INTRODUCTION TO NATURAL RESOURCES

What Are Natural Resources?
A good working definition of Natural Resources requires defining the two words, natural and resources, separately and combining those definitions. “Natural” can be defined as something present or produced, in nature. “Resource” can be defined as that which is useful and for which there is an available supply. By combining these two definitions, “natural resources” can be defined as something present in, or produced by, nature with an available supply that can be drawn upon when needed. Natural resources also can be categorized as earth materials and as all life forms. Those natural resources include air, water, soils, natural vegetation, and all rocks and minerals.

Who Uses Natural Resources?
People use natural resources. Every aspect of life requires that we use natural resources. When one gets up in the morning and eats breakfast, one is using natural resources. The electricity that turned on the lights, the water in the shower, and the food that is on the table came from natural resources. All day long we use natural resources. Sometimes they are used in other ways, such as enjoying one’s surroundings by visiting a state or national park or forest.

Alabama’s Natural Resources
Alabama is fortunate in that it has an abundance of many natural resources. Farmers use the soil to produce many products, such as cotton, potatoes, tomatoes, and peanuts. On some areas of land, trees are grown to produce wood to build houses and to make paper for many purposes. In recent years, oil (a product that we use every day) has been found, and drilled, for in Mobile Bay. Across the state, people use water to produce electricity (hydroelectric dams) and to fish for food and sport. As one can see, Alabama has an abundance of natural resources, BUT we must manage them correctly so that they will last for generations to come.

Conserving Our Natural Resources for Future Generations
It is important for Alabamians to pay close attention to the ways they manage natural resources. There are many public and private organizations that work to assure that our natural resources are adequately maintained, but, in the end, it is up to the individual citizen to do his or her part. Whether it is by picking up trash, recycling, planting trees, or volunteering with an environmental organization, everyone makes a difference, and everyone must help to insure that generations to come have the necessary natural resources.

Salty Mapping

OBJECTIVES:

The student will be able to:

1. Construct salt dough maps to show the geophysical regions of Alabama.
2. Describe the natural resources found in each region.

BACKGROUND:

Alabama can be divided into five land regions: the Coastal Plain, the Piedmont Upland, the Alabama Valley and Ridge, the Cumberland Plateau, and the Highland Rim. The East Gulf Coastal Plain is the largest land region with most of its land less than 500 feet above sea level. The East Gulf Coastal Plain has been considered the Timber Belt and is a major agricultural area. The Piedmont is made up of low hills and sandy valleys. The Ridge and Valley is rich in iron ore, coal, and limestone. The Cumberland Plateau is sometimes called the Appalachain Plateau and has tree-covered mountains. The Highland Rim is located just north of the Tennessee River and is sometimes called the Interior Low Plateau.

Grades:

3-5

Subjects:

Science, Social Studies

Time Needed:

Two 45-minute class periods

Materials:

cardboard 8 1/2" x 11" or larger
plastic bags
map of Alabama per group
geophysical map of Alabama
paints
one cup of flour per group
one cup of salt per group

VOCABULARY:

geophysical regions - the Coastal Plain, the Piedmont, the Ridge and Valley, the Cumberland Plateau, and the Highland Rim

East Gulf Coastal Plain - largest land region with most of its land less than 500 feet above sea level. It covers most of the central and most of the southern parts of the state, and contains pine forests and rich brown land.

Cumberland Plateau - sometimes called the Appalachian Plateau and has tree-covered mountains, flat land and rolling hills, has excellent fauna

Highland Rim - located just north of the Tennessee River and is sometimes called the Interior Low Plateau. The land is flat and is good for growing soybean, cotton and corn

Piedmont Upland - made up of tree-covered rolling hills and sandy valleys. These hills contain iron ore, limestone and marble.

Alabama Valley and Ridge - rich in iron ore, coal, and limestone. The mountains are part of the Appalachian Mountain range, contains limestone valleys and sandstone mountain ridges

ADVANCE PREPARATION:

1. Gather materials.

PROCEDURE:

Activity

1. Place approximately four students in each group for this activity. Assign responsibilities before beginning.
   - Have students label the geophysical regions on a blank paper map and discuss characteristics and resources of those regions.
   - Place the paper map on top of the cardboard. Secure the map with pins.
   - Trace over the paper map outline, pressing hard to transfer the outline to the cardboard.
   - Have students from each group measure one cup of flour and one cup of salt and place these ingredients into sealable plastic bags. Shake bags to mix the contents. Students should have just enough water for

each bag of ingredients to moisten the contents. They should begin mixing the dough in the bag until it forms a ball. When a ball is formed, students should take the ball out and knead it.
- The dough can then be applied to the cardboard and spread out into the shape of Alabama.
- Allow the dough to dry for several days and then paint, using different colors for the different regions.

Follow-Up
Maps should be checked for accuracy in labeling the geophysical regions.

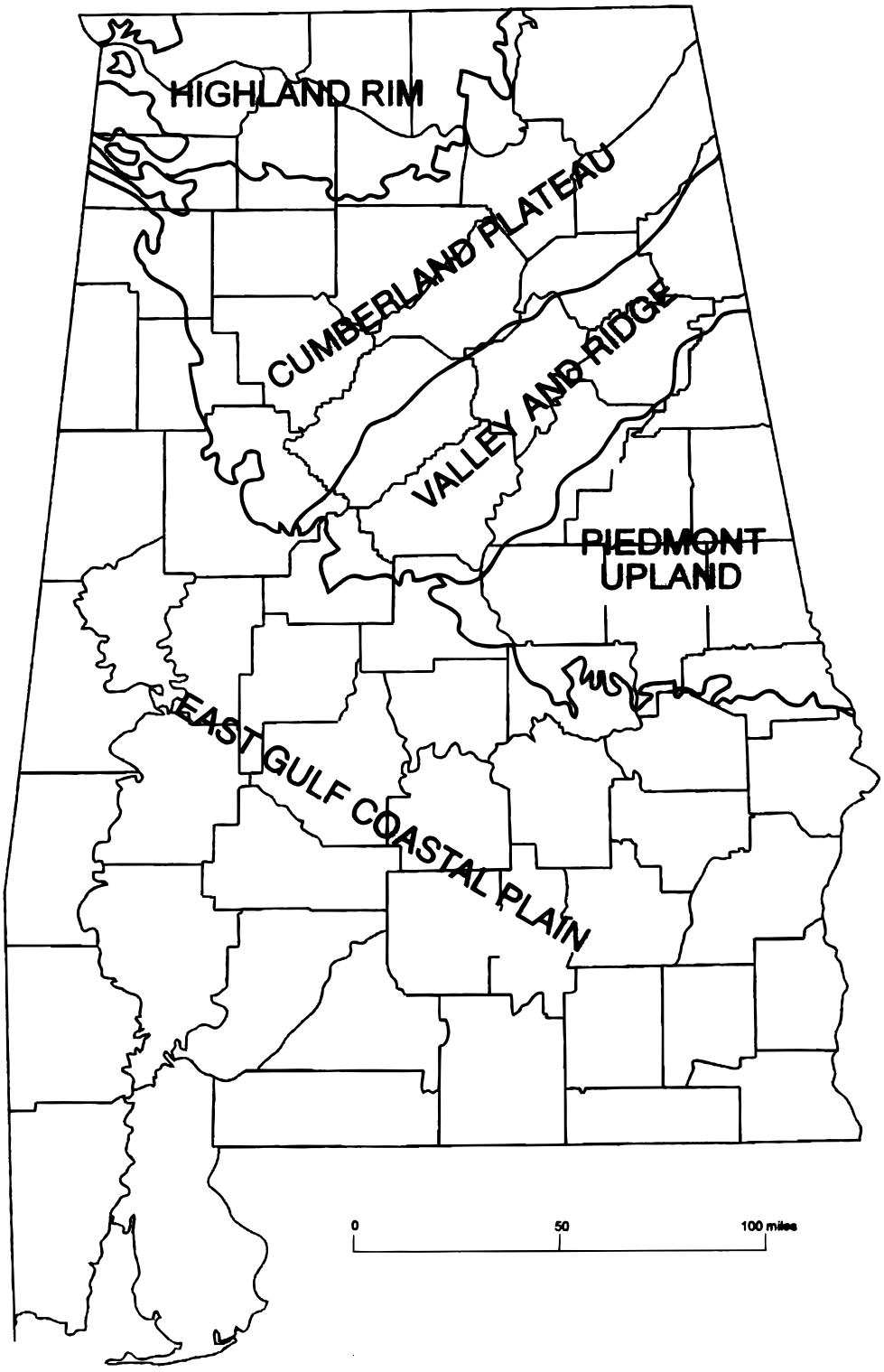
EXTENSION:

Students can prepare reports on the different regions including wildlife, plant life, and other resources indigenous to the region.

ORIGINAL DEVELOPMENT RESOURCES:

Owsley, F. & Stewart, J. (1961). *Know Alabama*. Northport, AL: Colonial Press.

General Physiography



Notes

Mining

OBJECTIVE:

The student will be able to:
Discuss environmental issues and decisions concerning the use and conservation of natural resources.

BACKGROUND:

Many natural resources including iron ore, limestone, bauxite, and coal are mined in Alabama. Mining these natural resources may have environmental impacts such as pollution, erosion, and the disturbance of the land. Though these environmental problems may result, natural resources provide many benefits.

VOCABULARY:

mineral - an inorganic substance found in nature such as gold, silver, or iron ore
nonrenewable resource - a natural resource that, in terms of human time scales, is contained within the Earth in a fixed quantity and cannot be replaced
ore - a natural combination of minerals from which metals or other valuable substances can be mined
reclaimed - returned to original condition
renewable resource - a natural resource, such as sun, wind, trees (forestry), and fish (aquaculture), in abundance that is continually produced.
strip mining - mining from an open mineral mine (coal, copper, zinc) where the topsoil is removed to expose and extract the mineral

Grades:

3-5

Subjects:

Science, Math

Time Needed:

One class period

Materials:

shoe boxes or plastic containers
sand
dirt
peanut M&Ms
leaves or grass
wooden skewers
tweezers
graph paper
play money

ADVANCE PREPARATION:

1. Obtain all listed materials.
2. Prepare shoe box mining sites by putting sand, dirt, peanut M&M's, and other natural material in the box. The M&M's should be buried in the dirt, and the dirt should then be slightly packed down. Add sand, leaves, or grass. Note: If potting soil is used, add some water to moisten and leave overnight before mining the M&M's. Also, be aware of the number of M&Ms in each box - you might want to write the correct number on the bottoms of the boxes and make certain each box contains the same number of candies.

PROCEDURE:

Setting the stage
Discuss the mining process with the students.

Activities
1. Put them into groups of four and assign them a mining site.
2. Tell students they represent a mining company and will do the following:
   - Name their mining company.
   - Find the ore (M&M's) using skewers.
   - Get the ore out of the ground using the tweezers.
   - Get the mineral from the ore. (Get the candy coating off the peanut.)
   - Dispose of the waste.

3. Describe the process and how the materials are to be used.
   - One person is in charge of the probe (skewer).
   - One person is in charge of the tweezers.
   - One person is in charge of getting the mineral from the ore.
   - One person is in charge of keeping track of the amount of mineral.
4. Tell the students that this is not a race with the other mining companies. The goal of the activity is to remove the ore from the ground without excessive, negative environmental impacts. Each company will theoretically get $3,000 for each piece of mineral. They will be fined $2,000 each if:
   - The mining site is not neat.
   - The candy is in the sand.
   - The site is not reclaimed.
5. Give the student 10 minutes to mine the ore, 10 minutes to process the ore, and 15 minutes to clean up.
6. Assign profits and fines. Use play money.
7. Allow each company to share its results, including how much money it earned.
8. Have the class plot the data from each mining company on a piece of graph paper. Students should tell what they did to disrupt the environment, and what they did to reclaim the environment.

EXTENSION:

Talk about how recycling things like aluminum (which Alabama manufactures) can help the environment.

ORIGINAL DEVELOPMENT RESOURCES:

Owsley, F. & Stewart, J. (1961). *Know Alabama*. Northport, AL: Colonial Press.

What's The Point?

OBJECTIVES:

The student will be able to:
1. Define appropriate cave terms.
2. Create stalactites and stalagmites from washing soda.
3. Discuss the formation of a limestone cave.

BACKGROUND:

A cave is a natural hollow in the ground. The caves in Alabama are in limestone rock.

The formation of a cave takes thousands of years and starts when surface water trickles down through tiny cracks in rock. Since the water contains carbon dioxide that has been absorbed from the air, it forms a mild acid that eats away at the limestone. Traveling underground, the water continues to eat away some rock (limestone), thereby forming passages and caves.

As the water seeps through the cracks in limestone, it dissolves a mineral called calcite that builds up in small layers. The odd shaped rock formations that are formed are called speleothems. The best-known ones are stalactites, which hang from the ceiling like icicles, and stalagmites, which rise from the floor like pillars. Sometimes they join and form a column.

The longest stalactite is about 23 feet long (in Ireland). The tallest stalagmite is 98 feet tall (in France). The tallest known cave column is 128 feet tall (in China).

Grades:
3-5

Subjects:
Science, Social Studies, Art

Time Needed:
Two class periods, ongoing project

Materials:
thick yarn
two jam jars
saucer
teaspoon
clothes detergent
water
brown construction paper
tempera paint (black, white, red, yellow)
straws
paint brushes
books and pictures about caves

Hundreds of cave painting sites have been discovered all over the world. Early artists began to engrave and paint on cave walls over 30,000 years ago. They mixed their paints using charcoal, clay, plant juices, and animal blood. Their four basic colors were black, white, red, and yellow. Some paint was rubbed on the surface of the rock. Some was brushed on with animal hair or vegetable fiber brushes. Some was blown onto the rock using hollowed-out bones.

Historians believe that the paintings were used during special ceremonies, which early people performed for success in hunting the animals painted. Many paintings are high up on the cave walls and ceiling. Therefore, the artists must have had ropes, ladders, or tree trunk scaffolding to reach them.

