2017-2018 ALABAMA CONSERVATION EDUCATION WORKSHOPS

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SOIL & WATER CONSERVATION COMMITTEE

MADISON COUNTY CONSERVATION DISTRICT

ALABAMA ASSOCIATION OF CONSERVATION DISTRICTS

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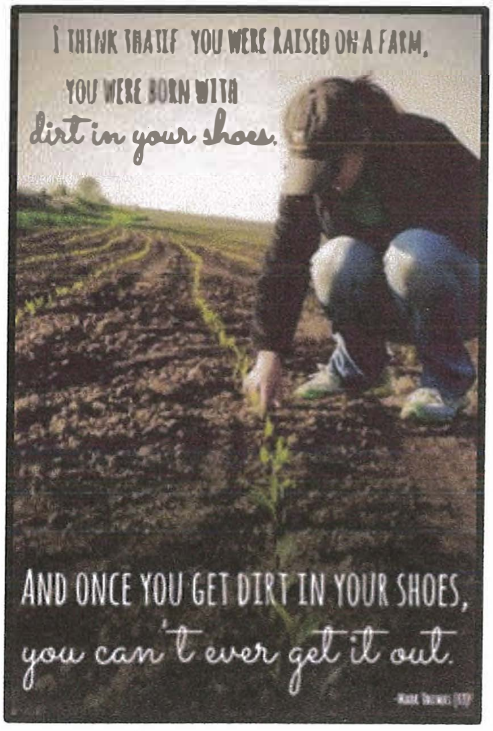
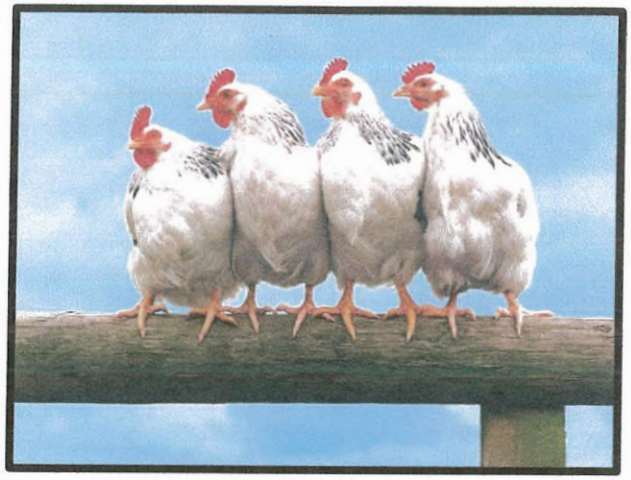


FOOD



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"Thou shalt inherit the holy earth as a faithful steward conserving its resources and productivity from generation to generation. Thou shalt safeguard thy fields from soil erosion, thy living waters from drying up, thy forests from desolation, and protect thy hills from overgrazing by the herds, that thy descendants may have abundance forever. If any shall fail in this stewardship of the land, thy fruitful fields shall become sterile stony ground or wasting gullies, and thy descendants shall decrease and live in poverty or perish from off the face of the earth."

The Eleventh Commandment" by Dr. Walter C. Lowdermilk, Jerusalem, June 1939

good life guide

KIDS' TABLE

SUMMER SCIENCE

Just because school's out doesn't mean the learning has to stop. Turn a few things you likely have around the house into an easy science experiment. Bonus: Kids will get a cool T-shirt out of the deal!

CHALLENGE MARKER MAGIC

EQUIPMENT Spray bottle, 70 percent rubbing alcohol, aluminum foil or cardboard, white T-shirt, permanent markers

EXPERIMENT Fill the spray bottle with rubbing alcohol. Cut foil or cardboard, and put it inside the shirt to keep the markers from bleeding through. Decorate the shirt with the markers, then spray with alc[illegible] Watch as the colors spread.

EXPLANATION The alcohol acts as a solvent that dissolves the ink as it saturates the shirt, causing the ink to spread.

BEFORE YOU WASH

After your shirt is dry, wash it by itself so the colors don't bleed onto the rest of your laundry.

Reprinted with permission from The 101 Coolest Simple Science Experiments *(Page Street Publishing Co.) by Rachel Miller, Holly Homer and Jaime Harrington*

A Look at *Alabama* Agriculture

Capital: Montgomery

Population: 4,871,547

Founded: December 14, 1819 (22nd)

State Bird: Yellowhammer

State Tree: Southern Pine

State Flower: Camellia

Number of Counties: 67

Largest City: Birmingham - 212,237

Number of Farms: 43,000

Average Farm Size: 206 acres

Farmland: 9 million acres

www.agclassroom.org/al

Climate & Soil

- Alabama has a mild climate.
- January temperatures average about 51° F in the southern part of the state, and about 46° F in the north.
- July temperatures average about 80° F throughout the whole state.
- The central and western counties in Alabama are known as the "Black Belt" because of the dark surface colors of many of the soils. Most of the soils of the Black Belt region of the state are used for timber production and pasture.
- Soil is one of Alabama's most important natural resources. It is vital to agriculture and forestry as well as to urban development, water quality and wildlife habitat.

Crops & Livestock

- Cotton is the State's largest row crop and is grown in 59 or Alabama's 67 counties.
- Alabama's green industry contributes $2.9 billion annually to the state's economy and employs 43,000 Alabamians.
- Peaches are the state's leading commercial fruit.
- Half of the peanuts produced in the U.S. are grown within a 100 mile radius of Dothan, AL.
- Alabama farmers primarily raise catfish but also farm tilapia, shrimp and crawfish. Alabama's catfish industry's annual economic impact is $158.4 million.
- Alabama is home to 1.2 million head of cattle and this is a $2.5 billion industry.
- Broiler production is Alabama's top agricultural commodity generating more than $15 billion annually. Poultry production and processing employs close to 90,000 people.

General

- Farmland covers about 25% of the state.
- Two-thirds of Alabama, or 23 million acres is covered in forestland.
- The queen honeybee is the official state agricultural insect.
- Alabama's top 5 commodities are: Poultry, Cattle and Calves, Greenhouse, Nursery and Sod, Cotton and Soybeans.

1. Broilers – Raking in $3.6 billion in cash receipts, the top commodity in Alabama ranked No. 2 in the U.S. Broilers, or chickens raised for meat, also accounted for 59 percent of the state's receipts.

2. Cattle and calves – Alabama cattle producers generated $477 million in cash receipts in 2013. There were around 1.24 million head in the state, up approximately 1 percent from 2012.

3. Chicken eggs – Producers earned $387 million in cash receipts from 180 million eggs, and ranked No. 9 nationally in 2013. Egg production is up 44 million from last year with an average of 237 eggs per layer.

4. Cotton lint – This fiber raised $235.9 million in cash receipts and is used to make plastics, explosives and high-quality paper products, to name a few. Alabama ranks 10th nationally in cotton production with 789 pounds per acre harvested.

5. Soybeans – Alabama soybean growers earned $219.68 million in cash receipts in 2013. Exports of soybeans, soybean meal and soybean oil to Korea, Colombia and Panama increased by $177 million in the past three years.

6. Peanuts – The 2013 peanut harvest generated $187.5 million in cash receipts thanks in part to Baldwin County producers, who lead the state in peanut production by the pound.

7. Corn – Grown in all 50 states, corn brought $139 million to Alabama in cash receipts in 2013. With harvested acres remaining constant, Alabama corn production was up 51 percent from 2012.

8. Wheat – Alabama's wheat crop garnered $125.1 million in cash receipts. Yield increased by 10 bushels per acre between 2012 and 2013, from 59 bushels per acre to 69 bushels per acre.

See Also: A+ for Alabama Ag in the Classroom

9. Aquaculture – Ranking fourth in U.S. production and totaling more than $116 million in cash receipts, Alabama's 156 aquaculture farms grow tilapia, trout, bass, carp, catfish and flounder.

10. Hogs – Swine brought in $48.2 million in cash receipts in 2013. Alabama hog farmers produced and sold a staggering 441,000 head, which is a 53,000 head increase from last year.


LAUDERDALE
LIMESTONE
MADISON
JACKSON
COLBERT
LAWRENCE
DEKALB
FRANKLIN
MORGAN
MARSHALL
MARION
WINSTON
CULLMAN
CHEROKEE
BLOUNT
ETOWAH
LAMAR
WALKER
FAYETTE
ST. CLAIR
CALHOUN
JEFFERSON
CLEBURNE
TUSCALOOSA
TALLADEGA
PICKENS
SHELBY
CLAY
RANDOLPH
BIBB
GREENE
CHILTON
COOSA
TALLAPOOSA
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PERRY
ELMORE
LEE
AUTAUGA
MACON
MARENGO
DALLAS
MONTGOMERY
RUSSELL
CHOCTAW
LOWNDES
BULLOCK
WILCOX
BARBOUR
CLARKE
BUTLER
CRENSHAW
PIKE
MONROE
WASHINGTON
HENRY
CONECUH
COFFEE
DALE
COVINGTON
HOUSTON
ESCAMBIA
BALDWIN
GENEVA
MOBILE

Gregory
Question Cards

Please tell me some good foods that are grown in Alabama & then feed me some of them.

I like to feel cotton. I also like to eat cotton. Do you eat cotton? Feed me some please.

Do you know which food group that apples would be in? Please tell me and then feed me some.

Which food did you bring into the class to study? Tell me about it and I really should taste it!

I love peanuts & I heard your teacher say that they were grown in Alabama. I'll bet you could get me some but I eat mine with the shell.

Think of a red food that can be grown in Alabama. I grew some of these in my backyard. What about a little taste?

Name a food that you have studied this week and put it into the correct food group. Did you know that you are very smart?

I wish I had some corn. Do you know if this is grown in the state of Alabama? If it is, could you direct me to the corn field? I am very hungry.

ALABAMA AGRICULTURE FACTS

How many counties are in Alabama? _____

Approximately how many farms are in Alabama? _____

What is the average farm size? _____

What is Alabama's most important natural resource? _____

Farmland covers about _____% of the state.

What is the official state agricultural insect? _____

Alabama's top 5 commodities are...

Alabama has a _____ climate.

_____ is Alabama's largest row crop and is grown in ____ of Alabama's 67 counties.

_____ are Alabama's leading commercial fruit.

ALABAMA AGRICULTURE FACTS

How many counties are in Alabama? 67

Approximately how many farms are in Alabama? 43,000

What is the average farm size? 206 ACRES

What is Alabama's most important natural resource? SOIL & WATER

Farmland covers about 25% **of the state.**

What is the official state agricultural insect? THE QUEEN HONEYBEE

Alabama's top 5 commodities are... Poultry, Cattle and Calves, Greenhouse, Nursery and Sod, Cotton and Soybeans

Alabama has a MILD **climate.**

COTTON **is Alabama's largest row crop and is grown in** 59 **of Alabama's 67 counties.**

PEACHES **are Alabama's leading commercial fruit.**

ALABAMA POULTRY & EGG ASSOCIATION

Serving Alabama's #1 Agricultural Industry

ALABAMA POULTRY FACTS

There are 11 meat-type poultry companies located in Alabama:

- Aviagen (Primary Breeder)
- Hubbard LLC (Primary Breeder) - Breeders Only
- Ingram Farms
- Keystone
- Koch
- Mar-Jac of AL
- Peco
- Perdue (Breeders only)
- Pilgrims
- Tyson
- Wayne

There are 23 broiler complexes scattered throughout the state.

There are 18 meat-type broiler processing plants located throughout Alabama processing over 21 million broilers per week (over 1 billion per year).

This makes us the #2 state in the U.S. in broiler production as Georgia processes about 23 million per week and Arkansas processes about 20 million per week.

There are 26 meat-type hatcheries located throughout Alabama hatching over 28 million chicks per week, a lot of these are raised and processed outside of Alabama.

There are approximately 2,775 poultry producers in Alabama located in 49 counties. They produce pullets, breeders, and broilers.

There is one egg-type hatchery in Alabama (Centurion Poultry in Bremen).

There are five table egg producers in Alabama with approximately 1.7 million birds:

- Cal-Maine – Baldwin County
- Weiss Lake Egg Co. – Cherokee County
- Keith James Egg Co. – Marshall County
- Warren Egg Co. – Marshall County
- Nature's Best Egg Co. (Robert Haynes) – Cullman County

Poultry has a $15.1 billion impact on Alabama's economy, generating more than 65 percent of agricultural ecommodity sales and employing more than 86,000 workers.

As of 5/22/17

CHICKEN CHAT

A female chicken that is raised for eggs is called a laying hen.

Chickens raised for their meat are called broilers or fryers.

Male chickens are called roosters. They have larger combs and waddles than hens and their feathers are more colorful.

Some breeds of chickens are: white leghorns, rhode island reds, Plymouth rock, polish, Sussex, and conchin.

Chickens swallow their food without chewing it and it is ground up in their gizzard.

A hen requires 24 to 26 hours to produce an egg! Chickens need grit in their diet to produce eggs. Most eggs are in the grocery store within 72 hours of being laid.

Arkansas is ranked 8th in egg production in the United States.

Eggs age more in one day at room temperature than in one week in the refrigerator.

Egg yolks are one of the few foods that naturally contain Vitamin D. Eggs contain the highest quality food protein known. They also contain 13 essential vitamins and minerals.

Each person eats approximately 250 eggs per year. Tremendously down since 1945 when each person ate approximately 402 eggs per year. Possible reasons are, two-income families, more items to choose from, more people skipping breakfast and lifestyle changes.

COTTONSEED PRODUCTS CHART

Cotton was first cleaned by hand. The cotton lint stuck to the seed. Families might have done this chore sitting around the fireplace at night after it was too dark to work outside. The cotton line was woven into a course material and made into clothes. If you have on a **tee shirt and jeans** chances are great that they are made from cotton.

Some years there is too much rain and some years it is just too dry to have a good crop of cotton. The boll weevil almost put cotton farmers out of business for many years. There is a monument erected in the town of Enterprise of a **boll weevil**. I have brought one in to show you. You would not think that a tiny bug like this could cause so much damage would you?

Now you would not think of this a something you would want to eat would you?

COTTON SEED OIL – Cooking, Snack Cakes and Chips, Mayo and Dressings, Explosives and Rubber; soaps

COTTON SEED MEAL AND CAKES ARE FOOD FOR: Beef and Dairy Cattle, Sheep and Goats, Horses and Mules, Poultry, Swine, Fish and Shrimp

LINTERS: Used in cosmetics and hair care products, food casings like bologna and sausages, toothpaste, paper, clothing, windshields, rugs cotton balls, swabs and Q-tips and money

CORN

MAIN USE – Livestock Feed (Dent Type)
Human Food (Sweet, yellow, white, popcorn) Meal, Grits and Hominy

DEXTRIN & DEXTROSE = Baby Foods, Licorice, Rubber, Vinegar, Wallpaper

ETHANOL = Gas for our vehicles

OILS = Things we eat and Industrial uses

STARCH = Aspirin, Bakery Products, Surgical Dressing, Chewing Gum, Diapers, Packing Peanuts

SYRUP = Canned Fruits and Juices, Dyes, Ice Cream, Marshmallows, Peanut Butter, sodas

SOYBEANS

MAIN USE = Protein and Oil

OIL = Cooking oils, crayons, inks, soaps, shortening, salad dressing

PROTEIN = Baby Foods, Noodles, Plastics, Soy Milk, Yeast

SOYBEAN HULLS = High Fiber Foods

WHOLE SOYBEANS = Baked Soybeans, Bread, Tofu

WHEAT

MAIN USE = Breads and Pasta (Mostly Human Food)

GRAINS = Cereal, Breads, Cakes

TYPES = Red Grains (spring) and White Grains (winter)

WHEAT HUSKS = Bran Muffins

FLOUR = Grain Ground and Sifted MANY TIMES

SOFT GRAINS = Cookies, Cakes

HARD GRAINS = Pastas

WHEAT STRAW = Livestock Feed, Mulches

CATTLE

MAIN USE = Meat

BLOOD = Ink, Medicine, Wallpaper, Bandage Adhesive

BONES, HORNS AND HOOVES = Piano Keys, Combs, Dice, Corks, Dog Biscuits

FATS & OILS = Candles, Crayons, Cosmetics, Paints, Plastics

GELATIN = Ice Cream, Marshmallows, Yogurt, Soap

HAIR = Paint Brushes and Air Filters

HIDE = Baseball Gloves, Wallets, Boots, Shoes, Luggage, Saddles

MANURE = Fertilizer and Methane Gas

PIGS

MAIN USE = Meat

BLOOD = Glue, Fabric Dye, Leather Finishes

BONES & HOOVES = Bone China, Combs, Gelatin, Umbrella Handles

FATS & OILS = Chewing Gum, Crayons, Lards, Paints

HAIR = Bristle Brushes and Upholstery

HEART = Heart Valves for Human Hearts

HIDE = Drum Heads, Fertilizer, Gloves, Shoes, Wallets

SHEEP

MAIN USE = Meat

RATTLESNAKE BITE = Anti-Venom made from sheep

BONES, HORNS & HOOVES = Piano Keys, Shampoo, Dice

FATS & FATTY ACIDS = Candles, Cosmetics, Floor Wax

HIDE = Blankets, Clothing, Coats, Tennis Balls

WOOL = Artist Brushes, Baseballs, Lanolin, Rug Pads

POULTRY

MAIN USE = Meat

FEATHERS = Bedding and Pillows

Candy Bars, Fertilizer

Ground up feathers add protein to Livestock Feed

TREES

MAIN USE = Lumber & Fiber – Nuts, Fruits

CELLULOSE (WOOD) = Popsicle Sticks, Toothpicks, Paper, Football Helmets, Cellophane

BARK = Cork, Dyes, Medicines, Mulch

SAP = Paint Thinner, Rubber, Sugar, Syrup

AGRICULTURE, QUITE A MIRACLE

THE FARMER HE MUST FEED THEM ALL

The King may rule ore land and sea
The Lords may live right royally
The Soldiers may ride in pomp and pride
The Sailors may roam over oceans wide.
THIS OR THAT OR WHATEVER BEFALL, THE FARMER, HE MUST FEED THEM ALL!
The Write thinks, the Poet sings
The Craftsmen fashion wondrous things
The Doctor heals, the Lawyer pleads
The Miner follows precious leads
THIS OR THAT OR WHATEVER BEFALL, THE FARMER HE MUST FEED THEM ALL!
The Merchant, he may buy or sell
The Teacher do his duty well
But Men may toil through busy days
Or men may stroll through pleasant ways
From King to Beggar whatever befall
THE FARMER HE MUST FEED THEM ALL!
The Farmers trade is one of worth
He is partner with the sky and earth
He is partner with the sun and rain
And no man loses for his gain
And Men may rise and men may fall
THE FARMER HE MUST FEED THEM ALL!
God bless the man who sows the wheat
Who finds us milk and fruit, and meat
May his purse be heavy, his heart be light
May his cattle, and corn, all go right
God bless the seeds his hands let fall

FOR THE FARMER, HE MUST FEED US ALL!

A DAY IN THE LIFE OF A FARMER

FARMERS must get up before sunrise to get ready for their day.

Add a YELLOW BEAD for the SUN as it appears over the farm.

Add a UV BEAD

Add a WHITE BEAD because the farmer needs to MILK his cows.

Add a UV BEAD

Add a BLACK BEAD because the farmer needs to FEED other animals

Add a UV BEAD

Add a RED BEAD because the BARN needs to be repainted.

Add a UV BEAD

Add a PURPLE BEAD because the farm WORKERS are arriving.

Add a UV BEAD

Add a GREEN BEAD for the John Deere TRACTOR that is used.

Add a UV BEAD

Add an ORANGE BEAD for Maintenance on farm equipment

Add a UV BEAD

Add a TAN BEAD for the HAY that needs to be bailed.

Add a UV BEAD

Add a BLUE BEAD for a day for family, friends, rest and worship!

New Mexico Agriculture in the Classroom

Relevancy and Engagement

nmaitc.org

How Many Hats Does a Farmer Wear?

Companion Resource

How Many Hats Does a Farmer Wear?

This elementary activity illustrates the wide array of career paths available in agriculture. Students will create a paper "pinwheel" illustration of the many hats that farmers wear.

Materials

- *How Many Hats Does a Farmer Wear* activity sheet, 1 per student
- Crayons or markers
- Scissors
- Metal brads, 1 per student

Procedures

1. Discuss the following agricultural careers:
    - **Veterinarian** - Must be able to recognize early signs of disease in animals, assist at birth of animals, and administer medicine to sick animals
    - **Engineer** - Must know how to plan and construct fences and buildings, build irrigation ditches and control the flow of water, and use natural resources to grow products useful to people
    - **Mechanic** - Must be able to operate and maintain both simple and complicated machinery, make repairs, and keep machines in good working order
    - **Business Manager** - Must be able to balance accounts, sell farm produce to the market, be responsible for making payments and meeting payrolls, and keep track of equipment, products, and land
    - **Nutritionist** - Must know how to prepare feed rations for best growth and production of livestock
    - **Forest Ranger** - Must be able to recognize the various kinds of trees, detect fires and know the methods for controlling them, and clear trees from land and prevent soil erosion
    - **Scientist** - Must be able to conduct experiments that help answer agricultural questions like which crops grow best in a particular climate or soil
    - **Weather Forecaster** - Must understand weather and climate, be aware of possible weather changes, and know how to prepare for these changes
2. Provide each student with a copy of the *How Many Hats Does a Farmer Wear* activity sheet, and ask them to color the farmer and the hats.
3. Instruct students to cut out the three circles on their activity sheets and stack them on top of each other so that the largest circle (the one with the career descriptions) is on the bottom and the smallest circle (the one with the farmer) is on the top. Fasten them in the center with a brad so that all three circles spin separately.
4. Ask the students to find a hat in the middle circle to put on the farmer's head and then match up the words that best describe what the farmer does when wearing that hat.
5. Discuss the following questions: Why is it important for a farmer to have a basic understanding of all these

careers? What other careers must a farmer use? Do you know people in your community who specialize in any of these eight career areas?

File, Map, or Graphic

- http://naitc-api.usu.edu/media/uploads/2015/12/11/activitysheets.pdf

Sources/Credit

Adapted from National FFA Food for America program.

Author(s)

Debra Spielmaker

Organization Affiliation

Utah Agriculture in the Classroom

Lessons Associated with this Resource

- A Day Without Agriculture
  [https://newmexico.agclassroom.org/matrix/lessonplan.cfm?lpid=104]
- Agriculture Pays
  [https://newmexico.agclassroom.org/matrix/lessonplan.cfm?lpid=291]
- Customary & Metric Food Measurement
  [https://newmexico.agclassroom.org/matrix/lessonplan.cfm?lpid=408]
- Let's Go Shopping! (Grades 3-5)
  [https://newmexico.agclassroom.org/matrix/lessonplan.cfm?lpid=526]
- Let's Go Shopping! (Grades K-2)
  [https://newmexico.agclassroom.org/matrix/lessonplan.cfm?lpid=525]

Many Roles of a Farmer

Grade Level: 1-3

Approximate Length of Activity: One-two class periods

Objective

Teacher

1. Explain how farmers must "wear many different" hats each day.
2. Help students understand the responsibility of a farmer.

Students

1. Learn about the roles of a farmer.
2. Gain an understanding of responsibility.

Michigan Content Standards: (Social Studies) 1-C5.0.1; 1-E1.0.5; 2-G5.0.1; 3-G4.0.1

Introduction:

Farming is an occupation –a way of earning money-that requires the farmer to do many different jobs during a year, and even during a day. In some lines of work, people do the same tasks every day. For some occupations, the tasks can be very different from one day to the next or from one season to the next. Agriculture, or farming, is like that. Farmers must do many different tasks. We call that "wearing a lot of hats."

Did You Know? One farmer can feed 144 people!

