses	Amphibians
Herbs	Reptiles
Scrubs	Mammals
Trees	Insects
Flowering Plants	Birds
Vines	Fishes
Other Non Flowering Plants (Mosses, Ferns, Lichens)	Fungi
	Protists
	Monerans

Identify and research 5 organisms from each of the categories that you chose.
Complete an "Organism Identification" sheet (next page) for each researched item.
Bind these sheets together with a Bibliography, and Title for the collection
Bonus points will be awarded for each reference that you found outside of class.
(Teacher discretion is final for bonus points.)
This portion of the assignment is due in two weeks.

Find, document, and bring a news article, in its entirety, to class.
It should relate to any organism from the categories listed above.
How to document a news article can be found in your resource notebook.
This portion of the assignment is due in one week.

Choose 1 organism for In Depth Research.
Prepare an oral and visual presentation for the class.
Guidelines for this presentation are on the third page of this handout.
Half of the class will present animallike organisms and half will present plantlike organisms, so be sure to decide early, in order that the choice you make is not already taken and that you have plenty of time to do a great job!
This portion of the assignment is due in 2 1/2 weeks

Your presentations will be displayed. Make them something to be proud of !!
To make this "YOURS", there will be a contest to name the display, and the location for the display. (eg. "S.A. Wildlife", area outside of Bio. classrooms).
This will take place at the end of the presentations.

ORGANISM IDENTIFICATION Name_____Period_____

Outline or silhouette the whole organism or parts of the organism which help to identify it. (eg. the shape or arrangement of the leaves)

Write a description of the organism, including color, shape, seasons when present in S.A. area, significant parts (eg. flowers, berries, beak shape, type of claws)

BEAR IN MIND!

PLAGIARISM IS A CRIME

Locate the origin of the organism (Is it native? If not, how, when,and why did it get to this area? Did it have to adapt to survive here?)

Uses for the organism (eg. medicinal, nutritional, predator, prey, furniture, hides)

Availability (eg. Is it nearly extinct? Is it plentiful? Overpopulation? Are there limited localities where it exists? Is it widespread?)

Classification

Is there a nickname, slang expression characterizing it?

Scientific: Kingdom
Phylum
Class
Order
Family
Genus
Species

Does the Latin interpretation explain a characteristic of the organism? What is it?
Who are its relatives?

BRIGHT IDEA

You may color code the information, highlight the terms that you use, use different color sheets for each category.

IN DEPTH RESEARCH

Visual Presentation Should include:

1. An 8 X 10 inch (minimum) visual of the organism alone or in its environment.
   This can be in the form of a collage, photo from news media or computer print out, snapshot(s), mosaic, sketch, outline, cardboard or poster board silhouette.
2. Dimensions of the organism drawn to scale.
   Label the parts/functions used for:
   - food gathering
   - barriers/protection
   - control center
   - waste removal
   - defense
   - locomotion/movement

   Briefly explain how they work
3. Map the region of its habitation in Texas. Mention if it lives in other places, and list the locations.
   Describe its habitat.
4. Complete an Identification Fact sheet.

BRIGHT IDEA  Big Books (Each Page = 1 Poster Board), "Stain Glass", Shadow Box (Shoe, Gift Box), Kaleidoscope, Window Display.

Oral Presentation

Should cover all materials included on the visual
A **bibliography** with your name on it is due at the time of the presentation
A copy of your evaluation will be copied on the back of the bibliography.
Use your visual for the oral presentation. Be sure it can be seen by your audience.

Presentations may make use of: tape recordings, information buttons/ recordings, slide shows, interviews, correspondence, individuals or groups, panel discussions, videos (with/without captions/titles), outdoor settings.

Some suggestions for group presentations: Native Organisms/Non Native Organisms Scientific Classifications, Localities. Be sure to involve everyone, and make visuals seen at time of presentation without distractions (visual or oral).

EVALUATION

News Article- graded according to the format already established in your resource notebook. Total 30 points.

Organism Identification Collection- will be graded for neatness (clarity, appeal), completeness (all required info.), and accuracy (correct, following format). 30 organisms X 3 criteria = 90 points
Bibliography and title page = 10 points

Bonus points awarded for finding and using your own references.
Copying other students' work results in sharing of the credit.

Visual/Oral Presentation

5 points for each of the following:

Neatness- Is it pleasing to the eye?
Is it easy to read?
Is it logical?
Is it legible?
Is it organized according to directions?
Can it be displayed?

Completeness - Is all required information available?
Is all of the information presented?
Does the display have complete thoughts listed?
Is there a Bibliography?
Was the student ready to present when asked?
Are all of the members in a group involved in presentation?
Are listings complete?

Accuracy- Is information correct?
Is it original, not plagiarized?
Are terms pronounced correctly?
Are terms explained correctly?
Are drawings to scale?
Are labels correct?
Are graphs and charts accurate?
Is spelling correct?
Are categories correct?
Is format correct?

Tutoring and Parental assistance will be offered until assignments are completed. Partial credit will be given, if late without consent. No zeros will be awarded.

Tree Cross Sections--A Lesson in History and Biology.

Objectives: Appreciate the conservation of nature, government intervention.
Learn about the history and the ecosystem of another area of the United States
Understand the parts and functions of a woody plant.

Procedure/Evaluation:

Read "Good Oak" excerpt from "A SandCounty Almanac" by Leopold Aldo (pp 6-18)

Answer the following on your own paper with a complete thought 5 points

1. During what period of time was this account taking place?
2. What animal affects the sprouting of the oak?
3. When would a tree ring be thick? thin? (2 points)
4. Where is the new ring of a tree added? near the bark? in the center?

Draw a cross section of the tree and **label** the year, event for each of the following:

* Wildlife that became extinct to the area.
* Wildlife that became endangered in the area 1 point for year, 1 for the event
* Goverment agencies/laws that were founded. total 50 points
* Non native species introduced to the area.
* Years of drough, flood,fire.

List all of this ecosystem's wildlife that is mentioned in the article. 40 points.

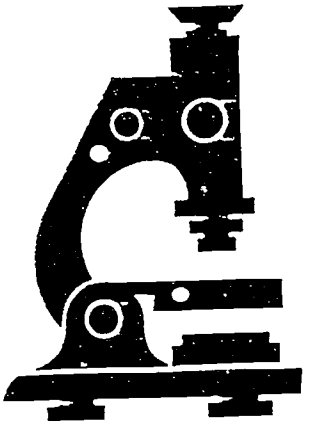
Outline a map of the United States and **label** where this oak grew. Include the following: county, state, major city, river and lake mentioned as closest to the tree. 6 points

Draw a woody plant and **label** the following parts, and **explain** the function/ feature of each part: sapwood, heartwood, bark, xylem, phloem, pith. 12 points

Remember your name and period. 2 points Total = 115 points

Extension: Using "Dating Game " from "Nature Puzzlers" by Lawrence E. Hillman , an understanding of non concentric growth of woody plants, and the effects of logging expeditions can be appreciated.

Adapted from Tree Cookies" found in Project Learning Tree.



MICRO ODYSSEY

OBJECTIVES

Students will 1) identify forms of microscopic life that live in water, 2) describe the interrelateness of various aquatic plants and animals, and 3) describe the preparation and observation of a microscopic specimen.

METHOD

Students will examine, draw, paint and identify microorganisms found in pond water.

MATERIALS

- Pond Water
- Coverslips
- Glass Slides
- Medicine Dropper
- Microscope
- Writing Materials
- Art Supplies
- Protist Identification Guide
- Textbook

BACKGROUND

When Linnaeus first developed his classification system in 1758, the microscope was still a relatively new invention, and the term organism brought to mind something microscopic. All living things were classified as plants or animals. Eventually, by using the microscope, a unique group of organisms was found that had the characteristics of both plants and animals. Today they are grouped in the kingdom known as Protista. They are unicellular (one celled) and eukaryotic (have a nucleus). Some are known to link together and form colonies.

There are thousands of these tiny organisms that make their home in the water. Without them, the entire aquatic ecosystem could not function. Protists are vital in the food supplies of fish aquatic birds, reptiles, amphibians and mammals.

PROCEDURES/OBSERVATIONS

1. Using the medicine dropper, put a drop of pond water in the center of a clean glass slide. Be sure to get water from within the container and not just at the surface.
2. Cover the drop of pond water with a coverslip. With your microscope set on low power, look for signs of life in the water.
3. When you find microorganisms, switch to medium power and focus with the fine adjustment. Observe how they react with one another.
4. Try to get a microorganism in the center of the field. Switch to high power and focus with fine adjustment. Do NOT focus downward or use the coarse adjustment.
5. Draw the protist and next to it describe its appearance and behavior. Note its shape, color, organelles and how it moves. A "fluttering" at the edges is a sign of cilia.
6. Using your text or a protist identification guide, try to identify the protista in your drawing.
7. Answer the following questions on your paper.
   - * What happens when they bump into an obstacle?
   - * Do some seem to be predators?
   - * Which of the other microorganisms do the predators prey upon?
   - * Using the background information and your textbook, what is a protist?
   - * What is an odyssey?
   - * What sort of events from outside the pond could be major disasters to all of the protists?
8. Write a short paragraph about the habits and habitat of one of these life forms. Make a large sketch, drawing or painting of it using detail and accuracy
9. Draw a low, medium, and high power observation of three different views seen through the microscope.

EVALUATION

Observation #5 = 3 points
#6 = 1 point
#7 = 6 points
#8 = 6 points
#9 = 9 points TOTAL 25 points graded during lab.

Research

1. Draw a simple illustration of the following pond organisms: daphnia, euglena, hydra, spirogyra rotifer, water mite.
   Label your drawing to include parts which have the following functions: locomotion, barriers, food gathering, control center, and waste elimination.
   Label the part and in parentheses list its function. eg. Flagella (Locomotion)
   36 points
2. Identify each organism in #1, plus sulfur bacteria, as producer (P), consumer (C), or a decomposer (D).
   To what Kingdom do the sulfur bacteria belong?
   To what kingdom do the organisms in #1 belong?
   Why is the sulfur bacteria listed in a separate kingdom?
   10 points
3. Use at least three of the organisms listed above, and others to construct an aquatic food web that might be found in a pond.
   14 points TOTAL 60 points

EXTENSIONS

* Observe pond water at later dates to note changes over time.
* Perform the Teacher Demo. from "Biology" by Miller/Levine (Prentice Hall) found in the Teacher Resource Manual entitled "The Effect of Various Stimuli on Paramecia"
* Collect water from various sources. Then label and compare them. eg. hay infusion (paramecia), tomato roots (amoebas), well water.
* Continue the Protist unit by investigating soil microbes and their role in their ecosystem. Utilize Chapter 2 "Biotechnology Readings" (Prentice Hall); and guest speaker or interview of owner of Gardenville for information on soil microbes.
* Continue with a moneran unit and utilize "Epidemics- Can We Escape Them?" by the N. Y. Science, Technology, and Society Education Project; "Biology," by Miller/Levine Science Reading Skill entitled "Problem Solving- How Scientists Solved the Problem of Yellow Fever"; excerpts from "The Hot Zone", by Richard Preston.

Adapted from Biology by Miller/Levine (Prentice Hall) Chapter 18 Lab Worksheet "Examining Protists"; and Aquatic Project Wild "Micro Odyssey".

Performance Assessment --- Microscopic Investigation of Pond Water

Objective: Understanding the parts aand function of the microscope, describe the sequence of steps take to prepare and examine a microscopic slide .

Preparation: Review the section of text that explains the microscope parts and function and microscopic investigation.

Procedure: Describe, chronologically and using your own paper, the steps taken in preparing and observing a microscopic specimen. Be accurate! Highlight each of the following terms as they are used:

Coarse Adjustment
High Power Objective
Arm
Coverslip
Eye Dropperb
Eyepiece
Microscopic Slide
Base
Monocular Lens
Low Power Objective
Textbook
Stage
Fine Adjustment
High Power Objective
Stage Clips
Protist Identification Guide
Nosepiece
Medium Power Objective
Iris Diaphragm
Light Source

20 points-- each term used correctly
20 points-- each term highlighted
20 points-- chronological
20 points-- accurately assessing another student
10 points-- neatness, on time
10 points-- made corrections

Total 100 points

Description is due at the beginning of lab
Evaluations and corrections due at the end of lab
Initial what you evaluate or lose 20 points!

Tools

News Articles for Science Credit

Cut out the article in its entirety.
Include the date and the publication name with the article.
Submit your written report of the article.

Written Reports

All written reports should include the following :

Your name and class period
Name of the publication
Date of the publication
Title of the article (heading for the report)
Area of science the article relates to
5 sentence summary. Use " ", if quoting.
Any comment, or a "no comment" statement
Definition of unfamiliar scientific vocabulary
Definition of other unfamiliar vocabulary.
(If no new vocabulary, state this.)

Any of the above requirements not met, or a nonscientific article chosen, the evaluator reserves the right to award **no credit.**

RESOURCES:

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Preston, Richard. The Hot Zone . New York: Random House, 1994.

OTHER CONTACTS

Gardenville
Malcolm Beck
7561 E. Evans Road
San Antonio, Tx. 78266
(210) 651 - 6115

New York Science, Technology,
and Society Education Project
89 Washington Avenue, Room 228
Albany, New York 12234
(518) 486 - 1726

Project Learning Tree
American Forest Foundation
1111 Nineteenth Street, NW
Washinton, DC. 20036
(202) 463 - 2462

Project 2061
Peggy Carnahan
Texas Center for Science and Technology
San Antonio College, Moody L. C. #659
1300 San Pedro
San Antonio, TX. 78212
(210) 733 - 2061

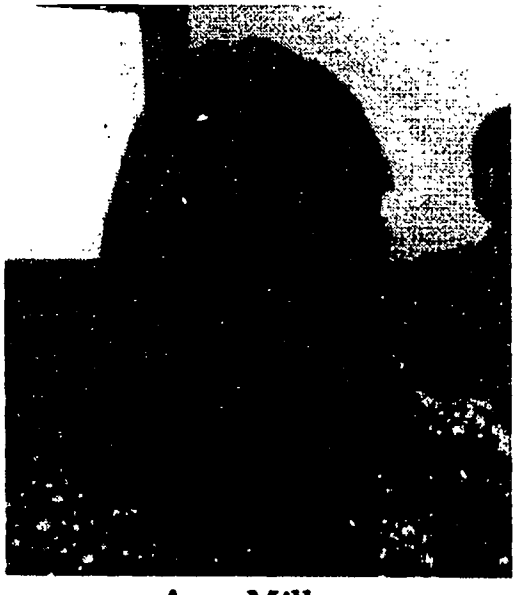
Project Wild -- Aquatic Project Wild
5430 Grosvenor Lane
Bethesda, MD. 20814
(301) 493 - 5447

Wisconsin Fast Plant Program
1630 Linden Drive
Madison, Wisconsin 53706 - 1598

Ann Miller

Texas Parks & Wildlife
Austin Texas

Dave Buzan - Mentor
4200 Smith School Road
Austin, Texas 78744



Ann Miller
Lake Travis Middle School
3322 Shannon Oaks Trail
Austin, Texas 78734

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Ann Miller

INTERNSHIP: Texas Parks and Wildlife Department

SCHOOL: Lake Travis Middle School

PRIMARY SUBJECT: 7th and 8th grade science

ACTIVITIES: Bug Picking in the Field

Bug Picking in the Classroom

Counting the Kill

SUMMARY: The activities listed above will involve students in careful observation of aquatic macroinvertebrates. Using the macroinvertebrates as "water canaries", students will determine the water quality of the stream the macroinvertebrates came from and learn about pollution threats to our fresh water resources. Students will also learn about how pollution and wildlife biologists perform some of their work and how citizens can be an intregal part of the team that investigates wildlife kills and chemical spills.

These activities are intended to:

- encourage teamwork among students
- involve students in problem solving, and critical thinking
- introduce students to wildlife biology as a career
- acquaint students with aquatic life in rivers, lakes, and streams
- help them to discover ways in which pollution affects aquatic wildlife

RESOURCES: Dave Buzan
Kills and Spills Team Leader
Texas Parks and Wildlife Department

Texas Alliance for Science, Technology, and Mathmeatics Education, TAMU,
Dr. Robert K. James, Director, Brian T. Walenta, Project Coordinator

COUNTING THE KILL

Written by: Ann Miller, teacher intern and Dave Buzan, mentor, at Texas Parks and Wildlife Department. For more information about this activity, contact Dave at (512) 389-4634 or Ann on TENET, afmiller@tenet.edu

OBJECTIVES

Students will be able to:

1. devise a method for estimating the number of "fish" in a specially prepared box
2. explain why fish killed in the field must be counted quickly and without bias by wildlife biologists
3. make educated guesses about what can cause fish or wildlife kills
4. describe how pollution biologists on the Kills and Spills team of Texas Parks and Wildlife respond to wildlife kills and pollution threats

METHOD

Using large boxes with lids and grids marked on the inside bottom, students will estimate the number of "fish" in a fictitious fish kill. Subsequent discussion will examine how fish and wildlife kills take place, how biologists estimate the cost of the lost wildlife and habitat, and how both citizens and pollution biologists with the Texas Parks and Wildlife Department can work together to reduce the threats to wildlife.

AGE

Grades 3 through 8

BACKGROUND

When fish and wildlife are killed or threatened by spills or leaks of hazardous chemicals, the Kills and Spills biologists of Texas Parks and Wildlife respond quickly to identify the problem, assist in clean-up efforts, estimate damages to wildlife and their habitat, and identify who is responsible for the pollution. Care is taken to assure that accurate counts are made of damage to wildlife so that restitution can be made by the responsible party. Because there are only 5 field biologists for the entire state, students are asked to report animal kills or chemical spills to their nearest Kills and Spills Team biologist as listed in the Kills and Spills Team brochure.