VOCABULARY:

speleothem - an unusually shaped rock formation formed over thousands of years from built-up layers of a mineral called calcite
spelunking - the sport of exploring caves and underground caverns
stalactite - a speleothem that hangs from the ceiling of a cave
stalagmite - a speleothem that builds up from the floor of a cave

ADVANCE PREPARATION:

1. Obtain books and pictures about caves to make available to students.

2. Collect supplies.
3. Make copies of student activity pages.

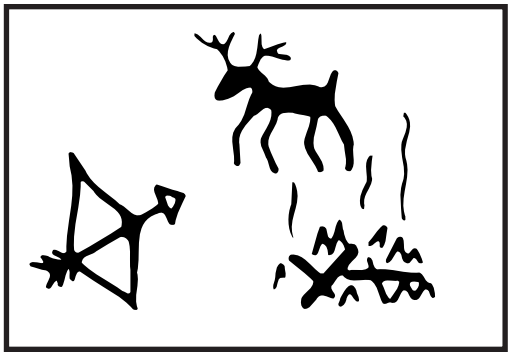
PROCEDURE:

Setting the stage

Have students close their eyes in the darkened classroom and imagine what it would be like to be in a cave. Then write the first 10 words describing how they would feel.

Activities

1. Fill the jam jars with warm water.
2. Dissolve as much washing soda as possible in each, a little at a time. Arrange the jars side by side with the saucer in between.
3. Arrange the yarn so that each end is in one of the jam jars and the middle is hanging over the saucer.
4. Put a small mound (one teaspoon) of washing soda on the saucer and leave the jar for several days.
   Note: The water and washing soda solution in the jars will drip onto the crystal in the saucer forming a column.



Follow-Up

1. Observe the formation of the speleothem.
2. Do cave painting (see background information).
   - Have students pretend that they are early Alabama Indians preparing for a big hunt. Use fingers and paint brushes. Also, blow through straws to paint on the construction paper cave wall.
3. Decorate the student activity page.
4. Tell students an easy way to remember which directions the speleothems grow is the following:
   Stalactite has a C so it comes from the ceiling. Stalagmite has a G so it comes from the ground.

EXTENSIONS:

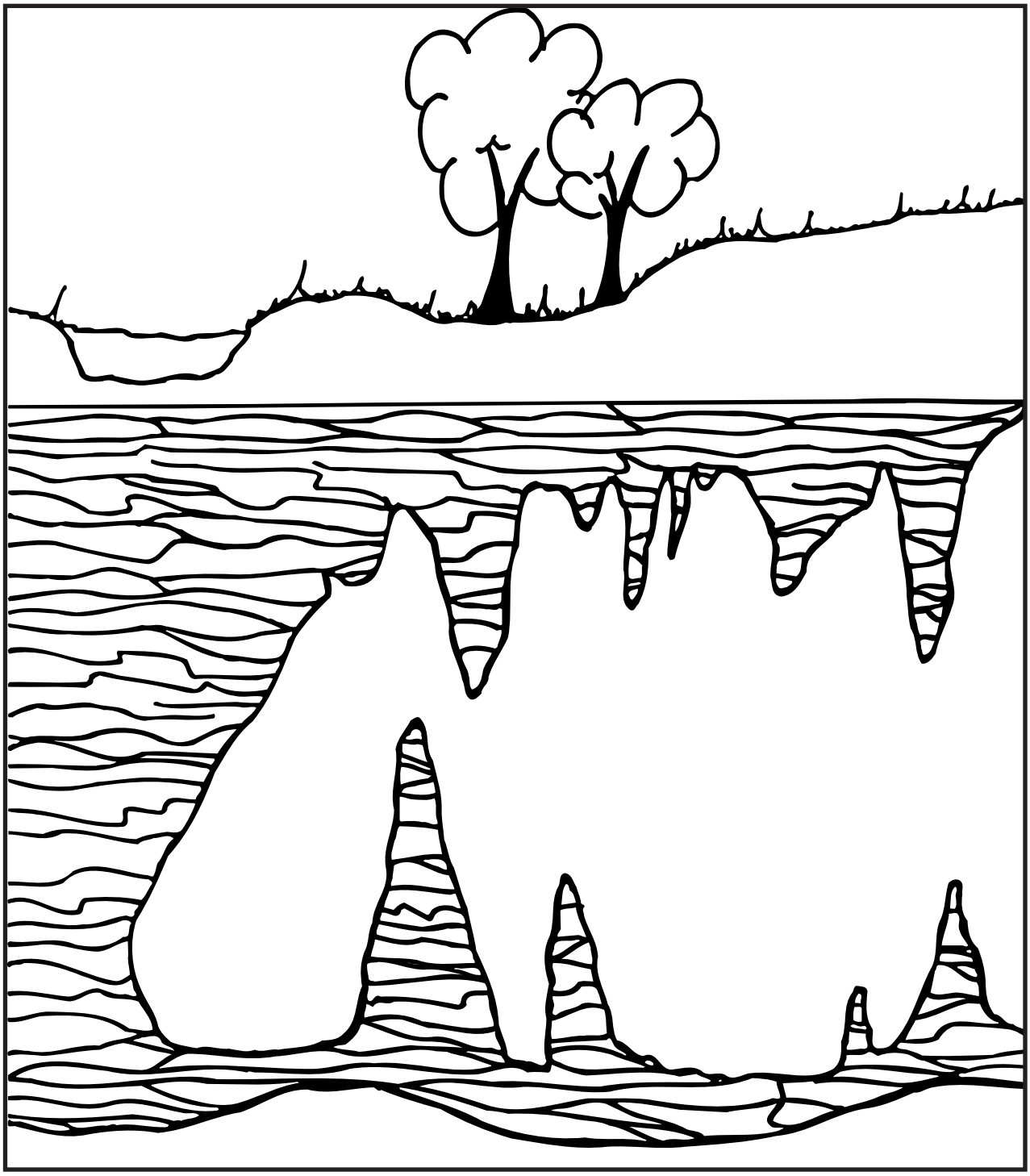
1. Create a story about spelunking and getting lost among the speleothem.
2. Take a field trip to a commercial Alabama cave in the area.
3. Make a cave in the classroom out of a large cardboard box (such as a refrigerator box) and papier mache'. Have students decorate the inside to look like a cave.

ORIGINAL DEVELOPMENT RESOURCES:

Wood, J. (1990). *Caves*. New York, NY: Scholastic, Inc.

Name: _____

Label stalagmite, stalactite, and developing column.
Decorate the cave to complete the habitat.
Include bats, spiders, and a hibernating bear.



Notes

Down Home Dinosaurs

OBJECTIVES:

The student will be able to:

1. Demonstrate how organisms leave traces.
2. Locate regions of the state that contain rock units formed during three geological eras including the Mesozoic era (the Age of the Dinosaurs) on a map of Alabama.
3. Discuss the uses of limestone rock.

BACKGROUND:

Living things have existed on the Earth for at least 3,800,000,000 (3.8 billion) years. To give an idea of how much time this is, imagine this time period shrunk to one year. To do this, one would have to compress 120 years into one second.

The creatures that have lived in the past have left evidence of their former existence. These include fossils or imprints of bones, shells, leaves, and other body parts. Another kind of evidence of former life is not part of the organism itself. Everywhere you go, you leave evidence of your passing; footprints are a prime example. Some other examples are seat marks where you sit on the ground, broken branches where you walk through the woods, tire tracks where you and your family drive off pavement. Animals leave other kinds: alligators make tail-dragging grooves, and bears leave resting marks where they lie in the mud.

Grades:

3-5

Subjects:

Science, Geology, Paleontology

Time Needed:

Two class periods

Materials:

waxed paper
tape
clay
seashell
petroleum jelly
small milk carton
water
plastic spoon
plaster of paris

Fossils are often found in limestone, a sedimentary rock. Sedimentary rock is used to make cement, building materials, and glass. It is an ingredient in agricultural lime used on soil by farmers. Chalk, a type of sedimentary rock, is formed from pure limestone. Gas and petroleum may be found in large limestone deposits.

Many fossils can be found across Alabama, but only the Black Belt area contains dinosaur fossils. Dinosaur means terrible lizard; however, the word is a bit of a misnomer because dinosaurs are more closely related to birds.

The Age of Dinosaurs actually occurred during the age of reptiles, the Mesozoic Era (245-65 million years ago). This was an era when life on Earth evolved quickly to cover the land with a wide array of plants and animals. For much of the preceding era, the Paleozoic life existed primarily in the sea, and the land was relatively sparsely settled. The most recent era, the Cenozoic Era, witnessed the flourishing of mammals and *Homo sapiens* (people).

Across Alabama, surface rocks can be found representing each of these eras including the amazing Mesozoic Era, The Age of Dinosaurs. Rock regions of Alabama separate the state into regions of similar surface appearance and geologic history. The northern half of Alabama is composed of Paleozoic rocks more than 225 million years old--too old for dinosaurs but with many other fossils. At the Fall Line begins the Mesozoic rocks of dinosaur age. Since the Jurassic and Triassic rocks are missing, there are no fossils in Alabama from these periods; but the Cretaceous is well-represented, especially in the fossil-rich Black Belt, an old sea bottom.

VOCABULARY:

Cenozoic Era - the time in the history of the Earth, about 65 million years ago to present, when recent life evolved on the Earth

fossil - trace or remains of an organism that was once alive

Mesozoic Era - the time in the history of the Earth, about 65 to 250 million years ago, during which reptiles were the major life form; the Age of the Dinosaurs

Paleozoic Era - the time in the history of the Earth, about 250 to 570 million years ago, when many new life forms appeared; the Age of Invertebrates

ADVANCE PREPARATION:

1. Make a transparency of the enclosed map.
2. Gather all materials.
3. Mix plaster of Paris according to the package directions.

PROCEDURE:

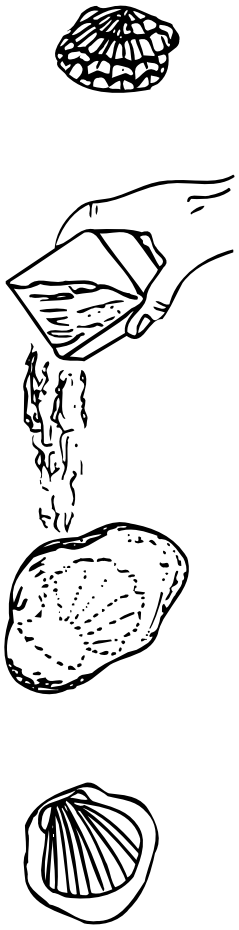
Setting the stage

1. Discuss the difference between mold and cast fossils. A mold forms when an object falls on sediment such as clay. If the clay remains undisturbed and hardens, the shape of the object is preserved. As the object decays, the shape fills with new sediment that hardens, forming a cast.
2. Read background information to the class and use a transparency of the Alabama map to discuss Alabama's rock regions.

Activity

Have students follow this procedure.

- Tape wax paper to your desk for the work surface. Press a ball of clay into a circle about 1/2 inch thick. Coat the clay with petroleum jelly.
- Press the outside of a shell into the clay. Cup the clay around the shell.
- Remove the shell. This forms the mold, leaving the shape of the shell in the clay.
- Carefully remove the plaster shape from the clay. This is the cast. A cast fossil forms when a mold fossil fills with sediment and hardens.
- Ask the students if preserved prehistoric bones and shells are fossils. (They are.) Now ask them if they know another kind of fossil. If necessary, help them to realize that footprints can be fossils, too. Ancient footprints, including dinosaur footprints, are trace fossils. They are preserved when fine sediment covers a layer containing footprints and fills the footprints. In this experiment, the plaster of Paris functions as the covering sediment.
- After the casts have hardened (consult package, but this will take almost an hour), the students may pick up and keep their trace "fossils."



Follow-Up

1. Have students share their fossils with the class.
2. Have students write essays describing how traces are formed and what they can teach us.
3. Plan an imaginary dig or expedition and share ideas about what the class discovers.

EXTENSIONS:

1. Dampen and flatten sand in a sand box and walk across the sand, leaving footprint tracks. Pour plaster of Paris into prints and discuss how tracks can be preserved. Repeat the experiment with pets or by manually moving objects over or pressing them into sand. Compare results of dry versus wet sand.
2. Borrow some fossil traces from a geologist, the Geological Survey of Alabama, natural history museum, or possibly a guest speaker and show the students traces like the ones they made can be preserved as fossils in rock for millions of years.
3. Have the students brainstorm all the ways they can think of that animals (and plants) can create traces. (Some examples are listed in the background section.)
4. Take a field trip to a museum to view fossils or go on a fossil dig.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama Museum of Natural History in Tuscaloosa. www.museums.ua.edu