Vocabulary

- **Veterinarian**
- **Engineer**
- **Mechanic**
- **Business Manager**
- **Resource Conservationist**
- **Nutritionist**
- **Forester**
- **Soil Erosion**
- **Water Pollution**
- **Meteorologist**
- **Agronomist**
- **Diversity**

Materials Needed

- Copies of worksheets A and B
- Crayons, colored pencils
- Brass fasteners
- Scissors

Activity Outline

1. Copy worksheets A and B for each student. Students may choose a male or female farmer and discard the other. Do not copy front to back.
2. Have the students cut out the circle on worksheet A, the biggest circle on worksheet B and one of the two farmer circles.
3. Fasten them in the center with a brass fastener. Make sure the largest circle is on the bottom and smallest in on top.
4. Make sure students are able to spin all three circles separately.
5. Ask the students to find a hat on the middle circle and put it on the farmer's head, then try to find the words that best describe what the farmer does when wearing the hat.

Discussion Questions

1. Why is it important for a farmer to have a basic understanding of all these careers?
2. What other job skills must a farmer use?
3. Do you know people in your community who specialize in any of these eight career areas?
4. Which of the jobs a farmer does is your favorite? Least favorite?
5. Which jobs are the hardest?
6. What other jobs can you think of that require people to wear so many different hats?

Answer Key for Hats

Veterinarian- Must recognize early signs of disease in animals; assist at birth of animals; administer medicine to sick animals; care for wounds and injuries.

Engineer- Must know how to plan and construct fences and buildings; build irrigation ditches and control the flow of water; design animal waste systems.

Mechanic- Must operate and maintain both simple and complicated machinery; make repairs and keep machines in good working order.

Business Manager- Must balance accounts; develop marketing strategy; sell farm produce to the market; make payments and meet payrolls; keep track of equipment, products and land.

Nutritionist- Must prepare feed rations for best growth and production of livestock.

Resource Conservationist- Must recognize kinds of trees; manage woodlots; detect fires and know the methods for controlling them; prevent soil erosion; protect water quality.

Agronomist- Must understand soil composition and determine the best fertilizer and seed for largest production; the effect of chemicals on animal and plant life.

Meteorologist- Must understand weather and climate; be aware of possible weather changes and how to prepare for these changes.

Related Activities

1. Invite agriculturally related speakers to tell students about their jobs and the many "hats" they wear.
2. Tour an agricultural facility, such as a farm or a processing plant.
3. The lesson plan "What's My Job?" located in the social studies section of this curriculum guide.

Book Resources

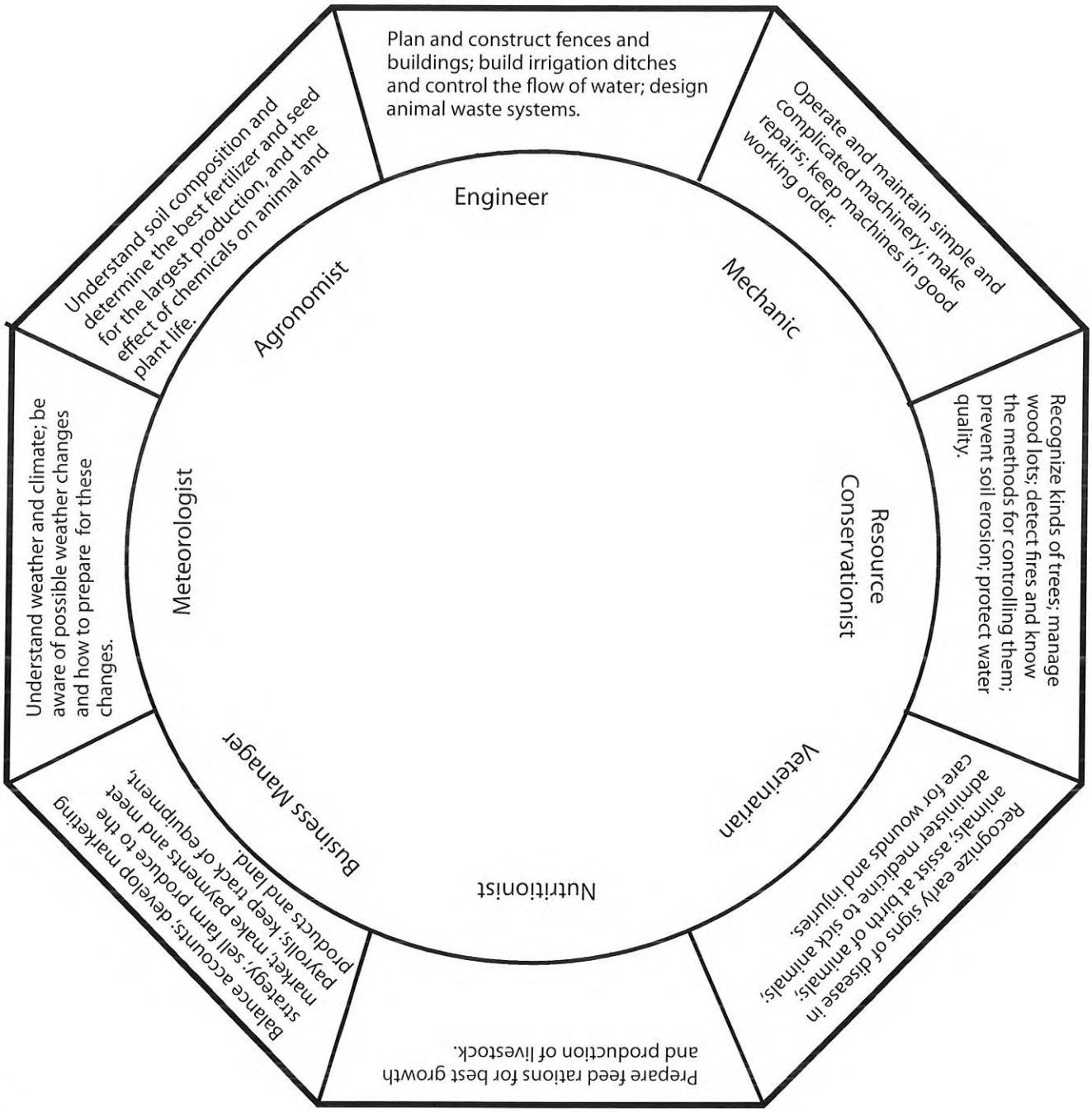
1. "Farming the Land: Modern Farmers and Their Machines" by Jerry Bushey
2. "The Old Farmer's Almanac for Kids" by Robert Bailey Thomas
3. "The Wonderful World of Agricultural Careers" by the Michigan Farm Bureau.

Acknowledgement: Adapted from "Many Roles of a Farmer" Alaska Agriculture in the Classroom.

Name:_____

Many Roles of a Farmer

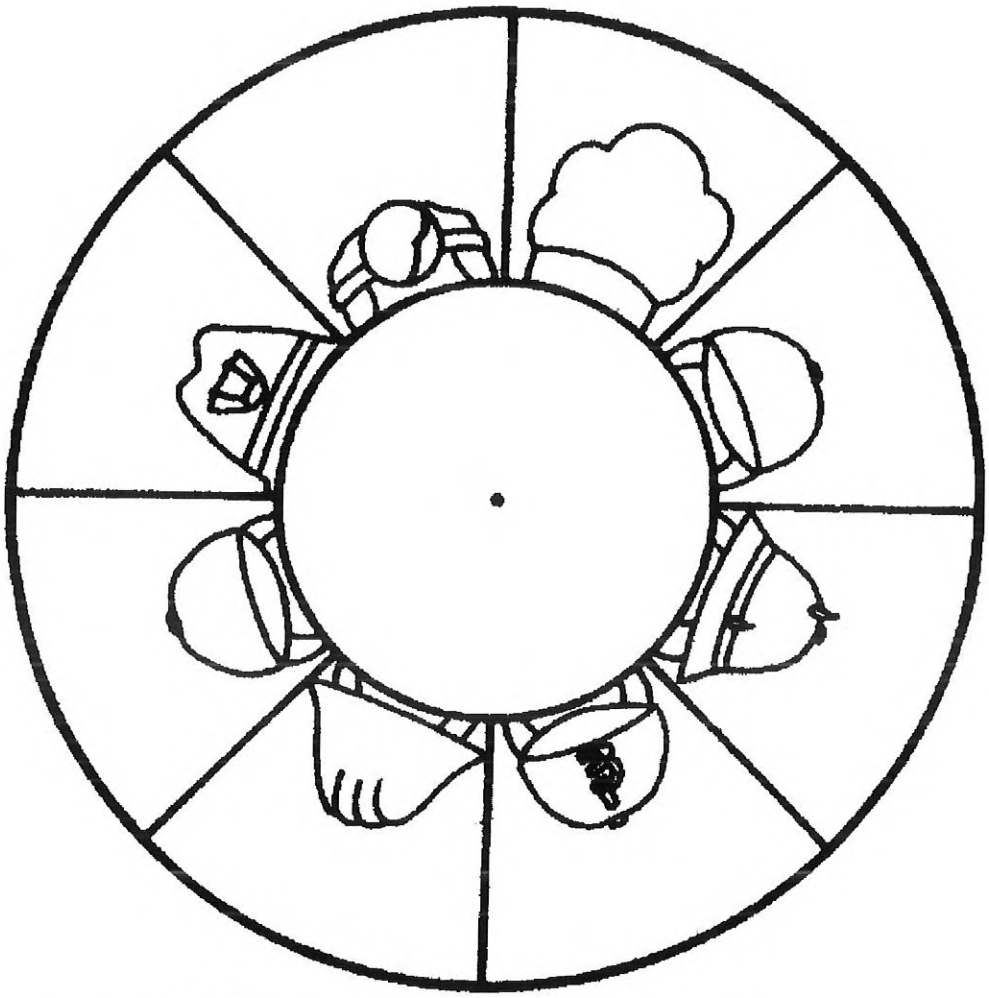
Worksheet A

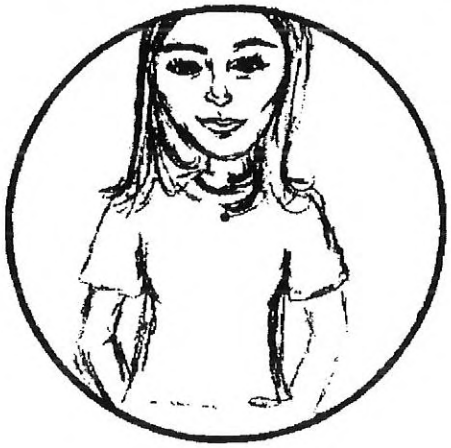


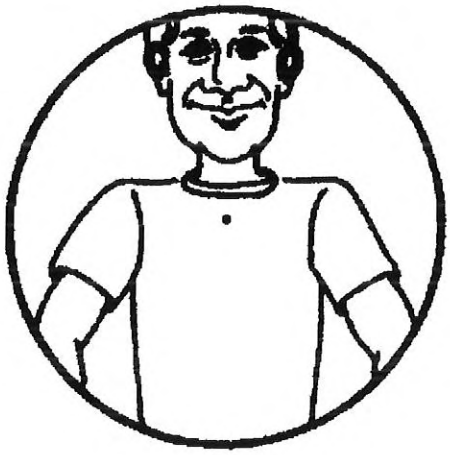
Name:_____

Many Roles of a Farmer

Worksheet B

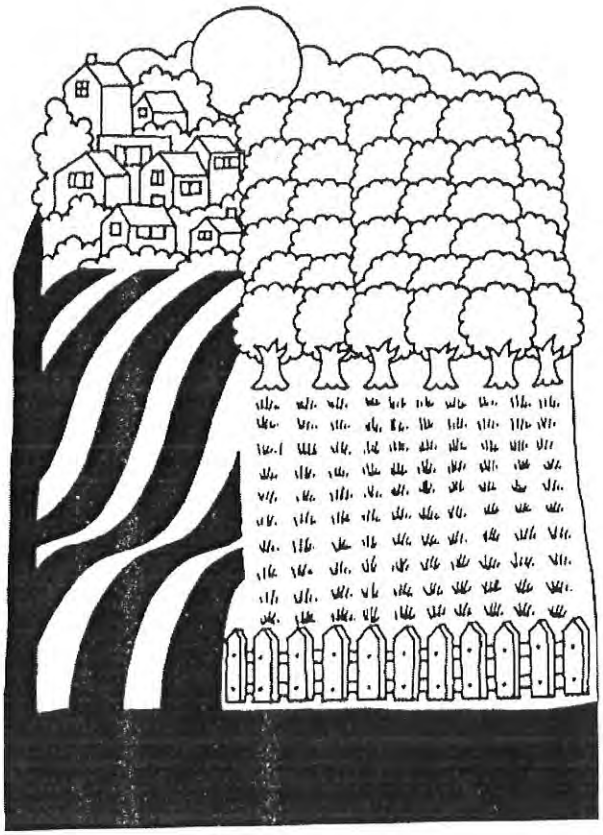






name_____

Student Lesson: Let's Explore Agriculture: Vocabulary



acre - a unit of measurement for land. Just over 43,000 square feet (this is about the size of the playing field for American football)

agriculture - the science, art, and business of farming: cultivating land, raising crops, and feeding, breeding, and raising **livestock**

climate - the weather in a location over a long period of time

diverse - many things that are different from one another

environment - the surroundings that affect an organism and its community

Europeans - people living on the continent of Europe

exports - **products** that are sold outside of the country

farmer - a person who make a living raising animals or food crops

forester - a person who work with trees

gardener - a person who grow smaller crops than **farmers**, often just enough for their family to eat.

geography - the study of the Earth's surface

global - worldwide, involving many countries

imports - **products** that are shipped into the country

ingredients - parts of a mixture

lab - (short for "**laboratory**") the place where scientists work and do their research

livestock - animals that are raised to sell

lumber - wood that has been cut from trees to be used by builders

products - anything that is created, often to sell

ranchers - people who raise **livestock** to sell.

*Integrated Pest Management is a specialized form of **environment**al management wherein scientific research and real-world application work together to reduce pests such as insects, diseases or weeds.*

1. Properly identify pests
2. Learn the pest/host biology
*3. Sample the **environment** for pests*
4. Determine an action threshold
5. Choose the best tactic
6. Evaluate results

name _____

Student Lesson: Let's Explore a
Farmers, Ranchers and Gardeners

Gardeners and **farmers** may raise the same crops, so why do they have different names?

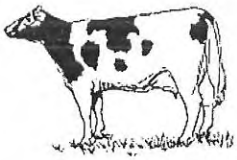
Gardeners usually only grow enough of a crop for their family and friends to eat. They may give some away or sell it at a farm stand or farmers' market. Most **gardeners** raises crops because they like fresh produce or because they enjoy gardening. They usually have other jobs, and buy a lot of their foods.

A **farmer** is someone who raises a large crop and sells most of it. He or she makes a living being a **farmer**. He may grow only one crop, like cabbage. No one wants to live on ***just*** cabbage even if it was healthy to! So, he probably has a garden for other vegetables, and will buy other food at the store.

Ranchers are also **farmers**, but they raise animals to sell. These animals are called **livestock**. Raising **livestock** is part of **agriculture**, too.

People all around the world are **farmers**, **ranchers** and **gardeners**. In many countries, people have to farm to feed their families

Think of one **agriculture** word for each letter of the alphabet. We've done a few of them to help you get started! Agriculture words can be anything related to plants, animals, soil, insects, farming, and eating!



My **Agriculture** Alphabet

A	_____	N	_____
B	_____	O	_____
C	_____	P	_____
D	_____	Q	Quince (an Asian fruit)
E	_____	R	_____
F	_____	S	_____
G	_____	T	_____
H	_____	U	_____
I	_____	V	_____
J	_____	W	_____
K	_____	X	Xylem (the part of a plant water moves through)
L	_____	Y	_____
M	_____	Z	Zinnia (a kind of flower)

name_____

Student Lesson: Let's Explore Agriculture

Is there more to agriculture than just the work of growing food?

Agriculture can be be one person working in a small garden, or hundreds of people running machinery on a thousand-**acre** farm. In both cases, success comes from understanding the **climate**, the other living creatures in the **environment,** how to take care of the soil and water, and how plants grow. **Agriculture** can be **foresters** raising **lumber** or even fish **farmers** raising fish in ponds!

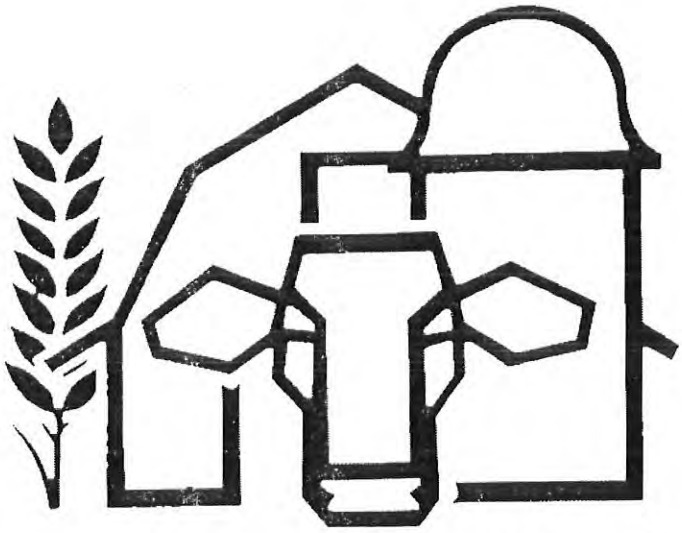
Working with the soil, getting exercise and fresh air, and seeing something grow because you made it possible, all feel great! We all need food, clothing and shelter to survive. **Agriculture** is the science of growing and raising these **products**... and a lot more!

As you learn more about what **agriculture** is, you'll see what an important part of your life it is, even when you don't see it everyday. As you learn about soil, the water system, insects, and plants and animals, you will be learning about our **environment** and how to care for it.

To care for our **environment**, you must have knowledge of how it works. The best way to do that is to get out there and experience it first-hand. So get ready to dig in!

Not many of us could survive without **agriculture**. It gives us food, clothing, shelter, medicines and **products** used in science and industry. Try to think of someone who does *not* use **agriculture**!

One of the best parts about studying **agriculture** is learning about the Earth and how to use its resources wisely. Some students have had the chance to grow something in a garden, or spend some time on a farm or ranch, but a lot of students today have not.



Agriculture is Quite the Miracle!

PRODUCT	CO-PRODUCT	BY-PRODUCT
Something produced by human or mechanical effort or by a natural process; a direct result.	A product produced together with another product.	Something produced in the making of something else; a secondary and sometimes unexpected result or consequence; a spin-off or side effect.

Can you live without agriculture? Can you have an ag-less day? Read on, and you'll find out there is just no way! Agriculture brings us almost everything we eat, wear and use each day. It brings us the meat, cheese, milk, eggs, fruits, fish and vegetables we need to sustain life. It also brings us thousands of co-products and by-products that are a vital part of our everyday life. There are many more, but today you'll learn about some of them that come from plants and animals grown and raised as part of Minnesota agriculture.

DID YOU KNOW . . .

- A 1,000 pound beef steer will produce about 432 pounds of meat and 568 pounds of valuable by-products.
- There would be no baseball without wool by-products!! The ball is stuffed with wool, it is sewn with wool thread, its rubber lining is made from stearic acid, and the cork center contains processed blood. All thanks to agriculture.
- Hog by-products are a source for nearly forty drugs and pharmaceuticals. These medical by-products are second in importance only to meat itself as an important contributor to society. They include heart valves, cortisone and hog skin for burn treatments.
- Minnesota has seventeen ethanol plants (fuel from corn) using about 200 million bushels of corn in 2006 (15% of total crop).
- Medicines such as rattlesnake bite antivenom come from sheep.
- In Minnesota, most turkey farmers use wood chips for bird bedding. Some use rice hulls or shelled sunflower seeds for bird bedding.
- A small bit of washed lambs wool is used in the toe of nearly all ballet shoes to cushion the toe when standing on it.
- Bison (buffalo) is the largest ruminant animal. At one time, 200 million bison roamed North America. Today, Minnesota farmers raise about 12,000 bison for their meat, which is low in fat. Bison by-products include: bison hides are used to make handbags, clothing and boots; bison skulls and other bones are used for ceremonial and decoration purposes; and bison fur and wool are used to make clothing.
- Wool unsuitable for fabric is used as mulch for plants, to clean up oil spills and grease around machinery, for insulation in homes and buildings, and as an interliner in winter clothes.
- Each ton of paper produced uses 28 pounds of cornstarch as sizing or finish.
- When you hear the word wheat, you probably think of bread first. Wheat is the largest acreage crop in the world and is the staple food of 35 percent of the world's population. The crop is also used as animal feed and kitty litter. And, scientists are studying ways to use wheat for non-food products such as makeup, medicines and biodegradable plastics.
- Poultry feathers can be processed as a source of protein for livestock feeds.

CORN

MAIN USE
Livestock Feed

DEXTRIN
Fiberglass
Wallboard
Wallpaper

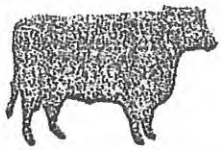
DEXTROSE
Baby Foods
Breakfast Foods
Dyes
Licorice
Rubber
Vinegar
Wine

ETHANOL

OIL
Edible Uses
Industrial Uses

STARCH
Adhesives
Aspirin
Bakery Products
Candies
Beverages
Candies
Chewing Gum
Cosmetics
Desserts
Drapes
Laundry Products
Paper Sizing
Surgical Dressings
Ties

SYRUP
Canned Foods & Juices
Confections
Dyes
Explosives
Ice Cream
Ink
Marshmallows
Pens & Leather
Soft Drinks



CATTLE

MAIN USE
Meat

BLOOD
Bandage Adhesive
Fabric Dyes
Ink
Medicine
Plastic
Wallpaper

BONES, HORNS & HOOVES
Bone Meal Fertilizer
Combs
Dice
Dog Biscuits
Piano Keys
Rose Food

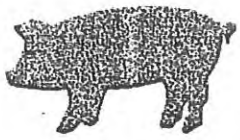
FATS & OILS
Antifreeze
Candles
Cellophane
Ceramics
Cosmetics
Crayons
Deodorants
Margarine
Paints
Perfume
Plastics
Soap

GELATIN
Candies
Film
Flavorings
Ice Cream
Marshmallows
Mayonnaise
Soap
Yogurt

HAIR
Air Filters
Paint Brushes

HIDE
Boots/Shoes
Baseball Gloves
Luggage
Saddles

MANURE
Urea Fertilizer
Methane Gas



SWINE

MAIN USE
Meat

BLOOD
Adhesives
Fabric Dyes
Glue
Inks
Leather Finishes
Plastics

BONES & HOOVES
Bone China
Combs
Gelatin
Umbrella Handles

FATS & OILS
Candles
Cellophane
Chewing Gum
Crayons
Lards
Lubricants
Paints

HAIR
Air Filters
Bristle Brushes
Felt Padding
Upholstery

HEART
Heart Valves for Humans

HIDE
Drum Heads
Fertilizer
Gloves
Luggage
Shoes (Suede)
Wallets

PANCREAS
Lipase (Enzyme)

SHEEP

MAIN USE
Meat

BONES, HORNS & HOOVES
Bone Charcoal Pencils
Bone Jewelry
Dice
Gelatin Capsules
Neatsfoot Oil
Piano Keys
Shampoo
Shepard Crooks

FATS & FATTY ACIDS
Antifreeze
Biodegradable Detergents
Candles
Cosmetics
Creams
Dog & Chicken Feed
Explosives
Floor Wax

HIDE
Blankets
Clothing
Coats
Drum Heads
Insulation
Tennis Balls

INTESTINES
Casing for Sausages
Instrument Strings
Surgical Sutures

WOOL
Artists Brushes
Baseballs
Lanolin
Rug Pads

POULTRY

MAIN USE
Meat and Eggs

Bedding & Pillows
Candy Bars
Clothing
Fertilizer
Livestock Feed
Noodles

SUGARBEETS

MAIN USE
Sugar

Livestock Feed (Beet Pulp)
Molasses
Monosodium Glutamate
Vinegar
Yeast

TREES

MAIN USE
Lumber and Fiber

CELLULOSE (WOOD)
Paper
Popsicle Sticks
Fuel Briquets
Football Helmets
Cellephane
Rayon

BARK
Cork
Dyes
Medicines
Mulch

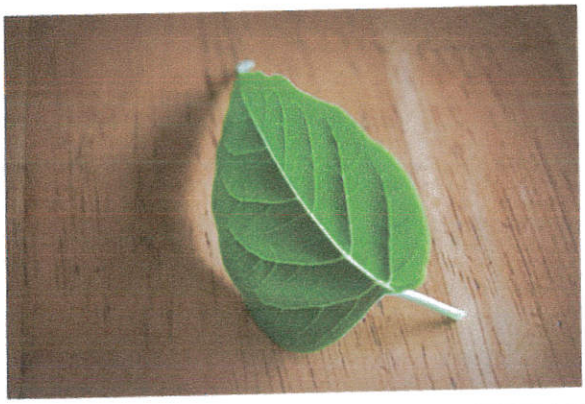
SAP
Paint Thinner
Resin Bags
Rubber
Sugar

Minnesota Agriculture in the Classroom
c/o Minnesota Department of Agriculture
Email: alan.withers@state.mn.us
Website: www.mda.state.mn.us/maitc

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Green and Leafy and Important

Plants are very important to watersheds. Why? They make water behave differently than it does when the land is bare.