MATERIALS FOR EACH GROUP

1. Large box with a lid that has a grid drawn on the bottom of the inside that divides the box into 6 sections. A boot box works especially well.
2. small colored marshmallows, fish crackers, beads, or any small token that can represent dead fish . You should use 2 or more different colors or shapes to signify different kinds of fish.
3. timer
4. one die
5. 1 student data sheet
6. slides or pictures that illustrate causes of wildlife kills

PROCEDURE

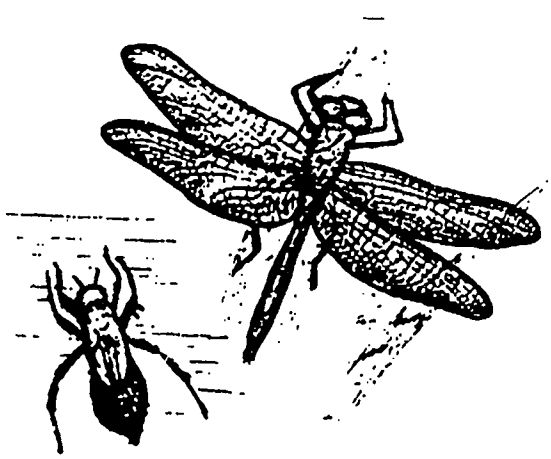
1. Use the Kills and Spills Team brochure to provide students with background information about the work of the pollution biologists.
2. Pass out the prepared boxes to each lab group and explain that one of the hardest jobs of the Kills and Spills team is to get an accurate estimate of the numbers of dead fish in a fish kill.
3. Before allowing students to look in their boxes, tell them that their job is to count the number of " fish" in their box in 30 seconds after you say "Go." (Biologists often have to count very quickly before the fish get carried downstream or are eaten by predators or scavengers.)
4. After 30 seconds is up, ask how each group did? Was it easy to count the fish? Can they think of a method to make counting easier in that time?
5. Using the grid on the bottom of the box, students generally come up with the idea of making an estimate by counting the number of items in one square and multiplying by the number of squares, which is called taking a "representative or scientific sample."

COUNTING THE KILL

7. Ask students to imagine they are biologists and that the box represents a section of a stream. Are there any squares with few "fish?" Are there any squares with a very large amount of "fish?" How do you decide which square to count? Biologists must make their counts in a way that is fair to both the people of Texas who may have lost wildlife and the people who may be held accountable for the losses. That means they can't just choose where to make their counts if they can't count all of the fish. They use a special book of random numbers that helps them pick a random section of the stream to count.
7. To simulate getting a random number, students will roll a die to see what section of the box to count. Then they should close the lid, shake the box gently, and wait until the signal to open the box and make a second count based on a representative sample. This time, give students 15 seconds to make their estimates.
8. Use the Student Data Sheet 1-6 to complete the activity.
9. Parts 7-9 and the Extension of the Student Data Sheet should be used to stimulate class discussion.
10. Show slides or pictures of fish and wildlife threats, including different types of pollution.

EXTENSIONS

1. Students could call their nearest Kills and Spills team member to find out about wildlife threats in their areas. See the Kills and Spills team brochure.
2. Students could interview wildlife biologists to find out what education they would need to do that job and what other types of jobs wildlife biologists do.
3. Students could research a particular pollution threat and report to the class.



COUNTING THE KILL - STUDENT DATA SHEET

1. What number did you roll for the count?_____

2. How many squares do you have in all?_____

3. Use the space below to arrive at an estimate of the total "fish" in your box.

4. How does your total compare with the totals in the rest of the class?

5. If you were going to be held responsible for paying for the dead fish, which total would you want?_____ Which one would you be unhappy with?_____

6. If the dead fish were given a value of $2.00 each with no difference for different kinds of fish, what would you have to pay?

   _____

7. Compute the amount owed if:
   fish # 1 cost $ 2.00 each and fish # 2 cost $1000.00 each.

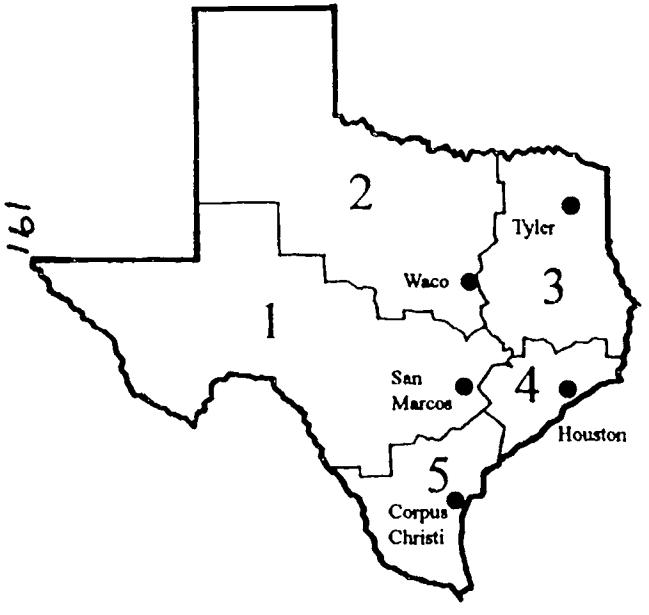
   How does this amount compare with the amount in # 6?

8. What are some of the causes of fish kills?

9. What can you do to help minimize problems that cause fish kills?

10. Who would you contact in your area to report a situation in which you saw dead or distressed wildlife?

The **Kills and Spills Team** is asking for your help. If you observe any pollution that appears to threaten fish and wildlife, or if you have any questions about water quality and its relationship to fish and wildlife, please contact the nearest **Kills and Spills Team** member. The names and phone numbers of the regional biologists can be found below the map.



Austin Headquarters: Dave Buzan (512) 389-4634

Austin Headquarters: 1 (800) 792-1112

Region 1: Cindy Hobson (512) 353-3474

Region 2: Joan Glass (817) 799-2448

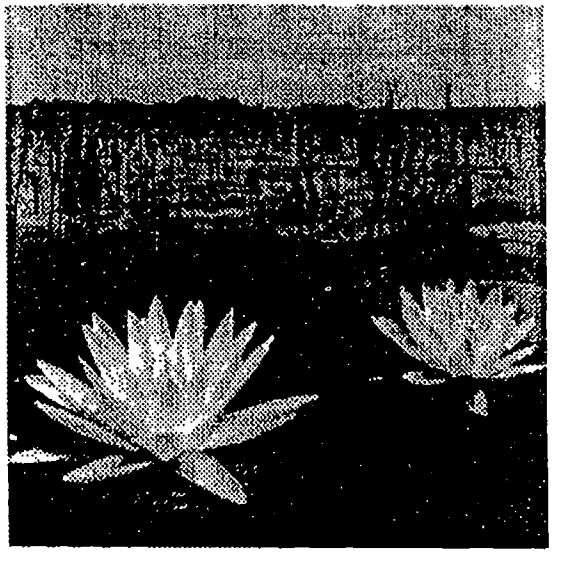
Region 3: Andy Labay (903) 566-2518

Region 4: Winston Denton (713) 291-9914

Region 5: Ken Rice (512) 993-4492

202

Protecting our Resources for Future Generations



U.S. FWS

Texas Parks and Wildlife Department
Resource Protection Division
4200 Smith School Road
Austin Texas 78744
(512) 389 - 4864

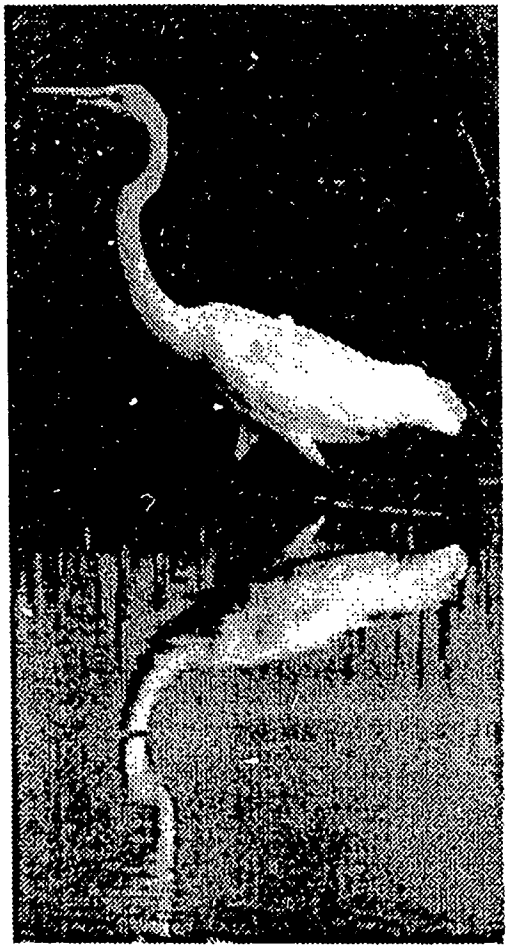
TEXAS KILLS & SPILLS TEAM

always on duty

203

identify who is responsible for the pollution.

In addition, pollution biologists on the **Kills and Spills Team** study waste water discharges to understand their impacts on wildlife. They work closely with other agencies.



Steve Delaney

Spilled oil in a marsh hurts shore birds and nurseries of many salt water animals.

The Water Quality Detective

Chapter 1

You can be a water quality detective by checking for the following signs:

Your creek may be polluted if:

- The water has a bad odor, like rotten eggs or sewage
- You see a lot of dead fish floating or washed up on the shore (this is a fish kill)
- You see fish swimming at the top of the water gulping for air
- The water is blackish, grayish, or pink
- There is a black or blue-green scum floating on the surface
- There is an oil sheen on the surface

Your creek is probably healthy if you can find some of the "bugs" pictured below underneath the rocks in your creek:

stonefly larvae

water penny

mayfly larvae

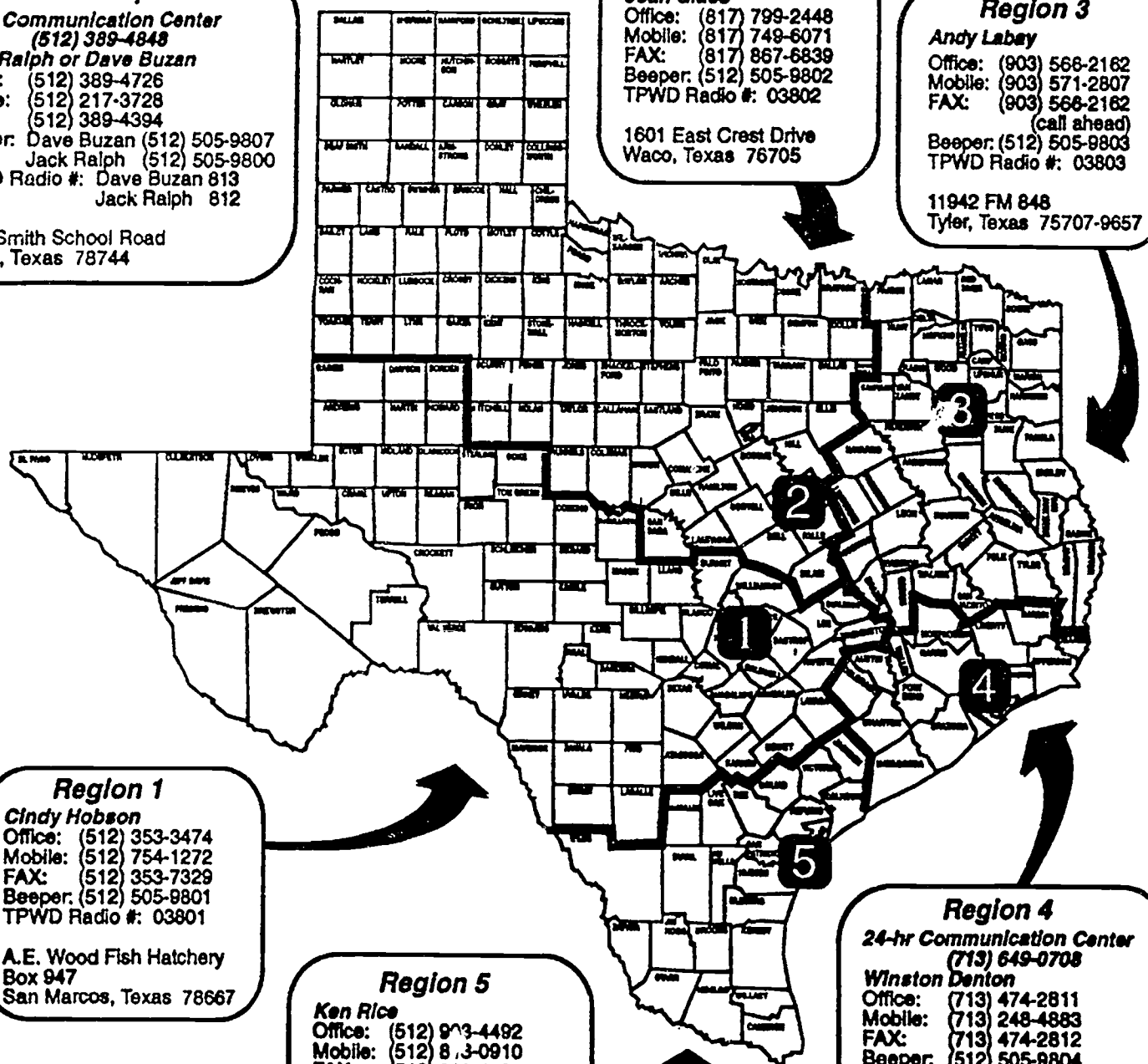
caddisfly larvae

riffle beetle

TEXAS PARKS AND WILDLIFE DEPARTMENT

Kills and Spills Team

If you see dead or dying fish and wildlife or pollution threatening fish and wildlife, call one of the regional biologists or 24-hour Communication Centers listed below immediately!



Austin Headquarters

24-hr Communication Center
(512) 389-4848
Jack Ralph or Dave Buzan
Office: (512) 389-4726
Mobile: (512) 217-3728
FAX: (512) 389-4394
Beeper: Dave Buzan (512) 505-9807
Jack Ralph (512) 505-9800
TPWD Radio #: Dave Buzan 813
Jack Ralph 812

4200 Smith School Road
Austin, Texas 78744

Region 1

Cindy Hobson
Office: (512) 353-3474
Mobile: (512) 754-1272
FAX: (512) 353-7329
Beeper: (512) 505-9801
TPWD Radio #: 03801

A.E. Wood Fish Hatchery
Box 947
San Marcos, Texas 78667

Region 2

Joan Glass
Office: (817) 799-2448
Mobile: (817) 749-6071
FAX: (817) 867-6839
Beeper: (512) 505-9802
TPWD Radio #: 03802

1601 East Crest Drive
Waco, Texas 76705

Region 3

Andy Labay
Office: (903) 566-2162
Mobile: (903) 571-2807
FAX: (903) 566-2162
(call ahead)
Beeper: (512) 505-9803
TPWD Radio #: 03803

11942 FM 848
Tyler, Texas 75707-9657

Region 4

24-hr Communication Center
(713) 649-0708
Winston Denton
Office: (713) 474-2811
Mobile: (713) 248-4883
FAX: (713) 474-2812
Beeper: (512) 505-9804
TPWD Radio #: 03804

P.O. Box 8
1018 Todville Road
Seabrook, Texas 77586

Region 5

Ken Rice
Office: (512) 993-4492
Mobile: (512) 813-0910
FAX: (512) 993-4597
Beeper: (512) 505-9805
TPWD Radio #: 03805

Campus Box 317
CCSU, 6300 Ocean Drive
Corpus Christi, Texas 78412

BUG PICKING IN THE FIELD

Stonefly

Written by : Ann Miller, teacher intern, and Dave Buzan, mentor, Texas Parks and Wildlife Department. For more information about this activity, write Dave at Texas Parks and Wildlife, 4200 Smith School Rd., Autin, Texas, 78744, or call him at (512) 389-4634. Ann can be reached through TENET, afmiller@tenet.edu

OBJECTIVES

Students will be able to:

1. collect and identify fresh water macroinvertebrates, including insects
2. use the collected macroinvertebrates to assess the current water quality of the stream

METHOD

During a field trip to a stream or river, students will gather, observe, and identify fresh water macroinvertebrates in order to determine the stream's water quality at that time.

AGE

Grades 3 through 8

BACKGROUND

This activity is designed for students who are able to take a field trip to a stream. The advantages of taking students to a site for a "hands-on" experience are obvious, but safety should be a primary consideration. Teachers should make a preliminary trip to the site and have one adult for every 5-10 students depending on the circumstances.

The activity is designed to acquaint students with various aquatic invertebrates that can act as indicators of stream health by their presence or absence. Each type of aquatic macroinvertebrate or "bug" has specific habitat requirements. Some can tolerate more pollution than others. If students find an abundance of pollution sensitive "bugs", the stream can be termed "healthy." A healthy stream would be one with good water quality and habitat. If few pollution sensitive "bugs" are found, but a good number of pollution tolerant "bugs" are present, then the stream may be somewhat polluted.