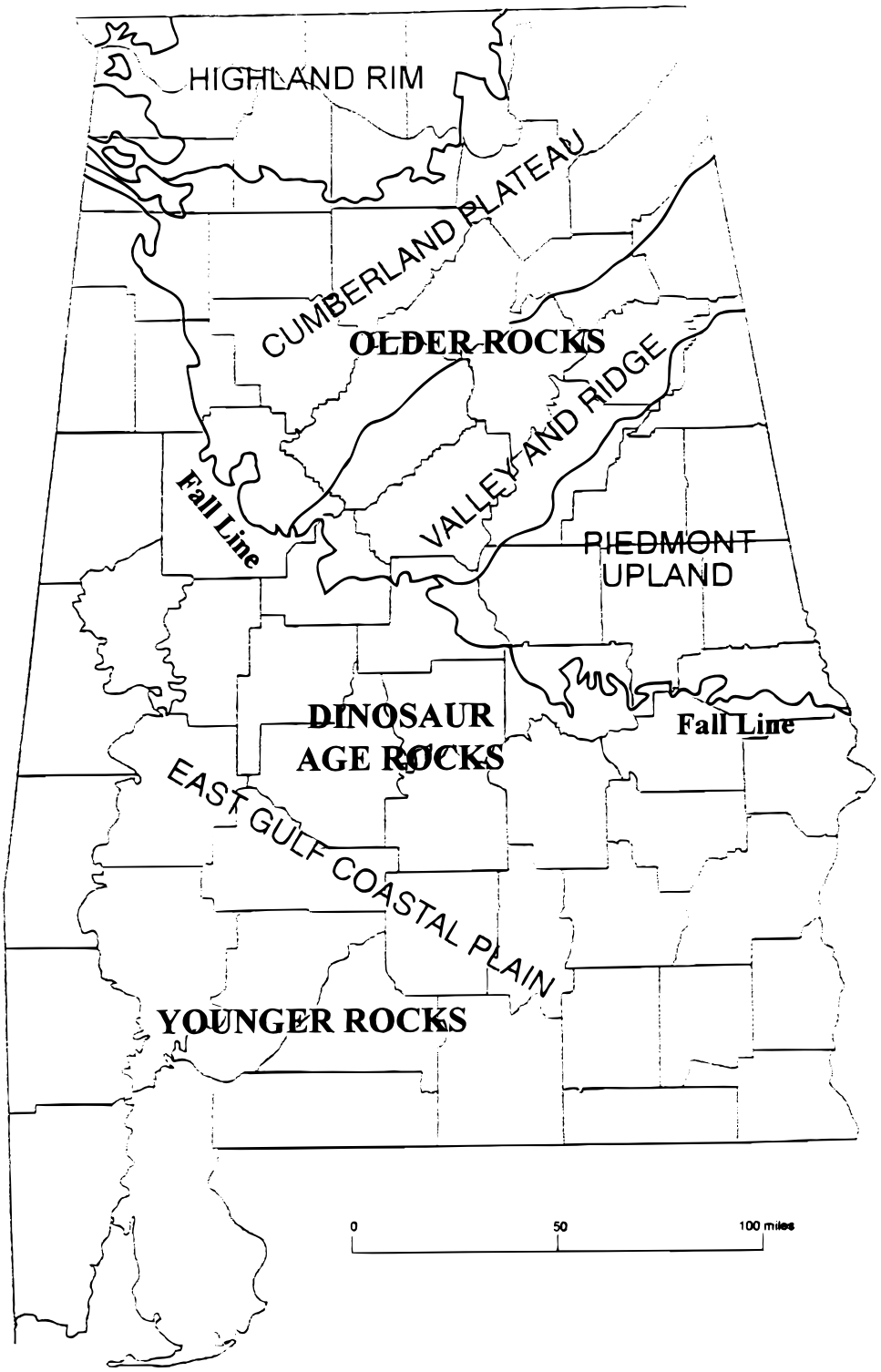
Baylor, B. (1984). *If you are a hunter of fossils*. New York, NY.: Aladdin Books, Macmillan Publishing Company.

Geological Survey of Alabama in Tuscaloosa.

Mankiewics, C. & Mendelson, C. (1993). *On the rocks*. Society for Sedimentary Geology.

Pearce, Q.L. (1989). *Quicksand and other earthly wonders*. Englewood Cliffs, NJ: Silver Burdett Press, Inc.

Alabama Rocks



The Value Of Water

OBJECTIVES:

The student will be able to:

1. Determine the amount of water used or misused daily in a home.
2. Identify certain ways to conserve the use of water.
3. Discuss why water is essential for day-to-day living and how water contributes to the standard of living for Americans.

Grades:
3-5

Subjects:
Science, Math

Time Needed:
Two class periods, ongoing

Materials:
collection box
a two-liter soft drink container

BACKGROUND:

Water conservation is important in all states and for all individuals. Because water has so many uses, the more water we conserve, the more water there is available for other uses.

Many homes waste water daily. This can be prevented with a simple method as well as becoming water conscious. We use water in everyday life. If you thought water was just for bathing, drinking, and swimming, then you're wrong!

Water Facts:

- It takes 1,800 gallons of water to produce cotton in one pair of jeans.
- It takes 400 gallons of water to produce cotton for one shirt.
- It takes 4,000 gallons of water to grow a bushel of corn.
- It takes 11,000 gallons of water to grow a bushel of wheat.
- It takes 1,000 gallons of water to grow enough wheat to make two one-pound loaves of bread.
- It takes 4,000 gallons of water to produce one pound of beef, so it takes 1,000 gallons of water for a Quarter Pounder at McDonald's.
- It takes 16.5 gallons of water to manufacture a 12-ounce Coke.

ADVANCE PREPARATION:

1. Copy five pages of the water dollars for each student. Label a cardboard box Water Bank and place it where the students can see it. Fill the two-liter soft drink container with water and place it next to the Water Bank.
2. Make a water-use poster. See attachments.

PROCEDURE:

Setting the stage

1. Discuss the useful and wasteful practices of water use.
2. Explain to the students that they are going to examine how they each use water by playing a water game. To learn about water use, each student will be required to pay for the water he/she uses with the water play money.

Activities

1. List on the chalkboard as many uses of water as possible. The poster provides some general categories. Have students identify the type of water use for each item on the list--in water, on water, and with water. Example: Students swim in water, boat on water, and wash with water.
2. Pass around the two-liter soft drink container. Explain that the soft drink container contains two liters of water.

3. Give each student one sheet of water dollars. Have each one cut out the play money and write his/her name on each dollar. Note that on each page there are three one-liter, three five-liter, four ten-liter, and two twenty-liter water dollars - a total of 98 liters of water dollars per page. Each student will start with a total of 490 water dollars. They will be required to make change for certain water uses.
4. Pass out the Water Tally Worksheet and have students use it at school and at home for one 24-hour day to determine if their homes conserve or waste water.
5. Each time a student uses water at school or at home, it will cost the listed amount of water dollars specified on the Water Use Chart. If a family chore is done using water the student must pay the Water Bank for those activities. Have students pay before using water at school and in the morning after using water at home. Place payments in the cardboard box labeled Water Bank.
6. Have students keep a record of how their dollars are spent by writing on the back of the dollars.
7. Discuss water usage and pay the Water Bank.

Follow-Up

1. After students do their home tally, combine student results and graph. Brainstorm how homes could conserve water use. Examples could include:
   • Not running water while brushing teeth.
   • Not filling the bathtub completely when bathing.
   • Running a full load of dishes in a dishwasher.
   • Installing flow restrictors in showers and faucets.
   • Fixing leaky toilets.
   • Installing water conservation devices in toilets.
2. Evaluate the graph and tally worksheets for completeness and accuracy.
3. Play the water game for two more days. Follow the same procedure, except do not list the water uses on the chalkboard. This time, at home and at school, have the students try the water-saving ideas identified by the class. Each time a student uses water at school or at home, this usage will cost the student the dollar amount identified on the Water Use Chart. If a family chore is done requiring water, a $5 payment must also be paid to the Water Bank. If water saving measures are introduced, refund to the students the dollar amounts listed in the column titled Potential Savings in Dollars. Each student begins with 1000 water dollars (10.2 water dollar sheets). On the third day, have the students compare the water dollars they had remaining after playing the water game the first time with the water dollars remaining after playing the game the second time.
4. Discuss the possible consequences of running out of water dollars. Use the following questions for discussion:
   • What if there are no water dollars left?
   • What can you do to get more water dollars?
   • Is it fair to share water dollars with someone who used all of theirs?
   • How could you have saved water dollars? If you played the game again, would you play any differently?
   • Who used the fewest water dollars and why?
5. Have the students identify the uses of water they feel are the most important and then discuss ways to conserve water. Other water-saving ideas not on the Water Use Chart include:
   • Sweep patio or driveway instead of washing it.
   • Install water-saving shower heads.
   Install water-saving toilets.
   • Only get water in restaurants when you are going to drink it.

EXTENSIONS:

1. Make an appointment to meet the public service director or community affairs director of a local TV station or radio station. Then create a Public Service Announcement (PSA) about the importance of conserving water and ways homeowners can conserve.
2. Take a field trip to a local water sewage treatment plant or recycling center.

3. Determine the amount of water out of a faucet, shower head, or hose by using a calibrated bucket. Watch and measure the volume of water that flows out in one minute. Your actual figures may differ from those listed on the Water Use Chart.

ORIGINAL DEVELOPMENT RESOURCES:

Goodman, Billy. (1990). *A kids guide to how to save the planet.* New York: Avon Books.

Kids for saving earth. (1994, May). *Chemtology magazine*. (Vol 23. p.3).

The Earthworks Group. (1989). *50 simple things you can do to save the earth*. Berkeley, CA: Earthworks Press.

Water Use Chart

Use Category	Water used*		Water dollars required **	Potential savings (in liters)	Water-saving suggestions **
	Amount in liters	Assumption			
Drinking	3	Daily requirement	3		
Toilet device	20	Per flush	20	5	Tank displacement
Brushing teeth	40	Leave water on for 2 minutes	40	35	Turn off water while brushing
Washing hands	20	Leave water on for 1 minute	20	15	Turn off water while soaping hands
Shower	100	5-minute shower	100	40	Take a 3-minute shower
Washing clothes	120	1 load	120	20	Washing full loads could save as much as 17%
Washing dishes	100	1 load, automatic dishwasher	100	17	Washing full loads could save as much as 17%
Washing car	100	5 minutes to complete	100	60	Turn off water when not washing
Lawn watering	250	Apply 2.5 centimeters to 10 square meters	250	150	Use native plants or plants that thrive on little water. Save as much as 60%

* Chart is based on the flow of water from a faucet, shower head, or hose of 20 liters per minute.

** Students give 1 water dollar for each trip to the drinking fountain. Five water dollars are required for 5 liters of water used, 20 water dollars are required for 20 liters of water used, etc. Saving 5 liters of water saves 5 dollars, saving 35 liters saves 35 water dollar, etc. Savings are given back to the students as refunds.

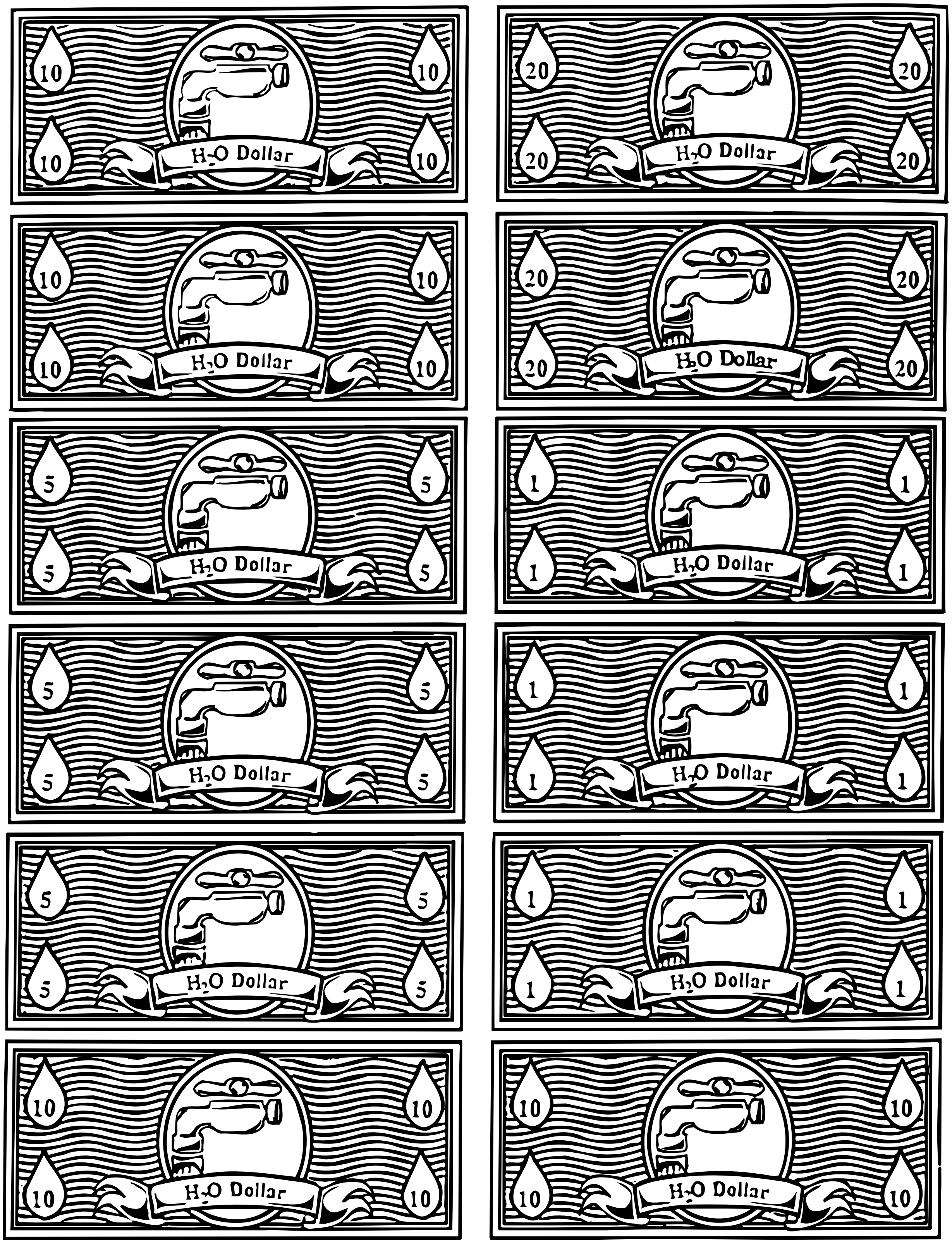
Source : Denver Water Department, Colorado River Water Conservation District

Water Tally

Activity	# of times/day =	# of days =	Total
Bathroom --			
Flushing toilet	x 5 gallons*	gal. x	
Showering	x 30 gallons	gal. x	
Bathing	x 40 gallons	gal. x	
Brushing teeth	x 1 gallon	gal. x	
Kitchen/Laundry --			
Washing dishes by hand	x 30 gallons	gal. x	
Dishwasher	x 15 gallons	gal. x	
Washing Machine	x 30 gallons	gal. x	
Outdoors --			
Washing car	x 20 gallons	gal. x	
Watering lawn/garden (30 min.)	x 240 gallons	gal. x	
Other		gal. x	

Grand Total = _____

* Quantities given are estimates.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20 20 H2O Dollar 20 20
10 10 H2O Dollar 10 10
20 20 H2O Dollar 20 20
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1 1 H2O Dollar 1 1
5 5 H2O Dollar 5 5
1 1 H2O Dollar 1 1
5 5 H2O Dollar 5 5
1 1 H2O Dollar 1 1
10 10 H2O Dollar 10 10
10 10 H2O Dollar 10 10

Gardening With Natives For Natives

OBJECTIVE:

The student will be able to:
Collect data on visits of insects, spiders, and birds to native plants.