- Plants keep water from washing the soil away. Their roots hold dirt together, and their leaves and branches stop heavy rain from hitting the soil directly.
- Land with a lot of plants growing on it will hold water longer and release it slowly. That helps prevent destructive floods.
- Plants also TRANSPIRE water into the air by taking it up through their roots and releasing it as WATER VAPOR.

Now that you know how land and plants affect your watershed, you might look out the window and wonder:

Read on: Is Your Watershed Healthy?

California Foundation for Agriculture in the Classroom

Plant Parts and Functions

Purpose

In this lesson students will learn about plant parts and how they function in plant growth and reproduction.

Time

Teacher preparation:
45 minutes

Student activities:
Two 60-minute sessions

Materials

For teacher demonstration:

- Celery or white carnation flowers
- Red or blue food coloring
- Two glass jars filled with water
- Potted plant
- Clear plastic bag
- Twist tie

For each group:

- 2-3 different types of leaves
- Clear nail polish
- Clear tape
- Microscope
- Elodea leaves
- 4 slides and coverslips

Background Information

Plants are vital to life on Earth. Plants are known as producers because they use energy from the sun to make their own food and are the main source of energy entering food chains. Sunlight energy is transferred by plants into chemical energy through the process of photosynthesis. Consumers like deer, humans, and mice eat plants and that energy gets transferred from one organism to another through the food chain.

Plants come in all shapes and sizes and can be found on mountain tops, in valleys, deserts, fresh and salt water—almost everywhere on Earth. Some plants, like the Giant Sequoia tree, are enormous while other plants, like the weeds growing in between sidewalk cracks, are tiny. There are carnivorous plants that trap and digest insects and animals as large as rats. The largest flower in the world, the Corpse Flower, *Amorphophallus titanium*, is also one of the smelliest. This flower can grow up to 20 feet tall and 16 feet wide, and it attracts flies, which are its pollinators, with an aroma of rotting meat.

Plants provide us with food, clothing, medicine, shelter, and oxygen. Everything we eat comes directly or indirectly from plants. Each part of the plant plays a specific role. Plants hold soil in place with their roots, and roots anchor the plant in the soil and absorb nutrients. Leaves act as food factories by capturing sunlight energy and transforming it into food for the plant through photosynthesis. Flowers are involved in plant reproduction. This lesson provides activities for students to explore the structure and function of plant parts.

Procedure

1. Set up the following class demonstrations to introduce plant parts and functions.

    a. Bring a potted plant to class and have the class observe the plant. Next, cover one branch and its leaves with a clear plastic bag and make a tight seal around the branch. Ask students to look at the branch, leaves, and plastic bag as soon as it has been attached. Water the plant as needed and observe the bag over the next couple of days. Condensation should develop inside the bag. Ask students to tell you why this is happening. This is an easy way to demonstrate transpiration from the leaves.

    b. To demonstrate the function of xylem, put cut stalks of celery in clear jars with water. Add red or blue food coloring to one

Plant Parts and Functions

For each student:

- *Plant Parts and Functions* handout (pages 13-16)
- *Plant Parts and Functions Lab* handout (pages 17-19)

California Standards

5th Grade

Common Core English Language Arts

RI.5.1
RI.5.2
W.5.2a
SL.5.1

Next Generation Science Standards

5-PS3.D
5-LS1-1
5-LS1.C
5-LS2.A
5-LS2.B

6th - 8th Grade

Common Core English Language Arts

SL.6-8.1
RST.6-8.2
RST.6-8.3
RST.6-8.4
WHST.6-8.1e
WHST. 6-8.4
WHST. 6-8.7

Next Generation Science Standards

MS-PS3.D
MS-LS1.A

jar. Have students observe the celery over the next day. Ask them why the leaves of one stalk of celery are turning the color of the food coloring. White carnation flowers may also be used for this demonstration.

c. Both of these demonstrations lead into the student handout, *Plant Parts and Functions*. Go over this informational handout together as a class.

2. Review *Plant Parts and Functions Lab*.

   a. Lead students in a demonstration of set up for the Stomata Observation activity and facilitate a discussion of the questions to be answered in the activity.

   b. Lead students in a demonstration of set up for the Chloroplast Observation activity and facilitate a discussion of the questions to be answered in the activity.

   Optional: Show students the labeled diagram of an Elodea cell. *www.exploratorium.edu/imaging-station/students/elodea.html*

3. After students have completed the Stomata and Chloroplast Observations, have a class discussion about what students observed. Draw labeled diagrams on the board to reinforce specific plant structures and functions.

4. As a conclusion to your discussion, ask students the following riddles about plants they eat.

   a. My taproot gathers nutrients from the surrounding soil. I am orange and I have feathery green leaves with veins in a netted pattern. Rabbits and people like to eat me.
   What am I? *carrot*
   What plant part am I? *root*

   b. I transport water, nutrients, and food the plant makes for itself. I have tubes that act as roadways for water, nutrients, and the food I make. I have red stalks and have poisonous green leaves at the top. I am often mixed with strawberries to make a special pie.
   What am I? *rhubarb*
   What plant part am I? *stem*

Plant Parts and Functions

California Standards (cont.)

6th - 8th Grade (cont.)

Next Generation Science Standards (cont.)

MS-LS1.B
MS-LS1.C
MS-LS2.A
MS-LS2.B

Standards descriptions are listed in the matrix on page 143.

c. I attract insects so that I can become pollinated and produce seeds. I am white and a member of the cabbage family. Some people say I look like clouds.
What am I? *cauliflower*
What part of the plant am I? *flower*

d. I have lots of iron. I use sunlight, carbon dioxide, nutrients, and water to make food for myself and the rest of my plant parts. I go well with salads. Popeye is a big fan.
What am I? *spinach*
What plant part am I? *leaf*

e. If planted and the conditions are right, I will grow into a tree. I have a light tan shell that easily splits in two and greenish colored nut. I grow on trees and have become a popular nut to grow in California. I start with a "P."
What am I? *pistachio*
What plant part am I? *seed*

f. I am the yellowish-orange fleshy substance around a large seed. I protect the seed and encourage insects or larger animals to eat me so that my seeds can be dispersed. I have fuzzy skin.
What am I? *peach*
What plant part am I? *fruit*

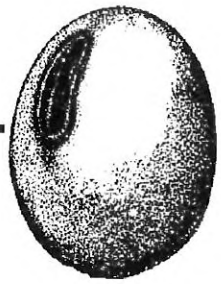
Variations

- If materials for Chloroplast Observation activity are not available, project the following website on the board and play the video clips of chloroplasts moving inside the Elodea leaf cells and have students answer the lab questions.
www.exploratorium.edu/imaging-station/students/elodea.html

- Have students draw their own plant, label the parts, and describe the functions of each plant part.

- Begin the lesson by making a KWL chart with your class. Have students copy the chart onto a piece of notebook paper. Conclude with a class exercise to complete the chart, filling in any of the blank spaces that were not filled in at the beginning of the lesson.

Beanie Baby



Common Core:

Language Arts: CCSS.ELA-Literacy.RI.4.3; RI.4.4; RI.4.5; RF.4.3a

Mathematics: CCSS.Math.Content.4.MD.A.2

Next Generation Science Standards:
Structure & Properties of Matter: 5-PS1-4

Materials Needed:

- Jewelry size re-sealable bag (found in craft stores)
- Crystal Soil
- Hole Punch
- Water
- Measuring Spoons
- Soybeans
- Yarn

Directions:

1. Punch a hole in the top of your bag.
2. Place a scant 1/4 teaspoon of Crystal Soil into the bag.
3. Add one tablespoon of water.
4. Gently push in two soybeans.
5. Seal your bag firmly.
6. Insert the yarn to make a necklace.
7. Wear your Beanie Baby around your neck and under your shirt to keep it in a warm, dark place.
8. Check your Beanie Baby several times a day for germination and record the growth.

Lesson Extender:

Soybeans have many different uses in today's society. Explain how the use of soybeans has evolved since George Washington Carver studied them. Be sure to include your own experiences along with information from the reading.

AG AS ART

Supply List:

Assorted seeds (Suggestion: use seeds local to your county. Your local seed dealer will probably be happy to help and provide for your workshop.)

Mod Podge

Foam Paint Brush

4x6 Canvas (can also use cardboard)

Instructions: Give each teacher a 4x6 canvas. Let them choose different kinds of seed to use. They can design their "art piece" any way they want. Use Mod Podge to hold everything in place and then put another coat on top to keep it secure.

Trading Commodities

Common Core:

CCSS.ELA-Literacy.RI.5.1; RI.5.5; RI.5.7; W.5.1; W.5.2; SL.5.1

Materials Needed:

- 1 set of trading cards (per person) found at http://www.agintheclassroom.org/TeacherResources/InterestApproaches/Trading%20Cards.pdf
- Trading situations—next page(s)
- Score sheet—next page(s)

Directions:

Students will simulate trade using agricultural commodities found in Illinois. The activity will introduce real world situations as they arise and explain how they influence agriculture.

Initial Scoring Rubric	
Corn:	10
Soybeans:	10
Pigs:	10
Beef Cattle:	9
Dairy Cattle:	9
Pumpkins:	9
Poultry:	8
Pizza:	8

1. Combine all cards (one set per player) into one deck. Mix up all the cards and deal out evenly amongst the players. Each player will end up with 12 random cards. Each card has a beginning value displayed on the rubric to the right.
2. After all cards have been dealt, 3 situation cards are randomly drawn and read aloud. (One person (marketer) will stand aside and keep track of "current" market prices, so that as they fluctuate, players can see each card's worth.) On the score sheet, calculate your total score using the "current" market prices after the situation cards are drawn. This will be your round 1 score.
3. After round 1 scores are written, there will be a 2 minute round of open trade. During this time period players will trade commodities contained in their hands. They should not disclose which items they are trading. Only trade with another player willing to trade the same amount of cards as you. That is: 1 for 1; 2 for 2; etc. Each player will call out the number wishing to trade and trade when another player is calling the same number as them. Trading begins when the marketer says: "Market open," and trading ends when 2 minutes has surpassed. The marketer will call out "Market closed."
4. The player to the left of the dealer randomly selects one of the trading situation cards. Follow the instructions on the situation card subtracting or adding points to the initial scoring rubric. Record your score in a column called round 2 score.
5. Combine all the cards. Shuffle the cards. Deal the cards. The dealer calls "Market open," again and trading ends when 2 minutes has surpassed. The player keeping time will announce: "Market closed." This time, the person to the left of the dealer will draw randomly 2 situation cards. They are in combination, therefore if one card decreases a commodity by 3 points and the other decreases the same commodity by 4 points, a combined 7 points will be decreased per card.
6. Tally up the scores and record this score as round 3 score. Now add up all the scores from each round and the highest score wins!

Trading Commodities

(continued)

Players' Name	Round 1	Round 2	Round 3

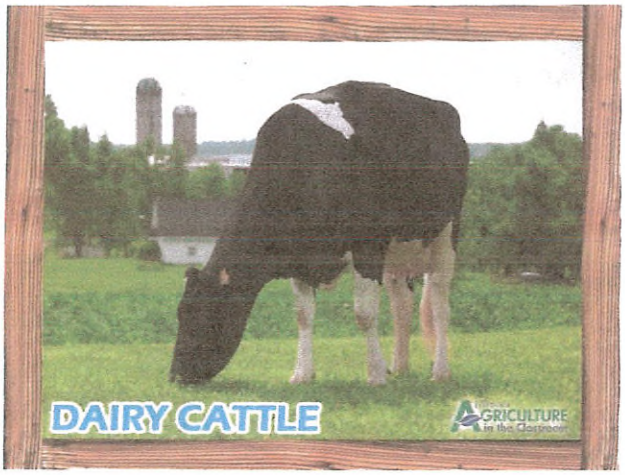
Lesson Extenders:

1. Explain your strategy during the trading part of the exercise. What were you trying to accomplish? Were you trying to get all of one commodity or were you trying to get a mix of several? Have a class discussion explaining the benefits and drawbacks of each.
2. Write a few paragraphs explaining how this trading exercise is similar to real experiences in the agriculture industry. Use examples from what happened during your activity.
3. Was there any time during the activity where you felt that it was a guessing game or it was difficult to come up with a strategy? Write and explain how this high level of prediction might be similar to what farmers experience?
4. Suppose it costs each player 8 points per commodity (card) to produce or raise it. Look back at the scores from Round 2 and Round 3. Did any players' score go below 96? What would this score represent? Do you think there are any farmers that lose money?
5. Write a paragraph explaining what you have learned from this activity. Participate in a class discussion sharing what you learned, drawing on key ideas from the activity.
6. Write a paragraph identifying ways people can help to reduce the risks or problems that emerged during this activity.

Trading Commodities

A new ethanol plant opens increasing demand for corn. Increase corn by 3 points.	Pumpkins are in high demand. Pumpkins increase by 3 points.	Cost of insecticides increases. Soybeans and field corn decrease by 3 points.	You had an incredible yield of specialty crops like peppers and onions. Increase pizza by 3 points.	There is a high demand for beef products. Beef cattle increase by 4 points.
Prairie Farms Dairy wants milk from your cows. Dairy cattle increase by 4 points.	Your tomatoes taste the best for pizza sauce! Pizza increases by 4 points.	Your machinery used to harvest crops needs repair. Soybeans, field corn, and wheat decrease by 4 points.	Companies want your soybeans to make biodiesel. Increase soybeans by 2 points.	Your apples are chosen to be used for applesauce. Increase apples by 3 points.
Your "you-pick" apple orchard is a huge agritourism spot. Apples increase by 6 points.	Illinois apples were the only ones not impacted by frost. Increase apples by 3 points.	Pork and bacon are in high demand. Increase pigs by 5 points.	You had a high yield of eggs from your chickens. Poultry increases by 4 points.	Your horses have won several racing awards and are in perfect health. Horses increase by 5 points.
The cost of animal feed increases. Poultry, pigs, beef cattle, and dairy cattle decrease by 3 points.	There is a high demand for soft red winter wheat to mix for all purpose flour. Wheat increases by 6 points.	Japanese beetles attacked your soybeans. Decrease soybeans by 3 points.	Some of your baby chicks didn't survive past the first couple of days. Decrease poultry by 1 point.	The mill is looking for a high amount of wool to process into yarn. Sheep increases by 5 points.
The market has an abundance of chickens causing a low demand. Decrease poultry by 4 points.	Your horse was just visited by the veterinarian and is in great health. Increase horses by 4 points.	Your pigs got sick because of improperly controlled temperatures. Pigs decrease by 5 points.	Everyone wants ice cream from the milk your cows produce. Increase dairy cattle by 3 points.	The European corn borer attacked your corn crops. Decrease corn by 3 points.


APPLES


DAIRY CATTLE

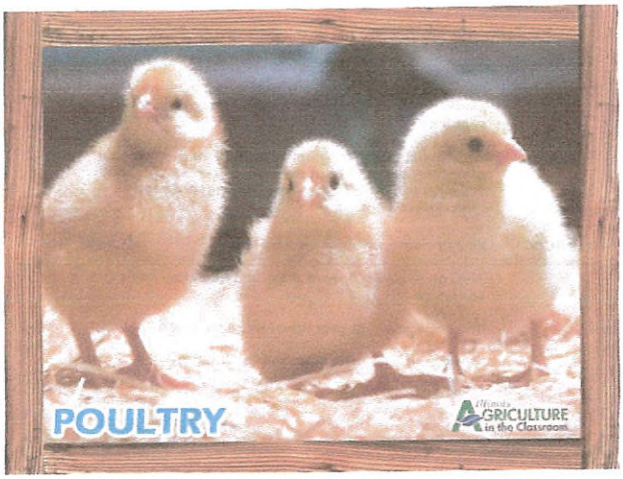

BEEF CATTLE

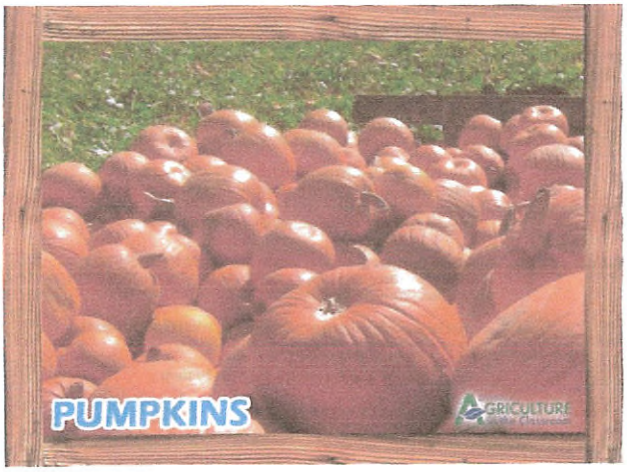

HORSES


FIELD CORN


PIGS


PIZZA


POULTRY


PUMPKINS


SHEEP


WHEAT


SOYBEANS

Futures Farming

Grade Level: 4-8

Objective: Students will demonstrate an understanding of marketing farm commodities by selling them (represented by M&M's candy) for a profit, demonstrate the ability to equate simple math functions, observe the challenges a farmer faces when marketing commodities by completing a hands-on activity, and define terms: commodity, acre, bushel, futures, expenses, profit and crop.

Common Core: Language Arts: CCSS.ELA-Literacy.RI.4.2; RI.4.6; W.5.1; SL.4.1; Mathematics: CCSS.Math.Content.4.OA.A.3; 7.SP.A.1

Suggested Reading Materials:
What is Scarcity of Resources? by Jessica Cohn | ISBN: 077874261X
What is Trade? by Carolyn Andrews | ISBN: 0778742636
What is Supply and Demand? by Paul Challen | ISBN: 0778744574

Introduction:
A lot of planning goes into the sale of a farmer's crop. In order to make the most money, a farmer must predict when he will receive the best price for his or her crop, even before the crop is harvested. This is called "futures" because the prediction the farmer makes is based on the future. The futures market can be both complicated and risky. In this activity, students will see if they are good predictors with their "crop" in hopes of making the most money. Share these definitions with your students before starting the activity:

- Futures: Commodities or stocks bought or sold upon agreement of delivery at a later time. A farmer only gets paid when he or she sells a crop. That payment may only be once a year (after harvest in November) or if he or she sells the crop before it is harvested - "future."
- Crop: The total yield of agricultural produce in a given season or place.
- Commodity: A commercial article, especially an agriculture or mining product, that can be transported.
- Acre: Portion of land about the size of a football field.
- Bushel: How the crop is measured; can be measured by weight or amount.
- Expenses: Items the farmer must pay for in order to stay in business; examples: Electricity, gasoline, taxes, chemicals.
- Profit: Amount of money made after expenses are paid.

What You Will Need:

- "Futures Farming" Worksheet
- 1.4 oz bag of M&M's (per student)
- Calculator

Futures Farming

Activity Instructions:

1) Introduce the "Farmer's Dilemma" activity by reading the introduction at the beginning of this lesson. Then place the terms given in the introduction on the board or overhead. Define the terms as a class or have the students do this individually.
2) Pass out the bags of M&M's and the worksheets. **Do not open the M&M's!** Using their worksheet and candy, students need to estimate how many M&M's of each color they think might be in their single bag before opening it.
3) Discuss the term "futures" that the students defined earlier. A farmer has the opportunity to sell his/her crop before they harvest it. For example, if the farmer thinks he might have 150 bushels of corn to sell in the fall, he might sell 100 bushels ahead of time at a higher price.
    a) Why wouldn't the farmer want to sell all 150 bushels at a better price? Answer: There might be a drought, flood or wind damage that could hurt the farmer's yield, he or she might not harvest 150 bushels of corn. In order to make money, that farmer must have the number of bushels he or she sold ahead of time, otherwise he or she loses money. It is like borrowing money; someday you have to pay it back. Remember, the farmer is taking a risk like the students are doing with their candy. Imagine taking a risk with thousands of dollars, not just candy.
4) Complete Step 3 on the worksheet.
5) Have students open their M&M's. No snacking yet. Complete Step 4 on the worksheet. Students may eat their candy when the directions on the sheet indicate to do so.
6) Complete Step 5 and finish the activity.

Discussion Questions:

1) How many of you realized that a farmer only makes money at certain times of the year?
2) How is the method of payment different than when some of your parents receive their paychecks?
3) What are some school subjects a farmer must be familiar with or understand well?
4) How would budgeting funds come into play in a farmer's family life?

Futures Farming

WORKSHEET

STEP 1: Do not open your bag of M&M's yet. Predict how many of each color of M&M's candy you will get in your bag. You will have approximately 55-60 M&M's in the bag.

Blue_____Brown_____Red_____Orange_____Yellow_____Green_____

STEP 2: This is the pre-harvest phase. Would you like to sell your crop (or M&Ms) before you harvest it and get a premium price for your commodity? Let's say your teacher (or grain elevator) will pay $4.50 now or $4.00 once you open your bag. Your teacher will also pay $4.75 for green M&M's or $4.25 after the bag is opened.

Pre-sold corn: Place the number you wish to sell in the first blank.

Blue	_____	x $4.50 = _____
Brown	_____	x $4.50 = _____
Red	_____	x $4.50 = _____
Orange	_____	x $4.50 = _____
Yellow	_____	x $4.50 = _____
Green	_____	x $4.75 = _____
Total Sold:	_____	Total Made: $_____

STEP 3: This is the harvest phase. Open your bag, but don't eat the candy yet. Count how many actual M&M's you have of each color. Set aside the pre-sold M&M's. Record the remaining number of M&M's (not pre-sold) below.

Blue_____Brown_____Red_____Orange_____Yellow_____Green_____

Take the information obtained above and use it below to find out how much money you made on the M&M's that were not pre-sold. If you oversold any color, place a zero in the space below.

Blue	_____	x $4.00 = _____
Brown	_____	x $4.00 = _____
Red	_____	x $4.00 = _____
Orange	_____	x $4.00 = _____
Yellow	_____	x $4.00 = _____
Green	_____	x $4.25 = _____

Total Made: $_____

Futures Farming

WORKSHEET CONTINUED

Add together the totals you made either from selling your crops at $4.50 or $4.00 (or green candies at $4.75 or $4.25).

You may eat the rest of the candy you have left.