MATERIALS FOR EACH GROUP

several small white plastic bowls or ice cube tray
1 hand held magnifying lens
1 pair of forceps
1 sampling net with mesh size no larger than 2 mm (see Notes)
1 handout, "Is the Creek Clean or Dirty?"
shoes and clothing appropriate for wearing in the water for those who will be gathering the insects

PROCEDURE

Gathering the Insects

1. Locate a safe, accessible section of a stream or river.
2. Hold the net downstream from a riffle area, or if a riffle is not available, choose a shallow area with vegetation, brush, or leaf litter.
3. Hold the net(s) so that the flat edge is located on the bottom of the stream and the top edge is vertical or slanted up stream.
4. While one person is holding the net, another person stands upstream in front of the net and disturbs the bottom so that rocks or other debris are lifted and carried down and into the net by the current. The bottom should be thus disturbed for about 18 inches upstream while the person holding the net follows closely. The net should catch all the "bugs " that try to escape or are clinging to the rocks. In streams with rocks, aquatic vegetation, or debris, it may be possible to collect the macroinvetebrates directly off of the rocks and other material without using a net.
5. Pull the net up with all that it holds and carry it to the nearest bank. Using fingers, forceps, and magnifiers, gently remove any "bugs" and place them in the bowls or ice tray filled with water from the stream. Carefully search the debris, the rocks, and the net to be sure you haven't overlooked any. Small size and camouflage coloration make them hard to find.

BUG PICKING IN THE FIELD

Identifying the insects

1. Separate the different kinds of "bugs" gathered. (This is where the different chambers of the ice trays come in handy.)
2. Compare them with the drawings on the handout "Texas Water Bugs and Friends" and try to identify them, checking the boxes of the types found in the right column. Make sure students notice that the "bugs" are divided into 3 groups according to how much pollution they can handle, with the ones that can handle the most pollution in group 3.

Determining water quality

Follow the directions on the "Is the Creek Clean or Dirty?" data sheet to determine the water quality of your stream.

EXTENSIONS

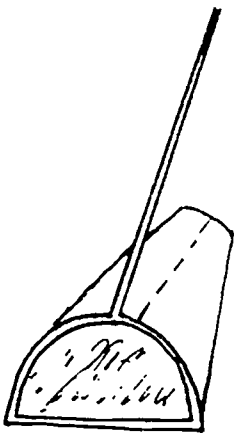
1. Ask students what causes poor water quality. This could be a good research topic if students are interested. Have them check into both point source pollution and non point source pollution.
2. Find out about the stream's relationship to other bodies of water. What does it flow into? This could lead into a study of the entire watershed.
3. Find out about the history of the stream. How was it different in the past? How have changes over time affected it?
4. Repeat the field trip at a different time of year and see if there is a change in the "bug" population.
5. Do other water quality tests of the stream. Check with Texas Watch at Texas Natural Resource Conservation Commission, (512) 239-4741 for information about volunteer water quality monitoring programs.
6. Describe the physical characteristics of the different macroinvertebrates. How are the physical features of the macroinvertebrates related to where they live?

EVALUATION

Ask each student group to report on that group's findings. How do the findings of the different groups compare? Each group should be able to defend their findings by using the data collected in the activity. If there are differences, be sure that students have time to explore reasons why the differences might have occurred.

NOTE

The type of net most often used for this type of sampling is called a "D" net because of its shape. Its handle and flat bottom make it very handy for using to catch critters on the bottom of the stream. See the drawing below.



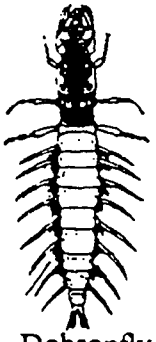
Bug Picking . . . Is Your Creek Clean or Dirty?

Many types of small animals live on the rocks and roots at the bottom of creeks and rivers. Some types of aquatic animals need very clean water to live in a creek. Other aquatic animals can live in dirty, or polluted, water. By recognizing the different types of aquatic animals on the stream bottom, we can learn if the water in the stream is clean or dirty.

Directions: Circle the picture of each type of animal you find from your creek. Add the points for all the animals you have circled. The creek water is clean if all the points added are more than 18. The creek water is ok if all the points added give a total more than 9 but less than 19. The creek water is dirty if all the points added give a total under 10.

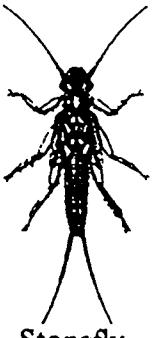
My Creek is: Clean_____ or OK_____ or Dirty _____ .

Clean Water Animals
(Pollution Sensitive)



Dobsonfly
3 points

Caddisfly
3 points



Stonefly
3 points

Water Penny
3 points

Riffle Beetle
3 points

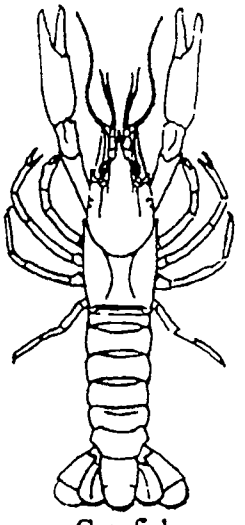
Mayfly
(top view)

Mayfly
(side view)

3 points

TOTAL POINTS = _____

Fair Water Animals
(Somewhat Pollution Tolerant)

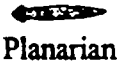


Crayfish
2 points

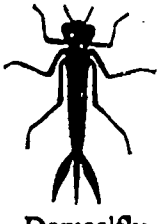
Scud
2 points

Clam
2 points

Dragonfly
2 points



Planarian
2 points



Damselfly
(top view)

Damselfly
(side view)

2 points

TOTAL POINTS = _____

Dirty Water Animals
(Pollution Tolerant)

Pouch Snail
1 point

Blackfly
1 point

Midgefly
1 point

Leech
1 point

Coiled Snail
(top view)

Coiled Snail
(side view)

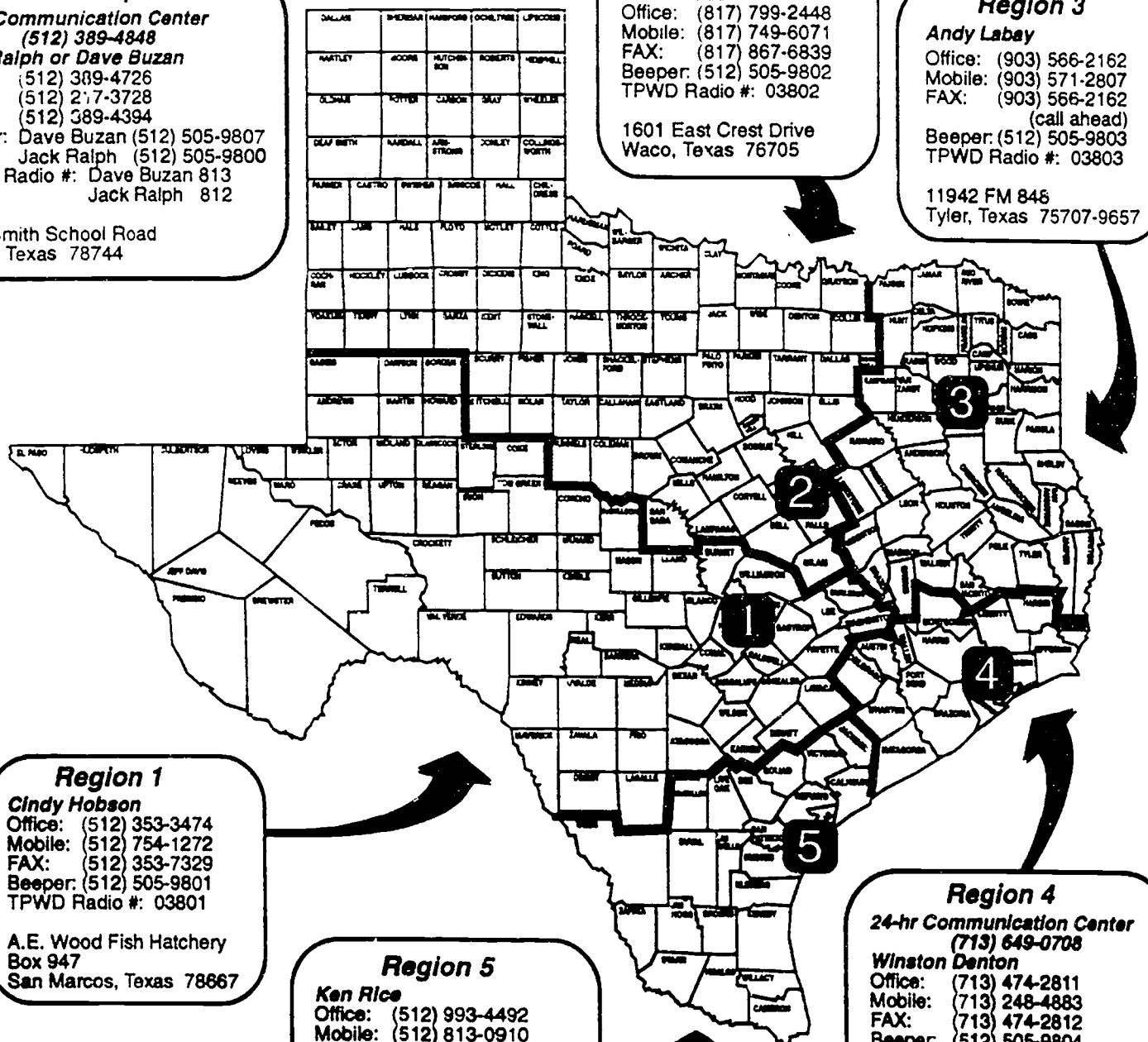
1 point

TOTAL POINTS = _____

TEXAS PARKS AND WILDLIFE DEPARTMENT

Kills and Spills Team

If you see dead or dying fish and wildlife or pollution threatening fish and wildlife, call one of the regional biologists or 24-hour Communication Centers listed below immediately!



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11942 FM 848
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Region 5

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TPWD Radio #: 03805

Campus Box 317
CCSU, 6300 Ocean Drive
Corpus Christi, Texas 78412

RP-Buzan-Map2 - Kills and Spills Team -04/07/94

BUG PICKING IN THE CLASSROOM

Written by: Ann Miller, teacher intern and Dave Buzan, mentor, at Texas Parks and Wildlife Department. For more information about this activity, contact Dave at (512) 389-4634 or Ann on TENET, afmiller@tenet.edu

---

OBJECTIVES

Students will be able to:

1. create a classification system for fresh water macroinvertebrates
2. use the "Bug Picking" data sheet to identify the macroinvertebrates
3. draw conclusions about the water quality of the stream or river the "bugs" came from

---

METHOD

Students will use tools provided to observe and classify macroinvertebrates that have been previously gathered at a stream or river. They will then use the "Bug Picking" data sheet to determine whether or not the stream is healthy.

AGE

Grades 3 through 8

BACKGROUND

This activity is designed to be used in the classroom by students who are unable to take a field trip to a stream. Using macroinvertebrates previously gathered and brought to the classroom (or cut outs of aquatic macroinvertebrates), students will practice classification skills in a hands-on activity that can engage students' interest in aquatic studies. See the Background of "Bug Picking in the Field" for an explanation of "bugs" as stream health indicators.

MATERIALS FOR EACH GROUP

10-15 macroinvertebrates in a pan of creek water
5 or 6 small white disposable bowls
a pair of forceps for each student
a "Bug Picking... Is Your Stream Clean or Dirty?" data sheet
several hand lenses

PROCEDURE

1. Pass out a tray of the macroinvertebrates to each group along with the bowls, forceps, and hand lenses.
2. Ask students to use the forceps and hand lenses to carefully and gently examine the "bugs." They will be looking for similarities and differences in order to divide them into groups. Once they have determined the different groups, ask students to use separate bowls for each group.
3. After students have completed dividing the organisms, ask them to discuss their criteria for separating the organisms into the different groups. Take time to allow students to respond to the different criteria used by different student groups.
4. Pass out the "Bug Picking" data sheet and ask students to compare their "bugs" with those pictured. They will notice that the "bugs" on the sheet have been divided into 3 groups according to how much pollution they will tolerate. This classification system helps biologists determine the water quality of the stream.
5. To determine the water quality of the stream, complete the computations as directed on the sheet and discuss the findings of the different groups.

EXTENSIONS

1. Allow students time to discuss the special adaptations that some of the organisms have to live successfully in the water. What do these organisms need to survive?
2. Ask students to identify what they think might pollute the water. What personal action can they take to help reduce pollution? What are some special pollution problems in their area? Students may want to begin a volunteer water monitoring

program sponsored by the TNRCC, called Texas Watch. Call (512) 463-8206 for information about this program.

3. Lead a discussion about the role these organisms play in the aquatic food chain. What do they eat? What eats them? Think of fishing lures and how we try to make them look like certain insects. Students could make colorful diagrams of aquatic food chains using some of the "bugs" they found.
4. Another interesting discussion could center around how some of these "bugs" change during their life cycles. Students could research and draw the life cycles of some of the insects showing the egg, larva or nymph, and adult stages.

EVALUATION

As well as determining the quality of the water in the stream or river their "bugs" were taken from, students could also trade their macroinvertebrates with another group to see if they came to the same conclusions as that other group.

NOTE

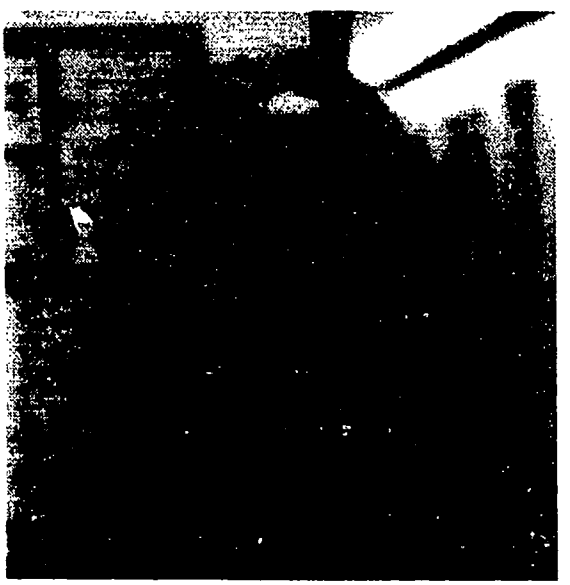
If it is impossible to get live macroinvertebrates, copy the "Bug Picking" handout as many times as needed to give each group 10-15 organisms after they have been cut apart. You may create fictitious streams and make groups of organisms that would indicate different water qualities for those streams. Then student groups could follow the directions just as if they were using the live macroinvertebrates.

If you can take students to a stream, refer to the activity "Bug Picking in the Field."

Vickie Smith

Texas Parks & Wildlife
Austin Texas

Linda Kissock - Mentor
Endangered Species Department
3000 IH 35S, Suite 100
Austin, Texas 78704



Vickie Smith
Fulmore Middle School
204 E. Mary
Austin, Texas 78704

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Vickie Dunlevy Smith

INTERNSHIP: Texas Parks and Wildlife Department
Endangered Resource Branch, Austin

SCHOOL: Fulmore Middle School, Austin

PRIMARY SUBJECT: Life Science

ACTIVITIES: Ecoregions of Texas Curriculum Guide
Ecoregions of Texas Video and Evaluation

SUMMARY: The curriculum guide is written as a seven to ten day unit to enable teachers to help students explore the vast natural resources, ecoregions, and heritage of Texas. The materials integrate science with Texas social studies, language arts and math. The eleven natural regions are featured in table format describing each region's size, topography, annual rainfall, vegetation, and rare plants and animals. A map of Texas divided into the ecoregions is provided for reference. The Texas Eco Trivia Game provides a tool for authentic assessment. The video, Ecoregions of Texas, describes the regions in seven, 10 minute segments showing the cultural and natural heritage of each ecoregion. The Texas Endangered Species Activity Book, produced by Texas Parks and Wildlife, is available to accompany this curriculum guide.

RESOURCES:

Texas Parks and Wildlife Department

Linda Campbell Kissock, Biologist, Texas Parks and Wildlife Endangered Resources Branch.

Texas Parks and Wildlife Media Services, Lydia Saldana, Branch Manager.

Texas Parks and Wildlife PBS/Television Broadcasts, Richard Roberts, Producer.

Texas Parks and Wildlife, 1995, Texas Endangered Species Activity Book.

Project WILD Activity Guide, 1994, second edition.

Winedale Conference, 1978, Natural Regions of Texas.

Texas Environmental Guide, 1991, Holt, Rinehart and Winston Inc.

INTRODUCTION

The purpose of this curriculum guide is to explore the natural and cultural resources that exist in each of the eleven natural regions or ecoregions of Texas. The purpose is to familiarize students with the resources of their state so that they will be better prepared to make informed choices regarding resource management and stewardship. The curriculum is written for students in grades 4 through 7. Both fourth and seventh grade curriculum includes the study of Texas history, and units on endangered species are often taught during the fifth or sixth grade year.

The goals of the curriculum guide are for students to:

1. become familiar with regional ecosystems
2. discern the ecological reasons for the unique attributes of each ecoregion
3. understand the importance of diversity in living communities
4. detect symbiotic relationships among particular Texas organisms
5. understand the interdependency of humans and natural systems
6. understand factors relating to the decline of some native plants and animals

This guide can be used as an ancillary with the state adopted text books and materials. It can also serve as an integrated unit with social studies, language arts, and math. The activities can be used in conjunction with the study of Texas history. Finally, the guide can be used as the basis for teaching separate units on ecology, natural regions, or endangered plants and animals of Texas.