BACKGROUND:

Many students do not realize the importance of native plants to wildlife. When an area is disturbed for development, such as constructing a building or a road, almost all the existing vegetation needed by wildlife is removed. Often the displaced wildlife will eventually return to take advantage of native plants that regrow naturally or are replanted. The numbers and types of animal visitors can be counted, tabulated, and analyzed to help determine the relationship between native wildlife and native plants.

VOCABULARY:

endemic - regularly found in a particular locality; restricted or indigenous to a certain locality
exotic - a species not native to the place where it is found
native - originating, grown, or produced in a particular region
pollination - when an insect or other agent pollinates plants by carrying pollen from one plant to the stamen of another plant

ADVANCE PREPARATION:

1. Gather materials.
2. Prepare copies of the survey sheet.

PROCEDURE:

Setting the stage
Survey school ground to determine area to be used for outdoor activities.

Grades:

3-5

Subjects:

Science, Math, Language Arts

Time Needed:

Weekly half-hour to one-hour sessions during growing season for observation and calculation; time to complete and gather project data including graphing and analysis -- could require two to three hours

Materials:

native plants (in pots or planted in garden) such as those from attached list
watering can
trowel
organic fertilizer
shovel and rake if planting
survey sheets for tabulating wildlife visits
outdoor thermometer
any other weather monitoring equipment available (humidity, wind speed/direction, barometer)
field guides

Activities

1. If desired plants or trees are not readily available, obtain potted native plants from local nurseries. (Note: Collecting or digging plants on public land is prohibited.) It is best to use several different species with at least one plant for each cooperative learning group. (See included list.) Use field guides for groups to identify plants and animals. The Planting Natives for Native Wildlife page is a general guide. Add local wildflowers, shrubs, and trees on the school grounds as needed for observation.
2. Observe and record wildlife visits to native plants. (See Survey Sheet: Use a specific time period. (Example: 8:00 a.m. and 2:00 p.m. each day for two days.)
3. Collect data over a period of time for compilation and analysis. Questions to be answered include: Which plants hosted the most or fewest visitors? What types of birds, insects, or spiders visited? What times of the day did plants receive the most or the least visitors?

Follow-Up

1. Check data collection and graphing.

2. Assign grade for analysis.

EXTENSION:

Establish a native plant garden on school grounds.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama Department of Conservation. Project WILD. *Developing an outdoor classroom*.

Field guides for plants, trees, insects, butterflies, and birds.

National Wildlife Federation. *Developing a backyard wildlife habitat*.

Planting Natives for Native Wildlife

WILDFLOWERS AND SHRUBS

Violets
Chickweed
Daisy fleabane
Oxeye daisy
Salvia
Oak leaf hydrangea
Queen Anne's lace
Jewelweed
Trumpet creeper
Black-eyed Susan
Butterfly milkweed
Wild sunflower (*Helianthus* sp)
Viburnum
Hawthorne
Wild lettuce
Buttonbush
Mountain mint
Sumac (non-poisonous sp)
Burdock
Ironweed
Liatris/Blazing star
Canada thistle
Cardinal flower
Goldenrod
Bee balm
Butterfly bush
Wild rose

TREES

Oaks (champion wildlife tree)
Pines
Dogwood
Redbud
Hollies (*Ilex* sp)
Sourwood
Maple
Wild black cherry
Sweet gum
Black gum
Magnolia
Beech
Sassafras
Hickories

Survey Sheet For Wildlife Visits
Group/Name_____
Date_____Plant_____
Weather Conditions
Temperature_____Humidity_____
Wind_____Precipitation_____
Air Pressure_____Cloud Cover_____

	Visit (Time Started - Ended)	Comments / Observations (Including Wildlife)
Day 1		
Day 2		

How Strong Are Your "Mussels"?

OBJECTIVES:

The student will be able to:
1. Identify ocean mussels as a source of food.
2. Identify and label the parts of a mussel.
3. Identify Alabama rivers and the Gulf of Mexico.

BACKGROUND:

The mussel in a bivalve animal found in water. It is found in many places in Alabama. The body of the mussel is covered by a hard shell made from calcium carbonate. The two shells are connected by a hinge that assists the mussel in opening and closing. Inside the hard shell is the soft body of the mussel that consists of a foot, stomach, heart, and gills.

Fresh water mussels are found in streams and lakes. On the inside of mussel shells is a hard substance called mother-of-pearl. Mother-of-pearl is used to make jewelry and buttons. Sea mussels live in the ocean and several types may be eaten. The sea mussels use the foot to spin a long thread called a byssus. This anchors the mussel to a rock.

VOCABULARY:

mussel - an ocean or freshwater animal covered by a hinged shell
byssus - a long, thin thread used by mussels as an anchor

Grades:
3-5

Subject:
Science

Time Needed:
one to two class periods

Materials:
blue mussels
plastic knives
paper towels
batter ingredients
electric skillet
oil
cooking utensils
plastic gloves

ADVANCE PREPARATION:

1. Purchase blue mussels from a seafood store or some grocery stores. Ask for the byssal threads to be left attached.
2 Run off student activity page.
3. Make two overhead transparencies of the mussel. One transparency should list the parts of the mussel and another without parts. Make transparency of the Alabama Rivers map.
4. Pass out plastic knives and paper towels to students.
5. Mix up a basic batter recipe.
6. Obtain an electric skillet, oil, and cooking utensils.
7. Copy the Bivalve Model.

PROCEDURE:

Setting the stage

1. Students should discuss and list known ocean and freshwater animals used for food. Use the Alabama Rivers map transparency to locate Alabama rivers and the Gulf of Mexico which boarders 53 miles of Alabama's coastline.
2. Provide students with the activity page and discuss the mussel parts. The teacher should assist using the overhead transparency.
3. Guide students in discussing differences between freshwater and saltwater mussels. (Freshwater mussels have thicker shells than saltwater mussels. Saltwater mussels are attached by threads they produce. Freshwater mussels are not attached. Freshwater mussels are partially buried in sand and gravel. Saltwater mussels are fully exposed.)

Activities

1. Purchase mussels from a seafood store or some grocery stores.
2. Provide groups of students with a blue mussel (saltwater mussel).
   - Give out one glove for each student.
   - Direct students to examine the shell. The outer shell and inner shell have different textures. The inner shell does not irritate the soft tender body of the mussel.
   - Use a knife to open shells or microwave for 2 minutes until mussels pop open.
   - Ask students to locate the byssal threads, foot, growth lines, edge of mantle, umbo, and excurrent siphon on the exterior of the mussel.
   - Using the plastic knives, disect the mussel.
   - Locate and identify the inside parts named on the student activity page.
3. Open mussels saved for eating.
   - Dip into batter and fry.
   - Eat and enjoy.

Follow-Up

Using an overhead transparency of the mussel, have the students identify the parts. Cut and assemble Bivalve Model.

EXTENSIONS:

1. Compare mussel shells to other types of shell fish. Use reference books on shells to compare and contrast.
2. Use the mussel shells for an art project.
   - Paint pictures inside the shell.
   - Drill a small hole at the top and hang by a string.
3. Have students bring in jewelry made from mother-of-pearl.

RESOURCES:

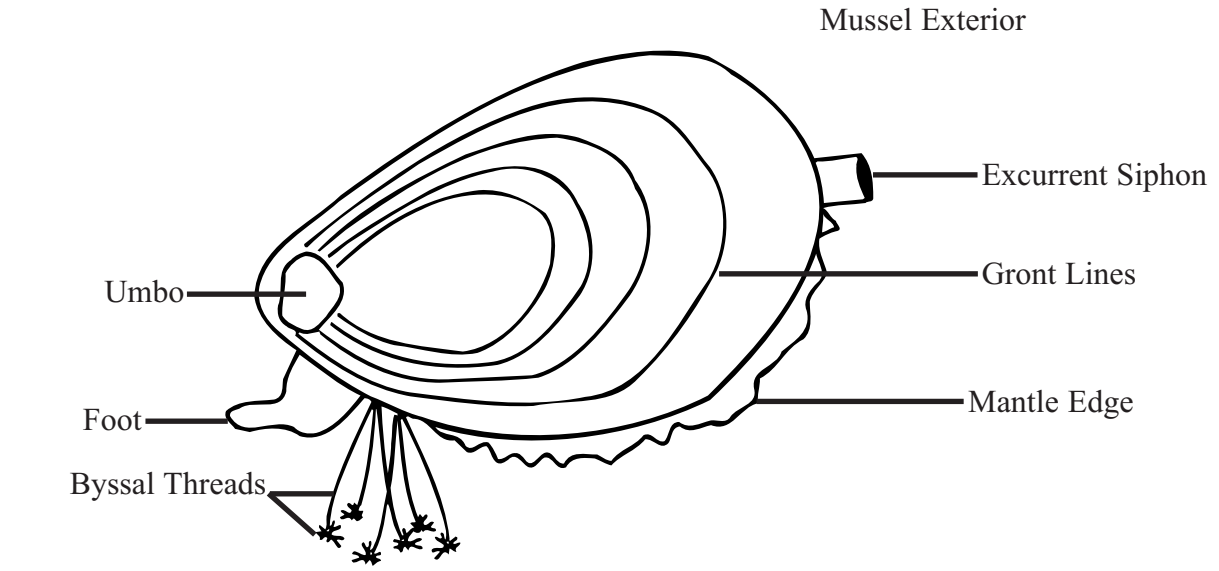
Butzow, C. (1989). *Science through children's literature*. Englewood, CO: Teacher Ideas Press.

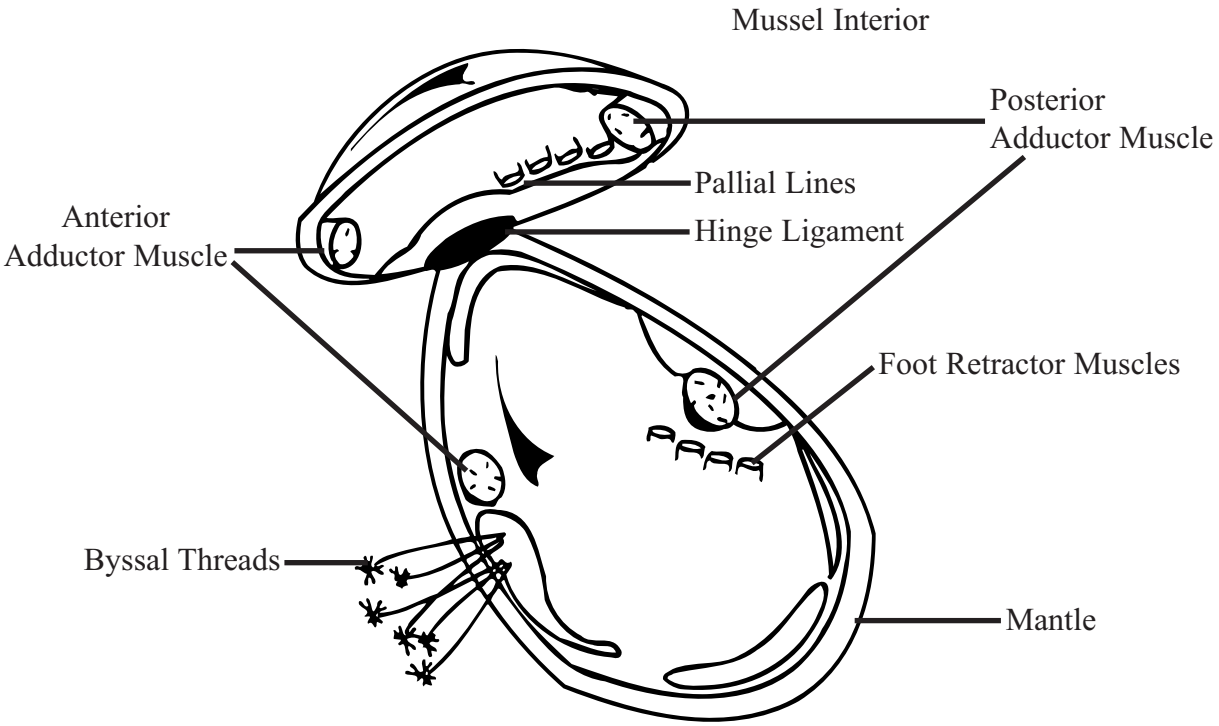
Jablonsky, A. (1991). *Discover ocean life.* Lincolnwood, IL: Louis Weber, C.E.O. Publications International, Ltd.

Talbot, F. H. (1995). *Under the sea*. San Fransisco, CA: The Nature Company Discoveries Library.