Overall total: $_____

STEP 4: Did you oversell any corn? Yes No

If yes (any color other than green), how many? _____ x $4.50 = _____
If yes (green only), how many? _____ x $4.75 = _____
Total Oversold _____

Overall Total: $_____ - Total Oversold _____ = $_____

Final Questions:

1. How many of each color did you oversell?
2. Did you make good choices when it came to the predictions?
3. Which commodity had the highest amount sold?
4. What can you do differently if you were to do it again?
5. What did you learn about farming while doing this lesson?
6. What was one thing that surprised you about farming?
7. As a class, discuss your answers at the end of the worksheet. Figure out who made the most profit and who owed the most. Explain why these students made the most or lost the most. Compare and contrast each student's outcome. Focus on the details an describe the differences and similarities.
8. What is one thing that surprised you about your predictions and actual calculations?
9. What did you learn about risk-taking? In your opinion, is it always better to take a risk? Was your opinion the same before the activity?
10. What was your favorite thing about this mini-unit?

Futures Farming

Extension Activities:

Averages
Group students in teams. Have the students calculate the following:

- Average total M&M's
- Average M&M's of each color
- Average $ made from pre-sold
- Average $ made not pre-sold
- Average overall $ made

Use the averages to answer the following two questions.

1. What trends do you notice as a group? As a class?
2. In general did the group take more risks, or were they less risky?
3. Why is it important to calculate averages? Would this help in determining the risk?

Graph It Out
Have each student create several graphs to display their colors from the bag of M&M's.

- Bar Graph—Create one to show a side by side representation of each color in your bag. Then create a second bar graph to show how many of each color were pre-sold and sold.
- Pie Chart—Create this to show a percentage of the overall total for each color.

Compare your graphs and charts with other students in the class. What similarities and differences do you see amongst the charts?

As a class, create the same graphs and charts for the overall averages.

Discuss with the students what they liked and did not like about the mini-unit. Have them give new ideas about what could be added and what should be changed about it. If possible, have a speaker come in to talk about farming. The students would most likely get a lot more information about the topic, and it will clarify any other questions the teacher cannot answer.

Each student should write two paragraphs explaining the main idea of the unit. Explain using details from the text and lesson.

Statistics
Using the information gained from the unit. Have students chart statistics from their population of M&M's. Explain the odds of drawing each color from the bag at random. Use this data to draw inferences. What are the odds of randomly selecting each color? Which is most likely?

California Foundation for Agriculture in the Classroom

That Was Then, This Is Now

Purpose

The purpose of this series of lessons is for students to learn about food prices, and how they have changed over time, as they perform mathematical computations, analyze data charts, and compare and contrast statistical information.

Time*

Reading a Chart – I
One 40-minute session

Reading a Chart – II
One 40-minute session

The Price of Food Today
Homework

* *Time for the lessons will vary depending on how many activities you perform and how you use this information in the classroom.*

Materials

For each student:

- *Reading a Chart-I* student worksheet
- *Reading a Chart –II* student worksheet
- *The Price of Food Today* homework assignment
- Colored pencils
- Graph paper

Introduction

This series of lessons includes information on how food price data can be used to make mathematical computation practice interesting and informative. The sequence of lessons is designed for a variety of math levels. Review the materials and revise them to meet the needs of your students.

You may choose to customize the lessons to include current and past newspaper grocery ads. Consider comparing commodity prices from one season to the next and from one year to another. Statistics and colorful graphs are available from a variety of sources. See the resource listings in the back of this unit for specific information.

As you use the attached lessons, it is important for students to realize that the United States has the safest, most abundant food supply in the world. Most farmers do not make a lot of money producing the food Americans consume. In fact, people who farm most often do it because they have a passion for it. Today, over 72% of the farmers have income outside of farming. Profit made in agriculture is most often accrued on the marketing end. It may be interesting for your students to meet an actual producer and learn about his/her operation.

Procedure

1. Review the enclosed worksheets and statistics. If necessary, rewrite the worksheets or create math problems that supplement the worksheets.
2. Introduce your students to the series of lessons by having them think about the prices their family pays for specific food items and how they think that price is determined. Possible discussion and/or writing prompts are listed below.
    - If you were to ask you parents, if the price of food is going up or down, what would they say?
    - On the average, is it less expensive, more expensive, or about the same to eat at a restaurant than at home? Explain.
    - How do you think the price of food is determined?
    - Do the farmers who grow the crops make a lot of money on the food you are eating?
    - If you were to compare the price of food in the United States to the price of food in other countries, would it be more or less expensive?

California Foundation for Agriculture in the Classroom

That Was Then, This Is Now

Content Standards

Grade 3

Mathematics

Number Sense • 2.0, 3.3
Algebra and Functions 1.0, 1.4, 2.1
Measurement and Geometry • 1.4
Mathematical Reasoning 1.0, 1.1, 2.3, 3.3

Grade 4

Mathematics

Number Sense • 1.0, 1.2, 2.0, 2.1
Statistics, Data Analysis and Probability • 1.0, 1.1
Mathematical Reasoning 1.0, 1.1, 2.1, 2.2, 2.3, 3.3

Grade 5

Mathematics

Number Sense • 2.0, 2.1
Statistics, Data Analysis, and Probability • 1.0, 1.2
Mathematical Reasoning 1.0, 1.1, 2.1, 2.2, 2.3, 3.3

Grade 6

Mathematics

Number Sense • 1.0, 2.0
Statistics, Data Analysis and Probability • 1.0, 1.1, 2.0, 2.1, 2.2, 3.2
Mathematical Reasoning 1.0, 1.1, 1.2, 2.4, 3.3

3. Introduce your students to the *Average Prices of Foods—Retail* chart. In general, discuss what the chart shows. Review the meaning of average.

4. Have the students complete the student worksheets and the homework assignment. Part of the homework assignment requires students to make a graph. Be sure they have the rough drafts of their graphs approved before preparing their final copies.

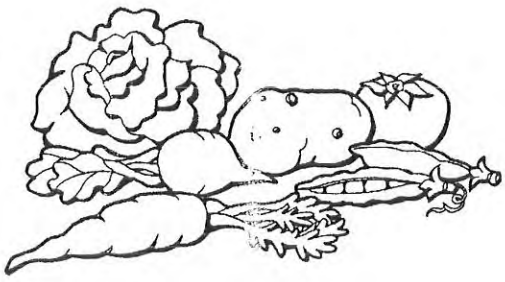
5. Share the graphs the students have created. Display the student graphs in the library, hallways, grocery stores, and at special events such as parent meetings and open houses.

Assessment

As well as examining the completed work of the students, include questions on your exams that require data analysis.

Variations and Extensions

- Convert the homework activity to a class field trip. Have students work in teams of two as they find information at the grocery store.
- Create large colorful graphs of the information they collected at the grocery store. Display the student graphs at the stores the students visited.
- Use the *Farm Facts Booklet* available from the American Farm Bureau Federation, to illustrate a variety of graphic ideas as well as information on the current agricultural states of American agriculture.
- Use grocery ads to determine the prices of the food items in the homework assignment.



Reading a Chart – I

A Look at Averages

Name _____

Date _____

Instructions

Using the chart provided by your teacher, answer the questions below.

1. For what years does the chart have food prices listed? _____

   _____

2. What do the numbers in the columns actually represent? _____

   _____

3. How many food items are represented in this charts? _____

4. Why do you suppose the United States decided to have these food items available for price comparison? _____

   _____

5. Averages:

   a) What does average mean in math? _____

   _____

   b) How much did an average one-half gallon of milk cost in 1989?

   _____

   c) In 1970, did every dozen eggs cost 61.4 cents? Explain.

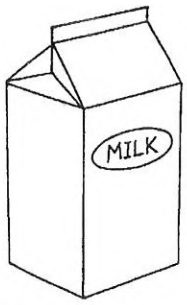
   _____

   _____

   d) How do you think the average retail price of food is determined? _____

   _____

   _____



Reading a Chart – I

A Look at Averages (Page 2)

6. How many cents did an average pound of tomatoes cost in 1960? _____¢. Express that number using a dollar sign and a decimal. _____

7. Did all food items listed in the chart cost more in 1989 than they did in 1988?
   ☐ Yes ☐ No. Explain. _____

   _____

   _____

8. An Average Meal

   Suppose it is 1970. Your family is going to have a hearty meal consisting of one loaf of bread, two pounds of chicken, 3 pounds of potatoes, ½ gallon of milk, and a salad made of ½ pound of tomatoes and one bunch of leaf lettuce (the lettuce cost 29 cents).

   a) What would the total average cost be for this meal? _____ Show how you got your answer in the space below.

   b) Explain why some families would have paid more for this meal and why some families would have paid less for this meal. _____

   _____

   _____

   c) Using the trends you see in the chart, would the same meal today cost more or less than the meal in 1970? ☐ More ☐ Less.

9. What is one thing you found interesting about the chart of data? *(Write your answer in a complete sentence.)* _____

   _____

Reading a Chart – II
Comparing Data

Name _____

Date _____

Using the chart provided by your teacher, answer the questions below.

1. How much did a dozen eggs cost in 1980? _____ In 1950? _____

2. According to the chart, in what year did five pounds of sugar cost the most? _____
   What was that price in cents? _____¢. Rewrite that price using a decimal and a $ sign.

   _____

3. Name two items that were more expensive in 1960 than they were in 1950.

   _____ _____

4. In what year(s) was the average price of a pound of potatoes less than a dime? _____

5. Name one item whose average price was less expensive in 1980 than it was in 1970.

   _____

   Discuss one possible reason why this happened. _____

   _____

   _____

6. Look at the average prices of tomatoes in the years 1970 and 1990. How much increase was there in the price per pound of tomatoes over this twenty-year period? _____

7. In 1950, about how much would it cost for two pounds of apples? _____

8. Pretend it is 1960 and you have three one-dollar bills. If you bought one pound of bacon, how many dollar bills would you give the cashier? _____ How much change would you get back? _____

9. It is 1970 and you plan to make cookies. You have all the supplies you need except the sugar, eggs, and butter. How much money would you need to buy a five-pound bag of sugar, one dozen eggs, and one pound of butter? _____

Reading a Chart – II

Comparing Data (Page 2)

10. How much would you have left over if, in 1989, you gave a grocery clerk two dollars for one-half gallon of milk? _____

11. In 1950, how many one-pound loaves of bread could you buy with two dollars?

_____

12. Write one problem of your own using information from the chart. Include the answer and show how you determined the answer.

Problem: _____

_____

_____

_____

_____

Answer: _____

13. Farmers produce the food we eat. Since on the average, most food prices have increased over the years, do you suppose the farmers are making more money on the food we eat?

☐ Yes ☐ No. Explain your reasoning. _____

_____

_____

_____

California Foundation for Agriculture in the Classroom

The Price of Food Today

Name _____

Date _____

Dear Parent/Guardian:

As part of a math lesson, your student will need to spend some time at the grocery store. Please include your child in one of your grocery store shopping trips so that he/she can complete the assignment below by the following date: _____ . He/she will be doing a graphing assignment using this information.

Thank you!

1. Go grocery shopping with a parent this week or make a special trip to the grocery store for this assignment. *As you travel throughout the store, remember to be courteous and respectful. You are representing your school, as well as yourself.*

2. Go to the appropriate section of the store and examine the prices of several brands of the items listed in the chart below.

3. Complete the following chart:

Item	Least Expensive Price	Most Expensive Price	Estimated Average Price
1 pound bacon			
5 pounds sugar			
1 dozen eggs			
1 pound butter			
1 pound tomatoes			
1 pound apples			
1 loaf standard white bread			
½ gallon of whole milk			
1 item of your choice			

The Price of Food Today *(Page 2)*

4. How did you decide what to write in the "estimated average price" column?

_____

_____

5. Do you suppose that the price of tomatoes is always about the same price? Why/Why not?

_____

_____

6. Name one item in the store that you think will not be in the store three months from now.

_____ Why do you think this? _____

_____

_____

7. In one well-written paragraph, explain what you learned from doing this exercise.

_____

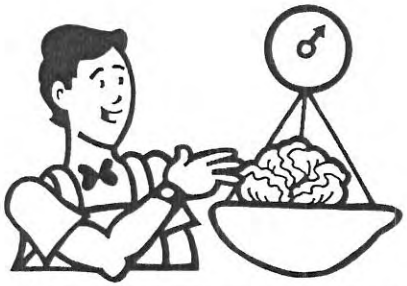
_____

_____

_____

8. Graphs often show information in a clear and simple way. Pick one of the ideas below and make a creative and colorful graph that represents your information. **Be sure to have a rough draft of your graph approved by your teacher before preparing your final copy.**

   - Show how one item's price has changed over time (ex. The price of bread in 1950, 1960, 1989, etc.)
   - Show today's current average prices (as you have determined them) of different food items.
   - Using your own idea, make a graph showing how prices change over time. Obtain permission from your teacher before beginning your graph.



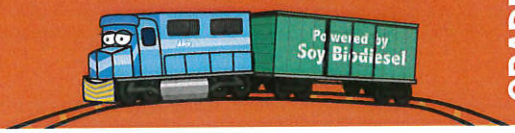
Average Prices of Food – Retail*

(Prices are in cents per pound, unless otherwise indicated)

esYear	Apples	Bread	Whole Milk 1/2 Gallon	Tomatoes	Bacon	Potatoes	Chicken	Sugar (5 lbs.)	Eggs (Dozen)	Butter	Corn Flakes
1950	12.0	14.3	38.6	24.3	63.7	4.6	59.5	48.7	60.4	72.9	18.5
1960	16.2	20.3	49.4	31.6	65.5	7.2	42.7	58.2	57.3	74.9	25.8
1970	21.9	24.3	57.4	42.0	94.9	90.0	40.8	64.8	61.4	86.6	31.5
1980	63.0	51.0	87.3	67.0	146.0	20.4	70.9	215.0	93.0	188.0	79.7
1988	73.0	61.0	116.0	83.0	188.0	26.0	85.0	182.0	79.0	216.0	N/A
1989	69.0	66.0	126.9	91.0	178.0	30.6	92.7	185.0	100.0	213.0	N/A
1990	72.0	70.0	142.0	53.0	213.0	33.8	90.0	200.0	101.0	N/A	146.0
1995	76.0	78.0	117.0	89.0	221.0	36.1	107.0	214.0	175.0	222.0	204.0
2000	81.0	83.1	123.0	99.0	247.0	37.9	109.0	222.0	189.0	232.0	209.0

* Obtained from the United States Department of Agriculture and the California Department of Food and Agriculture.

Export



GRADES 3 4

TEACHER GUIDE

The teacher will give a brief description of the concept of importing and exporting. Students will play a matching game to reinforce the information. After the game, the teacher will lead a class discussion about what the students learned about importing and exporting from the game. The activity will culminate with the students writing a brief paragraph that explains the reason for importing/exporting using the terms import, export, trade, scarcity, and surplus.

1. Create the import/export chart for the overhead. Display the chart while discussing with the class the terms and how it works.

2. Print the dark-orange cards and light-orange cards. Cut out and hand one dark-orange card and one light-orange card to each student. Students will collect the import card they need and give away the export card. Explain to them they should import what they need that is scarce and export the item that they have in surplus. Have them complete the game by moving among their peers to find their matches.

3. Once all matches have been made, regroup as a class and discuss the findings of the game. Reinforce the terms and purposes of importing/exporting.

4. Leaving the overhead chart for students to view, ask them to write a short paragraph. The paragraph should include the following:

   - Description of the concept of trade.
   - Explanation of what importing is and why countries import products (students should mention scarcity).
   - Explanation of what exporting is and why countries export products (students should mention surplus).

IL State Learning Standards Late Elementary English/Language Arts 1B2a, 1B2c, 1C2a, 3A2, 3B2a, 3B2b, 3B2c, 3B2d, 4A2a, 4A2b, 4A2c, 4B2b. Social Science 15A2a, 15B2a, 15B2c, 15C2b, 15D2a

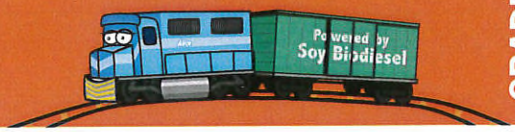
ILLINOIS SOYBEAN ASSOCIATION

Funded by the soybean checkoff.

www.ilsoy.org

www.podtoplate.org

Export



GRADES 3 4

IMPORTS/EXPORTS

TRADE: The act of buying, selling, or exchanging goods.

SCARCITY: Shortness of supply. Something is needed.

SURPLUS: When you have too much of something.

IMPORT: To bring in products from a foreign country.

EXPORT: To ship out products to other countries, exit the country.

EXAMPLE: The United States has a surplus of soybeans. We have more than we need to use. Soybeans are scarce in Mexico so they need more. To help each other, the United States and Mexico trade soybeans for money. Mexico gives the United States money for the soybeans. The soybeans exit the United States and go into Mexico. Mexico imports the soybeans and the United States exports them.

IL State Learning Standards Late Elementary English/Language Arts 1B2a, 1B2c, 1C2a, 3A2, 3B2a, 3B2b, 3B2c, 3B2d, 4A2a, 4A2b, 4A2c, 4B2b. Social Science 15A2a, 15B2a, 15B2c, 15C2b, 15D2a

ILLINOIS SOYBEAN ASSOCIATION

Funded by the soybean checkoff.

www.ilsoy.org

www.podtoplate.org

Export

GRADES 3 4

IL State Learning Standards Late Elementary English/Language Arts 1B2a, 1B2c, 1C2a, 3A2, 3B2a, 3B2b, 3B2c, 3B2d, 4A2a, 4A2b, 4A2c, 4B2b. Social Science 15A2a, 15B2a, 15B2c, 15C2b, 15D2a

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Import Cards

MEXICO EXPORT: DVDs IMPORT: SOYBEAN	**CHINA** EXPORT: TOYS IMPORT: MEDICINE	**JAPAN** EXPORT: CARS IMPORT: AIRPLANES	**TAIWAN** EXPORT: COMPUTER PARTS IMPORT: SOY OIL
INDIA EXPORT: CLOTHING IMPORT: SOY MEAL	**BRAZIL** EXPORT: HOUSEHOLD APPLIANCES IMPORT: FERTILIZER	**TURKEY** EXPORT: IRON IMPORT: COTTON	**GERMANY** EXPORT: ENGINE PARTS IMPORT: CHEMICALS
CANADA EXPORT: NATURAL GAS IMPORT: PLASTIC	**POLAND** EXPORT: FURNITURE IMPORT: COAL	**RUSSIA** EXPORT: STEELMAKING MATERIALS IMPORT: TRACTORS	**SOUTH KOREA** EXPORT: PETROLEUM PRODUCTS IMPORT: CORN
RUSSIA EXPORT: PESTICIDES IMPORT: MEAT	**CHINA** EXPORT: FOOTWEAR IMPORT: COPPER	**ITALY** EXPORT: JEWELRY IMPORT: MEDICAL EQUIPMENT	**SPAIN** EXPORT: VEGETABLES IMPORT: BARLEY
INDONESIA EXPORT: RUBBER IMPORT: WHEAT	**CANADA** EXPORT: ALUMINUM IMPORT: TRUCKS	**JAPAN** EXPORT: MACHINE TOOLS IMPORT: ORGANIC CHEMICALS	**GERMANY** EXPORT: TESTING INSTRUMENTS IMPORT: PRECIOUS METALS

Export Cards

UNITED STATES EXPORT: SOYBEANS IMPORT: DVDs	UNITED STATES EXPORT: MEDICINE IMPORT: TOYS	UNITED STATES EXPORT: AIRPLANES IMPORT: CARS	UNITED STATES EXPORT: SOY OIL IMPORT: COMPUTER PARTS
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UNITED STATES EXPORT: WHEAT IMPORT: RUBBER	UNITED STATES EXPORT: TRUCKS IMPORT: ALUMINUM	UNITED STATES EXPORT: ORGANIC CHEMICALS IMPORT: MACHINE TOOLS	UNITED STATES EXPORT: PRECIOUS METALS IMPORT: TESTING INSTRUMENTS

Edible Numbers

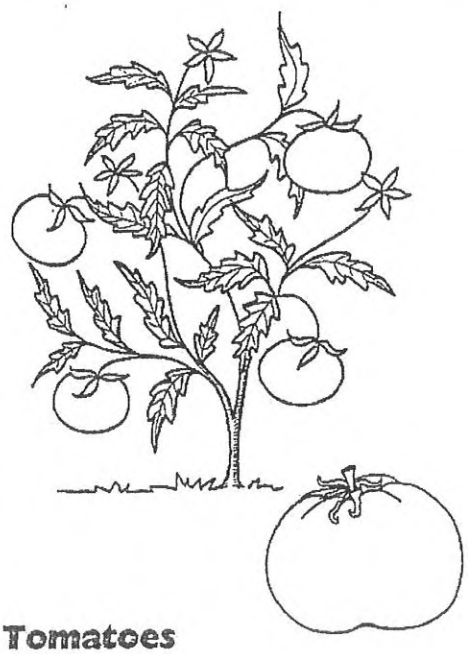
Grades 3-4
Grades 5-6

Authors
Pamela Emery
Gina Hieb

Scavenger Hunt
through grocery
ads

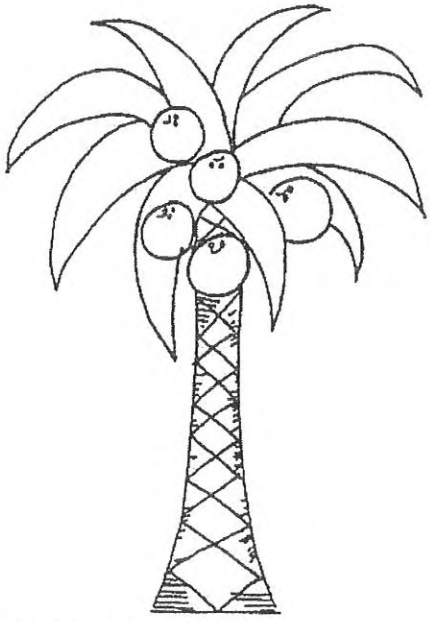
California Foundation for Agriculture in the Classroom