Format of the guide:

1. Descriptions of the Natural Regions of Texas
2. Ecoregion Map
3. Table - Features of the Natural Regions of Texas
4. Lesson Plan
5. Activities
6. Final Evaluation Activity
7. Appendix - More Suggested Activities
8. References and Resources

BACKGROUND INFORMATION

The organization of Texas into ecoregions or natural regions enables us to inform students about the diverse areas of Texas in an distinct way. By studying the similarities and differences of the various natural regions, students gain a practical and relevant perspective concerning how nature (rainfall, plants and animals, geology) and humans throughout history have shaped the Texas we know today.

Due to its size and geographic location, Texas is unique among states. The natural regions look different from one another, both in terms of the living aspects (plant and animal communities) and the non-living attributes (topography, geology, soils).

Texas is divided into the following eleven natural regions:

1. Piney Woods
2. Oak Woods and Prairies
3. Blackland Prairies
4. Gulf Coast Prairies and Marshes
5. Coastal Sand Plains
6. South Texas Brush Country
7. Edwards Plateau
8. Llano Uplift
9. Rolling Plains
10. High Plains
11. Trans Pecos

The accompanying table entitled Features of the Natural Regions of Texas highlights the unique features of each ecoregion, such as size, topography, rainfall, soil types, predominant vegetation, native plant communities, and rare plants and animals.

It may be convenient to group ecoregions in order to address each one in a seven to ten day time frame. The brackets on the list above suggest one way to group the natural regions for study. An interdisciplinary approach may be used by teaching the science portion of the unit in parallel with social studies, integrating the cultural aspects and geography of the regions into the social studies curriculum.

The following is a brief description of each of the ecoregions of Texas.

Region 1: Piney Woods

Rolling hills covered with pines and oaks, and rich bottomlands with tall hardwoods, characterize the forests of the east Texas Piney Woods. This region is part of a much larger region of pine-hardwood forest that extends into Louisiana, Arkansas, and Oklahoma.

The average annual rainfall of 36 to 50 inches is fairly uniformly distributed throughout the year, and humidity and temperatures are typically high. The soils of the region are generally acidic and mostly pale to dark gray sands or sandy loams. Elevations range from 200 to 500 feet above sea level.

The Piney Woods region can be described as pine and pine-hardwood forests with scattered areas of cropland, planted pastures, and native pastures. Timber and cattle production are important industries in the region. Farms and ranches are relatively small in size compared to the state average.

Longleaf pine forests once dominated the southeastern part of the Piney Woods. A few pockets of longleaf pine may still be seen today. Mixed pine-oak forests occur to the west and north of the longleaf pine area. Dominant trees include loblolly pine, blackjack oak, and post oak. Hardwood forests of sweetgum, magnolia, tupelo, elm, and ash occur in the lowlands. Swamps are common and are most outstanding in the southern part of the pine-oak forest.

Region 2: Oak Woods and Prairies

The Oak Woods and Prairies region is a transitional area for many plants and animals, whose ranges extend northward into the Great Plains or eastward into the forests. This region, sometimes called the Cross-Timbers, was named by early settlers, who found belts of oak forest crossing strips of prairie grassland.

Average annual rainfall averages 28 to 40 inches per year. May or June usually brings a peak in monthly rainfall distribution. Upland soils are light colored, acid sandy loam or sands. Bottomland soils may be light brown to dark gray and acid with textures ranging from sandy loams to clays. The landscape of the region is gently rolling to hilly and elevations range from 300 to 800 feet above sea level.

The region can be described as oak savannah, where patches of oak woodland are interspersed with grassland. Cattle ranching is the major agricultural industry in the Oak Woods and Prairies. Introduced grasses such as bermudagrass are grazed along with forage crops and native grasslands.

Region 3: Blackland Prairies

The Blackland Prairies region is named for the deep, fertile black soils that characterize the area.
Blackland Prairie soils once supported a tallgrass prairie dominated by tall-growing grasses such as big bluestem, little bluestem, indiangrass, and switchgrass. Because of the fertile soils, much of the original prairie has been plowed to produce food and forage crops.

The average annual rainfall ranges from 28 to 40 inches. May is the peak rainfall month

for the northern end of the region; however, the south-central part has a fairly uniform distribution throughout the year. Typically, soils are uniformly dark-colored alkaline clays, often referred to as "black gumbo", interspersed with some gray acid sandy loams. The landscape is gently rolling to nearly level, and elevations range from 300 to 800 feet above sea level.

Crop production and cattle ranching are the primary agricultural industries.

Region 4: Gulf Coast Prairies and Marshes

The Gulf Coast Prairies and Marshes region is a nearly level, slowly drained plain less than 150 feet in elevation, dissected by streams and rivers flowing into the Gulf of Mexico. The region includes barrier islands along the coast, salt grass marshes surrounding bays and estuaries, remnant tallgrass prairies, oak parklands and oak mottes scattered along the coast, and tall woodlands in the river bottomlands.

Average annual rainfall varies from 30 to 50 inches per year distributed fairly uniformly throughout the year. The growing season is usually more than 300 days, with high humidity and warm temperatures. Soils are acid sands and sandy loams, with clays occurring primarily in the river bottoms.

Native vegetation consists of tallgrass prairies and live oak woodlands. Brush species such as mesquite and acacias are more common now than in the past. Although much of the native habitat has been lost to cropland agriculture and urbanization, the region still provides important habitat for migratory birds and spawning areas for fish and shrimp.

Region 5: Coastal Sand Plains

The Coastal Sand Plains is fairly level with elevations less than 150 feet above sea level. Average annual rainfall is 24 to 28 inches per year and the soils are primarily windblown sands. The vegetation can be described as tallgrass prairie with live oak woodlands, mesquite savannah, and salt marshes. Woody vegetation is more extensive now than in pre-settlement times.

Most of this region is grazed by cattle. In the past, the Coastal Sand Plains were called the "Wild Horse Prairie" because of the large herds of feral horses roaming here in the 19th century.

Region 6: South Texas Brush Country

The South Texas Brush Country is characterized by thorny shrubs and trees on the plains and scattered patches of palms and subtropical woodlands in the Rio Grande Valley. The plains were once covered with open grasslands and a scattering of trees, and the valley woodlands were once more extensive. Today, the primary vegetation consists of thorny brush such as mesquite, acacia, and prickly pear mixed with areas of grassland.

The average annual rainfall of 20 to 32 inches increases from west to east. Average monthly rainfall is lowest during winter, and highest during spring (May or June) and fall (September). Summer temperatures are high, with very high evaporation rates. Soils of the region are alkaline to slightly acid clays and clay loams. The deeper soils support taller brush, such as mesquite and spiny hackberry, whereas short, dense brush characterizes the shallow caliche soils.

Although many land changes have occurred in this region, the Brush Country remains rich in wildlife and a haven for many rare species of plants and animals. It is home for semi-tropical species that occur in Mexico, grassland species that range northward, and desert species commonly found in the Trans-Pecos.

Livestock grazing and crop production are the principal agricultural land uses.

Region 7: Edwards Plateau

The Edwards Plateau region comprises an area of central Texas commonly known as the Texas Hill Country. It is a land of many springs, stony hills, and steep canyons. The region is home to a whole host of rare plants and animals found nowhere else on earth.

Average annual rainfall ranges from 15 to 34 inches. Rainfall is highest in May or June and September. Soils of the Edwards Plateau are usually shallow with a variety of surface textures. They are underlain by limestone. Elevations range from slightly less than 100 feet to over 3,000 feet above sea level. Several river systems dissect the surface, creating a rough and well-drained landscape.

The limestone of the Edward's Plateau is honeycombed with thousands of caves. Beneath the eastern edge of the Plateau lies a hidden world of underground lakes known as the Edwards Aquifer. This precious water resource also is home to a number of curious creatures, such as the blind salamander.

Today, the Edwards Plateau is characterized by grasslands, juniper/oak woodlands, and plateau live oak or mesquite savannah. Open grasslands and savannahs were more common in pre-settlement times than they are today. Ranching is the primary agricultural industry in the region.

Region 8: Llano Uplift

The Llano Uplift is also known as the central mineral region. Although surrounded by the Edwards Plateau region, the Llano Uplift is distinguished by its unique geology. Home to some of the oldest rocks in Texas, the central mineral region contains unique minerals and rock formations. The region is characterized by large granite domes, such as Enchanted Rock near Fredricksburg.

Rainfall averages about 24 to 32 inches per year, peaking in May or June and September.

The landscape is rolling to hilly and elevation range from 825 to 2,250 feet above sea level. Soils are predominantly coarse textured sands, produced from weathered granite over thousands of years.

Native vegetation consists of oak-hickory or oak-juniper woodlands, mesquite-mixed brush savannah, and grasslands. Open grassland and savannah were once more common than they are today. Ranching is the predominant agricultural industry.

Region 9: Rolling Plains

Several Texas rivers begin in the gently rolling hills and broad flats of the Rolling Plains. These rivers and their numerous tributaries are responsible for the rolling character of the land. The rivers have cut canyons that shelter some plants and animals typical of the Rocky Mountains.

Average annual rainfall is 20 to 28 inches, with peaks in May and September. A summer dry period with high temperatures and high evaporation rates is typical. Soils vary from coarse sands along outwash terraces adjacent to streams, to tight clays and shales. Soil reaction is neutral to slightly alkaline. Elevations vary from 800 to 3,000 feet above sea level.

The original prairie grasslands included tall and mid-grasses such as bluestems and gramas. Buffalo grass and other shortgrasses have increased under heavy, uncontrolled grazing. Mesquite is a common invader on all soils. Much of the Rolling Plains today can be described as a mesquite-shortgrass savannah. Stream floodplains are dominated by various hardwood species, and juniper is common on steep slopes along rivers.

Steep slopes, cliffs, and canyons occurring just below the edge of the High Plains Caprock comprise the Escarpment Breaks area of the Rolling Plains. The Breaks are an ecotone or transition zone between the High Plains grasslands and the mesquite savannah of the Rolling Plains. Crop and livestock production are the major agricultural industries in this region.

Region 10: High Plains

The High Plains region, together with the Rolling Plains, comprise the southern end of the Great Plains of the central United States. The High Plains is a relatively level high plateau, separated from the Rolling Plains by the Caprock Escarpment. Elevations range from 3,000 to 4,500 feet above sea level.

Average annual rainfall is 15 to 22 inches. Rainfall is lowest in winter and mid-summer and highest in April or May and September or October. Extended droughts have occurred here several times this century. Surface texture of soils ranges from clays on hardland sites in the north to sands in the southern portion of the region. Caliche generally underlies these surface soils at depths of two to five feet.

Native vegetation of the High Plains is shortgrass prairie dominated by buffalo grass. Although historically a grassland, mesquite and yucca have invaded parts of the region. Shinnery oak and sand sage are common invaders on sandy lands, and juniper has spread from the breaks onto the plains in some areas.

Immense herds of buffalo and pronghorn antelope once thundered across vast prairies of blue grama and buffalo grass. Today, the plains are mostly irrigated cropland and the native vegetation includes more mesquite and juniper. Although much of the shortgrass prairie and the vast prairie dog towns are gone, large flocks of wintering waterfowl still come to the playa lakes (shallow, round depressions which spot the surface, sometimes covering more than 40 acres).

Region 11: Trans Pecos

The Trans Pecos is perhaps the most complex of all the regions. It occupies the extreme western part of the state eastward generally to the Pecos River. This is a region of diverse habitats and vegetation, varying from the desert valleys and plateaus to wooded mountain slopes. Elevations range from 2,500 feet to more than 8,749 feet at Guadalupe Peak. Even the mountain ranges vary greatly in the environments they offer for plant and animal life. Some are characterized by volcanic rocks, others by limestone.

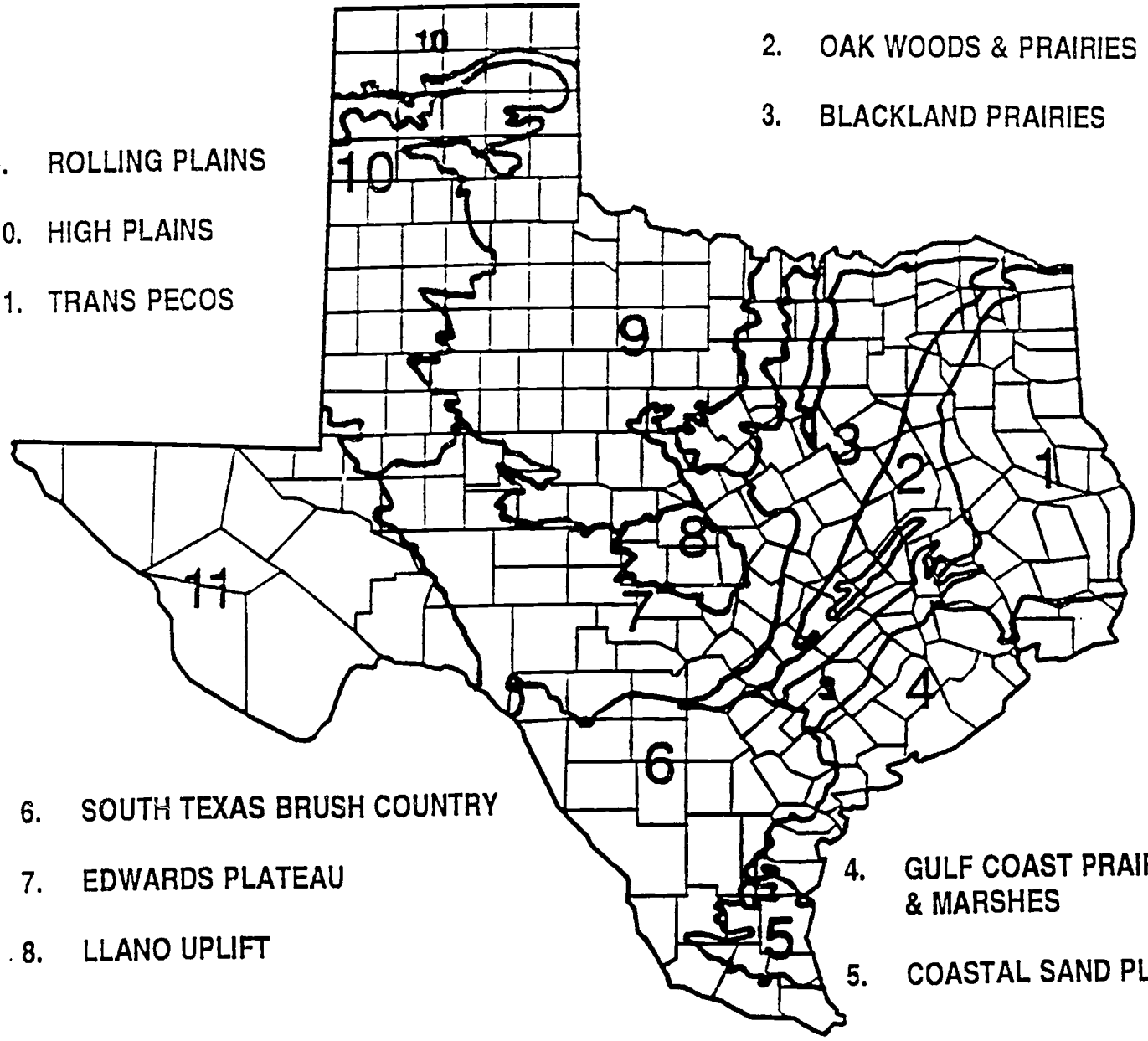
Over most of the area average annual rainfall is less than 12 inches, but varies greatly from year to year and from lower to higher elevations. July and August are usually the higher rainfall months. Mountain outwash materials have formed the soils of the Trans Pecos. Surface textures and profile characteristics are varied. Soil reaction is generally alkaline.

Due to the diversity of soils and elevations, many vegetation types exist in the region. The principal plant communities are creosote-tarbush desert scrub, desert grassland, yucca and juniper savannahs, and montane forests of pinon pine and oak.

The various subregions reflect the diversity of the Trans Pecos. The Sand Hills area consists of shin oak and mesquite on wind-blown dunes. Flat-topped mesas and plateaus intersected by steep-walled canyons and dry washes comprise the Stockton Plateau. Soils with high salt content and gypsum dunes are typical of the Salt Basin area. The Desert Scrub subregion is an area of low rainfall and rapid drainage. Creosotebush flats with yucca, lechuguilla, and various small-leafed plants are common. The Desert Grassland area occurs in the central part of the region, and is characterized by deeper soils with high clay content. Finally, the Mountain Ranges have higher rainfall and woody vegetation such as junipers, oaks, pinon pine, ponderosa pine, and Douglas fir.

Ranching is the primary industry in the Trans Pecos region.