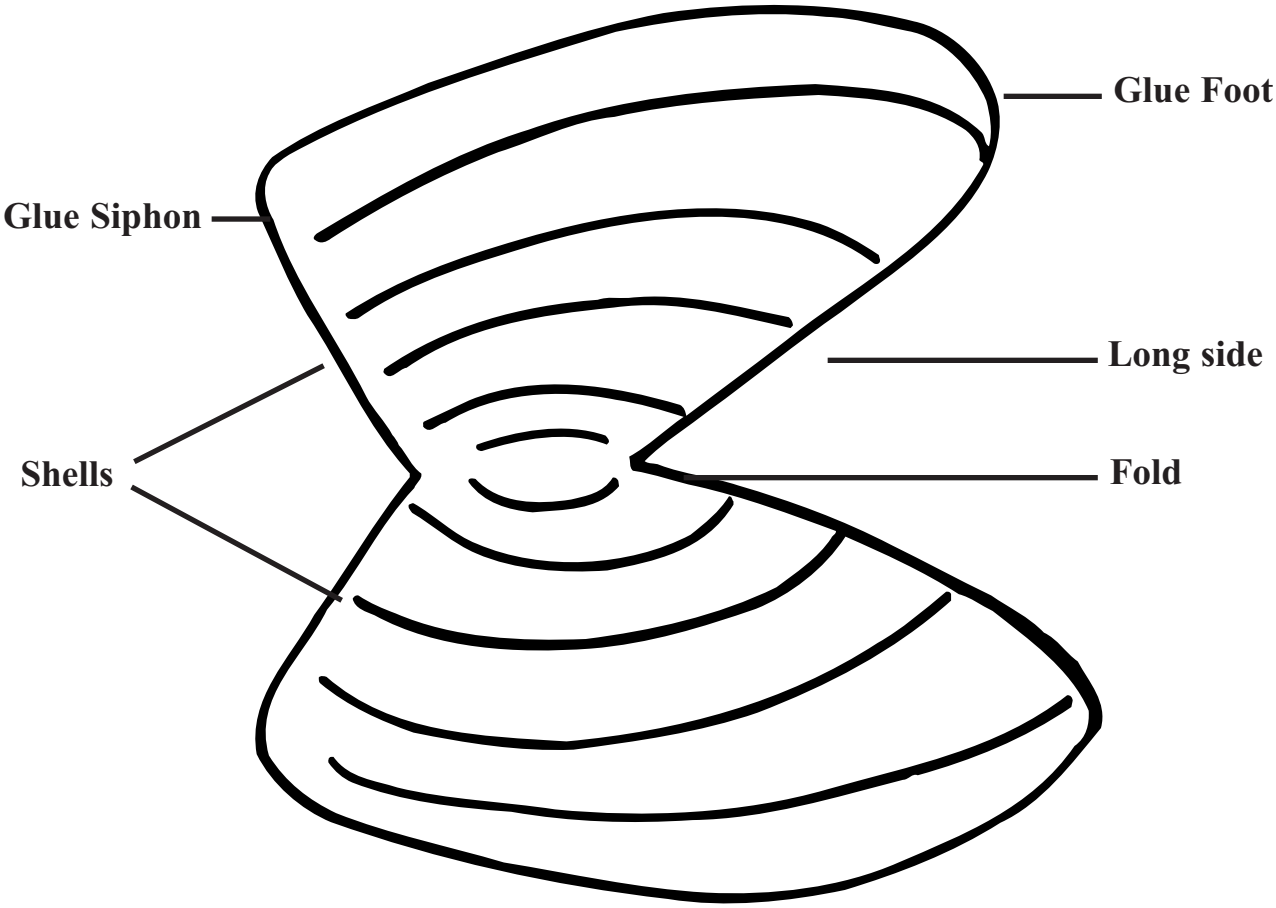
The world book encyclopedia. (1987*).* (Vol. 13). Chicago, IL: World Book, Inc.

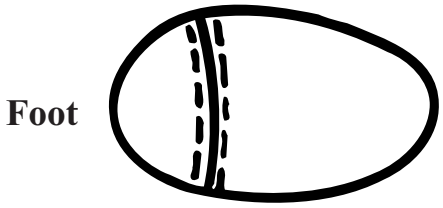
Mighty Mussels

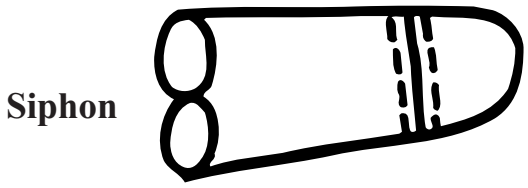




Bivalve Model







Directions:

1. Cut out shells, Foot, and Siphon.
2. Color them.
3. Glue the Foot inside the bottom shell at the longer side of the shell.
4. Glue the Siphon on the opposite side of the shell.
5. Fold Siphon and Foot at middle lines so that the dotted lines meet.

The Development Of Sunshine City: Simulation Activity

OBJECTIVES:

The student will be able to:

1. Explain how individuals, industries, and organizations can help protect environmental quality.
2. Describe how land-use decisions affect river quality.
3. Create an improved community by developing a city plan for future development.

Grades:
3-5

Subjects:
Science, Language Arts, Social Studies

Time Needed:
two class periods

Materials:
pencil
colored pencils

BACKGROUND:

Land-use decisions in a community affect the quality of the environment. Many land-use decisions, although appearing positive for today, may have long-range negative effects. Before a community makes any major decisions, it should carefully study the possible positive and negative results. Although many land-use decisions are complicated, effective compromises can often provide for community needs and protect the quality of the environment.

VOCABULARY:

gabions - rock-filled wire baskets that are placed along stream banks to prevent erosion
runoff - water, including rain and snow melt, that runs into a larger body of water such as a river or a lake

ADVANCE PREPARATION:

1. Prepare a set of fact cards for every group of four to six students. Laminate the cards for future use.
2. Divide students into groups of four to six.
3. Run two copies per group of the activity sheet 3, “Sunshine City.”

PROCEDURE:

Setting the stage

1. Brainstorm the way community decisions concerning land use affect the environment.
   - Explain that decisions made today must consider long-term results for the entire community.
   - Record responses on the board.
2. Distribute “Sunshine City” Fact Sheets 1 and 2.
   - Read Fact Sheet 1 together and locate the mentioned places on the drawing.
   - Would you like to live here? Why or why not?
3. Explain that the City Council of Sunshine City is experiencing difficulty making decisions because of the town’s rapid growth. You are the City Council and you must make wise, informed decisions.

Activities

1. Meeting of the city council
   - Distribute Fact Cards. Students should classify them as Postive for the city, Negative for the city, or both Positive and Negative.
2. Historical perspective
   •Draw what you believe Sunshine City looked like before people were there. Use student activity page 4, pre “Sunshine City.”.

3. Planning for the future
   - You cannot change the development that has already occurred, but it is your job to control the future development of Sunshine City.
   - Develop a plan for the next 10 years. What laws or rules would you make? What would you change? What would you add to the community? Would you build a dam?
   - Draw how you think Sunshine City looked about 100 years ago. Draw it 100 years in the future. Be able to defend your decisions.

Follow-Up

1. Each group will present its project to the class.
2. Discuss what problems were encountered by the group in making its decisions. How were disagreements solved?

EXTENSIONS:

1. Creative writing- You are the owner of Bailey Lumbering, Textiles Plus, the farm, or the recreation area. Write a letter to the local newspaper about your views concerning the future plans for Sunshine City.
2. Design a new "Welcome" sign for Sunshine City.
3. Research the effect Wilson Dam or Wheeler Dam had on the Tennessee Valley region of Alabama.

ORIGINAL DEVELOPMENT RESOURCES:

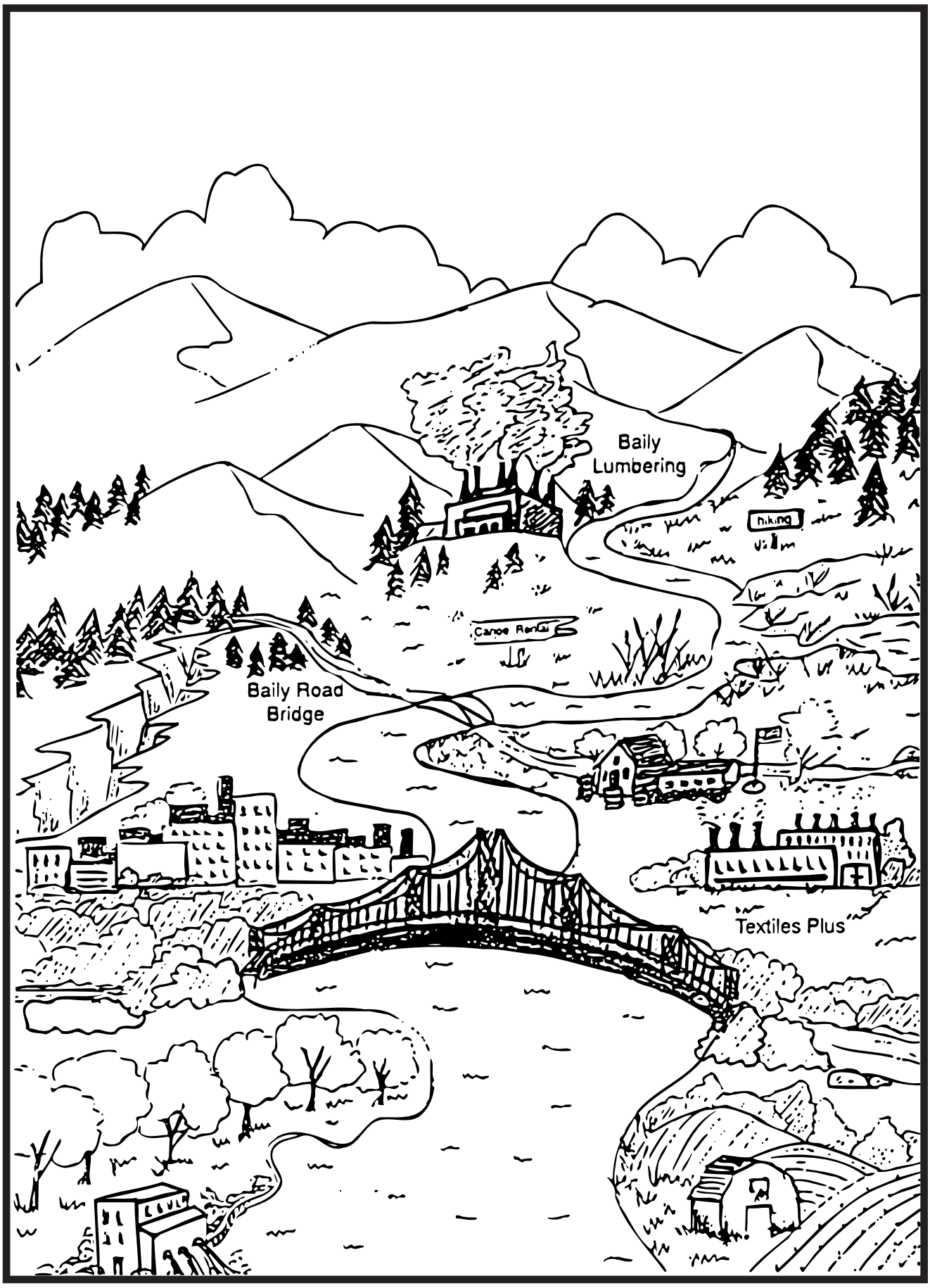
National Wildlife Federation (1988). *Conserving America: Rivers resource guide.* Washington, DC.

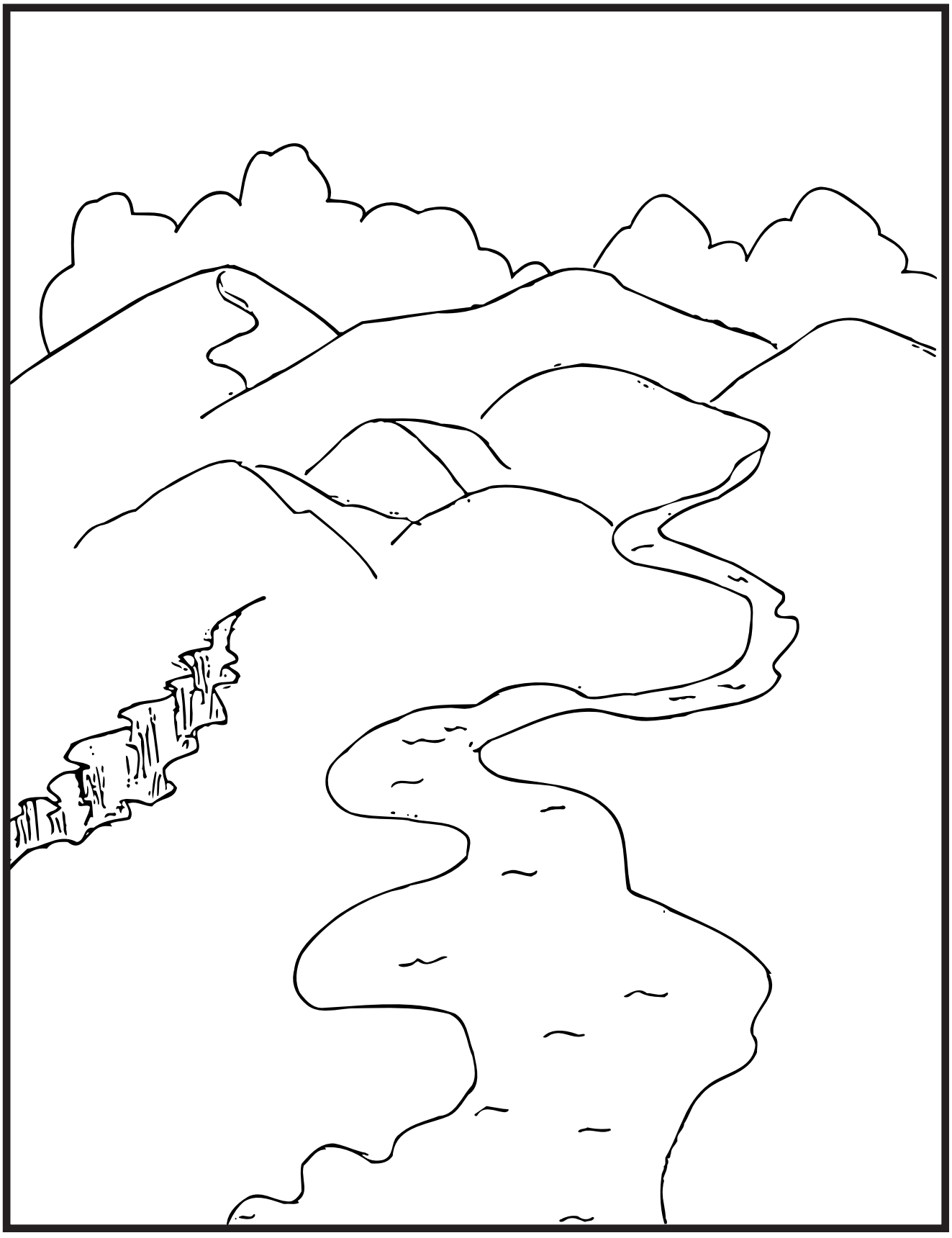
Sunshine City Fact Sheet 1

Farm fertilizers increase crop yields.	Farmers can do rotation farming (different crops each year) and cut down on their need for fertilizers.
Logging along streams decreases the stream nutrient supplies because leaves don't fall into the water.	Leaving woodlands along a river acts as a buffer zone and limits runoff, erosion, and protects animal habitats.
Logging may increase the silt in the stream.	Activities upstream affect water quality downstream.
Dams provide electric energy, recreation opportunities, flood control, increased river transportation, and irrigation.	Irrigation runoff often carries toxic substances.
Many communities use sea walls or gabions (baskets of wire filled with rocks) along stream banks to prevent erosion.	New industries can build retention ponds to catch runoff and allow pollutants to settle out before entering a local stream.
If there is too much fertilizer in a stream, plants may grow too fast and block or slow the flow of the stream.	Logging, farming, and industry create many job opportunities.
Public transportation (taxi, bus) decreases traffic, oil, and grease on highways and should lower accidents.	Fish ladders may be built at dams to allow fish to move upstream.