Food Pictures #1

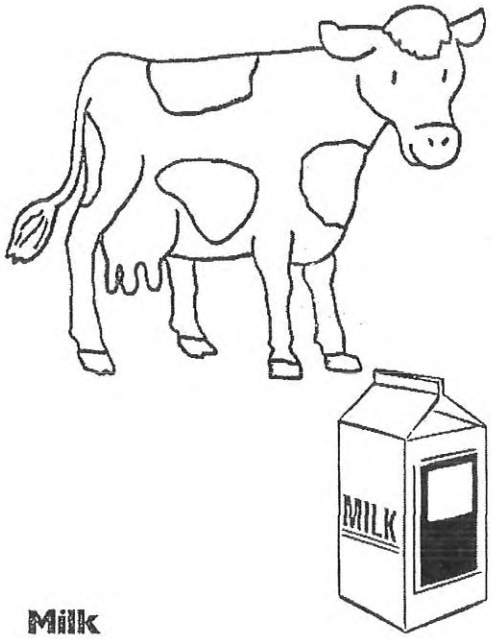


Tomatoes

Pumpkins



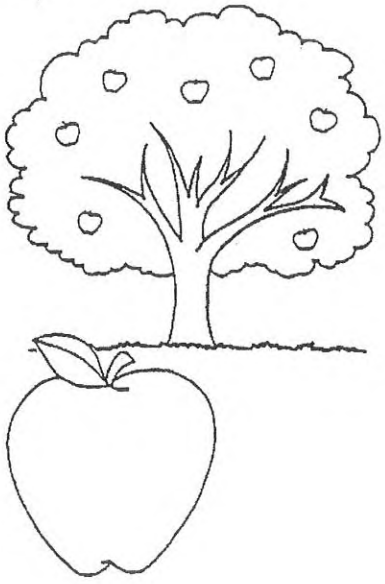
Coconuts



Milk

California Foundation for Agriculture in the Classroom

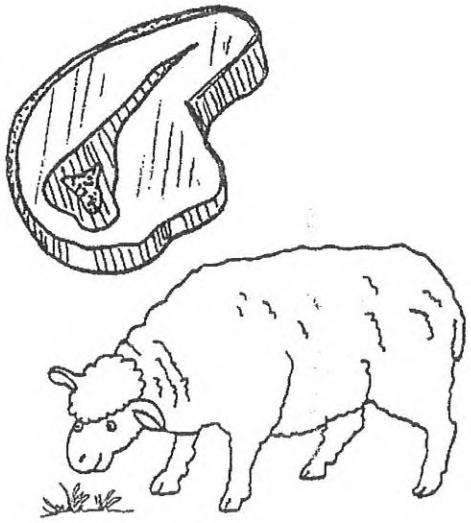
Food Pictures #2



Apples

Rice

Peanut Butter

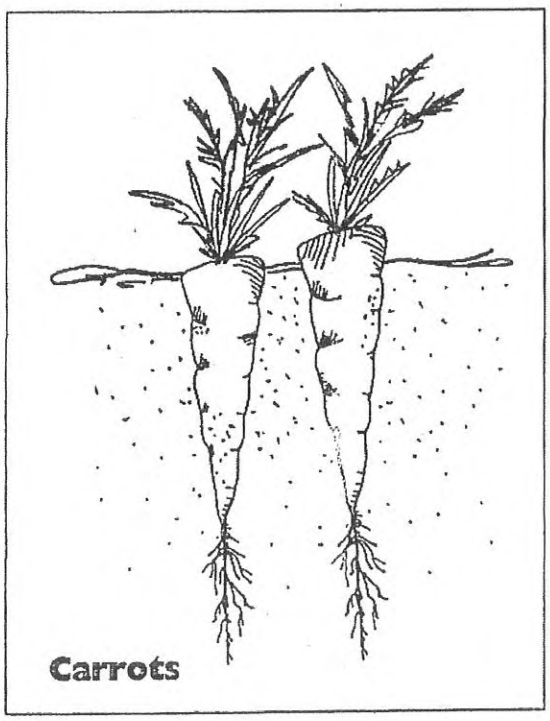


Lamb Chops

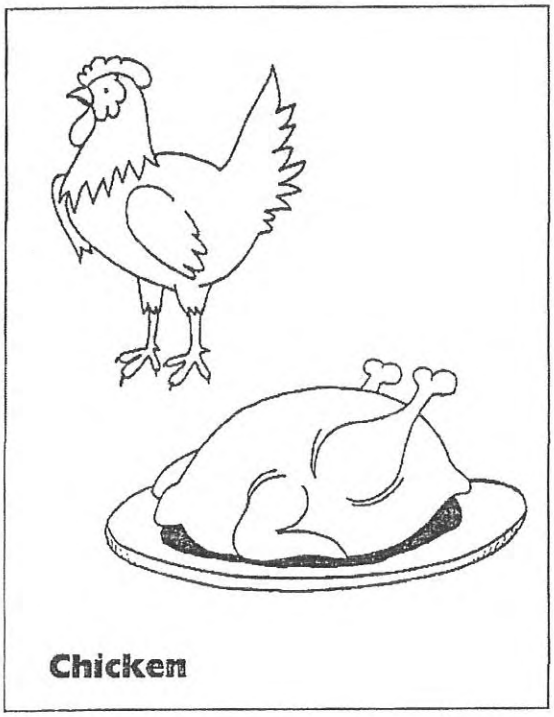
California Foundation for Agriculture in the Classroom

Food Pictures #3

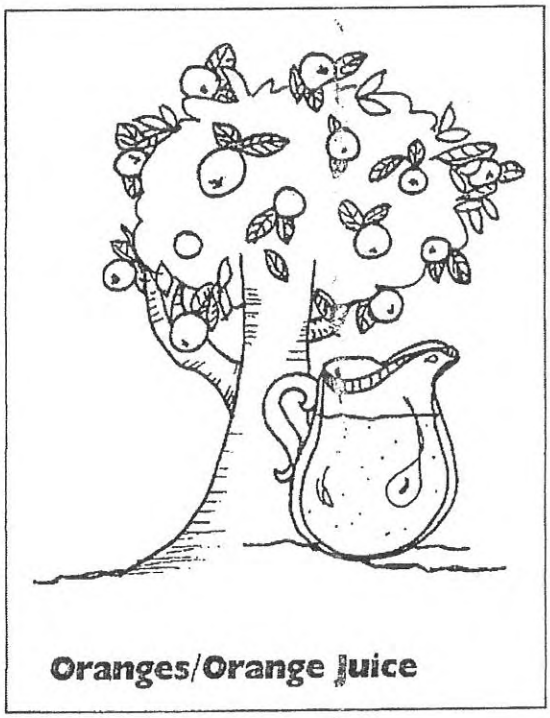
Peas



Carrots



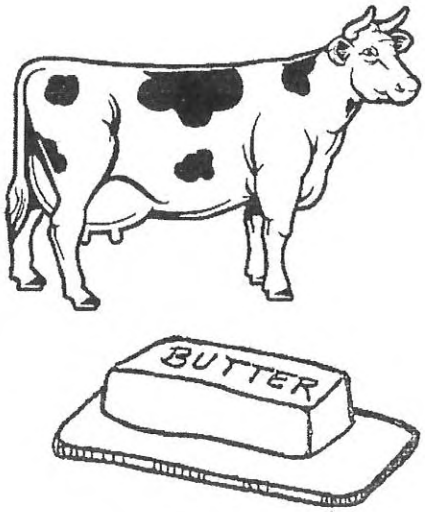
Chicken



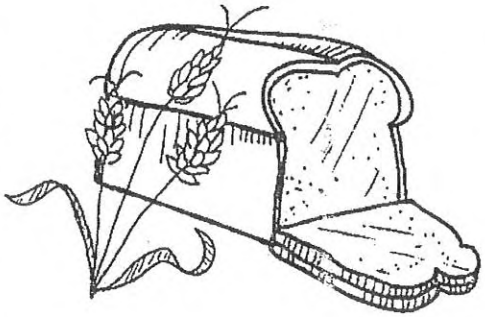
Oranges/Orange Juice

California Foundation for Agriculture in the Classroom

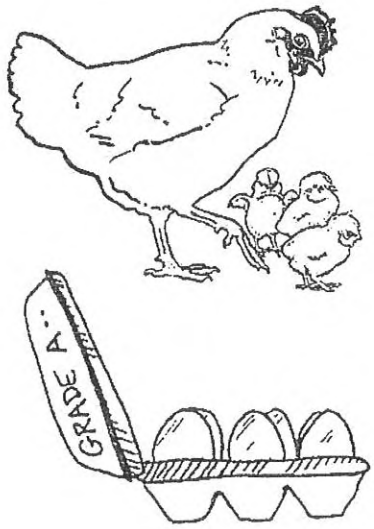
Food Pictures #4



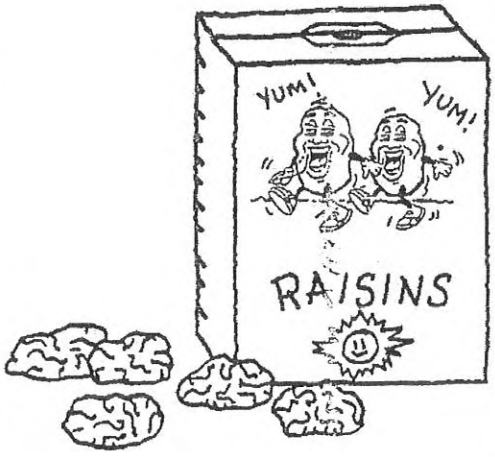
Butter/Cheese



Bread/Wheat



Eggs

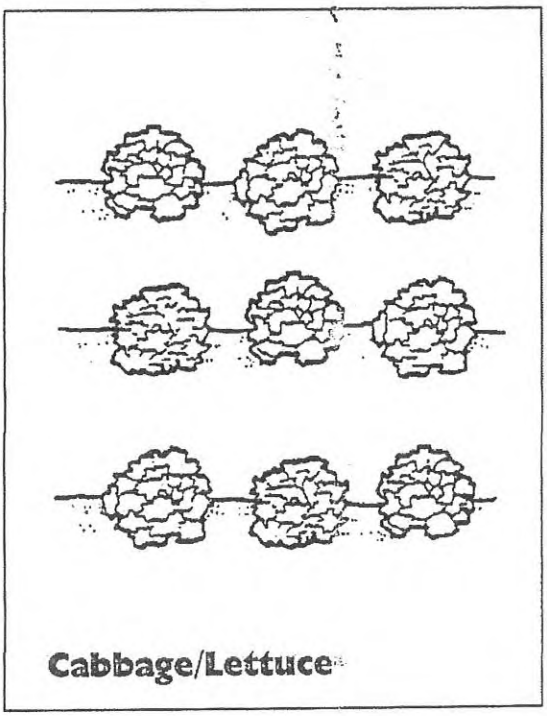


Raisins

California Foundation for Agriculture in the Classroom

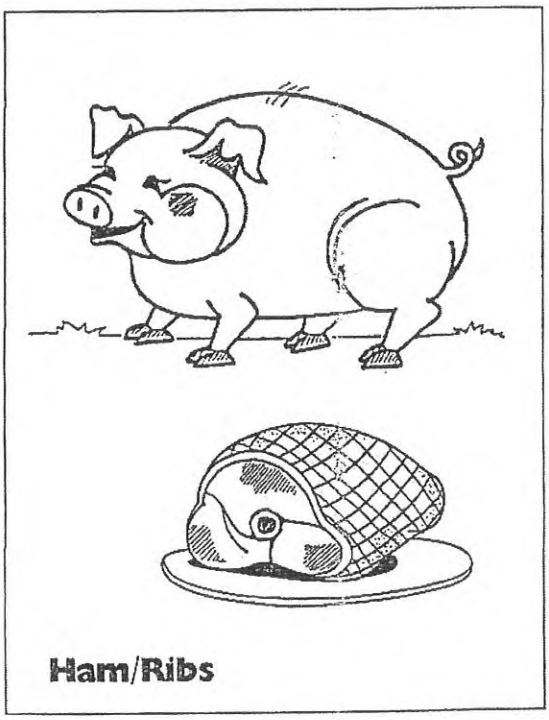
Food Pictures #5

Peanuts



Cabbage/Lettuce

Peas/Beans

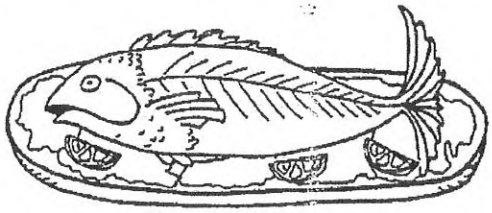


Ham/Ribs

California Foundation for Agriculture in the Classroom

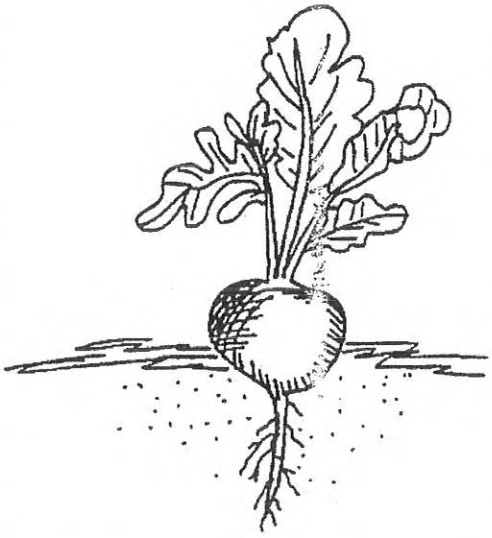
Food Pictures #6

Bananas



Fish

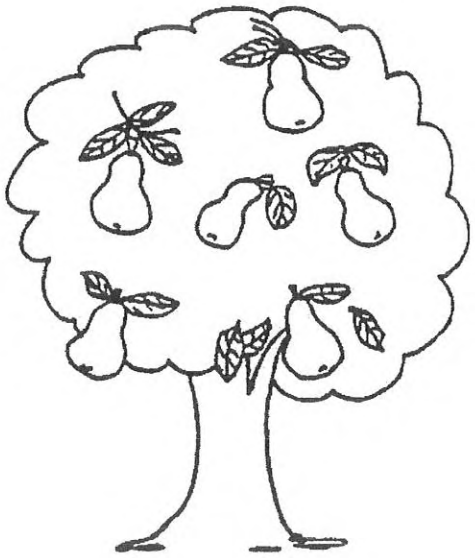
Grapes



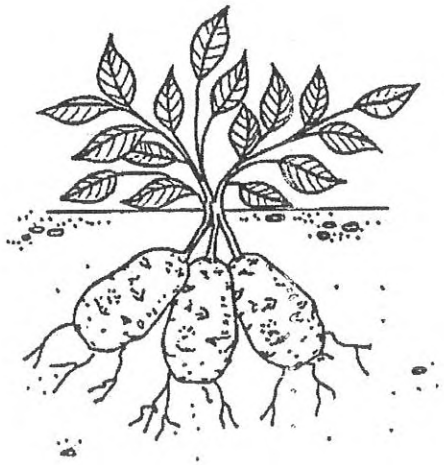
Radishes

California Foundation for Agriculture in the Classroom

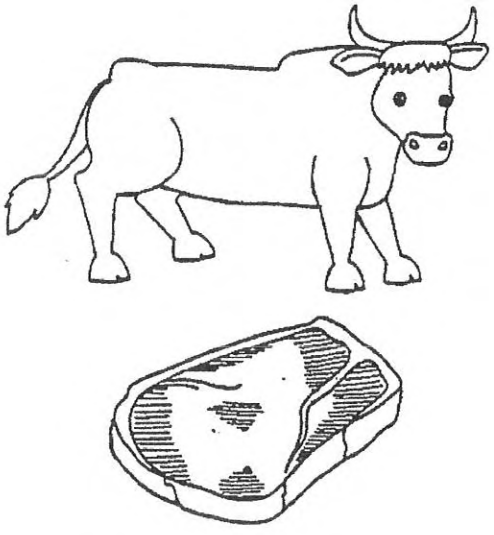
Food Picture #7



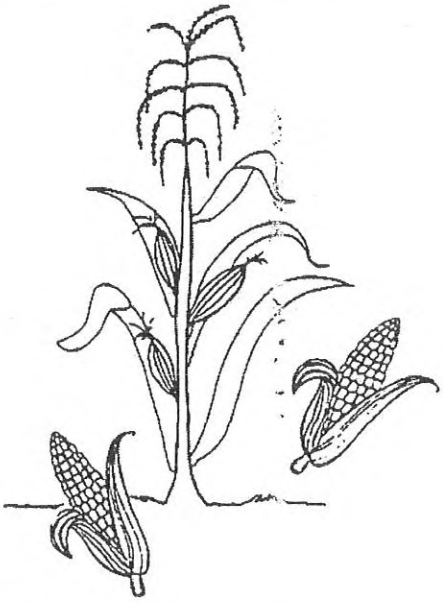
Pears



Potatoes



Steak



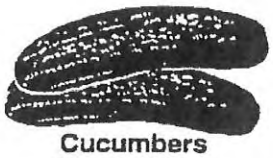
Corn

California Foundation for Agriculture in the Classroom

Sample Grocery Ads #1

Ketchup
100% Natural
28 oz.

99¢



Cucumbers
Firm and Green

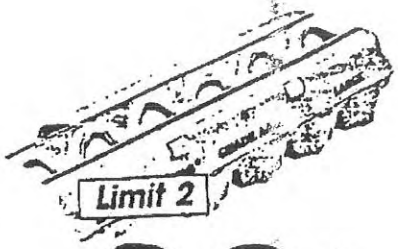
49¢ EACH

New Low Price

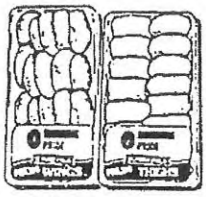
Lowfat Milk

4.07

Large AA Eggs



99¢ DOZEN



Chicken Wings
Chicken Thighs

79¢ LB.

String Cheese
8 Oz. Pkg.

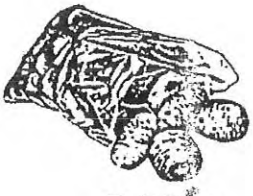
2.19

Apple Juice
12 Oz. Can

89¢

Baby Carrots

1.99 BAG



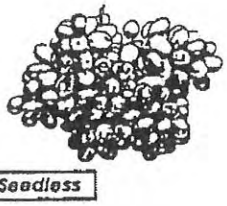
Potatoes
5 Lb. Bag

99¢ EACH

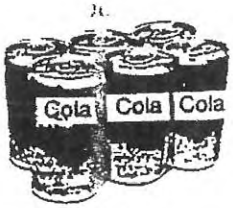
California Foundation for Agriculture in the Classroom

Sample Grocery Ads #2

Quick Rice
28 Oz. Package
1.99



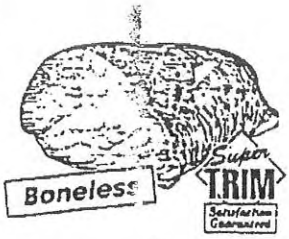
Red Grapes
1.69
Lb.



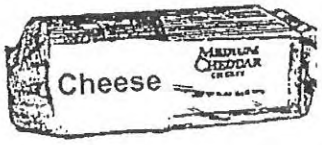
Cola
6-Pack 33 Oz.
1.79

Extra Lean Meat Franks
1 Lb. Package
1.49

Canned Dog Food
13.2 Oz. Regular or Prime Cuts or Canned Cat Food, 13 Oz. Assorted
2 for $1



Rump Roast
Beef Round or Sirloin Tip Roast
1.99
Lb.



Medium Cheddar
2 Lb. Package
5.79

Bread
Selected Varieties
1 Lb. Loaf
99¢

Salad Mix
EACH
1.99

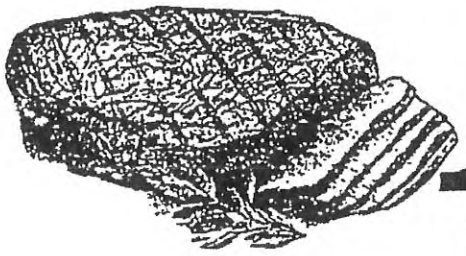
Bag Vegetables
Corn
99¢
16 Oz

California Foundation for Agriculture in the Classroom

Sample Grocery Ads #3

Round Steak

Super TRIM
Satisfaction Guaranteed



1.69 Lb

Lean Ground Beef
Not To Exceed 15% Fat

1.49 LB.

Low Fat Ice Cream
Assorted Flavors
Cholesterol Free
64 ounce carton

2 for $6

Mashed Potatoes

1.79 13 Oz.

Granulated Sugar
5 Pound Bag
1.97

Bagels
Selected Varieties
6 Oz. Pkg.
99¢

Kidney or Garbanzo Beans
15 1/4 to 15 1/2 Oz.
Regular or Lite

2 for $1

Fat Free Ricotta
2 Lb. Container
3.79

Flour
1.35 5 Lb

Flour Tortillas
79¢ 18 Oz.

Whole Asparagus
15 Oz
1.99 15 Oz

I Am What I Eat!

Grades 3-4

Name _____

Date _____

Instructions: List the foods you eat for dinner and dessert tonight. Place checks in the appropriate boxes. Bring this completed list back to class.

Food	Grows on Trees	Grows Above Ground But Not on a Tree	Grows Underground	Comes From an Animal	Food of Other Origin

Food Intake Record

Grades 5-6

Name _____

Date _____

Instructions: Record the food you eat for one 24-hour period. Bring this paper to class on the date indicated by your teacher.

Food	# of Servings	Bread, Cereal, Rice, and Pasta	Fruit	Vegetable	Milk, Yogurt and Cheese	Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts	Fats, Oils, and Sweets

Let's Eat!

Name(s) _____

	Ingredient	Food Group	Where Food Comes From
BREAKFAST			
LUNCH			
DINNER			

Scavenger Hunt I

Name(s) _____

_____

Instructions: 1. Read the math problem.
2. Find grocery ads you can use to solve the problem.
3. Cut the ads out of the newspaper and tape the ads on top of the problem.
4. Show your work in an organized fashion, on a separate sheet of paper. Be sure to write neatly and check your work!

1. Find a food that grows on a tree that costs less than a half dollar per pound.	2. Find a green food that you might put in a salad whose price has a nine in the hundredth's place.
3. Find the total price of two different canned vegetables you like to eat whose sum has a three in the ones place.	4. Find a fresh vegetable that costs more than three dimes per pound.
5. Find the price of two pounds of a yellow, orange, or green food that grows on a vine.	6. Find the total cost of two pounds of meat that comes from a steer and one pound of meat that comes from a pig.
7. Find a food made of potatoes whose total cost is over four quarters. Write the price as a decimal.	8. Find the difference in price between two different foods that grow underground.
9. Find the total cost of ½ pound of a fruit whose price per pound ends in an even number.	10. Find a red or green food that grows on a tree. It must cost more than two nickels per pound, but less than nine dimes per pound.
11. Find the total price of three pounds of a fruit and one pound of a leafy vegetable.	12. Write, in words, the total price of three pounds of an underground vegetable.

Scavenger Hunt 2

Name(s) _____

_____

Instructions: 1. Read the math problem.
2. Find grocery ads you can use to solve the problem.
3. Cut the ads out of the newspaper and tape the ads on top of the problem.
4. Show your work in an organized fashion, on a separate sheet of paper. Be sure to write neatly and check your work!

1. Find a dairy product whose price has a nine in the tenths place. How much will three of these items cost?	2. Find a food made of grain that costs more than 89¢ but less than $2.89. Is three one of its prime factors?
3. Find the total cost of two pounds of pork and one pound of beef. Convert your answer to a fraction and reduce to simplest terms.	4. Find the cost of one pound of a vegetable and one pound of lean beef whose total sum contains an eight in the hundreths place.
5. Find the price of one food that contains both grain and fruit. Round the price to the nearest dollar.	6. Find the total cost of three items you could use to make dinner for your family. Include one vegetable and one source of protein *(be sure to state the quantity of each item).*
7. Find the mean price per pound of two types of citrus fruit. Round your answer to the nearest dime.	8. Find the cost of four grain products whose total is over eight and three-fourths dollars.
9. Find a food that costs the same backwards as it does forwards. This is called a palindromic number.	10. Find the total cost of four different products that partially or completely come from plants.
11. Find an item that is sold in multiple pound quantities. Determine the price per pound. Round your answer to the nearest cent.	12. Convert the price of two pounds of leaves to a fraction. Reduce the fraction to lowest terms.

What Crops are in Your Shopping Basket?

Team Building Activity

1. Each group will be placed at a different station. Each station will have a group of product cards based on a commodity.
2. Corn, wheat, and soybeans contain 8 cards and cotton, sunflowers, and sorghum only contain 4 cards. Use your knowledge of the class to determine the number of cards to use. *(Younger grades should use less, etc.)*
3. Mix the crop commodity cards with the non-crop cards.
4. Students will have 2 minutes to work with their group to decide which products contain their station's crop.
5. Have the students rotate around and complete the six stations with the teacher checking for accuracy at each station.
6. After the stations activity is complete have the students come back together as a class.
7. Discuss some what they had found. Where there any surprises?

Conclusion Questions (Assessments)

1. What is a crop commodity? Name two.
   An agricultural product that can be traded or sold. Examples: Corn, wheat, milo, soybeans, cotton, etc.

2. What were a few surprises you found during the stations?
   Individual answers will vary.

Resources

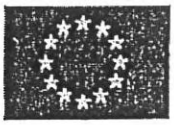
Exploring Plants: Crops Educator's Guide. Unit 4 - Kansas Crops.
Kansas Foundation for Agriculture in the Classroom. *To order, www.ksagclassroom.org*

Want More? Extensions

To add more depth to this lesson, you could tie in food selection. Show the students examples of food ingredient lists and how to read what items are in the food product. Mention that the items listed first are in a larger quantity than later listed items. Possibly develop a worksheet for the students to practice. Mention the importance of reading labels for individuals with food allergies.

Appendix

Crop Commodity: A good produced that is traded and exchanged with others. Examples are corn, wheat, etc.