Eco Regions of Texas



Features of the Natural Regions of Texas

Region	Size (sq. mi.)	Topography *	Rainfall (in./year)	Predominant Vegetation	Rare Plants and Habitat	Rare Animals and Habitat
1. Piney Woods	23,500	Gently rolling to hilly forested land	36-50	Pine, oak, and other hardwood forests	Texas Trailing Phlox — Deep sandy soils of long-leaf pine woodlands White Bladderpod — Natural openings of pine oak woodlands	Red-cockaded Woodpecker — Pinewoods with widely spaced large trees and old pine trees Bald Eagle — Breeding - In Texas along river systems or lakeshores with large, tall trees. Breeding populations occur in the eastern half of Texas. Wintering - Mostly near large lakes and reservoirs. Wintering eagles occur in suitable habitat throughout Texas
2. Oak Woods and Prairies	19,500	Gently rolling to hilly	28-40	Oak and hickory woodlands; tall grass prairies	Large-fruited sand verbena — Openings within oak woodland on deep sands Navasota ladies-tresses — Openings and drainages in post oak woodlands	Houston Toad — Pine/oak woodland or savannah on deep sandy soils
3. Blackland Prairies	25,500	Gently rolling to nearly level	28-40	Tall grass prairies; mesquite, cedar elm, sugarberry,	Tall Grass Prairie plant community has become rare in the Blacklands Region.	
4. Gulf Coast Prairies and Marshes	21,000	Nearly level	30-50	Grasses; tallgrass prairies; live oak woodlands; some mesquite, and acacias	Prairie Dawn — Poorly drained, sparsely vegetated areas in open grasslands Slender Rush Pea/ South Texas Ambrosia — Grasslands or mesquite invaded grasslands	Attwater's Prairie Chicken — Tall grass coastal prairie Eastern Brown Pelican — Offshore islands, spoil islands, mudbanks Eskimo Curlew — Migrates through the grasslands from the Arctic tundra to Pampas grasslands of Argentina Piping Plover — Winters along Gulf Coast, tidal mud flats, sandflats, or algal flats Whooping Crane — Winters on Texas Gulf Coast, marshes and sandflats of Aransas National Wildlife Refuge and nearby areas
5. Coastal Sand Plains	4,000	Fairly level to undulating	24-28	Tall grass prairie, live oak woodlands, mesquite savannah	Blacklace Cactus — Grasslands or mesquite invaded grasslands	

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6. South Texas Brush Country	28,000	Level to rolling	20-32	Thorny brush including mesquite, acacia, prickly pear, and some grassland areas	Ashy Dogweed	Mesquite grassland openings of thorny shrublands on deep, sandy soils	Jaguarundi and Ocelot	Dense thorny low brush
					Johnston's Frankenia	Rocky hillsides or saline clay loam flats within openings of thorny shrublands	Interior Least Tern	Bare sand, shell and gravel beaches and bars and islands associated with reservoirs along the Rio Grande
					Star Cactus	Openings of thorny shrublands on rocky clay loam soils		
					Texas Ayenia	Subtropical woodlands on alluvial deposits on flood plains and terraces of the Rio Grande		
					Walkers Manioc	Openings of thorny shrublands on sandy loam soils		
7. Edwards Plateau	31,000	Flat to rolling to steep (refered to as the Texas Hill Country)	15-34	Shortgrass grasslands, juniper shrubs and oak-juniper forest, mesquite	Texas Snowbells	Limestone edges or cliff faces along perennial streams	Black-capped Vireo	Semi open rangelands with a diversity of low growing shrubs
					Texas Wild-rice	San Marcos River; clear, constant temperature, spring-fed water	Golden-cheeked Warbler	Mature woodlands of oaks and Ashe juniper
					Tobusch Fishhook Cactus	Ashe juniper/oak rangelands on rocky alkaline soils	Edwards Aquifer Species San Marcos Salamander Texas Blind Salamander San Marcos Gambusia (fish) Fountain Darter (fish)	Spring fed waters of the San Marcos and Comal rivers in Central Texas
							Clear Creek Gambusia	Spring fed headwaters of Clear Creek a tributary of the San Saba River in Menard
							Karst Invertebrates Bee Creek Cave Harvestman Bone Cave Harvestman Tooth Cave Pseudoscorpion Tooth Cave Spider Tooth Cave Ground Beetle Kretschmarr Cave Mold Beetle Coffin Cave Mold Beetle	Limestone caves sinkholes and fractures
8. Llano Uplift	5,000	Rolling to hilly	24-32	Oak-hickory woodlands; some mesquite juniper brush and grasslands	Rock Quillwort	Wet weather pools on granite outcrops	Black-capped Vireo	
					Basin Bellflower	Gravelly or sandy soils		
9. Rolling Plains	43,500	Gently rolling to rough and dissected	20-28	Originally mid-sized grasses; now mixed with other grasses; invaded by mesquite and junipers, and hardwoods along and near streams	Texas Poppy-mallow	Within grasslands or open oak/mesquite woodlands, usually on deep sands	Interior Least Tern (see region 6)	Along the Canadian and Red rivers bare sand and gravel beaches, sandbars
							Concho Water Snake	Free flowing streams over rocks, shallow riffles, and rocks or crevices along banks and shorelines

10.High Plains	34,500	Fairly level	15-22	Short grasses; mesquite and yucca in some areas, oak and juniper in others	Native shortgrass prairies and their associated plant and animal life has become rare in the High Plains.	
11.Trans Pecos	38,000	Diverse, from valley floors to hills to plateaus to mountains	<10-18	Gradient from dry to wetter with increasing elevation: Desert shrubland and succulent shrubland, grassland, oak-juniper-pinyon woodlands; evergreen forests	Bunched cory cactus — Rocky slopes, ledges and flats in the Chihuahuan Desert on limestone Chisos hedgehog cactus — Open shrublands on gravelly flat alluvial fan deposits Davis Green Pitaya — Rocky hillsides of novaculite (a particular kind of rock) outcrops with sparse vegetation Nellie cory cactus — Dry, rocky limestone outcrops, on slopes in mountains of Chihuahuan Desert Sneed pincushion cactus — Dry, rocky limestone outcrops, on slopes in mountains of Chihuahuan Desert Hinckley's oak — Found along arid limestone slopes at mid-elevations in Chihuahuan Desert Little Aguja pondweed — Known to occur only within quiet seepage pools in Little Aguja Creek in the Davis Mountains Lloyd's manposa cactus — In full sun on limestone outcrops or rocky, alkaline soils on slopes or mesas Terlingua Creek cat's-eye — Barren, dry, gypseous clay or chalky shales on low rounded hills and slopes with sparse vegetation	Greater Long-nosed Bat — High desert regions of Big Bend National Park Mexican Spotted Owl — Canyon woodlands in mountains and ranges of West Texas Desert Spring Fishes Comanche Springs Pupfish, Leon Springs Pupfish, Pecos Gambusia, Big Bend Gambusia — Spring-fed desert wetlands and streams

*Although most of Texas is located on flat plains or rolling plains, there are substantial mountains in the Trans-Pecos region of far West Texas. The highest point in the state is Guadalupe Peak at 8,749 feet above sea level. Sea level is the lowest elevation in Texas and can be found in all coastal counties. Elevation naturally rises from east to west and south to north.

Student Copy

Features of the Natural Regions of Texas

Region	Size (sq. mi .)	Topography	Rainfall (in./year)	Predominant Vegetation	Rare Plants and Habitat	Rare Animals and Habitat
1. Piney Woods						
2. Oak Woods and Prairies						
3. Blackland Prairies						

4. Gulf Coast Prairies and Marshes						
5. Coastal Sand Plains						
6. South Texas Brush Country						

7. Edwards Plateau						
8. Llano Uplift						
9. Rolling Plains						

10.High Plains						
11.Trans-Pecos						

Critter/Plant List

NAME	WHERE FOUND	DIET	PREDATOR	INTERESTING CHARACTERISTICS

DAILY LESSON PLAN

OBJECTIVES

Students will be able to:

1. distinguish the ecoregions of Texas by the natural features they contain
2. identify on the Texas map approximately where each ecoregion is located
3. recognize the diverse cultural and natural history of Texas
4. explain why plants and animals need a certain kind of habitat to survive
5. name some rare plants or animals found in each ecoregion
6. define the term "endangered" with regard to plant and animal species

METHOD

One or two natural regions will be discussed each day. Grouping the eleven natural regions as follows will enable teachers to complete the unit in seven class sessions.

Day 1	Piney Woods
Day 2	Oak Woods and Prairies & Blackland Prairies
Day 3	Gulf Coast Prairies and Marshes & Coastal Sand Plains
Day 4	South Texas Brush Country
Day 5	Edwards Plateau & Llano Uplift
Day 6	Rolling Plains & High Plains
Day 7	Trans Pecos

The teacher will supply the tables and maps for students to complete as required. Teachers may wish to leave portions of the table blank for students to complete by taking notes. The amount left blank, if any, would vary by grade level and ability. Students should color the appropriate region on the map as each ecoregion is discussed. Activities from the Texas Endangered Species Activity Book can be used to supplement lessons on specific regions. The video, Eco Regions of Texas, has a ten minute feature for each of the seven ecoregion groupings.

Students should keep the tables, map, and notes in a notebook or a section of their notebook to be used as references for the final evaluation.

MATERIALS

Critter/Plant of the Day and Features of the Natural Regions of Texas tables
Eco Regions of Texas map
Eco Regions of Texas video
Texas Endangered Species Activity Book

PROCEDURE

1. Daily WARM-UP with Critter/Plant of the Day

To begin the unit each day, use an animal or plant example from the specific ecoregion to be discussed. The example can be as simple as a laminated photograph of a particular species of plant or animal or a living specimen such as a grasshopper in a plastic jar. Pass

this sample around the class in an assigned rotation to permit each student a close look. Describe the history of the object in a way to peak curiosity and show the special nature of each region. Students can jot down interesting facts about the organism on the Critter of the Day table. Examples of items to bring might include pine needles and pine cones from the Piney Woods, interesting rocks from the Trans Pecos, shells from the Gulf Coast, photos of the Texas Blind Salamander or Black-capped Vireo for the Edwards Plateau, or mesquite leaves or pricklypear pads from the South Texas Brush Country. Teachers may also want to have students bring examples of plants and animals that can be found locally for the class to name and learn about.

2. After a short introduction of the unit (see description of each region, use critter/plant of the day, or show video segment of the region), each student will receive the ecoregion map and the blank table entitled Features of the Natural Regions of Texas. Students can take notes by completing the blank table as the teacher provides information and leads discussions on each ecoregion.

3. The map can be colored to coordinate with the video as follows:

Piney Woods - green
Oak Woods and Prairies & Blackland Prairies - black
Gulf Coast Prairies and Marshes & Coastal Sand Plains - blue
South Texas Brush Country - yellow
Edwards Plateau & Llano Uplift - purple
Rolling Plains & High Plains - red
Trans Pecos - brown

4. Choose the activity from the Texas Endangered Species Activity Book which corresponds to the region being discussed:

Piney Woods - p. 13, the Red-cockaded Woodpecker
Oak Woods and Prairies - p. 44, the Houston Toad
Gulf Coast Prairies and Marshes - p. 37, the Whooping Crane
South Texas Brush Country - p. 34, the Ocelot
High Plains - p. 4, the Black-footed Ferret
Trans Pecos - p. 22, the Greater Long-nosed Bat

5. To integrate math concepts and skills, have students graph the size and/or annual rainfall data for each ecoregion. Teachers may want to have students work together in small groups and check their work with others.

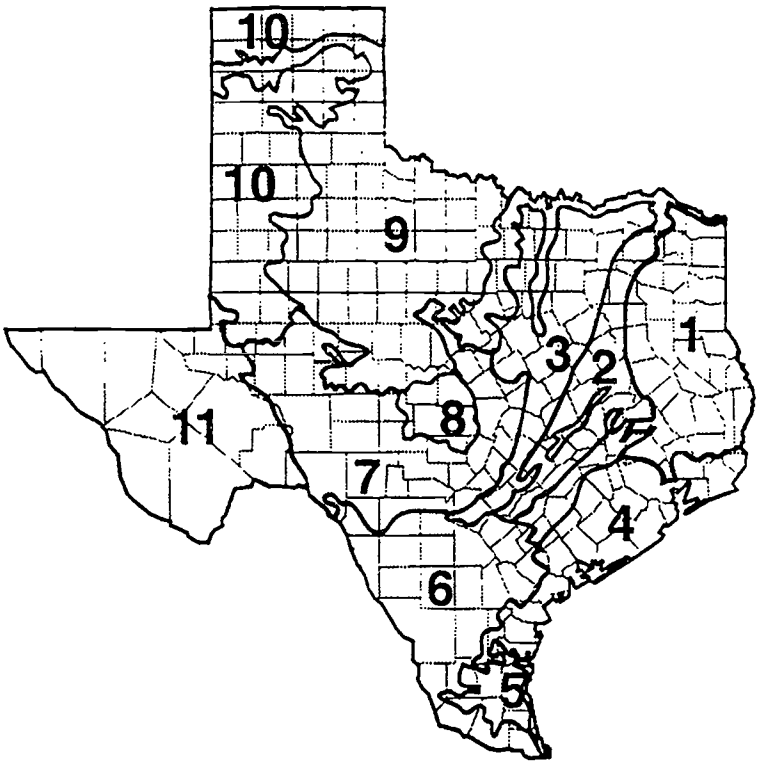
6. Upon completion of the tables, map, video, and activities have students discuss why some plants and animals are rare or have become endangered.
What are some things people can do to help endangered species?

EVALUATION

Texas Eco Trivia is a trivia game used as a final evaluation of the unit. This game may also take the place of the daily lesson format.

TEXAS ECO TRIVIA

1. Piney Woods
2. Oak Woods & Prairies
3. Blackland Prairies
4. Gulf Coast Prairies & Marshes
5. Coastal Sand Plains
6. South Texas Brush Country
7. Edwards Plateau
8. Llano Uplift
9. Rolling Plains
10. High Plains
11. Trans Pecos



OBJECTIVES

Students will be able to demonstrate knowledge of the diversity of Texas' ecoregions.

METHOD

Students team-teach ecoregion facts to the rest of the class and then compete in a trivia game.

MATERIALS

Texas ecoregion fact sheets, notes, writing materials, scissors (optional), timer or watch with a second hand.

PROCEDURE

1. Divide the class into three teams. Assign one of the trivia fact sheets to each team and give each team member a copy of the fact sheet. Each fact sheet contains ten questions and answers about the natural regions of Texas (the fact sheets can be cut into question cards, if desired). Tell the students that these questions will be the basis of a trivia game, so they should not let other groups see or hear their questions.

2. Instruct the teams to prepare a presentation of not more than 30 minutes to teach the rest of the class the facts on their sheet. The presentation must include all of the facts listed on the sheet (in any order), but the information should be given so that the actual questions are not obvious. Teams also need to create two additional questions of their own from the materials given (for a total of 12 questions). Give the teams ample time to research their topics and plan their presentations. All team members should participate.

3. Have teams teach their Texas eco trivia to the rest of the class. It might work best to have team-teaching for 30 minutes, three days in a row, rather than all in one day. Students are allowed to take notes during the presentation.

4. Hold a Texas eco trivia study session. Teams should study their notes from the presentations and drill each other on facts.

5. Hold the Texas eco trivia competition according to the following rules:

- Each group asks all of their questions as a set. The order of the groups should be decided randomly.
- Questions are directed to the remaining two teams on an alternating basis.
- A team has 30 seconds to discuss the question before they are required to give an answer (there should be some sort of official timer, whether it is a student watching the clock, a mini-hourglass, etc.).
- One point is awarded for each correct answer.
- The team with the most points wins. Tie-breaker questions should be used in the case of a tie.

6. After the game is over, ask students to name the trivia facts they felt were most important. List these on the board and discuss them in more detail.

ASSESSMENT

Ask students to name two important facts about the ecoregions of Texas.

ENRICHMENT

As a class, develop a board game based on the ecoregions of Texas. Put the game in the library so other students may play and learn from it.

Create a list of terms that are significant in the study of the eco regions of Texas. Break the class into two teams and play a version of "Pictionary" by having students illustrate the concept/term while teammates guess. If the team does not guess the correct term within a certain time frame, the other team can earn points if they guess the word.

The questions and answers from this game make great work station or independent desk activity work when the questions and answers are copied separately, laminated and used as matching flash cards.

TEXAS TRIVIA

Q. Texas is divided into eleven natural regions.

True or False?

TEXAS TRIVIA

Q. Blackland Prairies are found in far west Texas.

True or False?

TEXAS TRIVIA

Q. The Piney Woods is located in South, West or East Texas?

TEXAS TRIVIA

Q. The tallest mountains are found in which ecoregion?

TEXAS TRIVIA

Q. The Red-cockaded Woodpecker is found in which ecoregion?

TEXAS TRIVIA

Q. Name one plant community or ecosystem that has become rare in Texas.

TEXAS TRIVIA

Q. The Houston Toad is found in which ecoregion?

TEXAS TRIVIA

Q. The Attwater's Prairie Chicken is found in which ecoregion?

TEXAS TRIVIA

Q. The Oak Woods and Prairies are flat and dry.

True or False?

TEXAS TRIVIA

Q. The Coastal Sand Plains and the _____ are ecoregions located along the Gulf Coast of Texas.

TEXAS TRIVIA

Q. Name one rare plant found along the Gulf Coast.

TEXAS TRIVIA

Q. The Concho Water Snake may be found in which ecoregion?

TEXAS TRIVIA

Q. The Ocelot may be found in _____ region of Texas.

TEXAS TRIVIA

Q. The Llano Uplift and the _____ are the smallest ecoregions in size.

TEXAS TRIVIA

Q. The "Texas Hill Country" refers to which ecoregion?

TEXAS TRIVIA

Q. The largest ecoregions by size are the Trans Pecos and the _____.

TEXAS TRIVIA

Q. Lots of thorny brush like acacias and mesquite are found in the _____ region.

TEXAS TRIVIA

Q. The Texas poppy-mallow is a rare plant found only in the Rolling Plains region.

True or False?

TEXAS TRIVIA

Q. Name one rare animal found in the Edwards Plateau region.

TEXAS TRIVIA

Q. The area of Texas with the largest number of rare plants and animals is the _____ region.

TEXAS TRIVIA

Q. The region of Texas with the least amount of rainfall per year is the _____.

TEXAS TRIVIA

Q. The Greater Long-nosed Bat is found in the _____ region of Texas.

TEXAS TRIVIA

Q. Prairie dog towns can be found in the _____.

TEXAS TRIVIA

Q. The word endangered means:

_____

TEXAS TRIVIA

Q. Loss of habitat is a main reason that plants and animals become endangered.

True or False?