Sunshine City Fact Sheet 2

Many communities have recycling centers for oil, paper, plastic, and glass.	Livestock, cows, and horses may trample vegetation and cause erosion problems. They may also drink, swim, and deposit waste in the water.
Pesticides get into streams and may kill aquatic plants and animals.	Some communities are using non-polluting energy sources such as wind and solar power. This decreases oil and hydroelectric use.
Nitrogen and phosphorous cause growth of algae. Bacteria feed on algae and multiply. They use up oxygen in the river.	Some communities discourage pesticides and fertilizer use in city lawns.
Farmers may plant a grassy or wooded buffer zone. They slow runoff and protect the waterway.	Many recreation areas spray for insect control.
When a dam is built, river habitats are flooded. Plants and animal homes are destroyed.	Boats with motors leave oil and grease on the water.
Some sewage treatment plants remove nitrogen and phosphorous from the water before it is released.	Litter is a problem in many picnic and recreation areas.
Many cities landscape their river banks to prevent erosion and beautify their city.	Some companies install special pollution devices to cut down on air emissions.


Baily
Lumbering
hiking
Canoe Rental
Baily Road
Bridge
Textiles Plus



Start Shredding The News

OBJECTIVE:

The student will be able to:
Make paper from pulp.

VOCABULARY:

couching - taking a new sheet of paper from the mold and allowing it to adhere to a blotter.
deckle - a frame that fits over the mold
mold - a frame covered with screening
pulp - the ground-up material, moistened with water, from which paper is made
sizing - a substance added to give paper a certain surface or finish
slurry - pulp mixed with enough water to make a liquid
wet leaf - the newly formed sheet of paper (before it is dried)

ADVANCE PREPARATION:

1. Collect pulp materials.
   - Recycle paper of all kinds.
   - Experiment with plant fibers such as weeds, leaves, grasses, sawdust, cornhusks, and straw. Cut them up and mix in a blender with water.
2 Make the mold and deckle from two rectangular wooden frames of the same size (the size wanted for the sheets).
   - Staple fine screen on one frame for the mold.
   - Use the empty frame.
3. Obtain a large container for the slurry.
4. Collect sponges, cloths, and other absorbent materials.
5. Gather other materials.

Grades:

3-5

Subject:

Art

Time Needed:

One to two class periods

Materials:

large tub
dishpan or sink
two wooden frames (same size - one with fine wire screening)
blender
blotters (cotton cloth, felt, or paper towels)
rolling pin
iron
sponges
waste paper
bleach (optional)
colorant (optional)
gelatin or acrylic spray (optional)

PROCEDURE:

Activities

1. Make new paper from recycled paper.
   - Fill the blender about 3/4 full with water. Add the shredded paper (and perhaps other fibers). A bleaching agent may be added at this stage. One tablespoon of starch for every two cups of water may be added for sizing. If colored paper is desired, add dye (diluted with water) to the mixture. You may add a tablespoon of colored latex paint instead. Blend until the mixture is finely ground and smooth.
   - Hold the mold so the screen side is up. Place the deckle on top of the mold.
   - Pour the slurry from the blender into the dishpan. Stir it to keep the particles from settling out. Holding the mold and deckle firmly, scoop them down and under the water. Hold them level as you once again stir the slurry (to get an even distribution on the screen). Avoid touching the screen since it will cause matting of the particles. Gently shake the frames from side to side; and in one motion, lift the frames out of the slurry. Keep them level at all times. Keep them over the dishpan. The water will run through the screen and leave a thin layer of pulp (the wet leaf) on the screen. If the pulp is not smooth and even, the paper will not be either. Wash off the screen and dip again until you get a good wet leaf. This takes some practice. Finally, allow the mold and deckle to shed the excess water. Once most of the water has dripped through, turn them vertically to drain. (The wet leaf will leave water marks, however.)

- Set the mold and deckle on a pad of dry cloths or paper towels. Remove the deckle. Place a blotter of cotton cloths or paper towels over the wet leaf and smooth gently. Then turn over the frame and blotter (face down) on the table.
- Sponge excess water from the screen. Then carefully remove the mold. If done correctly, the sheet will adhere to the blotter.
- Place more blotters on top of the new sheet. Use a rolling pin to squeeze out any excess water. Flat cloths placed on top and wrung out each time work well.
- Now decorate the paper by either of these optional techniques:
  a. Brush a diluted dye solution on the damp sheet for a water color effect.
  b. Imprint a leaf, twig, or some other design by pressing it into the sheet. Remove it when the imprint is made.
- When the sheet has been blotted thoroughly, iron the sheet between several sheets of paper or cloth. Use the cotton setting on the iron.

2. Finish the sheet.
   - After being ironed, the sheet may be sprayed with a clear acrylic spray. Allow this to dry thoroughly.
   - You may wait a day or two and press the sheet directly (with no cloth or paper covering it) with the iron for a glossy surface.
   - You may "size" your paper with gelatin. Heat 1-1/2 ounces of clear gelatin with one pint of water. Pour the dissolved gelatin and water into a dishpan. Add a pint of cold water to the mixture. Slide a sheet of dry handmade paper quickly into and out of the sizing mixture. Blot it and press it dry with an iron. This will make the paper less absorbent.
   - You may further decorate the paper with silk screening or block printing.

OTHER HINTS/SUGGESTIONS:

- Paper should be finely shredded before mixing in the blender.
- Food coloring may be used as colorant.
- Screen splatter guards, such as those used over skillets, may be used to pour slurry through. Allow the paper to drain overnight, then remove the screen. It can then be blotted and ironed using spray starch as a sizing and finish. This paper is thicker and less smooth than using the deckle/mold method.

EXTENSIONS:

1. Make a matching envelope.
   - Choose a ready-made envelope of the size and shape you wish to make. Separate its glued seams and spread it out flat.
   - Use it as a pattern by laying it down on a sheet of the homemade paper and tracing it.
   - Cut the traced pattern out of the sheet. Fold it to match the original envelope and glue it together at the seams.
2. Visit a paper mill.
3. Invite a guest speaker from the paper industry.
4. Obtain pulp samples from a local paper mill. These can be frozen to preserve them.

ORIGINAL DEVELOPMENT RESOURCES:

The University of North Alabama Environmental/Energy Education Center. (April, 1991). *Environmental awareness activity guide for grades K-6*.

Color My World Natural

OBJECTIVES:

The student will be able to:
1. Understand the effects of dye on the environment.
2. Make natural dyes using organic materials.

BACKGROUND:

The products we purchase are often colored or printed with synthetic dyes and inks. Some of the inks and dyes that are used contain materials that could become hazardous to the environment. As these harmful elements are extracted, toxic residues could remain. It is important to look at natural ways to dye materials and lessen the impact that synthetic dyes and inks have on the environment.

ADVANCE PREPARATION:

1. Gather materials.
2. Store hard-boiled eggs in the refrigerator.

The night before :

3. Prepare the dyes.
   - Boil a small amount of a source (see materials list) in two cups of cold water.
   - Simmer for 10 minutes, then turn off heat.
   - Cover and steep for 30 minutes.
   - Remove residues.
   - Place in containers and refrigerate.

Grades:

3-5

Subject:

Art, Science

Time Needed:

One class period

Materials:

chilled hard-boiled eggs
containers for heating, storing, and dyeing
a choice of dyes from some of the following sources:
- walnut shells (lt. brown)
- red cabbage (blue)
- orange peels (yellow)
- carrots (yellow)
- fresh cranberries (dk green)
- spinach (greenish gold)

portable electric burner

PROCEDURE:

Setting the stage

1. Ask students where the colors in their clothes come from. Do they know any sources for colors?
2. Discuss how things were colored in the past and what might have been used for inks and dyes.
3. Tell them that many of the colors used to make products today are derived from heavy metals.

Activities

1. Show students the dyes that you prepared along with their source materials.
2. Assemble dyes, eggs, and recycled containers.
3. Dye the eggs in small groups. Coloring time varies according to the source used and the intensity of color desired.

Follow-Up

Review the benefits of using natural dyes.

EXTENSIONS:

1. Have students experiment with making other natural dyes.
2. Use dyes for water coloring.
3. Use dyes for tinting while making paper from recycled paper.

ORIGINAL DEVELOPMENT RESOURCES:

The University of North Alabama Environmental/Energy Education Center. (April, 1991). *Environmental awareness activities guide for grades K-6.*

Home Sweet Home

OBJECTIVES:

The student will be able to:
1. Identify different types of regions and landforms unique to Alabama.
2. Decorate a cake depicting Alabama's regions and landforms.

BACKGROUND:

The Coastal Plain covers the southern two-thirds of the state and the western corner to Tennessee. It is an important farming region.

The Black Belt is a narrow strip of rolling prairie. It was named for its sticky black clay soils.

The Appalachian Ridge and Valley Region is an area of sandstone ridges and limestone valleys. The region has coal and iron ore.

The Piedmont is an area of low hills. The soils have been badly eroded. Most of the land is forest.

The Cumberland Plateau varies from flat to rolling land. The land is used to raise poultry and grow cotton.

Alabama's coastline extends for 53 miles (85 km) along the Gulf of Mexico. It is an important harbor area.

ADVANCE PREPARATION:

1. Bake a sheet cake for each group according to the directions.
2. Precut each cake into the shape of Alabama. The map of Alabama included may be enlarged. (You may also draw the shape of Alabama onto the cake using a tube of frosting gel.)
3. Copy the region map for each group.

PROCEDURE:

Setting the stage
1. Review the background information about Alabama's land regions.
2. Share the ingredients used to illustrate the regions and products of Alabama.

Activities
1. Divide students into groups of four.
2. Instruct students to frost their cakes.
3. Apply the ingredients to show the regions and products using the map provided.

Follow-Up
Eat the cake and enjoy !

Grades:
3-5

Subject:
Geography

Time Needed:
45 minutes

Materials:
one sheet cake for each group (may be precut into shape of state)
light chocolate frosting to cover each cake
landform and region ingredients as follows :
- mountains - chocolate chips or Hershey's Kisses
- cornbelt - candy corn
- grasslands - green coconut
- Coastal Plain - cinnamon sugar
- forests - mint tea leaves
- waterforms - light blue icing
- Black Belt - crushed chocolate or chocolate sprinkles
- soybeans - green jelly beans
- iron ore - silver cake decorating balls
- peanuts - peanuts
- poultry - yellow jelly beans
- coal - licorice or miniature chocolate chips
- cotton - popcorn

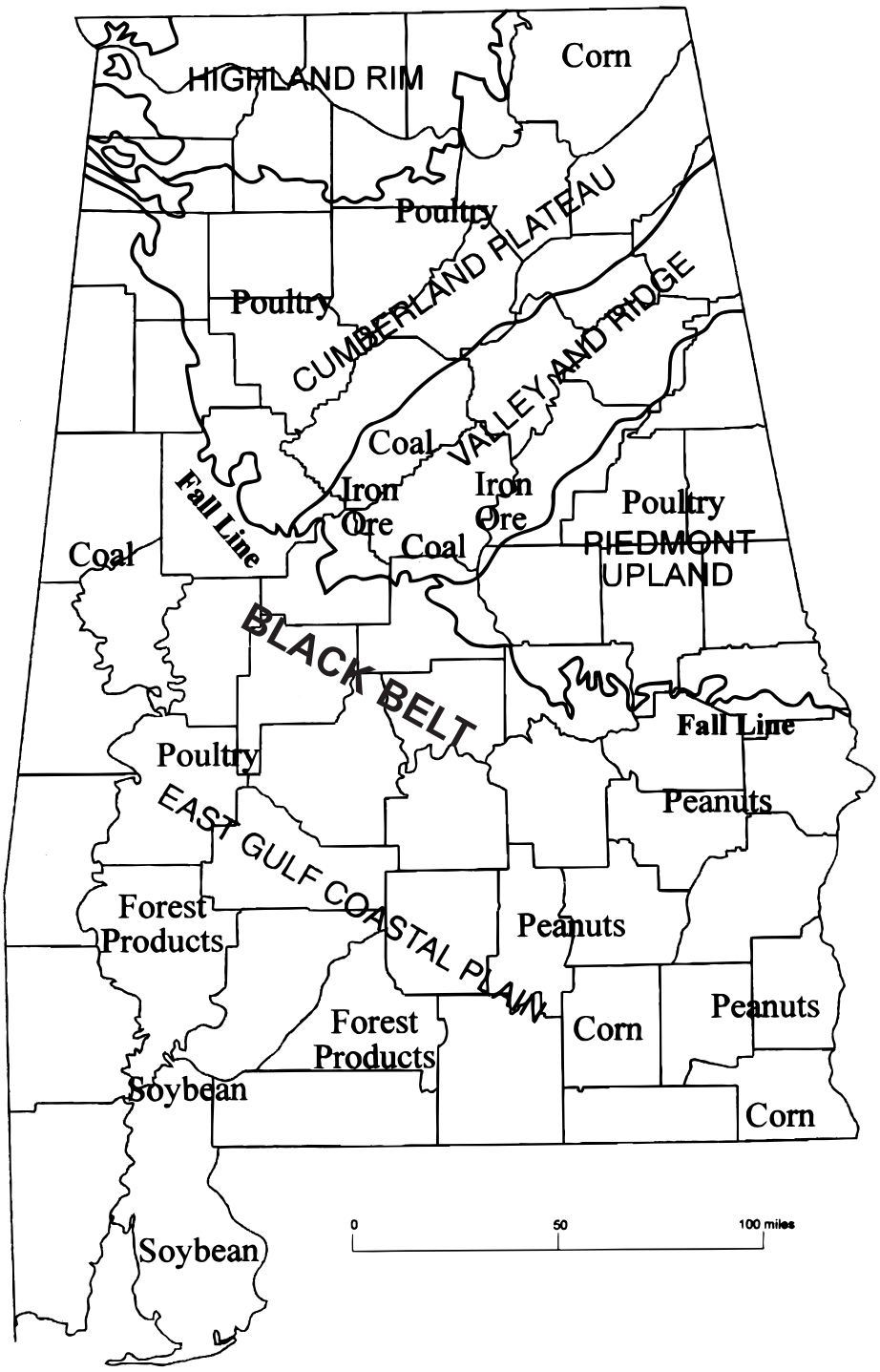
EXTENSIONS:

1. Create Alabama sugar cookies.
2. Make a puzzle of the state out of empty cereal boxes.
3. Learn the Alabama State Song.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama. (1988). *World book encyclopedia*. (Volume 1). Chicago: World Book, Inc.