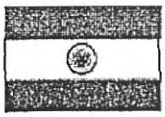
European Union

Imports:

cocoa beans	coffee	tea
rice	soybeans	spices

Exports:

wheat	beef	pork



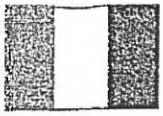
India

Imports:

soybeans	cotton	fruits

Exports:

seafood	rice	tea
coffee	spices	



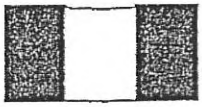
Cote d'Ivoire

Imports:

rice	wheat	corn

Exports:

fruit	cocoa beans	coffee
cotton		



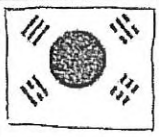
Australia

Imports:

rice	vegetables	soybeans
fruits	tea	

Exports:

beef	seafood	wheat
pork	cotton	



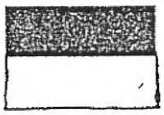
South Korea

Imports:

beef	pork	soybeans
corn	wheat	cotton

Exports:

fruits	tea	seafood



Indonesia

Imports:

cotton	wheat	soybeans
corn		

Exports:

coffee	spices	rice
fruits	seafood	cocoa beans

CIRCLES OF THE EARTH BRACELET
COURTESY OF ILLINOIS FARM BUREAU
AG IN THE CLASSROOM
www.agintheclassroom.org

Circles of the Earth bracelets are great craft items, and using them is a great lesson for your students as they prepare for Earth Day celebrations and discover the circles of the Earth.

Materials for Circles of the Earth bracelets can be purchased at most craft stores.

1 12"-14"	Brown leather strap	
1 Small	Clear adjuster bead	People
1 Small	Blue adjuster pony bead	Water
1 Small	Green pony bead	Plants
1 Small	Brown pony bead	Soil
1 Small	Orange pony bead	Day
1 Small	Black pony bead	Night
1 Small	White pony bead	Air
1 Small	Yellow pony bead	Sun

Tie a knot on one end of the leather strap at about 4"-5". String the colored beads to represent the circles of the Earth. Take the end of the leather strap without a knot and lace it through the clear "People" bead. Tie a knot at the end. (Now your clear "People" bead is an adjuster for the bracelet.)

People move in circles. The earth provides us with everything we need to survive. We must take great care of our valuable resources! Clear Bead = People

Water is a circle. Water rains down on land. Water collects in oceans, rivers, lakes, and streams. It evaporates back up into the sky and collects in clouds. The clouds become heavy, and rain falls down to land again. Blue Bead = Water

Plants and soil are circles. Plants grow from soil. Plants provide food for animals. Animals provide food for other animals. Animals die and decompose. New soil is made. New plants grow. Plants = Green Bead Soil = Brown Bead

Earth is a circle. Earth is spinning through space, rotating on its axis, revolving around the Sun. The Earth and Sun give us the circle of the seasons and the circle of night and day. Day = Orange Bead Night = Black Bead

Air is a circle. Animals breathe in oxygen and exhale carbon dioxide. Plants take in carbon dioxide, use it to make food, and give off oxygen. Animals breathe it in again. Air = White Bead

The Sun is a circle. The Sun provides warmth for light for all of the Earth's circles. Without the Sun, plants and animals would not survive. The Sun binds us together. Sun = Yellow Bead

PART I: FARMLAND

Whole Apple - Planet Earth	1/8 - Habitable Land
¾ - Water	3/32 - Habitable, but Unarable Land
¼ - Land	1/32 - Arable Land
1/8 - Uninhabitable & Unarable Land(poles, deserts, swamps, mountains)	1/32 - Peel - Topsoil

1. Hold the apple out so the class can see it.
   "This apple represents our planet."
2. Cut the apple into quarters. Hold out ¾ in one hand and ¼ in the other.
   "What do these ¾ represent? (Water.) So, only ¼ of the Earth's surface is land."
3. Set the ¾ representing water aside. Slice the remaining ¼ representing land in half, lengthwise. Take 1/8 in each hand, and hold out one of them.
   "1/8 of the Earth's surface, or half of all land, is inhospitable to people and to crops: these are the polar regions, deserts, swamps, and high or rocky mountains."
4. Set that 1/8 aside and hold out the other.
   "This 1/8 of the Earth's surface, the other half of all land, represents the total area on which people can live, but can't necessarily grow food."
5. Slice the 1/8 lengthwise into four pieces. Hold out 3/32 in one hand and 1/32 in the other.
   "Each of these pieces represents 1/32 of Earth's surface. These three represent land that never was arable because it's too rocky, wet, cold, steep or have soil too poor to produce food. They also contain land that was once arable but I no longer because they've been turned into cities, suburbs, highways, shopping centers, schools, parks, factories, parking lots and other forms of development that makes them incapable of growing food."
6. Set 3/32 aside and hold out 1/32.
   "So, only 1/32 of the Earth's surface has the potential to grow the food needed to feed all the people on Earth."
7. Carefully peel the 1/32 slice of Earth, and hold this peel up so they can see it.
   "This tiny bit of peeling represents the topsoil, the dark, nutrient-rich soil that holds moisture and feeds us by feeding our plants. The U.S. currently loses an inch of topsoil every 16 years. Because it takes nature 500 years to build one inch of topsoil, (1) it is considered a non-renewable resource."

The Earth As An Apple

Hold Up an Apple – This Represents the Whole Earth – ¾ of the Earth is Water!
Cut Apple in Half – And then cut one of the halves in quarters – One quarter of the apple represents the total land area

Take one quarter and cut it into eighths

One Eighth is where people live, but not necessarily where they grow their food

Take the other 1/8 and divide it into 4 pieces (side cuts)

Three of the four pieces represent areas that are too rocky, too wet, too cold, too

steep or with soil that is too poor to actually produce food.

Some of this is land is buried under cities, highways, suburban developments, shopping centers and other structures that people build.

This leaves 1/32 of that apple that represents the earth – Peel the tiny bit of peeling – This tiny bit of peeling represents the surface, the very skin of the earth's crust upon which mankind depends. Less than five feet deep, it is a quite fixed amount of food producing land.

Now you should realize that protecting our land resources are so important. Advanced agricultural technology has enabled the world to feed many of its people. But, with a fixed land resource base and an ever increasing number of people trying to feed themselves from that fixed base, each person's portion becomes smaller and more important to the individual person. We must protect the environmental quality of our air, water and land.

FUN CONSERVATION SONGS

YOU ARE MY SOIL

(Sung to the tune of "You are my sunshine")

You are my soil...my only soil;
You keep me vital, night and day.
This much I know friend, you do support me,
Please don't erode my life's soil away!

DIG, DIG, DIG YOUR PIT

(Sung to the tune of "Row, Row, Row Your Boat")

Dig, Dig, Dig your pit,
Dig it nice and steep.
Shovel, shovel, shovel, shovel
Until it is a meter deep!

I LOVE DIRT

(Sung to the tune of "Three Blind Mice")

I love dirt, I love dirt,
It won't hurt, on my shirt.
I love to quirt it with a hose,
I love to squish it between my toes,
The fun we have just grows and grows
Oh, I love dirt, I love dirt.

WHERE HAVE ALL THE BEDROCKS GONE?

(Sung to "Where Have All the Flowers Gone?")

Where have all the bedrocks gone?
Long time weathering,
Where have all the bedrocks gone
That formed so long ago?
Where have all the bedrocks gone?
Gone to sediments and vital soil...
When will we ever learn, when will we ever learn?

FUN CONSERVATION SONGS

OH GIVE ME A HOME ON A DEEP MELLOW LOAM

(Sung to "Home, Home, On the Range")

Oh, give me a home on a deep mellow loam,
That supports the trees and the grass;
Where we hardly recall a bad crop year at all
And the crickets rejoice as we pass.
Home, home on the loam,
That supports the trees and the grass.
Where we hardly recall, a bad crop year at all;
And the crickets rejoice as we pass.

PURELY PITTY

(Sung to the tune of "Jingle Bells")

Had a pit, cement in it, couldn't dig no more.
We were glad, cold and sad
Our hands were dirty and sore...ore
We had to dig, deeper still, a meter from the top,
It was hard and rough, but we were tough,
And digging never stopped!

Say It With Soil

Soil Quotes Handout

⇒ Soil, like faith, is the substance of things hoped for, the evidence of things not seen. It is the starting point for all living things that inhabit the earth. -Firman E. Bear; 1986

⇒ I know of no pursuit in which more real and important services can be rendered to any country than by improving its agriculture. -George Washington; July 20, 1794

⇒ The soil is the source of life, creativity, culture and real independence. -David Ben Gurion, Hazon VeDerek; 1950s

⇒ There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace. -Aldo Leopold; 1949

⇒ A nation that destroys its soil, destroys itself. -Franklin D. Roosevelt; 1937

⇒ A conservationist is one who is humbly aware that with each stroke he is writing his signature on the face of the land. -Aldo Leopold; 1949

⇒ When tillage begins, other arts follow. The farmers therefore are the founders of human civilization. -Daniel Webster; 1840

⇒ If in the human economy, a squash in the field is worth more than a bushel of soil, that does not mean that food is more valuable than soil; it means simply that we do not know how to value the soil. In its complexity and its potential longevity, the soil exceeds our comprehension; we do not know how to place a just market value on it, and we will never learn how. Its value is inestimable; we must value it, beyond whatever price we put on it, by respecting it. -Wendell Berry; 1995

⇒ We know more about the movement of celestial bodies than about the soil underfoot. - Leonardo DaVinci; 1500s

⇒ Essentially, all life depends upon the soil...There can be no life without soil and no soil without life: they have evolved together. -Charles E. Kellogg; 1938

⇒ ...the Latin name for man, homo, derived from humus, the stuff of life in the soil. -Dr. Daniel Hillel; late 1900s

⇒ I saw all the people hustling early in the morning to go into the factories and the stores and the office buildings, to do their job, to get their check. But ultimately it's not office buildings or jobs that give us our checks. It's the soil. The soil is what gives us the real income that supports us all. -Ed Begley; late 1900s

⇒ Plowed ground smells of earthworms and empires. -Justin Isherwood; 1990

⇒ Soil erosion is as old as agriculture. It began when the first heavy rain struck the first furrow turned by a crude implement of tillage in the hands of prehistoric man. It has been going on ever since, wherever man's culture of the earth has bared the soil to rain and wind. -Hugh H. Bennett and W.C. Lowdermilk; 1930s

⇒ We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. -Aldo Leopold; 1949

⇒ I bequeath myself to the dirt, to grow from the grass I love; If you want me again, look for me under your boot soles. -Walt Whitman; 1855

⇒ We are part of the earth and it is part of us...What befalls the earth befalls all the sons of the earth. -Chief Seattle; 1854

⇒ Each soil has had its own history. Like a river, a mountain, a forest, or any natural thing, its present condition is due to the influences of many things and events of the past. -Charles Kellogg; 1956

⇒ Nature has endowed the earth with glorious wonders and vast resources that man may use for his own ends. Regardless of our tastes or our way of living, there are none that present more variations to tax our imagination than the soil, and certainly none so important to our ancestors, to ourselves, and to our children. -Charles Kellogg; 1956

⇒ Man and man's earth are unexhausted and undiscovered. Wake and listen! Verily, the earth shall yet be a source of recovery. Remain faithful to the earth, with the power of your virtue. Let your gift -giving love and your knowledge serve the meaning of the earth. -Friedrich Nietzche; 1870's – 1880s

⇒ A cloak of loose, soft material, held to the earth's hard surface by gravity, is all that lies between life and lifelessness. -Wallace H. Fuller; 1975

⇒ I cannot conceive of the time when knowledge of soils will be complete. Our expectation is that our successors will build on what has been done, as we are building on the work of our predecessors. -R.S. Smith; 1928

⇒ Soils are developed; they are not merely an accumulation of debris resulting from decay of rock and organic materials...In other words, a soil is an entity – an object in nature which has characteristics that distinguish it from all other objects in nature. -C.E. Millar & L.M. Turk; 1943

⇒ We spend our lives hurrying away from the real, as though it were deadly to us. "It must be somewhere up there on the horizon," we think. And all the time it is in the soil, right beneath our feet. -William Bryant Logan; 1996

⇒ The wealth of Illinois is in her soil and her strength lies in its intelligent development. -Draper; 1899

Did You Know?

Φ Shrinking and swelling of some kinds of soil damages buildings, roads, and other structures. Repairing this damage costs our Nation more each year than repairing the total damage from hurricanes, tornadoes, and floods.

Φ The tips of small plant roots move through the soil with a twisting screw-like motion. Mature trees can have as many as five million active root tips.

Φ A single spade full of rich garden soil contains more species of organisms than can be found above ground in the entire Amazon rain forest.

Φ Although the soil surface appears solid, air moves freely in and out of it. The air in the upper eight inches of a well-drained soil is completely renewed about every hour.

Φ The plants growing in a 2-acre wheat field can have more than 30,000 miles of roots, greater than the circumference of the Earth.

Φ The wonderful "earthy" smell of newly plowed ground is believed to result from chemicals produced by microorganisms. One of these chemicals, called geosmin, is produced by actinomycetes, organisms that have some properties of both bacteria and fungi.

Φ About 10 percent of the world's land is used to grow plants and to feed either animals or humans. About 20 percent of the land in the United States is used to grow crops.

- Soil can act as either a sink or a source of greenhouse gases. An estimated 30 percent of the carbon dioxide, 70 percent of the methane, and 90 percent of the nitrous oxide released to the atmosphere each year pass through the soil.
- Worldwide, an estimated 25 percent of the soils used for agriculture are being eroded at an unacceptable rate.
- In the spring of 1934, a dust storm originating in the Great Plains carried an estimated 200 million tons of soil to the Northeastern United States and out to sea. This storm caused "muddy rains" in New York and "black snows" in Vermont.

On the Internet

S.K. Worm: www.nrcs.usda.gov/wps/portal/nrcs/main/national/people/teachstudent/
Backyard Conservation: www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/features/?cid=nrcs143_023574
USDA-Natural Resources Conservation Service in Alabama: www.al.nrcs.usda.gov/

The Dirt on Soil

Soil Horizons and Soil Color

We know less about life in the earth under our feet than we do about the far side of the moon. Yet every plant and animal you can think of depends on the soil for survival. The clothes we wear (cotton), the houses we live in (wood/trees), and the food we eat all exist because of SOIL!

What's the difference between soil and dirt? Dirt is what you find under your fingernails (soil that is out of place). Soil is what you find under your feet. Think of soil as a thin living skin that covers the land. It goes down into the ground just a short way. Even the most fertile topsoil is only a foot or so deep. Soil is more than rock particles. It includes all the living things and the materials they make or change.

Let's take a ride from the surface to the bedrock below. We'll pass several distinct layers, or **horizons**, as we go down. Together, these layers form the soil profile. (Demonstrate the soil horizons using previously collected soil profile samples).

Ground level: Plants grow and animals live here. A thick cover of plants can keep the soil cool, keep it from drying out, and keep it from eroding.
Topsoil (A): Plants grow and animals live in the top layer of the soil. This is sometimes called the organic layer. Decomposers recycle dead plants and animals into humus.
Subsoil (B): This is a mix of mineral particles and some humus near the top. Subsoil is very low in organic matter compared to the topsoil. This is the layer where most of the soil's nutrients are found. Deep plant roots come here looking for water. Clays and minerals released up above often stick here as water drains down.
Weathered parent material (C): This horizon can be very deep. There's no organic matter here at all. We're out of reach of all living and dead organisms down here. It's all rock particles, full of minerals. The entire soil profile used to look like this all the way to the surface. Weathering broke the parent material (rock) up into small pieces.
Bedrock: We finally found solid rock! The bedrock formed before the soil above it. It will wait here until erosion or an earthquake exposes it to the surface. Then some of it will be weathered to become the next batch of parent material. The soil-making process will start all over again.

What is the most obvious difference you see in the soil horizons as you go down the profile? Differences in soil **COLOR**!

The first impression we have when looking at bare earth or soil is of color. We notice red soils, gray soils, black soils, and even the white sand beaches.

(Show examples of previously collected soil samples with color differences.)

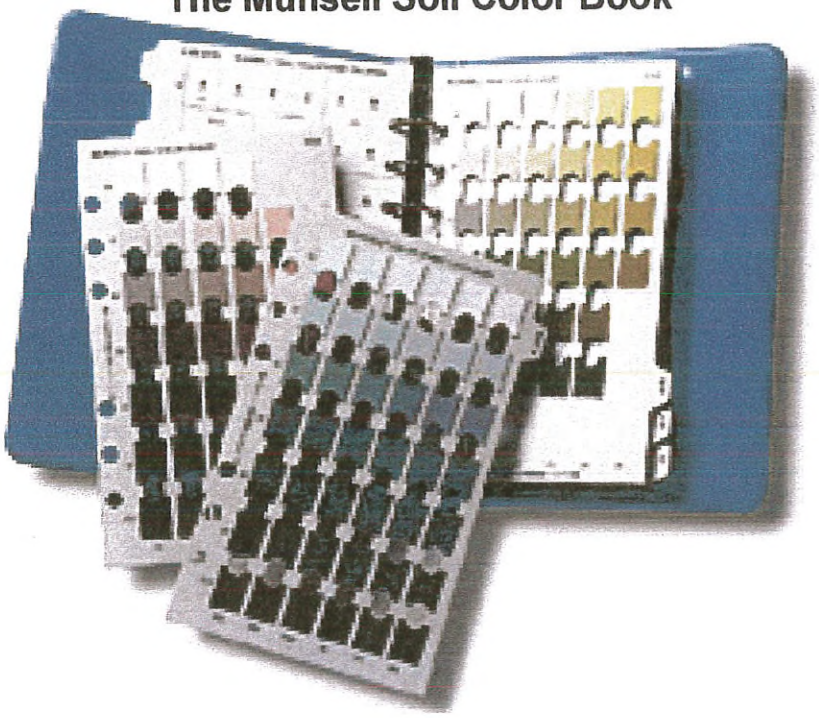
Red, brown, yellow, yellowish-red, grayish-brown, and pale red are all good descriptive colors of soil, but not very exact. Just as paint stores have pages of color chips, soil scientists use a book of color chips that follow the Munsell System of Color Notation. The Munsell System allows for direct comparison of soils anywhere in the world. The system has three components: hue (a specific color), value (lightness and darkness), and chroma (color intensity) that are arranged in books of color chips. Soil is held next to the chips to find a visual match and assigned the corresponding Munsell notation.

Procedure

1. Divide students into groups so that each group has a Munsell Color Book and 2 or 3 different soil samples.
2. Take a ped of soil from each sample and check to see if it is dry or moist. If the soil ped is very dry, lightly moisten it using the water bottle.
3. Break the soil ped into.
4. Stand in a well-lit area (preferably sunlight) and hold the broken side of the ped underneath the color chips.
5. Determine which color chip best matches your soil color.
6. Record the Hue, Value, and Chroma for your soil samples on the data sheet.

Color can tell you a lot about a soil. For example, the color black can indicate organic matter, red can indicate the presence of iron, and gray indicates the presence of a water table. Soil color and other properties including texture and structure are used to distinguish and identify soil horizons (layers) and to group soils according to the soil classification system called Soil Taxonomy. Color development and distribution of color within a soil profile are part of weathering.

The Munsell Soil Color Book



The Dirt on Soil

Soil Horizons and Soil Color

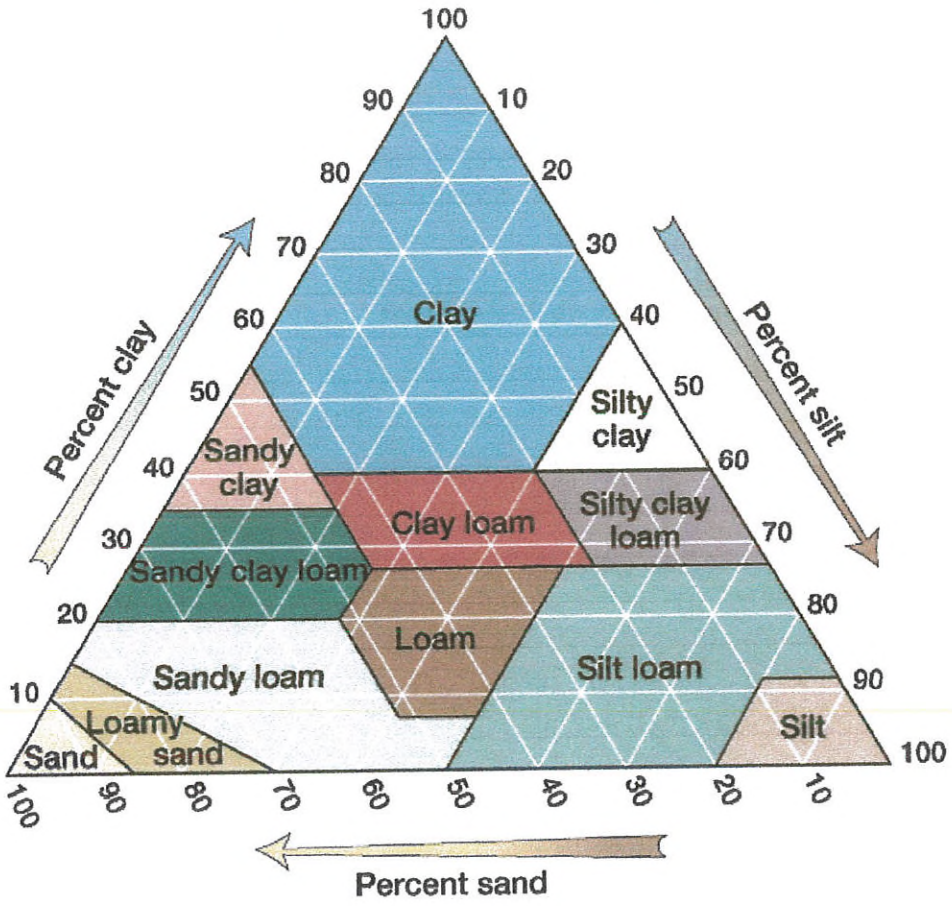
Soil Sample #	Hue	Value	Chroma	Color Description

Soil Texture

The way a soil "feels" is called the soil texture. Soil texture depends on the amount of each size of particle in the soil.

Sand, **silt**, and **clay** are names that describe the size of individual particles in the soil.
Sand particles are the largest particles and they feel "gritty." Sand particles feel rough to the touch because they have rough angular edges and do not "hold" nutrients very well.
Silt particles are medium sized, and they feel soft, silky or "floury." Silt particles have a smooth texture.
Clay particles are the smallest sized particles. They feel "sticky" when wet and they are hard to squeeze. Clay has the ability to hold a lot of nutrients, but because it is very compact, it does not allow air or water to pass through it.

Soil Texture Triangle



The size of particles is a very important characteristic of soil. Smaller particles, like clay, will not let water pass through as easily as larger particles, like sand. Soil that allows water to drain, and not pond, is best for growing gardens, building buildings, and many more uses. However, soils that hold water create good habitats for fish and waterfowl and are good for recreational uses, but not for roads and buildings. Knowing how much sand, silt and clay are in a soil helps determine how much water and heat will be held in soil and move through soil, and also how well nutrients will be held in soil for plant use.

(Allow students to "feel" the texture of several different prepared soil samples of known texture. Discuss the difference between "fine" and "coarse" particles.)

Sand: Too Coarse. Soils with lots of sand have big spaces between the particles. They don't hold water or nutrients. Sand doesn't react with other chemicals. Sandy soils don't stick together very well. Plant roots can't hold onto this soil. But the big spaces do allow air into the soil. There are some plants that are able to grow in sandy topsoil by putting their roots deep, through the sand to the subsoil.
Silt: Too Light. This is material which is finer than sand, but still feels gritty. Silt is commonly found in floodplains and is the soil component that makes mud. Soils with a lot of silt make excellent farm land, but erode easily. This is the soil blown away in dust storms and carried down stream in floods.
Clay: Too Fine. Lots of clay makes the soil heavy and dense. The spaces between soil particles are very tiny. When clay soil is dry, it's almost as hard as concrete. Plant roots can't push through it. No air can get in from the surface.
Loam: Just Right. The perfect soil for plants and soil organisms has about the same amount of sand and silt, plus a smaller amount of clay. This soil has enough large and small spaces for air and water to flow in. Plant roots can easily grow through these spaces. This is what farmers and gardeners are talking about when they call a soil "a loam" or "loamy."