TEXAS TRIVIA

Q. The Golden-cheeked Warbler and the Black-capped Vireo can both be found in the _____ region of Texas.

TEXAS TRIVIA

Q. Bald Eagles may be found in a number of regions, but they breed in the _____.

TEXAS TRIVIA

Q. The Texas snowbells is a rare plant found in the _____ region of Texas.

TEXAS TRIVIA

Q. Whooping Cranes can be found in the _____ region.

TEXAS TRIVIA

Q. The most common trees found in the forests of East Texas are _____.

A. False. The Blackland Prairies are found in east-central Texas.	A. True. There are eleven natural or ecoregions of Texas.
A. The tallest mountains are found in the Trans Pecos region.	A. The Piney Woods region is located in East Texas.
A. The Blackland Prairies, the Shortgrass Prairies, and Longleaf Pine Forests are examples of plant communities that have become rare in Texas.	A. The Red-cockaded Woodpecker is found in the Piney Woods region.
A. The Attwater's Prairie Chicken is found in the Gulf Coast Prairies and Marshes region.	A. The Houston Toad is found in the Oak Woods and Prairies region.
A. Gulf Coast Prairies and Marshes are also found along the Gulf Coast.	A. False. The Oak Woods and Prairies are gently rolling to hilly and receive 36 to 40 inches of rain annually.

A. The Concho Water Snake can be found in the Rolling Plains region.	A. Some rare plants found along the Gulf Coast include: Texas prairie dawn, slender rush pea, South Texas ambrosia, and black lace cactus.
A. The smallest regions in size are the Coastal Sand Plains and the Llano Uplift.	A. The Ocelot may be found in the South Texas Brush Country region.
A. The largest regions in size are the Trans Pecos and the Rolling Plains.	A. The Edwards Plateau is sometimes called the "Texas Hill Country."
A. True. The Texas poppy-mallow is found only in the Rolling Plains.	A. These plants are found in the South Texas Brush Country.
A. The Trans Pecos has the largest number of rare plants and animals.	A. Rare animals found in the Edwards Plateau are the Black-capped Vireo, Golden-cheeked Warbler, San Marcos Salamander, Texas Blind Salamander, San Marcos Gambusia, Fountain Darter, and the Clear Creek Gambusia.

A. The Greater Long-nosed Bat is found in the Trans Pecos.	A. The Trans Pecos has the least amount of annual rainfall.
A. Endangered means: in danger of becoming extinct.	A. Prairie dog towns are found in the High Plains region.
A. The Edwards Plateau is the region where the Golden-cheeked Warbler and the Black-capped Vireo can be found.	A. True. Loss of habitat is a main reason that plants and animals become endangered.
A. The Texas snowbell is found in the Edwards Plateau	A. The Bald Eagle breeds in the eastern half of Texas.
A. The most common trees are pines.	A. Whooping Cranes can be found in the Gulf Coast Prairies and Marshes region.

APPENDIX

More Suggested Activities for Daily Lesson Planning

Introduction to the Unit
These two activities can be done outdoors or in a gym.

QUICK FROZEN CRITTERS!
Use this Project WILD activity for a fast moving and attention getting unit initiation. Objectives: to discuss predator/prey relationships, recognize limiting factors which affect wildlife populations, and the importance of adaptations in predator/prey relationships.

HABITAT LAP SIT!
Also from Project WILD. Objectives: to identify components of habitat and how humans and other animals depend upon habitat.

Day 1: Piney Woods
The Changing Face of Texas
From Texas Environmental Guide. The features of each region are listed, adding information concerning what the Piney Woods and other regions were like prior to the first Spanish settlements of the 1680's.

Wildlife 1 and *Wildlife 2*
From the Soil Conservation Service guide (see references). *Wildlife 1* introduces wildlife habitat management, and looks closely at wildlife habitat on a school site. *Wildlife 2* introduces students to outdoor recreational fishing.

Day 2: Oak Woods and Prairies and Blackland Prairies
OH DEER!
From Project WILD. Objectives include: identify and describe food, water, and shelter as three essential components of habitat; describe the importance of good habitat for animals; define "limiting factors" and give examples; and recognize that some fluctuations in wildlife populations are natural as ecological systems undergo constant change.

Texas Endangered Species Supplemental Activities
Developed specifically for Texas by Texas Parks and Wildlife, these variations of Project WILD's *OH DEER!* allows students to: define what it means for a plant or animal to be endangered or threatened; identify and name a number of Texas endangered and threatened species; describe factors which may cause species to decline and become endangered, and discuss why we should care about endangered and threatened species.

Day 3: Gulf Coast Prairies and Marshes and Coastal Sand Plains
Getting Out of a Bind
From A Big Sweep Elementary Activity Guide by Ripples. This activity will demonstrate what an animal must go through to survive humans improper disposal of trash.

Wheel of Trouble
From Nature Scope Endangered Species. this activity addresses why sea turtles are endangered.

ARE YOU ME?
From Aquatic WILD, this activity challenges students to match the various larval and juvenile stages of aquatic animals to their corresponding adult form.

Day 4: South Texas Brush Country
Identifying Some Common Shrubs and Trees
From Texas Environmental Guide. Students learn to use a dichotomous key to identify plants. Besides learning a basic science skill, students can be challenged to create and use keys to identify plants in their local area.

Toothpick Camouflage
From Environmental Education Activities for Children and Youth by Dr. Milton Payne, Science and Outdoor Education, Stephen F. Austin State University, Nacogdoches, Texas. This activity shows how adaptations such as camouflage help animals like the Ocelot and Jaguarundi survive in their dense brushy habitat, and how lack of cover decreases their chances of survival.

Day 5: Edwards Plateau and Llano Uplift
Aquifers and Springs and *Protozoa and Green Algae in a Texas Pond*
From Texas Environmental Guide. These activities will help students recognize the significance of aquifers and springs, determine the environmental consequences of the loss of ground water contained in aquifers, and observe the diversity of microscopic organisms found in local ponds.

Day 6: Rolling Plains and High Plains
Describing a Texas Plant Community
From Texas Environmental Guide. This activity teaches the concept of a "plant community" and helps students learn about the composition of a plant community in their area. The activity can be the basis for a discussion of plant communities in these ecoregions.

What Texas Organism am I?
From Texas Environmental Guide. This activity integrates art into the basic science lesson. Species such as the Black-footed Ferret, Texas Horned Lizard, Prairie Dog, Plains Spotted Skunk or Swift Fox can be used in this activity to enhance awareness concerning the loss grassland habitat for these animals.

Day 7: Trans Pecos
Texas Cacti, Pollination in Texas Flowers, and *Making Dyes From Texas Plants*
From Texas Environmental Guide. These activities will introduce the Trans Pecos flora,

help create an awareness of Texas cultural history, and help students recognize that materials used in our everyday life have natural resource origins.

Wildlife 3
From Soil Conservation Service lesson plan guide. This activity integrates math by using percentages to calculate the survival and reproduction rates of wildlife species.

Related Activities:
Water
From Soil Conservation Service lesson plan guide. This activity integrates math by discussing how varying rainfall amounts affect the environment.

Endangered Species
From Texas Environmental Guide. This activity helps students develop an awareness of endangered and threatened plant species of Texas.

Food Chain Game
From Environmental Education Activities for Children and Youth by Dr. Milton Payne, Stephen F. Austin State University, Nacogdoches. This activity identifies the roles of individuals in a food chain and the proper proportions of individuals needed in a food chain.

Eco-Acting Problem Solving
From Environmental Education Activities for Children and Youth by Dr. Milton Payne, Stephen F. Austin State University, Nacogdoches. This activity has students use given information, observation, inference, and nonverbal communication to recite an exact phrase.

Wildlife 4
From Soil Conservation Service lesson plan guide. This activity introduces terms for use in describing aggregations of animals.

A to Z Walk
From Environmental Education Activities for Children and Youth by Dr. Milton Payne, Stephen F. Austin State University, Nacogdoches. This activity requires students to walk and record observations using all five senses. Observations are recorded using words starting with each letter of the alphabet.

Microtrek Treasure Hunt and *Litter We Know*
Adapted from Project WILD, this activity emphasizes observation and categorizing skills.

MAKE A COAT!
From Project WILD. In this activity, students learn that plants and animals are important sources of clothing materials, both today and in the past. Students also collect and analyze data to infer the sources of most materials used in clothing today, and distinguish between

some examples of renewable and nonrenewable natural resources.

DRAWING ON NATURE
From Project WILD, this activity integrates art so that students will be able to generalize that wildlife and other animals are important inspiration for art as well as subjects of science.

Where's My Baby
From Bat Conservation International, this activity shows how mother free-tailed bats find their babies.

REFERENCES AND RESOURCES

Texas Parks and Wildlife Department 1-800-792-1112

Kissock, Linda Campbell, 1995. Endangered and Threatened Animals of Texas - Their Life History and Management. Texas Parks and Wildlife Department, Austin, Texas

Dallas Morning News, 1994-95, Texas Almanac

Holt, Rinehart, and Winston, 1991, Texas Environmental Guide

Texas Parks and Wildlife Magazine, various articles on endangered and threatened species, reference list compiled by Linda Kissock and Cidney Sunvison, Endangered Species Program, 1994 (updated regularly)

Project WILD, 1994 edition, Western Regional Environmental Education Council, Inc.

Bat Conservation International, 1991, Educator's Activity Book About Bats

U. S. Natural Resources Conservation Service (formerly Soil Conservation Service), State Public Affairs Specialist, Temple, Texas (817-774-1228), Suggested Environmental Education Lesson Plans

Clark Andersen

University of Texas Medical Branch
Galveston Texas

Dr. Raleigh Johnson - Mentor
1,120 B Jennie Sealy
Galveston, Texas 77555

Clark Andersen
La Marque High School
300 Vauthier Road
La Marque, Texas 77568

NAME: Clark R. Andersen

INTERNSHIP: University of Texas Medical Branch, Galveston
Department of Radiology

SCHOOL: LaMarque High School

SUBJECTS: Algebra II or Pre-Calculus

ACTIVITY: Investigation of Strategies for Interpolating Missing Data Elements in a Data Set

ABSTRACT: Given a simulated data set representing a linear sequence of pixels from a digital image, students will selectively remove three elements from the set, then investigate three methods of numerical interpolation of the missing data elements, comparing their interpolated elements to the originals to determine the best interpolation strategy. Interpolation strategies will include linear interpolation, polynomial interpolation, and least-squares interpolation.

RESOURCES: University of Texas Medical Branch, Galveston
Department of Radiology
Raleigh Johnson, Jr., Ph.D
John Brunner, Ph.D

Texas Alliance For Science, Technology, and Mathematics Education, TAMU
Dr. Robert K. James, Director,
Brian T. Walenta, Project Coordinator

Any generic Algebra I text will include a discussion of linear interpolation; as used here, it is simply finding the equation of a line between two points. In the simplest case, it can be viewed as finding the midpoint between two points.

Likewise, the procedure for fitting a polynomial to two or more points (used in polynomial interpolation) will be discussed in any generic Algebra II text as part of solving systems of equations.

"Numerical Analysis," 4th Edition, by Richard L. Burden and J. Douglas Faires, PWS-Kent Publishing company, 1989.

"Modern Elementary Statistics," 7th Edition, by John Freund, Prentice-Hall, 1988.

"Interpolation Algorithms for 3-D Reconstruction of Magnetic Resonance Images," by Gregory Rose, Raleigh Johnson, and Donald Brunder. Personal communication.

CURRICULUM IMPLEMENTATION PLAN

ACTIVITY: INVESTIGATION OF STRATEGIES FOR INTERPOLATING MISSING DATA ELEMENTS IN A DATA SET

TEACHER: Clark R. Andersen

MENTOR: Raleigh Johnson, Jr., Ph.D

GOAL: To make students aware of the application of interpolation methods in mathematics, computer science, and imaging science, and to foster interest in related career fields.

OBJECTIVE: The student will be able to interpolate missing data elements in a data set using linear interpolation, polynomial interpolation, and least-squares interpolation.

LEARNING ELEMENTS: Oral communication skills, teamwork, problem-solving skills, critical thinking skills, career opportunities awareness.

MATERIALS: Calculators would be helpful.

CLASSROOM ARRANGEMENT: Students will likely be most successful in small groups of 2 to 3. This way they can compare answers and assist each other in understanding the methods and checking the calculations.

CLASS TIME: This lesson/project will likely take 2-3 days to complete.

THE DATA SET: The data set is a simulated linear sequence of pixels from a digital image. An actual image at high resolution would show a smooth transition of intensities approximating a smooth curve. I approximate this by generating the data elements from a polynomial.

{4.3, 7.3, 7.3, 5.8, 3.9, 2.9, 2.6, 3.0, 4.0, 4.9, 5.4, 5.1, 4.0, 2.4}

EXPERIMENTAL DATA SET: Created by simply removing three elements from the original data set. The three missing elements are to be found by interpolation.

{4.3, 7.3, 7.3, ___, 3.9, 2.9, 2.6, ___, 4.0, 4.9, 5.4, ___, 4.0, 2.4}

PREPARATION: Have students separate into small groups. Each student should do the work, but they should check each other's work and assist each other in the calculations and arrive at some consensus as to which interpolation method is most successful.

Students should make a table listing the actual value of each element to be interpolated (from the original data set), along with the values resulting from the various interpolation methods, and show the actual and percentage difference between the interpolated and original value.

EXAMPLE TABLE:

	ELEMENT #4	DIFF	%	...AVG %
ACTUAL VALUE	9.2	--	--	--
LINEAR INTERP.	8.6	0.6	6.5%	_____
CUBIC POLY INTERP.	9.4	0.2	2.2%	_____
LEAST SQ. INTERP.	8.9	0.3	3.2%	_____

Students should complete the table for missing elements at index #4, index #8, and index #12. Once all interpolations are complete, students should average the percentage differences for all three missing elements for each interpolation method used and use the average of the percentage differences to determine which interpolation scheme was most successful.

LINEAR INTERPOLATION:

The simplest approach to linear interpolation is to simply average together the two elements adjacent to the missing element. Have students try this calculation on each missing data element and record their results in their table.

EXAMPLE: Given {...7.5, 8.2, ____, 9.4, 9.2,...}

Missing element = (8.2 + 9.4)/2 = 8.8

POLYNOMIAL INTERPOLATION:

To save time, use a cubic polynomial. Students will need to use two elements on either side of the one they wish to interpolate, treat these elements as (x,y) ordered pairs (element index, element value), and use the 4 ordered pairs to set-up a system of 4 cubic polynomial equations, then solve the system of equations. Use the resulting polynomial to solve for the missing element's value.

EXAMPLE: Given {...7.5, 8.2, ____, 9.4, 9.2,...}

Treat these values as the ordered pairs:

(1, 7.5), (2, 8.2), (4, 9.4), (5, 9.2)

Fit to cubic polynomial:

$$y = Ax^3 + Bx^2 + Cx + D$$

Create a system of equations:

$$7.5 = A(1)^3 + B(1)^2 + C(1) + D$$

$$8.2 = A(2)^3 + B(2)^2 + C(2) + D$$

$$9.4 = A(3)^3 + B(3)^2 + C(3) + D$$

$$9.2 = A(4)^3 + B(4)^2 + C(4) + D$$

Solve the system of equations to obtain the polynomial:

$$y = -0.0583x^3 + 0.375x^2 + 0.0167x + 7.2$$

Solve for the missing element using the derived polynomial using x = 3.

$$y = -0.0583(3)^3 + 0.375(3)^2 + 0.0167(3) + 7.2$$

$$y = 9.051$$

For a challenge, try using 6 elements and a polynomial of degree 5. Compare this result.

LEAST SQUARES INTERPOLATION:

Least squares interpolation is a bit of a guessing game. The idea is to

1. GUESS an approximation of the missing element value
2. Treating the guessed value and the 4 adjacent values as ordered pairs, use the DISTANCE FORMULA to find the distance between the guess and each of the 4 adjacent elements
3. Sum the distances.
4. Repeat the process, seeking the smallest sum. The guess with the smallest sum of distances is the closest least squares fitted value.

DISTANCE FORMULA: d=((X1-X2)^2+(Y1-Y2)^2)^(1/2)

EXAMPLE: Given {...7.5, 8.2, ____, 9.4, 9.2,...}

Treat these values as the ordered pairs:

(1, 7.5), (2, 8.2), (4, 9.4), (5, 9.2)

Least squares interpolation for the missing element at index #3 [ordered pair (3,GUESS)] yields:

GUESS	SUM	
8.4	6.78	
8.5	6.74	
8.6	6.72	<--- Smallest sum
8.7	6.73	
8.8	6.75	
8.9	6.80	

Thus, least squares interpolation yields 8.6 as the best fit for element #3.

CHALLENGE: Try least squares interpolation of the nearest 2 and the nearest 6 elements. Compare results.

FOR THOSE WITH A TI-82 CALCULATOR
Here is a program I wrote to do a least squares interpolation. Enter the nearest 4 ordered pairs in the STAT memory as L1 (x's) and L2 (y's), then run the program below, enter "3" when it prompts "Enter X", then enter your GUESS when it prompts "Enter Y." The program will complete the sum of the distances for you.