Regions And Products Of Alabama



Notes

Energy From Water - Free For The Taking

OBJECTIVES:

The student will be able to:
1. Draw and label the basic stages of the water cycle.
2. Recognize that flowing water provides energy.
3. Build a model showing that moving water provides energy.

Grades:
3-5

Subjects:
Science, Language Arts

Time Needed:
Two to three class periods

Materials:
milk cartons (half gallon)
scissors
razor/knife
compass
ruler
pencil
long thin nail
button
string
stapler

BACKGROUND:

The water cycle, powered by the sun, provides an endlessly recycled energy resource: flowing water. Water evaporates as the sun's rays shine down on the Earth's surface. The water vapor condenses in the air, forming clouds and causing rain to fall. Falling rain keeps rivers flowing. Flowing water can provide energy for people to use.

Thousands of years ago, ancient people invented water wheels - devices that harnessed the energy of flowing water for tiring and time-consuming work, like grinding grain. As more machinery was developed, water wheels became used for many more purposes (milling lumber, finishing textiles, operating bellows in metal-working factories, and others). Eventually, the refinement of water wheels led to the development of turbines, which are more efficient and powerful.

With the development of devices that use electricity and the increased demand for it, turbines were used to generate electricity. In order to generate commercial (large) quantities of electricity, turbines must spin very rapidly. This means that the water must strike the turbines with great force. Constructing dams across rivers allows water to be stored so that it can be used to generate power whenever needed and creates the force needed by the turbines. To generate electricity, a control gate in the dam is opened, allowing water to rush through a tunnel-like passage before striking the turbine. As the turbine spins, it, in turn, spins the generator. Within the generator, the spinning causes electricity to be generated. This hydroelectric power (electricity from flowing water) is then sent through the power system to be used for the many ways in which electricity makes our lives easier.

Hydroelectric generation is, in many ways, the best way to generate the amounts of power we demand. No fuel is required, so it is both cleaner and cheaper than other conventional ways of generating electricity (fossil fuel-burning plants and nuclear plants). In the Tennessee Valley where rivers are abundant, hydroelectricity is an important part of the energy picture.

VOCABULARY:

dam - a structure built across a waterway to block the flow of the waterway
generator - a machine that changes mechanical energy into electrical energy
hydroelectricity - electricity produced using the energy of flowing water
turbine - a device in which a bladed wheel is turned by the force of jets of water (or steam); connected by a shaft to a generator

water cycle - the natural cycle in which water evaporates from the surface of the Earth, rises through the atmosphere, condenses, and returns to Earth as precipitation

water wheel (turbine) a wheel having blades or buckets and mounted on an axle; water striking the blades or buckets causes the wheel to turn and powers the machinery attached to the axle.

PROCEDURE:

Setting the stage

1. Share the background information, as appropriate, with the class.
2. Show the students a glass of water and ask the following questions:
   - Do you think this water can produce energy? How could it do this? (Lead the students to realize that the energy of moving water could be used.)
   - Does using water use it up? (Lead the students to recognize that we do not consume water when we use it; water is continuously recycled.)
3. Make a transparency of the Teacher Sheet "The Water Cycle", and use it to review the water cycle with students.
4. Discuss the fact that using water's energy requires no fuel and produces no pollution.

Activities

1. Investigate how the energy of falling water is used.
   - Share with the students the following information:
     Today we are going to learn about the energy of falling water. We will do this by making and using a waterwheel or turbine. Some power plants use falling water for energy to make electricity. Water held behind a dam is released through large pipes down to a nozzle. The water squirts out of the nozzle with great force, hitting a water wheel (turbine) and making it spin. This spinning turbine drives the generator that makes electricity. This is how we get electrical energy from falling water. Electricity from falling water is called hydroelectric power.
   - Give each student a copy of the student sheet "How To Make A Water Wheel". Give each student the materials listed on the Student Sheet. (student activity sheet 1)
   - Have each student demonstrate how the water wheel works at a sink or by holding it over a pan and having a helper pour water onto it.
2. Investigate how hydroelectric dams work.
   - Some electricity comes from dams. There are about 40 hydroelectric dams in the Valley region. Ask the students if they can name the seven states that are part of the Valley region. (Tennessee, Alabama, Georgia, Mississippi, Kentucky, Virginia, and North Carolina)
   - Make a transparency of the Teacher Sheet "How A Dam Works". Discuss with the students how a dam uses the energy of falling water to produce electricity. A dam is used to store water. A gate in the dam releases water through the dam as it is needed to generate electricity. The water rushes down a long tunnel with tremendous force. It hits the turbine at the bottom of the tunnel and spins it around rapidly. This spinning drives the generator that makes electricity.
   - Divide the students into groups of three or four. Give each group a copy of "A Homemade Dam" (student activity sheet 2) and the materials needed to build the models of dams. Have them build the models.
   - Have the students demonstrate how the energy of falling water spins turbines by holding the models above the turbines they built and releasing water onto the turbines.

Follow-Up

1. Have each student draw and label the basic stages of the water cycle.
2. Ask the following questions:
   - How did we prove that flowing water provides energy? (Discuss the student activity.)
   - What is another word for water wheel? (turbine)

- What do we call the electric power that we generate using falling water? (hydroelectric power or hydroelectricity)
- What is the name of the machine that changes the energy of the spinning turbine into electrical energy? (generator)
- What is one reason we build dams? (to use water energy to produce energy)
- Name three advantages of using falling water to produce electricity. (pollution-free, uses no fuel, no cost for the water)

3. Have the students write a paragraph describing how flowing water is used to produce electricity in a dam. A second paragraph describing the advantages of using water energy to produce hydroelectricity should also be written.

EXTENSIONS:

1. Have the students make a collage of magazine pictures showing ways to use electricity.
2. The students may write haiku poems about the water cycle. A haiku has three lines, the first has five syllables, the second has seven syllables, and the third line has five syllables.
3. Have the students make posters of the water cycle.
4. Have the students research careers related to hydroelectric power.
5. Plan a field trip or encourage students to visit a dam that is a hydroelectric generating plant.

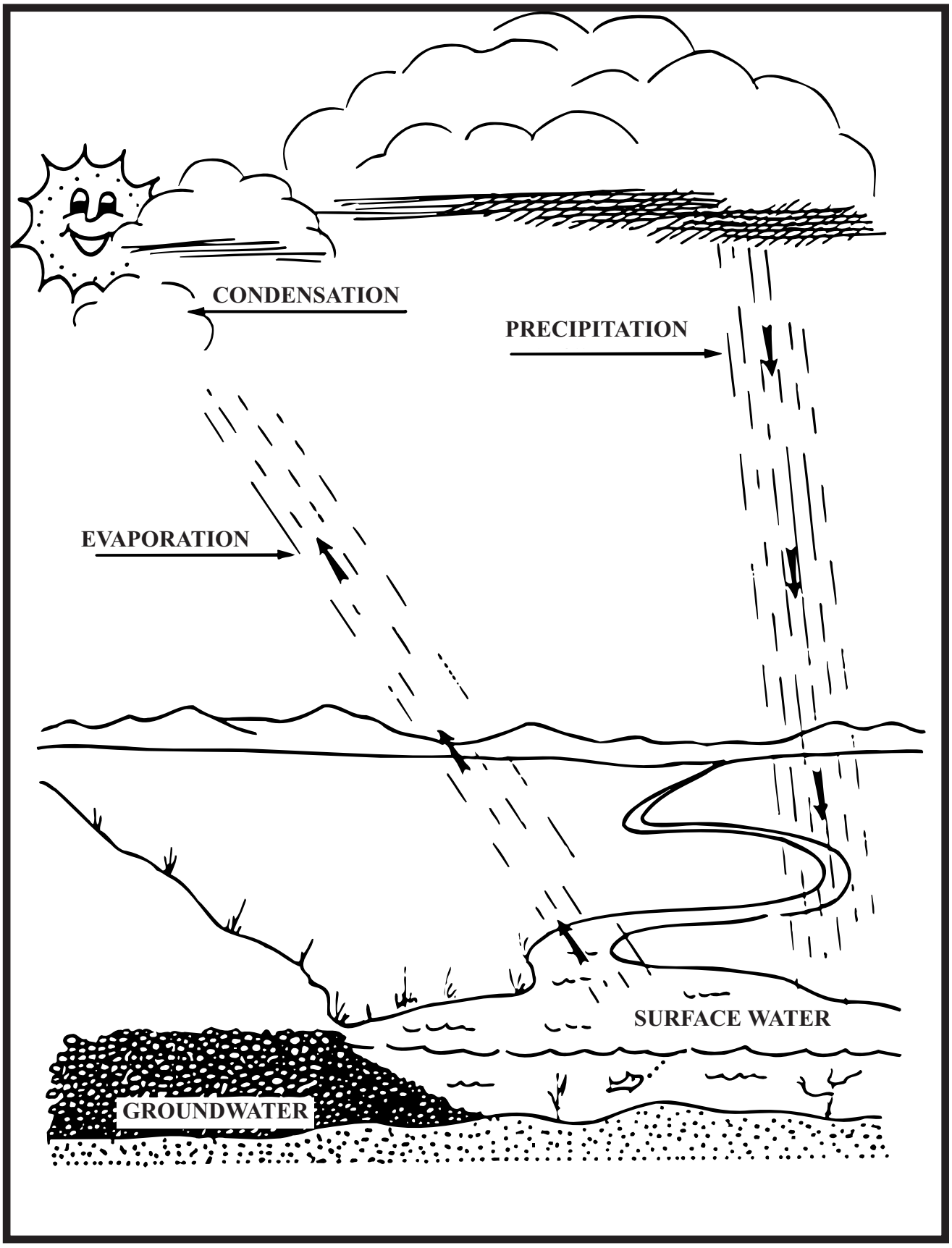
ORIGINAL DEVELOPMENT RESOURCES:

Fritz, S. (1984, March 30). Power from the ocean tides. *Science world*. pp. 12-14.

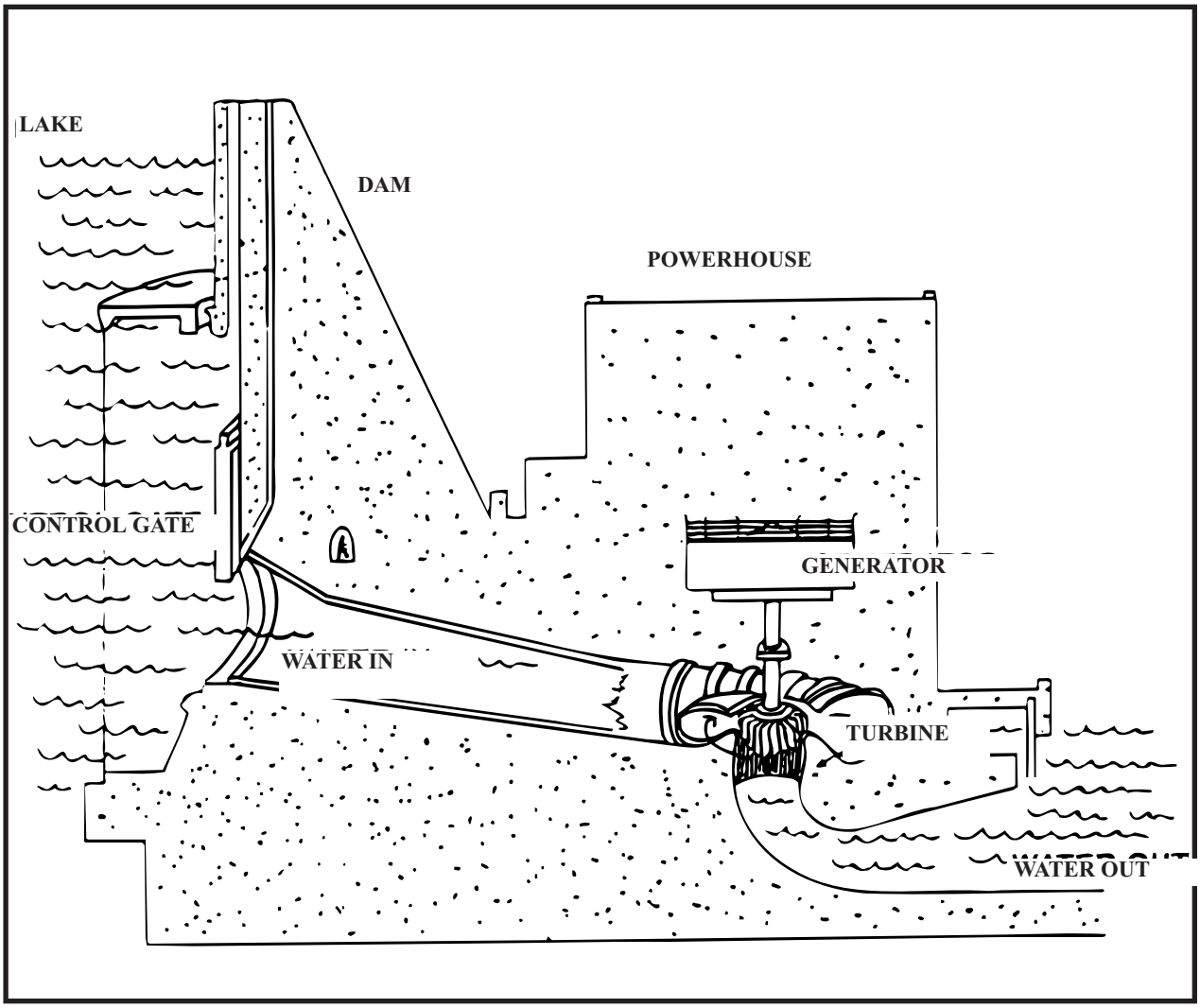
Gutnik, M. (1975). *Energy: Its past, its present, its future*. Chicago, IL: Children's Press.