Procedure
(Soil Texture Kit)

This test is designed to separate soil into its 3 basic mineral fractions: sand, silt, and clay. The amount of time required for the soil particles of different sizes to settle in the separation tubes is used to determine the percentage of each fraction in the original soil sample.

1. Collect soil samples from two different areas or use previously collected samples.
2. Place the 3 Soil Separation Tubes in the rack.
3. Add the 1st soil sample to Tube "A" until it is even with line 15. Gently tap the bottom of the tube on the table to pack the soil and eliminate air spaces.
4. Use the pipet to add 1 mL of "Texture Dispersing Reagent" to the sample in tube "A". Dilute to line 45 with tap water.
5. Cap the tube and gently shake for 2 minutes, making sure the soil sample and water are thoroughly mixed. The sample is now ready for separation. Be sure to continue to gently shake the tube until step 6.
6. Place tube "A" in the rack. Allow it to stand undisturbed for 30 seconds.
7. Carefully pour off all the solution from tube "A" into tube "B". Return tube "A" to the rack. Allow tube "B" to stand undisturbed in the rack for 30 minutes.

8. Carefully pour off the solution from tube "B" into tube "C". Return tube "B" to the rack.
9. Add 1 mL of Soil Flocculation Reagent to tube "C". Cap and gently shake for 1 minute. Place tube "C" in the rack and allow it to stand (up to 24 hrs) until all the clay in suspension settles. (You do not have to wait for the clay to settle, because you can calculate the % clay fraction from the sand and silt.)
10. Read tube "A" at the top of the soil level. Record this on the data sheet provided.
11. Read tube "B" at the top of soil level and record this number on the data sheet provided.
12. Using the data sheet, calculate the percentages of sand, silt, and clay in the soil sample.
13. Use the soil texture triangle to determine the texture of the soil sampled.

(Screen Sieves- demonstration)

This test is designed for easy separation of soil into the various particle sizes. Porosity and permeability are greatly affected by particle size (texture). These properties may also be investigated with the screen sieves.

1. Collect soil samples from different areas (different soil types). Spread the samples out on paper towels and allow them to dry overnight (or longer).
2. Crush the soil aggregates into individual soil particles using only your fingers. Weigh the original soil samples.
3. Arrange the screen sieves with the largest screen on top, decreasing in size to the closed bottom container.
4. Place one of the soil samples in the uppermost sieve, cover it, and lightly shake it back and forth.
5. Carefully remove each sieve and weigh the particles in each sieve.
6. Determine the percentage of each particle size by dividing the mass of each size by the total original weight of the sample. The following chart shows the particles found on each screen sieve.

1st sieve	#5 mesh	Gravel
2nd sieve	#10 mesh	Fine gravel
3rd sieve	#35 mesh	Very coarse sand
4th sieve	#60 mesh	Coarse sand
5th sieve	#120 mesh	Medium sand
6th sieve	#230 mesh	Fine sand
Bottom pan	-	Silt & Clay

Why is soil texture important?

Soil texture is important for several reasons. The size of the particles in the soil determines the size and amount of the pore spaces and how the soil holds water. Very sandy soils have many large sand particles and large pore spaces. In these soils, water infiltrates through the soil very quickly. This may be good for drainage purposes, but it may also be negative because the water moves out of the root zone too quickly for the plant roots to absorb the water. In contrast, a soil that has mostly clay or silt particles has many very small pore spaces which means slow water and air movement. These soils can, however, store a large amount of water. Soil texture also determines the amount of nutrients that a soil is able to hold. Both water and nutrients are essential for plant growth.

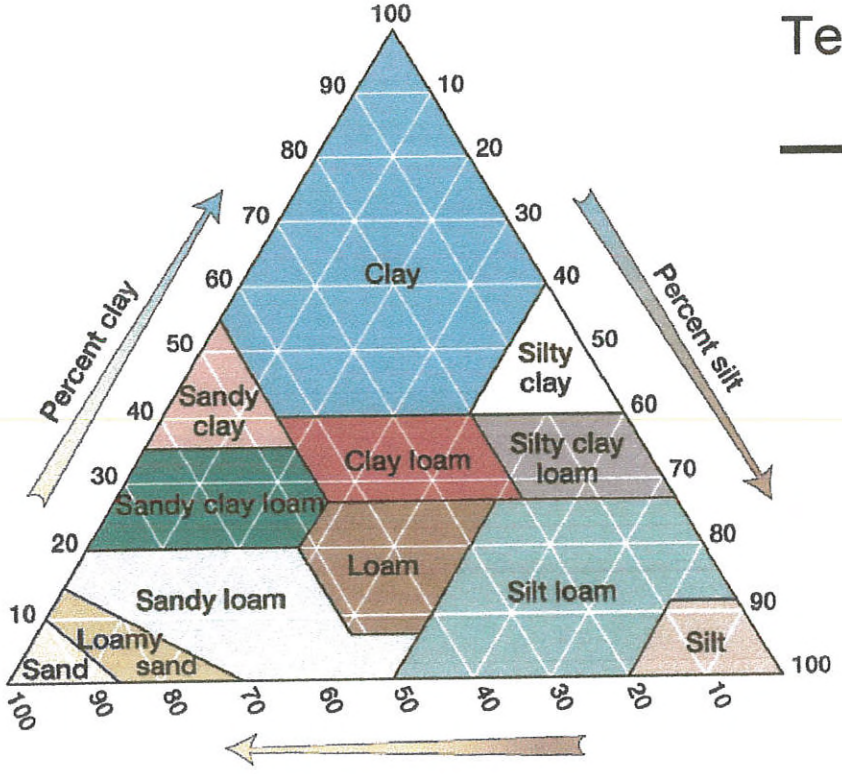
Name:_____

Soil Texture

Calculations

Soil Sample Tube	Reading from Tube		Original Soil Volume				
A		÷	15	x	100	=	_____% Sand
B		÷	15	x	100	=	_____% Silt

100	-	_____ % Sand	-	_____ % Silt	=	_____ % Clay	



Texture of Sample:

_____

Soil Fertility

What makes your garden grow?

Have you ever planted a seed in the soil and watched in amazement as a tiny plant begins to emerge from the soil? Did you know that besides needing water, the type of soil and what goes on in the soil determines how well plants grow?

Soil and plants play a very important part in the survival of humans and animals. Soil protects plant roots from exposure to the sun's heat; it filters pollution that comes from rain and water runoff; it us used to build with and on; and soil is what plants need to grow and be supported while growing. Plants are not only used for human food, but are also used to make fabrics and dyes, medicines, building materials, and food for animals (which we also eat).

About 16 chemical elements are essential for plant growth. Three of these nutrients (**Nitrogen, Phosphorus, & Potassium**) are considered "primary nutrients" because they are the ones that most often limit crop production. Plants must have these nutrients in order to grow healthy and strong. N, P, & K are often "managed" by the addition of fertilizers to soils, while the other nutrients are most often found in sufficient quantities in soils.

How can we know if our soils have enough N, P, & K to support proper plant growth? SOIL TEST! The best option is to take a sample of the soil and send it to a soil testing lab, such as the one at Auburn University. You can pick up soil sample boxes at the Cooperative Extension System. Fill the box with soil and mail it to the address on the box. You will receive a report back from the lab in a few weeks. This report will tell you how much of each nutrient you can apply to get the maximum yield (best growth) of the particular plant that you are growing.

Let's test some soils to determine if they have enough nutrients for good plant growth. We will test Nitrogen, Phosphorus, and Potassium. Then we will talk about the function of these nutrients in the plant.

Procedure

(N-P-K-soil kit – demonstration)

Extraction

1. Fill the round extraction tube to the 30 mL line with distilled water.
2. Add 2 Floc-Ex tablets. Cap the tube and mix until the tablets have disintegrated.
3. Remove the cap. Add 1 heaping teaspoon of soil.

4. Cap the tube and shake for one minute.
5. Let the tube stand until the soil settles out. The clear solution above the soil will be used for the N, P, & K tests.

Nitrogen test

1. Use the pipet to transfer the clear solution above the soil to a square test tube until it is filled to the shoulder.
2. Add one Nitrate WR CTA tablet. Cap and mix until the tablet disintegrates.
3. Wait 5 minutes for the color to develop. Compare the pink color of the solution to the Nitrogen color chart and record the result on your data sheet.

Phosphorus test

1. Use the pipet to transfer 25 drops of the clear solution above the soil to a square test tube.
2. Fill the tube to the shoulder with distilled water.
3. Add one Phosphorus tablet. Cap and mix until the tablet disintegrates. Wait 5 minutes for the color to develop.
4. Compare the blue color of the solution to the Phosphorus color chart and record the result on your data sheet.

Potassium test

1. Use the pipet to transfer the clear solution above the soil to a square test tube until it is filled to the shoulder.
2. Add 1 Potassium tablet. Cap and mix until the tablet disintegrates.
3. Compare the cloudiness of the solution in the test tube to the potassium color chart. Hold the tube over the black boxes in the left column and compare it to the shaded boxes in the right column. Record the result on your data sheet.

(Nitrogen, Potassium, & Phosphate Test---Biology & Chemistry Kit)

1. Fill a cup or 250 mL beaker with a collected soil sample. Then fill the rest of the beaker with distilled water.
2. Thoroughly stir the soil and water mixture together for several minutes, then allow the mixture to stand undisturbed until the soil settles (about 30 minutes) and the water starts to clarify.
3. Label the 3 test tubes "Nitrogen", "Phosphorus", and "Potassium" (and pH if desired). Using a pipet, add 2 mL of the clarified soil water to each test tube.
4. Next add 2 mL of the nitrogen test reagent solution to the corresponding test tube. Then carefully swirl to mix the test mixture and observe any color changes. After 3-4 minutes, compare the result to the soil test color chart for nitrogen. Record your results on the data sheet provided.
5. Repeat step 4 for the phosphorus, potassium, and pH tests, if desired.

Soil Fertility

What makes your garden grow?

Soil Sample	Nitrogen	Phosphorus	Potassium

Soil Sample	Nitrogen	Phosphorus	Potassium

1. Which nutrient(s) might need to be added to the soil in order to grow healthy plants?

_____

2. Why is it necessary to test the soil for nitrogen, phosphorus, and potassium content?

_____

_____

Soil Fertility

What makes your garden grow?

Nitrogen

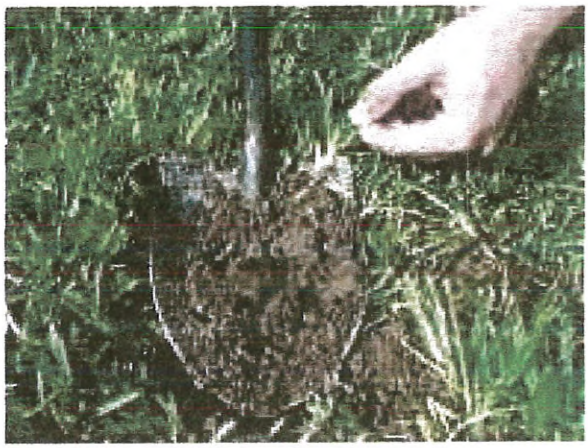
Nitrogen (N) helps plants use carbohydrates to gain energy. It also helps plants make protein that helps them grow strong and healthy. Plants that don't get enough N have thin stems and their growth is stunted. Their older leaves turn yellow from nitrogen starvation. When plants get too much N they have a lot of leaf growth but they are not strong. They will get diseases much more easily and may eventually fall over and die (lodging).

Phosphorus

Phosphorus (P) is known to help plants during photosynthesis, it helps them respire, and provides energy transfer and storage. When plants don't get enough P, they have weak thin stems and their growth is stunted. The older leaves turn a purplish color. However, too much P may be eroded by rainwater to runoff and pollute our streams, rivers, and lakes.

Potassium

Potassium (K) is important in plant photosynthesis (helping them metabolize food to make energy). K also controls the absorption of water into plant pores (stomata) like the pores on your skin. When plants don't get enough K, they do not have enough energy to grow properly, their roots do not form well, and they have weak stems and stalks. The edges of older leaves may look "burned" (dead tissue on leaf edges).



Soil Moisture & Temperature

All plants need 3 basic things: light, water (moisture), and soil (or other growth medium). Some plants thrive in a very hot, dry, environment with sandy soil. The desert regions provide a good environment for these plants. Other plants need continuous moisture and a warm humid environment with just the right amount of sunshine. Rain forest plants could never survive in a desert setting. Even some houseplants cannot tolerate full exposure to the sun. Different plant types have very different needs.

Temperature is also very important to plants because some seeds will not germinate until the temperature reaches a certain point (warm enough). This is why we must wait until it warms up in the spring before we plant our gardens. It is not the air temperature, but the soil temperature that is important. In addition, temperatures that are too high in the summer time can cause death of some plants.

You can easily control the amount of light and water that your houseplants receive by whether you place them by a window or whether you water them often. However, this is not quite as easy in a garden or a cropland setting. The composition of the soil plays an important part in the moisture and temperature of the soil type. Some soils tend to hold moisture quite well, while others remain dry most of the time. The water flows through some soils very quickly, leaving little or no moisture in the soil for the plants to use. In addition, some soils will naturally be warmer than others for various reasons.

In choosing an area to farm, a farmer must consider the soil type and its ability to hold moisture. Some crops cannot grow on particular soils. In addition, the soil temperature must reach a certain point before seeds can germinate. How can we know something about the soil moisture content and soil temperature? Let's look at several different soils and compare the differences in moisture content and temperature.

Soil Moisture (Kelway Soil Acidity & Moisture Tester -- demonstration)

1. Select several different sites to examine soil moisture (a cropland field, forested area, shady wet spot, very sandy area, etc.)
2. Keep the tester's plates clean and free of contamination. **Always** rub the metal plates clean (use dull side of film) before each use with the Kelway Conditioning Film.
3. Soften the soil in the spot to be tested. Break up pieces if it is hardened. Remove grass, leaves, pebbles, and other debris.
4. Gently insert the tester vertically into the softened soil so that the metal plates are fully covered. Press the soil tightly around the tester so that the metal plates are in close contact with the soil.
5. Press the button to read moisture content on the lower scale. Hold the button in the depressed position (2-3 minute stabilization period).

6. Record the reading on your data sheet. This reading is percent relative saturation (not % moisture by weight).
7. After use, wipe the plates clean with a paper towel to remove all dirt particles.

Soil Temperature

1. Use the ReoTemp soil thermometer to measure the temperature of the soil at the different sites. Carefully insert the thermometer into the soil without pushing the thermometer head.
2. Record your readings on the data sheet provided.

Complete the data sheet and discuss the questions. Discuss why some soils have greater moisture holding capacity than others.

Soil Moisture & Temperature

Soil Sample	Soil Temperature (°F)	Soil Moisture (% Relative Saturation)

1. Which site had the warmest soil?

2. Which site had the soil with the most moisture?

3. Which soil is the driest (least soil moisture)?

4. Which site do you think would be best for plant growth?

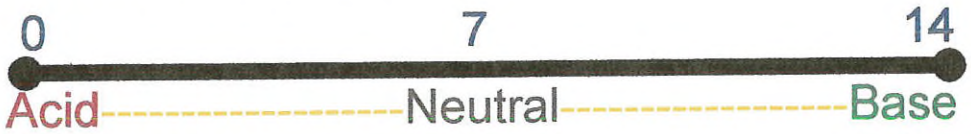
5. Is there anything we can do to change the soil temperature and moisture content?

Soil Acidity and pH

At an early age, our taste buds indicate to us whether something we eat is sour or bitter. For example, some foods we eat are very sour, like a dill pickle. Other substances, like soap, are very slippery, and if you get any in your mouth it is very bitter. There is a scientific reason for this: these substances are either acidic or basic. Bases are very bitter and cause surfaces to be slippery. Acids are very sour, and if very strong, they can cause burns on your skin.

Some substances are not really an acid or a base, like pure water (near neutral). Some acids are rather weak and some are very strong. For example, small amounts of weak acids are found in our mouths and stomachs. These acidic solutions serve to help break down and digest the food we consume every day. A weak base is one of the major components found in dishwashing liquid and bath soap. Strong acids and bases are important in industry.

Most of the substances around us are either acidic or basic....even the dirt (SOIL) in our back yards. A special name is given to the acid or base characteristic of a substance: it is called the pH of a substance. It is important to understand the pH of soils in which food crops and plants are grown. Some plants prefer acidic soils whereas others grow best in basic soils. The acidic or basic nature of the soil can even affect the color of the leaves and flowers as well as the overall health of the plant. Scientists devised a pH scale, which determines whether a substance is an acid or a base. This scale is like a number line. The numbers range from 0 – 14, with 7 as the midpoint. Any substance which has a pH value of less than 7 is considered an acid, and a pH value greater than 7 is a base. This leaves a pH of exactly 7 being neutral.



How do scientists/farmers know whether the soil in which they plant seeds or young plants is basic or acidic? They can take soil samples and send them to a lab for analysis. Or they can use special test paper strips or a meter to measure the pH of a soil. When the special test paper strips are placed in a solution, they turn a specific color depending on the pH value of a substance. Knowing the pH of the soil can help a farmer know what soil type is best in which to grow particular plants, vegetables, or flowers.

Procedure:

(pH paper)

1. Select 3 test sites (or have 3 samples already prepared); Dig approximately 6 inches down into the area and place the bottom half of the sample into the plastic bag and label according to the site.
2. Place one tablespoon of soil from the collection bag into a small plastic cup. Add ¼ cup of distilled water.
3. Swirl the soil and water mixture 3 times.
4. Place the edge of a 2 inch piece of pH Hydrion paper into the mixture. Observe the color change of the pH paper.
5. Try to match the resulting color to the colors listed on the key to determine the pH value of the soil. If the number is <7, the soil is acidic. If the number is >7, the soil is basic.
6. Repeat the procedure using soil from different sites. Record information on data sheet provided.

(Kelway soil acidity meter demonstration – on site demonstration)

1. Rub metal plates clean with Kelway conditioning film.
2. Soften the soil in the spot to be tested. Break up pieces if it is hardened. Remove grass, leaves, pebbles, and other debris.
3. Gently insert tester vertically into the softened soil so that the metal plates are fully covered. Press the soil tightly around the tester so that the metal plates are in close contact with the soil.
4. Read the pH on the upper scale. Generally the tester indicator needle makes a swing to the right and then drops to the correct pH reading, where it stabilizes in 2-3 minutes. The proper reading should be made at the time of stabilizing. ***Reading pH requires some moisture to be present. If the tester's indicator needle does not deflect during the 2-3 minute pH test period, the soil may need moisture. Moisten soil slightly with distilled water.
5. After use, wipe plates clean with paper towel to remove all dirt particles.

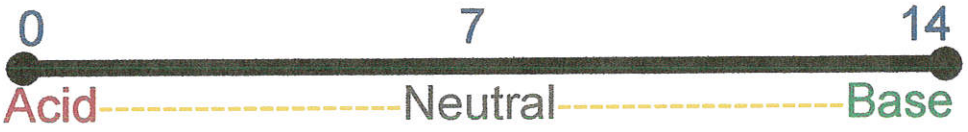
Compare your results to see if there are any differences in the pH of different areas tested. Using a handheld magnifier, observe the 3 soil samples for differences in particle size and texture.

Why is soil pH important in soils?

The effect of soil pH is great on the solubility of minerals or nutrients. Fourteen of the seventeen essential plant nutrients are obtained from the soil. Before a nutrient can be used by plants it must be dissolved in the soil solution. Most minerals and nutrients are more soluble or available in acid soils than in neutral or slightly alkaline soils. A pH range of approximately 6 to 7 promotes the most availability of plant nutrients. Some plants, such as azaleas, blueberries, white potatoes and conifer trees, tolerate strong acid soils and grow well. Also, some plants do well only in slightly acid to moderately alkaline soils. The soil pH can also influence plant growth by its effect on activity of beneficial microorganisms. Bacteria that decompose soil organic matter are hindered in strong acid soils. This prevents organic matter from breaking down, resulting in an accumulation of organic matter, which may tie up nutrients.

Name:_____

Soil Acidity and pH



Soil Sample #	Sample Location	Color of pH Paper	pH

Soil Permeability

Movement of Air and Water through the Soil

Hidden beneath the earth's surface, filling the crevices and pore spaces between particles of rock and soil, lies a natural reservoir of water which we call "groundwater". As the water from rainfall seeps into the ground, it passes through various layers of rocks and soils. Soil layers that allow water to move through quickly are described as "permeable". Other soils (with a lot of clay) have small pores between their particles and are considered "impermeable". Groundwater continues to move downward until it reaches an impermeable layer. Then the water stops moving and forms a saturated zone. The top of this saturated zone is called the "water table".

How quickly water passes through, or "infiltrates" the soil depends on the size and shape of the soil particles and the amount of pore space between the particles (texture). For example, soils that consist primarily of larger sand and gravel particles tend to have larger, interconnected pore spaces that allow water to flow easily and quickly. In comparison, silts and clays tend to have smaller, poorly connected pore spaces that prevent water from flowing through the soil very easily. **Permeability** is a measure of how quickly the water passes through the soil.

Let's determine and compare the permeability of 3 different materials (coarse sand, fine sand, and gravel).

Procedure:

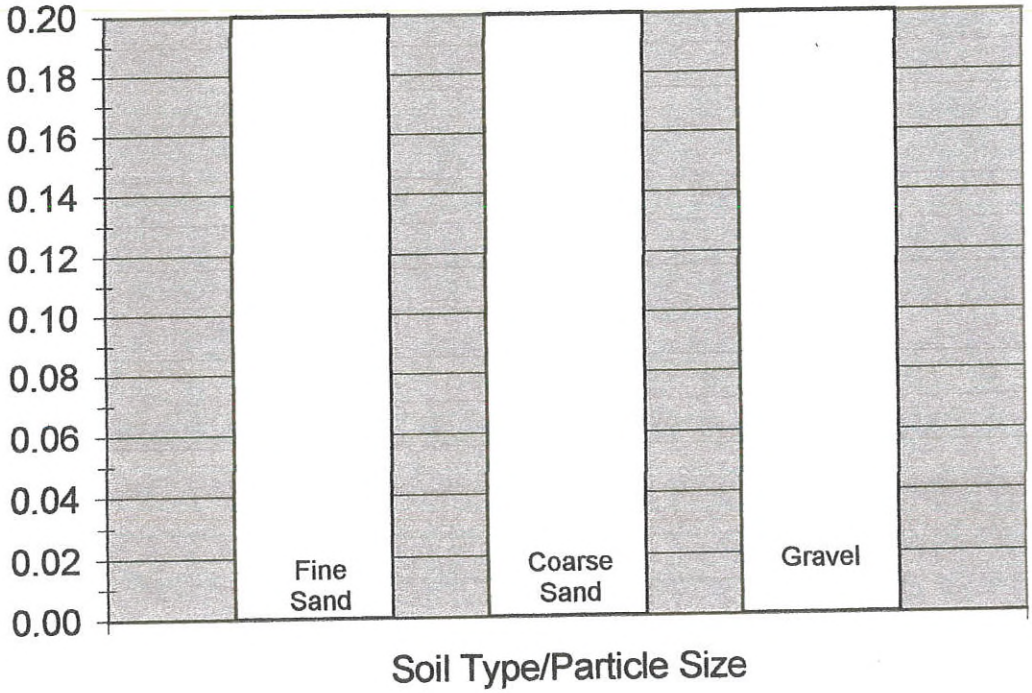
1. Provide each group with 3 clear tubes with caps. Students should place a cap on the bottom of each tube.
2. Using a graduated cylinder, each group should measure 125 mL each of the fine sand, coarse sand, and gravel. Pour each sample into a clear tube.
3. Fill a graduated cylinder with water to the 100 mL mark. Start the timer and slowly pour the water into the tube with **fine sand.** Continue to add water until the sand is fully saturated and the water level has reached just up to the surface of the soil.
4. Record on the data sheet the length of time it takes for the water to reach the bottom of the tube. This will be used to measure the permeability of the fine sand. The shorter the time for the water to pass through, the greater the permeability of the material.
5. Repeat steps 3 & 4 with the **coarse sand** and **gravel**.
6. Use the data sheet to determine the permeability and compare the movement of water into the 3 materials.