LEAST SQUARES INTERPOLATION PROGRAM (TI-82):

```
ClrHome
Disp "Enter X"
nput X
Disp "Enter Y"
Input Y
0->S
1->K
Lbl A
((X-L1(K))^2+(Y-L2(K))^2)^(1/2)+S -> S
1+K->K
If (K<=4)
Goto A
Disp S
```

ANALYSIS OF RESULTS: After students have applied all three interpolation strategies to all three missing elements and averaged the percent differences, determine which strategy was the most successful. Discuss why this strategy is the best, and whether there might be situations in which other strategies would be superior. Discuss how they might improve their results even further. Try graphing the original and interpolated data sets. Discuss the results.

DISCUSSION: Discuss careers in which students might find themselves using interpolation strategies.

Point-out that, in practice, interpolation is usually automated by computer...but someone still has to program the interpolation algorithms into the computer and determine which interpolation strategy is best for the job.

Mention other methods of interpolation such as wavelets and fourier transforms.

Discuss problems of extending the interpolation strategies into 2 or 3 dimensions.

EVALUATION: Evaluate each group based on the accuracy of their work and the contributions made to the discussion.

GUEST SPEAKER: Invite a professional in the field of image processing or data analysis to speak to the class. Request that they spend some time discussing how they use interpolation in their work, and which methods they use most often.

	ELEMENT #4	DIFF.	% DIFF.		ELEMENT #8	DIFF.	% DIFF.		ELEMENT #12	DIFF.	% DIFF.		AVERAGE % DIFF.
ACTUAL VALUE		X	X			X	X			X	X		X
LINEAR INTERPOLATION													
CUBIC POLY. INTERPOLATION													
LEAST SQUARES INTERPOLATION													

Vonda Hellner

University of Texas Medical Branch
Galveston Texas

Phillip Turk - Mentor
Marine Biomedicial Institute
League Hall
Galveston, Texas 77555

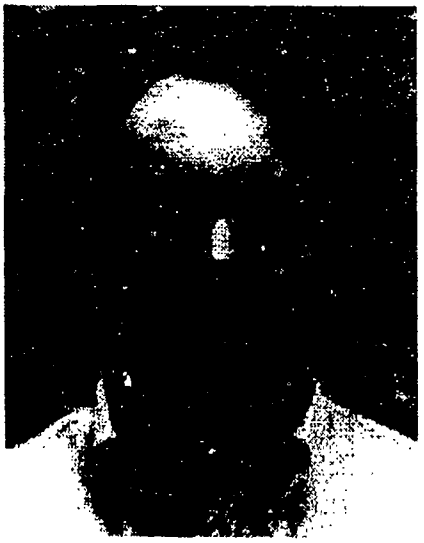
Vonda Hellner
Dickinson Middle School

Dickinson, Texas

Michael Schofner

University of Texas Medical Branch
Galveston Texas

Dr. Louis Justamente
3.158 Medicial Research Building
Galveston, Texas 77555



Michael Schofner
Clear Creek High School
4607 FM 2351
Friendswood, Texas 77546

NAME:	Michael L. Shofner
INTERNSHIP:	University of Texas Medical Branch-Galveston Department of Microbiology / Immunology
SCHOOL:	Clear Brook High School Friendswood, Texas
PRIMARY SUBJECT:	Biology I
ACTIVITIES:	*Applying the Scientific Method to Everyday Problems *Isolating Bacterial Colonies *Trouble-shooting Lab
SUMMARY:	By successfully completing these activities, the student will have the opportunity to learn and demonstrate the ability to safely use sterile technique and basic microbiological equipment. He will show that the scientific method can be applied to solve common everyday problems. In addition, he will utilize higher level thinking skills to isolate the source of error in a simple laboratory activity. A special presentation by Dr. Louis Justement will supplement the standard curriculum to address the topic "How to prepare for a career in science".
RESOURCES:	UTMB-Galveston, Department of Microbiology and Immunology, Louis B. Justement, Phd., and Mark Bobbitt, MS. Texas Alliance for Science, Technology, and Mathematics Education, Texas A&M University, Dr. Robert K. James, Director and Brian T. Wallenta, Project Coordinator. Salle, A.J. 1970, Laboratory Manual on Fundamental Principles of Bacteriology, McGraw-Hill.

CURRICULUM IMPLEMENTATION PLAN

TEACHER: Michael L. Shofner

MENTOR: Louis B. Justement, Phd.
Department of Microbiology / Immunology
University of Texas Medical Branch-Galveston

GOALS: To acquaint students with practical use of the scientific method and familiarize them with basic principles and skills of microbiological laboratory technique.

OBJECTIVES:

1. The student will utilize proper sterile technique to isolate and grow a pure strain of bacteria.

2. The student will demonstrate the ability to successfully interact with others in a team effort to achieve a common goal.

3. The student will show how to apply the steps of the scientific method to solve a common problem not related to scientific research.

4. The student will apply the scientific method towards solving a specific problem which arises during the course of laboratory research.

ACTIVITY: APPLYING THE SCIENTIFIC METHOD TO EVERYDAY PROBLEMS

OVERVIEW: The scientific method is used in scientific research because it is a proven, effective way of solving problems. However, its principles can also be successfully used to solve many problems which are not scientific in nature. Most important decisions should involve definition of a clear problem, gathering of information, some sort of educated guess, testing, recording of results, and good conclusions based on facts. Being aware of such reasoning processes allows better decisions to be made.

MATERIALS: Pencil or pen, paper; can be done individually or as a group activity

INTRODUCTION: Students can choose their topic for investigation or can be assigned one by the teacher. An example such the one below should be done as a class discussion activity to avoid confusion. The activity may be done as a general exercise to show how the scientific method can be used for problem solving or as an in-depth project requiring the steps to be researched for specific facts upon which to to base conclusions, etc.

EXAMPLE: Use the steps of the scientific method to decide which car to buy.

Define the problem: Which car should I buy which is economical, reliable, and costs less than $12,000? (must be specific question)

Gather information: Consumer Reports, interview mechanics and people who own cars which may fit the description in the problem

Hypothesis: I should buy the Tanaka Accordion (mythical) *This is a good place to point out that hypotheses may change as new facts are discovered. A hyothesis is dynamic, not fixed.

Experimentation:	Visit dealerships and test drive several Accordions as well a number of other similarly priced and equipped cars. Perhaps ask a friend to test drive a similar car he may own. *Emphasize that there must examples with which to compare your hypothesis.
Record results:	Keep a file of index cards. Each time a car is driven, write down answers to specific questions which were composed at the beginning of the experimentation process as well as additional comments. (ex: cost, acceleration, braking ability, handling, roominess, etc .)
Draw conclusions:	Compare recorded results on index cards. Base conclusions on the facts only. (Hypothesis supported, hypothesis not supported, hypothesis inconclusive). *Emphasize that all of these are valid as long as they agree with the results. Conclusion: Hypothesis inconclusive. Results are mixed and further testing is required.
Report results:	Tell friends. *This step is not so critical in everyday life as in scientific research.

QUESTIONS:

1. Why is it important for the steps of the scientific method to be followed in order?

2. What is meant by the phrase "jumping to conclusions"?

3. Are all sources of information in the "gathering information" step equally good? If not, tell which ones are not as good and explain why you believe this.

4. Why is it important to record results accurately after testing?

5. What factors make a conclusion a valid one?

6. While the scientific method can be used in almost any problem solving situation, some of the steps may not be as important in everyday decision making? Which steps would these be? Explain why you think so.

ACTIVITY: ISOLATING BACTERIAL COLONIES

OVERVIEW: To assure that experimental tests are valid, it is important to be sure that all the bacteria used are as genetically alike as possible. Any variations due to mutation could cause differences in the experimental tests which might be misunderstood and which could result in incorrect conclusions. The following procedures are designed to isolate bacteria which have been reproduced from a single parent and are genetically alike. In order to avoid contamination with unwanted bacteria, special precautions are taken to keep all other microorganisms, such as bacteria and molds in the air, out of the cultures used for experimentation.

MATERIALS: Nutrient broth culture of Escherichia coli and Staphylococcus epidermidis Incubator set to 37 degrees Celsius, sterile Petri dishes with nutrient agar (2 per group), Bunsen burner, inoculating loop, wax pencil, distilled water, clean microscope slides, Gram stain materials, tubes of sterilized nutrient broth (if pure cultures are to be kept for further research)

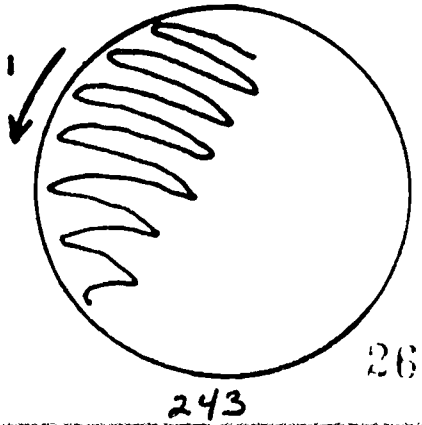
*Agar plates may be made by the students as a separate lab activity.

PROCEDURE:

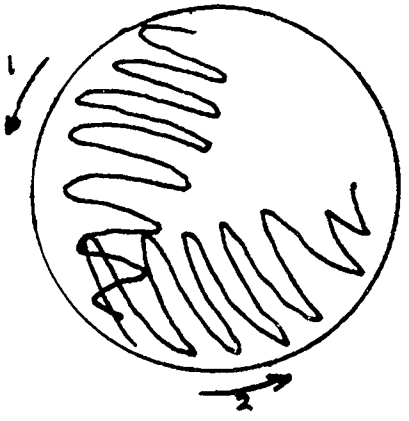
1. Sterilize the inoculating loop by holding in the the Bunsen burner flame until the wire glows red hot. After removing the top from the tube with bacterial culture, sterilize the mouth of the tube by passing it slowly through the flame.

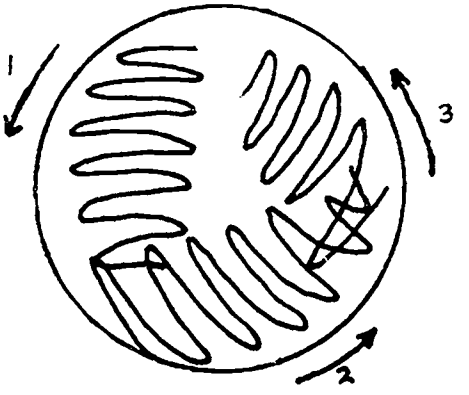
2. Ater allowing the loop to cool for a few seconds, insert it into the culture tube and remove a loopful of culture. If culture sizzles when loop is inserted, it was too hot. Replace the top on the cuture tube.

3. Invert the bottom of one of the nutrient agar plates overhead (to minimize bacterial contamination from dust in the air) and spread the loopful of culture by streaking the loop in a back-and-forth pattern across the surface of the agar (see figure 1). Use very light pressure to avoid slicing the agar. Streaks should be about one-fourth inch apart.



4. Turn the plate slightly to the right and again streak the loop across the agar by dragging the loop through the bottom of the last streak and extending the streak downward as before. This thins out the bacteria and helps to separate them (see figure 2).





5. After turning the plate again, streak the agar a third time. As before, drag the loop across the end of the previous streak and extend the streak downward (see figure 3).

6. Close the Petri dish and invert it to prevent condensation from forming on the agar which would cause the bacterial growth to spread and interfere with the formation of colonies. Using a wax pencil, mark the plate with the date, student initials, and some designation such as IA to identify the plate.

7. The second plate is not streaked, but is marked "control" and used to test the sterility of the agar and the technique use to prepare them. It may be designated IB.

8. Both plates are incubated at 37 degrees Celsius for 24 to 48 hours. Check after the first day for the presence of colonies. If they are not visible or are extremely small, the culture should incubate one more day.

9. After incubation, examine each plate for the presence of small "dots" which are the bacterial colonies. There should be no colonies in the control plate, but should be readily visible on the test plate IA. Look for colonies of two different appearances, representing the two species of bacteria in the original culture. Each colony represents the offspring of a single parent, and should be genetically alike.

10. Select one well-isolated colony of each species.

11. After flaming the inoculating loop as you did before, open the Petri dish, invert it, and elevate it overhead.

12. Cool the loop by touching it to a clear part of the agar where no colonies are present. Using the loop, remove a portion of one of the colonies and swirl it into a loopful of distilled water on a clean microscope slide. Do the same with the other selected colony on a separate slide.

13. Using the loop, smear the drop across the microscope slide and allow it to dry.

14. Gram stain the two samples to verify that they are different species. One should be a blue gram-positive coccus (S. epidermidis) and the other a red gram-negative rod (E.coli).

15. Examine samples with the oil immersion lens of your microscope. Use sterile technique to transfer other colonies to tubes of nutrient broth for further testing if desired.

QUESTIONS:

1. Why is the plate streaked three times instead of just once?

2. List at least 3 things which are done in this activity to prevent contamination of the bacterial culture.

3. Why is it important to isolate a single colony of bacteria for use in tests.

4. Why must the loop be cooled before transferring bacteria to another container?

5. What factors are used to verify that the colonies are really composed to two different species of bacteria?

ACTIVITY: TROUBLE-SHOOTING LAB

OVERVIEW: This activity is designed to test the integrity of the students' scientific data and to allow them an opportunity to design and implement a procedure for determining the cause of failure in experimentation. Of necessity, the actual goals must not be revealed to them prior to the activity. The basic idea is to deliberately alter the reagents or equipment in such a way as to render results which are inaccurate or greatly skewed. Student reports will then be scrutinized for manipulation of data to fit pre-announced expected parameters. Then they should work together in groups to design a way of testing what went wrong in the experiment.

The example given below involves "poisoning" bacterial growth media by adding acid or base to exceed acceptable ph ranges for bacterial growth. Lab groups grow samples in different temperatures and use different media bottles with varying pH levels to further complicate matters.

This activity takes more time than usually associated with lab exercises since time must be given for design and implementation of tests to check "what went wrong." However, since incidents of unexpected results occur frequently in real laboratory investigations, it is particularly important in teaching problem solving skills and in reinforcing the realization that scientific research is not always as clear-cut and straight forward as it may appear. It is also a good opportunity to examine the temptation to manipulate results rather that to remain objective.

MATERIALS: Bottles of nutrient agar with varying pH levels (since 7.2 is usually used, values may range considerably either

hig

her or lower), Bunsen burners, sterilized Petri dishes,

support rings, matches or flint strikers, lab thermometers, pH meter or pH test strips, nutrient broth culture of E.coli bacteria (dilute), oven mitt or tongs colony counter or counting grid

DIRECTIONS
TO STUDENTS:

1. Melt the agar in the bottle by placing the bottle into an 800 ml. beaker of boiling water. Be careful to undo the top of the tube and loosely place it resting on top of the bottle while it is in the bath.

2. Using sterile technique and flaming mouths of tubes and inoculating loops, transfer one loopful into an empty sterile Petri dish. Rubbing the loop against the bottom of the dish to dislodge some of the bacteria should do the trick. Lift the lid of the dish only enough to allow the loop inside. Do not take the lid completely off.

3. Remove the agar from the water bath when it is completely melted. Use an oven mitt or tongs to avoid being burned.

4. Check the temperature of the agar as it cools by using the thermometer. When it reaches 50 degrees Celsius, it is ready to pour.

5. Lift the lid of the dish just enough to allow the mouth of the bottle to enter and the agar to be poured. Flame the mouth of the bottle before pouring. Pour enough agar to cover about one-half to two-thirds of the bottom of the dish. Then swirl gently to spread the agar evenly and mix in the bacteria.

6. Invert plates, label with a wax pencil, and incubate at 37 degrees Celsius for 24 hours.

7. The next day, check the plates for bacterial growth. Ideally, there should be between thirty and three hundred colonies on the plate. Calculate the number of colonies using the procedure below and record this information in your lab report.

8. Position the Petri dish on the grid so that the colonies of bacteria can be seen against background of the grid. Choose five to ten of the squares at random, and count the numbers of bacterial colonies in each.

9. Add all the counts from all the squares together and divide this total by the number of squares counted to give the average count per square.

10. Calculate the total surface of the dish by squaring the radius of the plate and multiplying

11. To obtain an estimate of the number of colonies on the whole plate, multiply the average number of colonies per square by the surface area (in sq. cm.) of the entire plate.

Questions:

1. Why must the agar be cooled to 50 degrees Celsius before pouring the plate?

2. What are some possible sources of error which could occur in an experiment such as this? How could these be minimized or eliminated in advance?

3. How is contamination of the plates minimized?

4. What environmental conditions are optimum for bacterial growth? Are these present in our procedure? Explain.

5. What safety precautions are taken in the lab activity? Be specific.

After reviewing results, it should be obvious that something has gone wrong. Now lab groups should begin brainstorming about possible sources of error. The activity can stop here, but it is more effective if students can actually design tests to determine the source of error and then perform the tests to identify the problem.