Hall, M.Y. (1972). Flowing water. *Simple science experiences*. (p. 8).

The Water Cycle



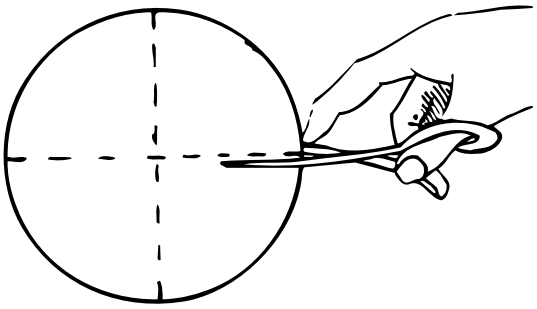
How A Dam Works



How To Make A Water Wheel

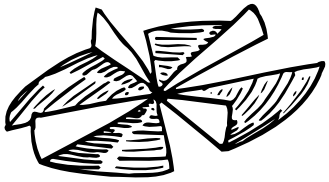
Materials: milk carton, scissors, compass, ruler, long nail, piece of string, button.

1. Cut a side out of a milk carton.



2. Use a compass or a pattern to draw a circle on the side of the milk carton. Cut it out.

3. Use a ruler to draw two dotted lines that divide the circle into fourths. (Be sure the lines go through the center of the circle.) Cut along the dotted lines but not through the center.

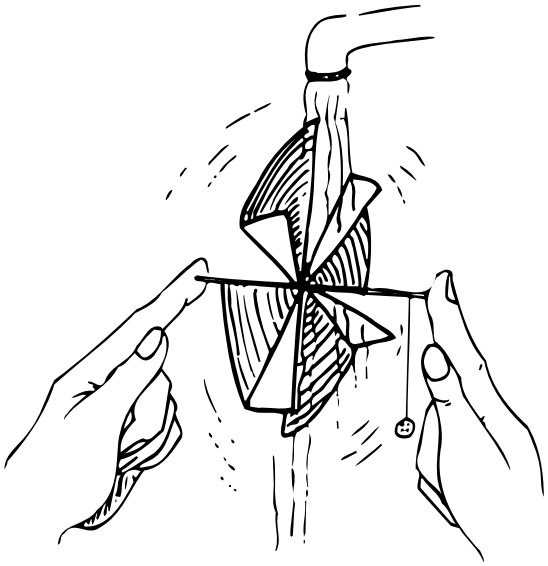


4. Fold down the edge of each fourth.

   (See the picture)

5. Put a nail halfway through the center of the circle. (Leave about half of the nail on each side of the circle.)

6. Make your water wheel do some work. attach a button to one end of a piece of string. Tie the other end to the nail. Now, hold the water wheel under running water. The water will turn the wheel. The string will wind around the nail and lift the button.

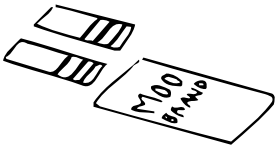


A Homemade Dam

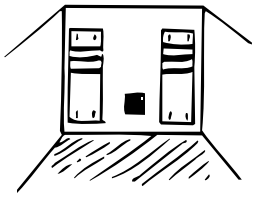
Materials: milk carton, scissors or razor/knife, ruler, stapler

1. Cut out one side of the carton.

2. Cut two pieces (2"long x 1" wide) from the side you cut out of the carton. Keep the piece that is left over; you will use it too.

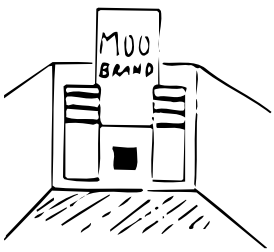


3. Cut a square hole about 1/2" wide and 1/2" high out of the bottom of the carton. It should be closer to the back of the carton than to the side you cut out.

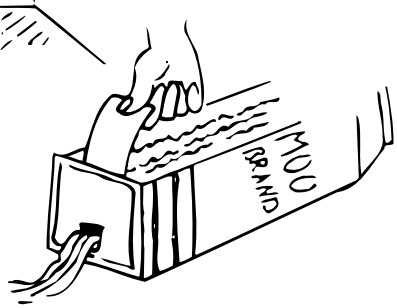


4. Staple the two strips onto the inside of the carton on either side of the square hole.

5. Use the leftover piece to cut a strip that will fit snugly between the two stapled pieces. Tuck its edges between the stapled-on strips and the carton's bottom. Slide it up and down to make sure it covers the little square hole and it moves.



6. Cover the square hole and fill the carton with water. Now you have a model of a lake and a dam.



7. Pull up the strip. It acts as the gate on the dam. What happens when you open and close the gate?

Notes

Some Like It Hot

OBJECTIVES:

The student will be able to:
1. Describe many uses for solar energy.
2. Construct a solar water/soup cooker and evaluate the design.
3. Predict new uses of solar energy in the future.

BACKGROUND:

One of the benefits of living in the South is that there are very few days without sunshine. Solar energy, which is the cleanest source of energy, has become a very important source of alternative energy. Its light and heat are free as well as unlimited in supply. There are many ways we use this energy source. Solar greenhouses, home heat, and hot water heating are just a few of the ways it is used.

The potential of solar power is still far from understood. In only 15 minutes, the sun sends more energy to Earth than we consume in every other form in one year. Of all the uses, perhaps the most beneficial and least heard about is in the field of space satellites. Solar energy is converted to electricity for powering instruments and transmitters. The sun has powered some of these instruments for over six years without any stoppages or difficulties.

VOCABULARY:

solar energy - the energy of heat or light received from the sun.

Grades:

3-5

Subjects:

Science, Math

Time Needed:

Two class periods

Materials:

heavy cardboard boxes
soup cans
clear tape
scissors
serrated knives
water or soup
plastic wrap
flat-black spray paint
aluminum foil
thermometers
hand mirror

ADVANCE PREPARATION:

1. Collect cardboard boxes.
2. Spray outside of soup cans with flat-black spray paint.

PROCEDURE:

Setting the stage

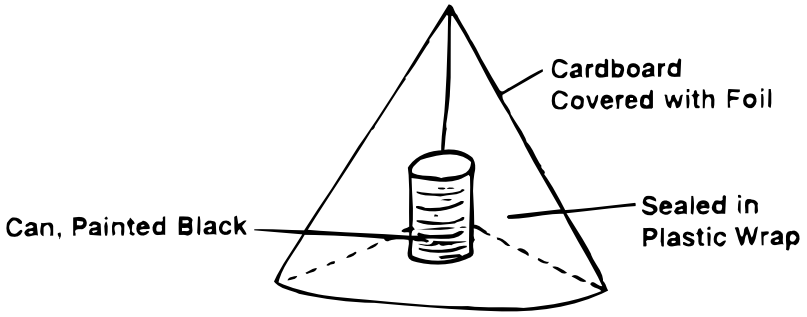
1. Early humans from many cultures worshiped the sun as a god. Why do you think people would worship the sun?
2. Have you heard people say, “It is hot enough to fry an egg?” Can we really use the sun’s power to cook?

Activity

Building a Solar Soup Cooker

- Using a serrated knife, cut out the corner of a corrugated grocery carton. Fold in any open flaps and tape them down.
- Spray the outside of soup can flat black.
- Cover the entire corner of the box with aluminum foil. Avoid taping; cover smoothly and completely.
- Place the can in the corner; do not let the can touch the sides of the box. Fill half full with water or soup, cover with plastic wrap, and place a thermometer in the can. This gives the can a greenhouse effect.
- Take the box outside and use a mirror to help position the can in the box so that it faces the sun.
- Take the temperature and record the data. Recheck the temperature every 15 minutes. On a bright sunny

day, soup can be cooked in about one hour. Water can heat even on cool days when the sun is bright. The sun's rays are most effective between 10:30 am, and 2:00 pm.



Follow-Up

1. Compare the rates of temperature increase among the different heaters.
2. Have students redesign their solar cooker to make it more efficient.
3. Predict four uses for solar energy in the year 2025.

ORIGINAL DEVELOPMENT EXTENSIONS:

1. Investigate solar water heaters in homes. Do they operate on a similar principle?
2. Your opinion please: Is solar energy free?
3. SOLAR ENERGY: Use these letters to form an acrostic about the sun and solar energy. Note: An acrostic is a series of written lines or verses in which the first, last, or other particular letters form a word or phrase.

ORIGINAL DEVELOPMENT RESOURCES:

Tennessee Valley Authority. (1990). *The energy source book, grades 3-5.* Communications Power Group. Environmental Education Resource Development Group.

Wilson, M. (1967). *Energy*. New York: Time Incorporated.

How Are You Gonna Keep It Down On The Farm?

OBJECTIVES:

The student will be able to:
1. Compare and contrast traditional row farming to contour farming.
2. Examine the contents of runoff.
3. Expand knowledge of TVA agricultural programs.

Grades:
3-5

Subjects:
Science, Math, Social Studies

Time Needed:
60-90 minutes

Materials:
(For each group)
two half-gallon milk cartons
two books - each 1" thick
scissors
two sprinkling cans or spray bottles
two buckets (identical)
dirt or potting soil
ruler
water
measuring cups
filter paper (can use old pantyhose)
kitchen scales

BACKGROUND:

In 1933 Congress created the Tennessee Valley Authority (TVA) and charged the agency "with the broadest duty of planning for the proper use, conservation, and development of the natural resources of the Tennessee River drainage basin and its adjoining territory for the general, social, and economic welfare." The Act also provided for "proper use of marginal lands..agricultural and industrial development...promoting the prevention of soil erosion and otherwise..to use such products in cooperation with practical farmers..for the general, social, and economic welfare." The intent of Congress was that TVA agricultural development activities be a part of a total united development and be directed toward promotion of long-range agricultural adjustment and development.

There were about 349,000 farms in 1934 primarily depending on natural forces of rainfall, sunlight, and air. In the Tennessee Valley, the land had been ravaged by flooding. This resulted in the loss of nutrients and valuable topsoil. Poor land use practices intensified this problem. The main thrust of the TVA plan dealt with demonstrating to all farmers the effects of improved crop and farm management skills. Among the farming skills taught were crop rotation and contour farming.

VOCABULARY:

contour farming - plowing perpendicular to the slope or at a constant elevation (example: Plow around a hill instead of up and down the hill).

ADVANCE PREPARATION:

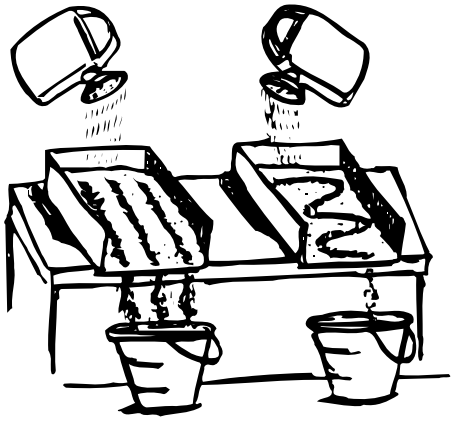
If using a whole-group presentation, prepare the milk cartons before class.

PROCEDURE:

Setting the stage
1. Show pictures of badly eroded lands, flooded areas, and plowed fields.
2. Discuss the background information.

Activity
Experiment
- Cut off one side and the top of the milk cartons. Then cut the remaining sides and bottoms so they are four inches high.

• Fill the cartons with dirt (equal amount in each) and shape them into mounds that taper down at the open end of the cartons. Set the cartons at the edge of a table, the back ends on books, and place the two buckets below to catch the runoff.



• In carton 1, furrow three parallel lines down the length of the dirt mound. In carton 2, furrow four parallel lines crossways in the dirt.
• Now the miniature farms are ready for a rainstorm. Simultaneously trickle a pint of water from the sprinkling cans or spray bottles.
• Make and record observations. Filter the runoff and weigh solid particles. Measure the remaining runoff water.
• May also weigh both cartons (after runoff is complete) to show which farm holds more moisture.
• Draw conclusions about farming practices.

Follow-Up

1. Each group should report its results.
2. Calculate the mean, median, mode, and range of the data. Why do the results differ so greatly?
3. As a group, answer the following question: What difference does contour farming make for water quality, crop production, the farmer, and beauty of the country-side?

EXTENSIONS:

1. Research other specific ways TVA helped agriculture and the environment.
2. Use the farm models to investigate other ways to prevent erosion (plant grass, build a retaining wall, mulch, diversion ditches).

ORIGINAL DEVELOPMENT RESOURCES:

Henderson, R.A. (Undated). *Developing tennessee valley agriculture*. Division of Agricultural Development, Tennessee Valley Authority.