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Peter Bowman, Phd., UHCL

Mark Bobbitt, MS. UTMB-Galveston

Heidi Kieschnick

APPENDICES

TEXAS TEACHER INTERNSHIP PROGRAM
Intern Information List
Summer 1995

NAME:	James N. Roe
ISD:	Del Valle ISD
SCHOOL:	Del Valle H.S.
PRINCIPAL:	Gordon Perez
AREA(S):	Composite Science
SPONSOR:	Advanced Micro Devices 5204 E. Ben White Blvd. Austin, Tx. 78741
MENTOR:	Mark Harris 512-602-4677
HOME:	1800 Rainy Meadows Austin, Tx. 78758
SCHOOL:	2409 Shapard Lane Del Valle, Tx. 78617 512-389-7300

NAME:	Mark Briles
ISD:	Bremond ISD
SCHOOL:	Bremond H.S.
PRINCIPAL:	Deborah Doan
AREA(S):	Biology
SPONSOR:	Texas A&M University Biochemistry Department College Station, Tx. 77843
MENTOR:	Dr. Jim Hu 409-862-4054
HOME:	109 Ridgewalk Rolling Ridge Park College Station, Tx. 77845
SCHOOL:	P.O. Box 190 Bremond, Tx. 76629 817-746-7145

NAME:	Jilla Khalilolahi
ISD:	Houston ISD
SCHOOL:	Scarborough HS
PRINCIPAL:	Ms. Ansen
AREA(S):	Chemistry
SPONSOR:	GeneMedicine, Inc. 8301 New Trails Drive The Woodlands, Tx. 77381-4248
MENTOR:	Eric Eastman 713-364-1150
HOME:	3131 Timmons Lane #136 Houston, Tx. 77027
SCHOOL:	4141 Coast Rica Houston, Tx. 77092 713-681-4618

NAME:	Tanja Shank
ISD:	Pre-Service
SCHOOL:	
PRINCIPAL:	
AREA(S):	Earth Science/Mathematics
SPONSOR:	Texas A&M University Biochemistry Department College Station, Tx. 77843
MENTOR:	Dr. Ryland Young 409-845-2087
HOME:	1105 Francis Drive College Station, Tx. 77840
SCHOOL:	

NAME:	Donna Bairrington
ISD:	College Station ISD
SCHOOL:	Rock Prairie Elem.
PRINCIPAL:	Dr. Nancy Thornberry
AREA(S):	Elem. Ed. 1-8
SPONSOR:	National Oceanic and Atmospheric Administration 1716 Briarcrest, Suite 702 Bryan, Texas 77802
MENTOR:	Shelly DuPuy 409-847-9296
HOME:	311 Stanford Drive College Station, Tx. 77840
SCHOOL:	3400 Welsh College Station, Tx. 77845 409-764-5570

NAME:	Linda Ray
ISD:	College Station ISD
SCHOOL:	Consolidated H.S.
PRINCIPAL:	Chrissy Hester
AREA(S):	Business Composite
SPONSOR:	Texas A&M Univ. Ocean Drilling Dept. College Station, Tx 77845-9547
MENTOR:	Lisa Patton 409-845-3031
HOME:	15590 Whites Creek College Station, Tx. 77845
SCHOOL:	701 West Loop S. College Station, Tx 77840 409-764-5500
E-MAIL:	lray@tenet.edu

TEXAS TEACHER INTERNSHIP PROGRAM
Intern Information List
Summer 1995

NAME:	George Weissenberger
ISD:	Pre-Service
SCHOOL:	
PRINCIPAL:	
AREA(S):	Science
SPONSOR:	Texas A&M University - Veterinary Medicine College Station, Tx. 77843
MENTOR:	Dr. Jorge Piedrahita 409-845-0732
HOME:	1700 Southwest Pkwy #18 College Station, Tx. 77840
SCHOOL:	

NAME:	Kathleen McGurk
ISD:	Northside ISD
SCHOOL:	Taft H.S.
PRINCIPAL:	Roger Harris
AREA(S):	Science
SPONSOR:	Texas Parks & Wildlife/RayCo,Inc. 134 Braniff San Antonio, Tx. 78216
MENTOR:	Rufus Stephens 210-349-2174
HOME:	4203 Tall Elm Woods San Antonio, Tx. 78249
SCHOOL:	11800 FM 471 San Antonio, Tx 78250 210-688-6000

NAME:	Eleanor Duggar
ISD:	Austin ISD
SCHOOL:	River Oaks Elementary
PRINCIPAL:	Joy Hueble
AREA(S):	Elementary
SPONSOR:	Texas Parks & Wildlife 4200 Smith School Road Austin, Tx. 78744
MENTOR:	Steve Hall 512-389-4568
HOME:	500 Hesters Crossing (106) Round Rock, Tx. 78681
SCHOOL:	14201 Schofield Farms Austin, Tx. 78758 512-832-0772

NAME:	Ann Miller
ISD:	Lake Travis ISD
SCHOOL:	Lake Travis M.S.
PRINCIPAL:	Bill Wakefield
AREA(S):	Life/Earth Science
SPONSOR:	Texas Parks & Wildlife 4200 Smith School Road Austin, Tx. 78744
MENTOR:	Dave Buzan 512-327-2868
HOME:	1602 Shannon Oaks Trail Austin, Tx. 78746
SCHOOL:	3322 Ranch Road 620 S Austin, Tx 78734 512-263-4500
E-MAIL:	afmiiler@tenet.edu

NAME:	Erica Lindstrom
ISD:	Pre-Service
SCHOOL:	
PRINCIPAL:	
AREA(S):	Elem. Ed.
SPONSOR:	Brazos Valley Museum of Natural History / Texas Parks & Wildlife 3232 Briarcrest Dr. Bryan, Tx. 77802
MENTOR:	Jeff Henson 409-822-5067
HOME:	4302 College Main #211 Bryan, Tx. 77801
SCHOOL:	

NAME:	Vickie Smith
ISD:	Austin ISD
SCHOOL:	Fulmore Middle School
PRINCIPAL:	Victoria Baldwin
AREA(S):	Composite Science
SPONSOR:	Texas Parks & Wildlife, Endangered Species Dept. 3000 IH 35S, Suite 100 Austin, Tx. 78704
MENTOR:	Linda Kissock 512-448-4311
HOME:	2505 Bowman Ave. Austin, Tx. 78703
SCHOOL:	204 E. Mary Austin, Tx. 78704 512-320-0111

TEXAS TEACHER INTERNSHIP PROGRAM

Intern Information List

Summer 1995

NAME:	Clark Anderson
ISD:	La Marque ISD
SCHOOL:	La Marque H.S.
PRINCIPAL:	Carol Robertson
AREA(S):	Math
SPONSOR:	UTMB-Galveston 1.120 B Jennie Sealy Galveston, Tx. 77555
MENTOR:	Dr. Raleigh Johnson
HOME:	P.O. Box 306 League City, Tx. 77574
SCHOOL:	300 Vauthier Road La Marque, Tx. 77568 409-938-4261

NAME:	Vonda Heliner
ISD:	Dickinson ISD
SCHOOL:	Dickinson MS
PRINCIPAL:	Linda Hanson
AREA(S):	Earth Science
SPONSOR:	UTMB-Galveston League Hall Galveston, Tx. 77555
MENTOR:	Phillip Turk
HOME:	121 Chariss Glen League City, Tx. 77573
SCHOOL:	

NAME:	Michael Schofner
ISD:	Clear Creek ISD
SCHOOL:	Clear Brook H.S.
PRINCIPAL:	Sandra Mossman
AREA(S):	Biology/Chemistry
SPONSOR:	UTMB-Galveston 3.158 Medical Research Build. Galveston, Tx. 77555
MENTOR:	Dr. Louis Justamente 409-772-4965
HOME:	907 Buoy Rd. Houston, Tx. 77062
SCHOOL:	4607 FM 2351 Friendswood, Tx. 77546 713-996-5446

TEXAS TEACHER INTERNSHIP PROGRAM
Summer 1995
Program Evaluation

MENTORS

Circle type of facility:

University Government Agency Industry

List at least two things that you and/or your department gained by hosting a teacher intern this summer.

- Opportunity to contribute to the professional development of the intern.
- The opportunity to be involved in the education of the children that participated in the summer nature camp.
- Developed an insight into how an outdoor classroom can be correlated with existing curriculum especially related to the limitations that teachers experience.
- Learned a lot about the human resources within the education community.
- Our teacher's completed project will be a great benefit to us and will help us tell the world about who we are and what we do.
- In being a mentor I learned a great deal about working with people in a supervisory capacity, and how much patience it can take to teach someone something new.
- Better understanding of what is being taught in high schools today, primarily in the sciences, as well as an idea about the quality of the teachers.
- Better understanding of the needs of teachers and schools to help them prepare students for higher education or jobs.
- Refinement of educational materials including brochure, activity sheets, & teacher packet.
- A good sharing of experiences and understanding.
- An excellent product to further education goals.

Describe the development of the teacher's position (i.e. the job description/project from conception of the idea to implementation with the intern). Include information about changes that were made along the way and why.

- All of the curriculum was well thought out in advance so that we only needed to work out a few logistical details before the beginning of the summer.
- We had recognized a need for information on how teachers could integrate outdoor classrooms into existing curriculum, so what we envisioned the intern doing never changed from the beginning. However, the stipend was the problem & with the help of local non-profit groups we now have assistance.
- After our original project idea fell through, we found out what area our teacher was interested in learning about. We were able to create a new project along those lines.
- Reviewed resumes, looked for a good fit with groups and activities within the company. Selected a teacher for an interview. Interviewed and made the final selection. This led to the development of a work scope and assignment of responsibility for supervision.

- We developed a job description and allowed the intern freedom to accomplish the task and we were again very pleased with the work.

Did the teacher fit into the natural flow of production/work in your facility?

yes	no
100%	

Please describe any transition problems that occurred during the first few weeks.

- We had the typical problems associated with the start of any new project. It took us a little while to get all the necessary equipment together and to block out the project itself.
- The only problems were computer compatibility problems.

Were you involved in the interview/selection of the teacher intern?

yes	no
86%	14%

If yes, what was your involvement and how would you change this in the future.

- More applications to select from.
- I evaluated all the teacher applications and selected one with experience and interests that fit with our department.
- I arranged the interviews and a group of about 6 were involved with the selection process and the development of the scope of the summer project.
- The mentors had the final say after being nominated by the program director.

Comments/Suggestions:

- Try to expand program.
- This has been an excellent opportunity to develop our educational materials.

TEXAS TEACHER INTERNSHIP PROGRAM
Summer 1995
Program Evaluation

15 Interns -	Male	5	White	14
	Female	10	Other	1

TEACHERS

1. Please rate the values of your internship experience compared to other professional development experiences you have had.

Scale: 1 = low/poor . . . 5 = outstanding/excellence

1	2	3	4	5
			8%	92%

2. The best thing about my summer internship was ...

- Because I hold the position of teacher, I was treated in a special way that makes me feel important. I think the feeling of being an important part of society was what I liked best about this summer.
- Learning the science behind the experiments we performed.
- The diving! Working with a wonderful staff in our department.
- Helpful people, who were not even necessarily responsible for answers and the assistance to ensure success.
- The new technology that I learned.
- Learning about gene therapy and its implications.
- Broadening my understanding of ecological concepts and how TPWD works to protect resources.
- I gained valuable experience which provided me with a more secure feeling towards my future as a teacher.
- Learning how to set up and maintain a tropical aquarium.
- Being placed in the role of "learner" again provided insight into my students situation. Reinforcement of previous perceptions regarding scientific research.
- Networking with adults.
- Working with real & useful applications of science & mathematics.

3. The worst thing about my summer internship was ...

- Too short!
- No real clear direction initially.
- Not having a mentor who could help me with my job.
- It was short. It might be a good idea to continue this partnership over two summers.
- Feeling like I didn't have enough time to accomplish all my goals.
- Too long.
- Long hours.
- Not enough time.

4. The most important thing that I have gained (personally and/or professionally) from my internship experience was ...

- Meeting new people, experiencing professional who will also be helpful resources for classroom mentors.
- A new outlook on mathematics in science.

- The exposure to biology.
- Speaking confidence. Learning to write effectively. Learning to listen.
- A usable program for students & information on "how to" do this.
- The new ideas that I have to take back to my school district.
- To have the knowledge that there are people in industry who care about education in this country.
- I see more ways to demonstrate to students real life applications of scientific principals.
- A more open mind towards diverse/disabled students.
- Seeing how scientific research is conducted in a true lab setting.
- Confidence in communicating with my students about the nature of research, science careers, and importance of teamwork in the real world!
- I was challenged and enjoyed that my teaching experience meant I could design a curriculum I knew nothing about and relate it to the classroom.

Please rate your job assignment and teacher/mentor relationship using the following scale:

Job Assignment	Teacher/mentor relationship
1-Not beneficial	1-Non existent
2-Rarely beneficial	2-Barely existent
3-Beneficial	3-Sometimes good
4-Very beneficial	4-Good most of the time
5-Extremely beneficial	5-Consistently good

5. My job assignment was:					
Clearly defined	1	2 8%	3 8%	4 38%	5 46%
Appropriate for my background	1	2	3	4 25%	5 75%
Mentally stimulating/challenging	1	2	3	4 8%	5 92%
6. My mentor was:					
Prepared for my arrival	1	2 8%	3 15%	4 23%	5 54%
Knowledgeable about the program	1	2 8%	3 23%	4	5 69%
Supportive of my effort/work	1	2	3 8%	4 15%	5 77%
Supportive of my curriculum plan	1	2 8%	3 8%	4 30%	5 54%
Helpful in my transition to the new environment	1	2 8%	3 8%	4 30%	5 54%
7. Overall, my mentor/teacher relationship was:					
Professionally fulfilling	1	2	3 8%	4 15%	5 77%
Effective for my growth	1	2	3 8%	4 15%	5 77%
Contributed to the attaining of my goals for the internship	1 8%	2 8%	3	4	5 84%

General comments about your mentor/teacher relationship ...

- Generally very supportive and helpful; however, professional interaction was lacking.
- While my mentor had to be absent for a goodly portion of my time in the lab, we had frequent constructive meetings about expectations & frequent discussion of education as preparation for scientific careers.
- I have developed a relationship with my mentor that I feel will continue in the future.
- It would be ideal to work with a mentor who know about my job assignment and could help when problems arise.

Please rate each of the following outcomes based on its relevance to your internship experience. Indicate in the left margin if your rating refers to personal (p) or professional (w) outcomes.

1-Not relevant at all
2-Slightly relevant
3-Moderately relevant
4-Relevant
5-Very relevant

8. Increased self-confidence	1	2	3	4 8%	5 92%
9. Personal revitalization	1	2	3 8%	4 46%	5 46%
10. Renewed enthusiasm for teaching	1	2	3	4 42%	5 58%
11. Increased knowledge of your teaching subject area	1	2	3 8%	4 23%	5 69%
12. Increased knowledge of practical applications within your subject area	1	2	3	4 33%	5 67%
13. Increased knowledge in other related subject areas	1	2	3 8%	4 30%	5 62%
14. New perspectives on the teaching of your subject	1	2 8%	3 8%	4 17%	5 67%
15. Increased knowledge of careers	1	2	3 15%	4 15%	5 70%
16. Increased knowledge of necessary skills and background required in the workplace	1	2	3 15%	4 15%	5 70%

Based on your internship experience, rate the likelihood of translating the following activities to your students (i.e. incorporating activities/ideas into your classroom).

1-Not likely at all
2-Somewhat likely
3-Probably likely
4-Very likely
5-Definitely likely

17. Addition of new content to lessons of labs	1	2	3	4 42%	5 58%
18. Revision of content within existing lessons	1	2 9%	3 9%	4 55%	5 27%

19. Examples and applications from internship work (with necessary modifications of activities for your classroom)	1	2	3	4 38%	5 62%
20. Lessons on careers and educational requirements	1	2 8%	3	4 38%	5 57%
21. Visits from your mentor and other professional from your internship site	1	2 15%	3	4 15%	5 70%
22. Providing opportunities for interaction between your students and professionals from your internship site	1	2 15%	3 8%	4 23%	5 54%
23. Using materials and equipment from your internship site	1 8%	2 15%	3 15%	4 15%	5 47%
24. Sharing materials and resources with other teachers	1	2	3 8%	4 15%	5 77%
25. Sharing experience details and benefits/ information with teachers and community members/groups	1	2	3 8%	4 30%	5 62%

Using the same scale as on the previous page, indicate the likelihood that you **will increase your emphasis** on the following instructional strategies as a result of your internship experience.

26. Assigning projects based on "real-world" problems	1	2	3	4 45%	5 55%
27. Having students working in groups	1	2	3 16%	4 25%	5 59%
28. Requiring students to complete group projects	1	2	3 25%	4 16%	5 59%
29. Requiring oral reports and group presentations	1	2	3 25%	4 50%	5 25%
30. Requiring formal written reports	1	2 8%	3 33%	4 43%	5 16%
31. Integrating math, science and technology	1	2	3 9%	4 36%	5 55%
32. Integrating other subject areas	1	2	3	4 42%	5 58%
33. Introducing new technology	1	2 17%	3	4 33%	5 50%
34. Using computer applications	1	2 8%	3 25%	4 17%	5 50%
35. Emphasizing work habits (i.e. deadlines, neatness, etc.)	1	2	3 25%	4 17%	5 58%
36. Emphasizing laboratory safety	1	2 9%	3 18%	4 9%	5 64%

Please feel free to make comments on the program. Positive and negative feedback is appreciated in order to continue improving the program.

- This was one of the most valuable teacher/education experiences I have been involved with. I appreciate the program and hope to become involved again next year.
- Extend the program for 2 summers for teachers.

- Get more industries involved.
- I feel that it would be beneficial to have the interns/mentors meet on a Saturday before the internship begins. As a group we could all work on goal setting and could discuss our expectations. We could also then be able to correspond throughout our experience!
- Super program!
- Need more in school/ in district advertisement of program.
- This was a super opportunity; one which expanded my horizons markedly. Especially vital is the 8 week exposure as opposed to a shorter period of time. Make every effort to expand to other industries, include more participants, etc. Thanks for all your hard work on our behalf.
- I want to thank Brian Walenta and the Texas Internship Program for making this internship and learning experience possible. It was a very positive opportunity.