Soil Permeability

Movement of Air and Water through the Soil

	Fine Sand (Small Particles)	**Coarse Sand** (Medium Particles)	**Gravel** (Large Particles)
Total volume of soil material (mL)			
Water volume required to fill pores (mL)			
Wetting front travel time (sec)			
Permeability (1 ÷ travel time)			

1. Which material did water pass through in the shortest amount of time?
2. Which material is the most permeable?
3. What is the relationship between soil particle size and permeability?
4. Plot your results on the bar graph below.

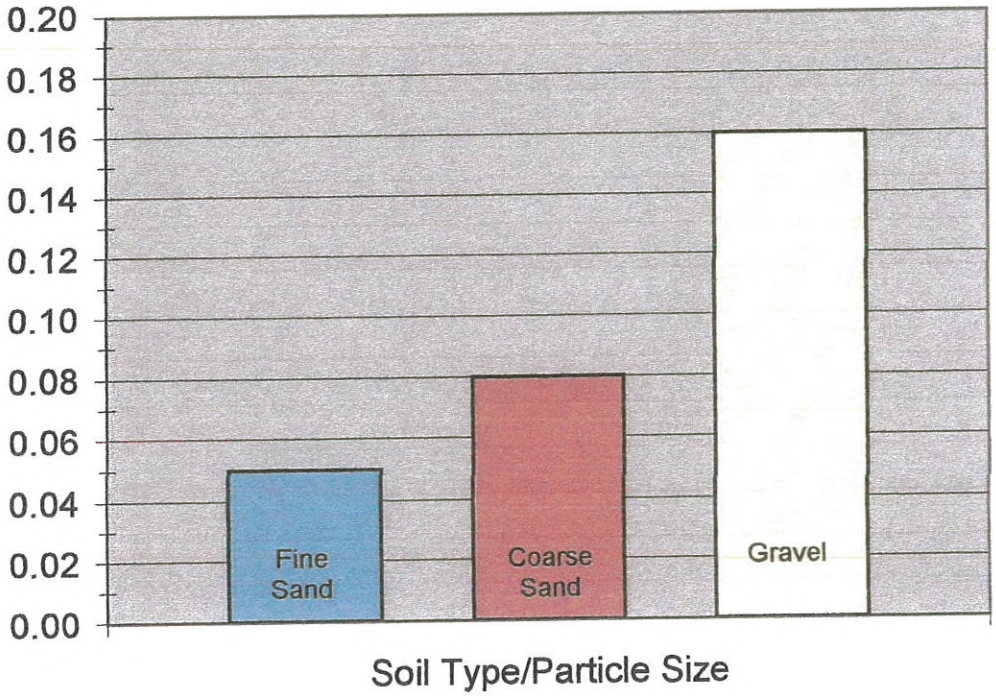


Soil Permeability

Answer Sheet

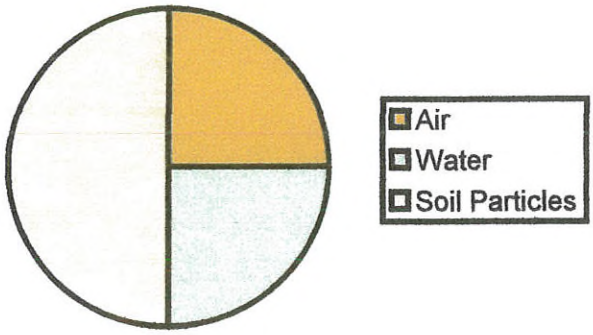
	Fine Sand (Small Particles)	Coarse Sand (Medium Particles)	Gravel (Large Particles)
Total volume of soil material (mL)	125	125	125
Water volume required to fill pores (mL)	50	55	60
Wetting front travel time (sec)	21	12	6
Permeability (1 ÷ travel time) (1/sec)	0.05	0.08	0.16

1. Which material did water pass through in the shortest amount of time? **gravel**
2. Which material is the most permeable? **gravel**
3. What is the relationship between soil particle size and permeability? **The larger the particle size, the greater the permeability. Water passes through larger particles more quickly and finer particles more slowly.**
4. Plot your results on the bar graph below.



Soil Compaction

A typical soil contains about 50% soil particles and 50% pore space by volume. The pore space is made up of approximately 50% water and 50% air by volume.



How does soil become compacted?

The air and water content in a soil is constantly changing. Tilling the soil when it is too wet is one cause of compaction. Also, tilling the soil too often can cause compaction at the base of the "plow layer", creating a "hard pan". Heavy construction and maintenance vehicles as well as tractors and other farm equipment can cause "traffic" compaction. Because the soil particles and water can't really be compressed, compaction causes the soil particles to rearrange themselves and reduce the volume of air. This slows down water and air movement and reduces the water holding capacity of the soil.

Excessive soil compaction may cause poor drainage; need for increased tillage for crops; reduced crop yields because of reduced water and air movement in the soil; reduced rate of root growth; and delays in tillage, planting and harvesting.

(Show some previously collected soil profiles with different horizons and explain where compaction could be a problem.)

Let's compare some soils and see how compacted they may be.

Procedure (On-Site Demonstration):

1. Choose several different sites, preferably a compacted and a non-compacted site. It is best to use the compaction tester when the soil has good moisture content.
2. (1st use)Remove the saddle clamp on the shaft of the tester. Check the gauge and see if it is on 0. If not, pull on the shaft or gently tap the gauge.
3. Select and install the tip for your type of soil ($^1/_2$" for firm soil or ¾" for soft soil).

4. Apply even pressure to the handles on the instrument to keep the rod point penetrating the soil at a slow even pace.
5. As the rod penetrates the soil, the gauge readings at the 3", 6", 9", 12", 15", & 18" depths should be noted on the data sheet provided.
6. Repeat steps 3-5 several times for each site.
7. Note any compacted layers on the data sheet. Compare the different sites for compacted layers.

The dial on the compaction tester has 2 scales, one for each tip. It is color coded for reference: green (0-200 psi), yellow (200-300 psi), and red (300 psi and above). Most crop roots can grow well in the green range, fair in the yellow range, and poor in the red range.

A compacted layer will be shown by the gauge indicator increasing upscale into the red range and then moving back down scale after passing through the compacted layer. The depth of the beginning of the compacted layer and depth of leaving the compacted layer should be noted.

**Multiple readings in an area will more accurately define the compaction layer if one exists.

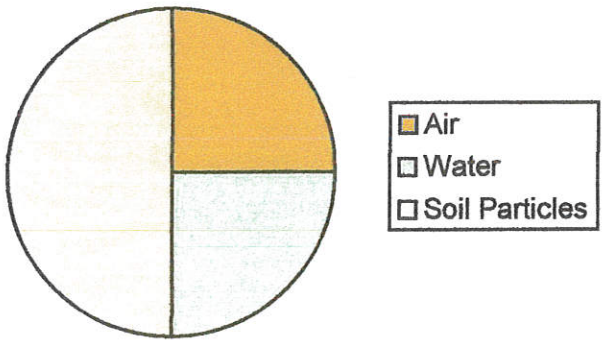
What are some ways to prevent soil compaction?

1. Reduced tillage (conservation tillage) – fewer trips over the field.
2. Don't till when soil is wet.
3. Remove excess weight from tractors and equipment.
4. Good crop rotation (deep-rooted crops build soil aggregates).
5. Improve drainage of wet soils.

Name:_____

Soil Compaction

Soil Depth	Site # 1			Site # 2			Site # 3		
	Sample #			Sample #			Sample #		
	1	2	3	1	2	3	1	2	3
3"									
6"									
9"									
12"									
15"									
18"									



Soil Compaction Tester Readings

Green – good crop root growth

Yellow – fair crop root growth

Red – poor crop root growth

Many Kinds Of Soils In Alabama

OBJECTIVE:

The student will be able to:
1. Describe the various characteristics of soil, including color and texture.

BACKGROUND:

Soil covers the surface of the Earth. Soil is made from eroded rock and mineral particles that have been mixed with plant and animal matter. Soil may have different textures and colors due to factors such as the amount and kinds of minerals and decayed matter in the soil.

VOCABULARY:

soil - part of our environment and Earth surface that is made up of mineral materials from rocks, partially decayed materials, and living organisms.

ADVANCE PREPARATION:

Gather materials for the activity.

Grades:
K-2

Subject:
Science

Time Needed:
First day: 40 minutes
Second day: 20 minutes

Materials:
towel
clear plastic cups
clear plastic jar
sample of river bank soil

PROCEDURE:

Setting the Stage
Introduce the lesson by chanting the poem "Dirt" by Mary Ann Jenkins.

Dirt

I like dirt
Itty, bitty, gritty dirt.
I like dirt
Fuddy, duddy, muddy dirt.
I like dirt
In my socks or on my shirt.
I like dirt.

Activities
1. Ask the students to describe the dirt they might find in the school yard. Lead the students on a walk in the school yard. Collect dirt from different areas of the yard in clear plastic cups. Gather dirt from under vegetation, along the road or parking lot, in the playground. Dig a hole with the shovel to gather dirt from underground.
2. Lead the students in comparing the colors and textures of the dirt. Pour the dirt of different colors in layers in the clear plastic jar. Display the jar of dirt in the classroom.
3. Allow the students to bring samples of dirt from their own yards. Encourage them to try to find different colors and textures of dirt. On the following day, compare these samples. Ask the students if dirt from a river bank would be different in color and texture from their samples. Provide a sample of dirt from the edge of a river for the students to examine and compare.
4. Graph dirt samples by color and texture.

5. Discuss with students the type of soil that is best for growing plants (dark soil with a lot of decayed material). Ask students why this is the best kind of soil for growing plants (more nutrients for the plants). Also discuss what kind of soil students think would be best to build houses on. Ask them to give their reasons.

Follow-Up

Have students divide into cooperative groups and write a list of describing words for each sample collected. Make sure students identify where each soil sample came from.

EXTENSIONS:

1. Draw a design on cardboard. Spread glue. Then sprinkle dirt of different colors to create a "dirt picture."
2. Grind dirt into a powder-like form. Alternate layers of dirt types in a small glass or plastic bottle to make dirt patterns similar to colored sand art.

ORIGINAL DEVELOPMENT RESOURCES:

U.S. Department of Agriculture Soil Conservation Service. (1992). *Teaching soil and water conservation.* More info found at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/newsroom/features/

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surface erosion - wearing away of Earth's surface by wind or water
vegetation - all the plants or plant life of a place

ADVANCE PREPARATION:

Gather soil from the school grounds. Prepare one vegetation sample tray by planting grass seeds two weeks before date of experiment. If you do not have wooden trays, line a sturdy cardboard box with plastic and notch at the end.

PROCEDURE:

Activities

1. Allow students the opportunity to investigate several soil samples. Have a magnifying glass available. Be sure they notice any grass roots clinging to the soil.
2. Prepare a second soil box by placing bare soil in it. Place receptacle jars in position (below the notched areas on each container - see illustration).
3. Pour equal amounts of water on each box until soil runoff is detected in at least one box. Predict what will happen to the soil and the water.
4. Examine both boxes and receptacle jars and compare levels of erosion.
5. Measure the water in the receptacles and compare with original amount.

Follow-Up

Have students diagram the two boxes of soil and illustrate how they were affected by surface erosion. Discuss and list reasons the surface erosion differed for each sample.

EXTENSIONS:

1. Teach students the erosion song "There is a Rut" (included). Students should learn this song and sing it throughout the year. It may also be used as a handwriting activity.
2. Refer to "Many Kinds of Soils in Alabama" in Learning Through Legacy (K-2).

"There is a Rut" (Tune: Bingo)
There is a rut in the
sandy soil,
and water is the cause
of it.
W-A-T-E-R (repeat three times)
What are we to do?

There is a rut in the
farmer's field,
And water is the cause
of it.
W-A-T-E-R (repeat three times)
What are we to do?

Plant some flower, trees,
and shrubs
To keep the soil in place.
S-O-I-L (repeat three times)
Let's keep that soil in place.

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U.S. Department of Agriculture Soil Conservation Service. (1992). *Teaching soil and water conservation.* More info found at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/newsroom/features/

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Edible Soil Profile

Preparation:

1. Read recommended resource *Soil! Get the Inside Scoop*, background information, lesson plan and student worksheets in their entirety.
2. Make copies of *Soil Layers* and *Factors That Build Soil* worksheets.
3. Purchase ingredients and supplies for edible soil profile.
4. Pour vanilla wafers, marshmallows, cereals, M&Ms and gummy worms separately into serving bowls.
5. Arrange and label bowls on a table in the following order: bedrock (vanilla wafers), parent material (marshmallows), subsoil (toasted oats), topsoil (chocolate puffs), organic matter (M&Ms) and decomposers (gummy worms).
6. Place serving tongs into the vanilla wafer and gummy worm bowl, measuring cups in toasted oat and marshmallow bowls and tablspoons into the M&M and chocolate puff bowls.

Procedures:

1. Have students wash their hands.

2. Give each student one cup.

3. Have each student layer the ingredients in the cup, allowing them to have different amounts of each ingredients to demonstrate how soil layers differ.

   - Vanilla wafers - 2
   - Marshmallows - 1/4 cup
   - Toasted oats - 1/4 cup
   - Chocolate puffs - 2 tablespoons
   - M&Ms - 1-2 tablespoons
   - Gummy worms - 2

4. Hand out worksheets.

5. Discuss the layers of a soil profile, particle size and how soils are formed while the students enjoy their Edible Soil Profile.

6. (Optional) Take digital photos of each student's soil profile to compare and measure the depth of the layers.

Materials:

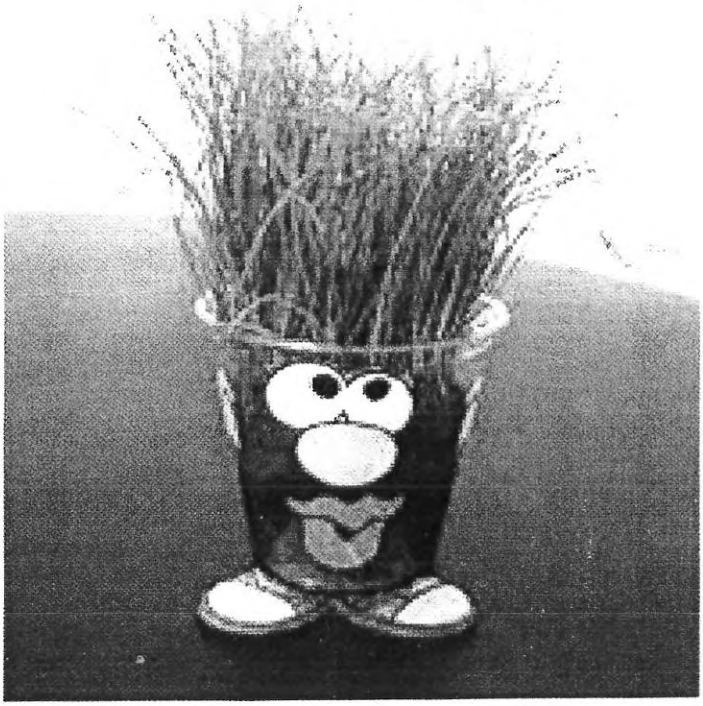
- 6 serving bowls
- Clear, plastic 4-6 oz. cups, 1 per student
- 2 measuring cups (1/4 cup)
- 2 measuring spoons (Tablespoon)
- 2 serving tongs
- Vanilla wafers
- Mini marshmallows
- Toasted oats cereal
- Chocolate puffs cereal
- M&Ms
- Gummy worms
- Labels for each serving container (i.e bedrock, parent material, subsoil, topsoil, organic matter, decomposers)
- Soil Layers and Factors That Build Soil worksheets, 1 per student

EDIBLE SOIL PROFILE

ONE CLEAR CUP WITH LID FOR EACH STUDENT

BEDROCK	VANILLA WAFERS	2 EACH
PARENT MATERIAL	MARSHMALLOWS	¼ CUP
SUBSOIL	CHEERIOS (OATS)	¼ CUP
TOPSOIL	CHOC RICE CRISPIES	2 TABLESPOONS
ORGANIC MATTER	M&Ms	1 TABLESPOON
DECOMPOSERS	GUMMY WORMS	2 EACH

Soil Buddy



What you will need

1- 10 to 12 oz clear plastic glass
2- Potting soil
3- Grass seed
4- Gravels
5- Activated Carbon Charcoal

Put about ½ inch gravel in bottom of glass

Put 1 tsp activated charcoal on top of gravel

Fill glass about ¾ full with soil

Sprinkle a fair amount of grass seed on top

Then finish filling glass with soil leaving enough space at top for watering

Keep moist grass should sprout in about 4 to 5 days

After grass is about 2 to 3 inches tall use your imagination and decorate

Dirt Baby

You'll Need: knee-high stockings
potting soil
grass seed (2 cups will be an ample amount) Rye
baby food jars, detergent caps or small plastic cups
scoop
wiggle eyes
craft glue
red felt or foam

Directions:

1. Wash and dry baby food jars.
2. Turn the top of the stocking down until the toe is exposed.
3. Place several pinches of grass seed in the toe of the stocking.
4. Add one large scoop of potting soil on top of the seed. This should be about one cup.
5. Gently shake the stocking to settle the grass seed and soil firmly in the toe. Knot the stocking to hold the soil in place.
   (the toe of the stocking becomes the top of your baby's head)
6. Cut a mouth from red felt or craft foam.
7. Attach wiggle eyes and mouth to the dirt baby's head.
8. Allow time for eyes to dry. Gently water the top of the dirt baby's head and rest of the stocking.
9. Place the top end of the stocking in a clean baby food jar so that the dirt baby's head rests on the rim of the jar. Add water to the jar and place it in a well-lighted spot. Fill jar as needed.
10. Your dirt baby should begin to get hair in about seven days. It really grows so be ready to give your baby a haircut.

California Foundation for Agriculture in the Classroom

Soil: More Than Dirt

California Standards

5th Grade

Common Core English Language Arts

- RI.5.1
- RI.5.2
- RI.5.4
- W.5.1b
- W.5.1d
- W.5.9b
- SL.5.1

Next Generation Science Standards

- 5-LS2.A
- 5-LS2.B
- 5-ESS3.C

6th - 8th Grade

Common Core English Language Arts

- SL.6-8.1
- RST.6-8.2
- RST.6-8.3
- RST.6-8.9
- WHST.6-8.1e
- WHST.6-8.4
- WHST.6-8.7

Next Generation Science Standards

- MS-LS4.D
- MS-ESS3.A
- MS-ESS3.C

Standards descriptions are listed in the matrix on page 143.

Procedure

Preparation

As a homework assignment, ask each student to bring in one cup of a soil sample for examination in class. Samples should be placed in a plastic bag and labeled with the student's name. Instruct students to dig in an approved area, and provide some extra samples for those students who may not have a place to dig for soil. The soil must be dug no more than 24 hours prior to the class activity to ensure that soil organisms will be alive for observation. Make sure students know not to use pre-packaged soil from a garden center.

Collect one bucket of soil for the whole class to use as a comparison to the samples each student has collected for homework.

Complete the following introductory activity with your students.

Have students pick up a handful of soil from their sample bag and imagine that this is the Earth's surface. Immediately have them take away three fourths of the sample and put it back into their bag. Tell them this is how much of the Earth's surface is covered by oceans, rivers, and lakes. What's left in their hand is what represents the land. Now drop one half of the remainder back into their bag. This represents desert regions, glacial poles, and mountain peaks where many things won't grow. Now drop one tenth of what is left back into the bag to account for places where the land is used for cities, towns, and roads. Tell the students that what is now left in their hand represents all the soil we have to grow crops and support life on Earth. While this activity provides a good model to help students understand that soil is a precious resource, it is an approximation of the amount of soil available for farming as these numbers constantly change.

Divide the students into groups of three or four. Each group should obtain one cup of the soil sample you have provided for the class. Each student should bring their own soil sample to share with their group. Using a hand lens, have the students observe each of the different samples and complete the *Soil's Soil—Or Is It?* handout.

Variations

- Bring in a variety of different soil samples collected from different locations rather than having the students bring samples.

PLAY IT AGAIN, NITROGEN!
(A Nitrogen Cycle Role-Play)

PURPOSE

This lesson will connect the previous activities on cycles and decomposition by having students closely examine the nitrogen cycle. The decomposers in "The Rotting World" experiment are animated in a role-playing scenario. Through the role-play of the nitrogen cycle, the students will consider the agricultural and environmental consequences that occur when the nitrogen cycle is interrupted.

CONCEPTS

- The nitrogen cycle is complex and includes interactions between plants, animals, special bacteria, decomposers, air, water and soil.
- The nitrogen cycle is a key nutrient cycle for the survival of plants and animals.
- The nitrogen cycle is sensitive to human interventions and disruptions.

MATERIALS

- **Transparency** of "Nitrogen Role-Play" classroom diagram
- Room deodorant spray (to represent air pollution)
- Baby powder or cornstarch (to represent fertilizer)
- "Nitrogen **Ready...Lightning...Action"** role-play cards (cut up)

TIME

1 thirty-minute lesson
2 fifty-minute lessons
2-3 thirty-minute group work sessions
1 twenty-minute presentation period for groups

BACKGROUND INFORMATION

Grade level and class disposition should be considered when preparing and organizing for the role-play activity. Make appropriate procedural changes to meet the needs of your students and classroom. Perhaps the activity can be completed outside.

If you have not attempted a role-play with your students before, the following warm up suggestions may be helpful:

- Explain to the students that they are going to enact a situation.
- Have the whole class participate in sample role-plays to lower their anxiety levels and inhibitions. (Example: Have students pretend they are licking an ice cream cone. Then say, "You're outside and it's 90 degrees". Have students demonstrate what would happen.)
- Have the students make suggestions for rules of action (noise level, movement, staging, etc.) that will facilitate a **successful** role-play.

The role-play will help reinforce the idea that humans do affect various cycles of nature. They will see how their individual actions can make a difference in regard to environmental quality.

NITROGEN READY ... LIGHTNING ... ACTION!
(Role-Play Cards)

(Make one copy of this handout and cut on the dotted lines. Place the strips in a hat or container and have each student group pick a paper strip. This will be the group they will represent in the role-play.)

Read to students:

Above ground are the wonders of the plant and animal kingdoms surrounded by an ever changing sky. Below ground lies the mysteries of decomposers, nitrates and elaborate root systems. The nitrogen cycle involves experiencing both worlds. The actors in the nitrogen cycle will be represented by the following groups -- decomposers, nitrates, nitrogen fixing plants, denitrifying bacteria, green plants, animals and nitrogen gas.

- -

GROUP # 1 - DECOMPOSERS
The **Decomposers** capture dead plant and animal matter that's working its way down into the soil. They change them into nitrates. Each time the Decomposers capture decomposing matter, it must release a cleaned up nitrate. The Decomposers are a hard working group. They take the **yuck** of the Earth and change it into something very useful. It's a dirty job, but someone has to do it.

(Figure out where you are coming from, where you are going and how you will act out your job at role-play time.)

- -

GROUP # 2 - THE NITRATES
The **Nitrates** are a very motivated group. They have been reformed, changed and given a new mission in life. They must make it back to the wonders above ground. It's a long journey up through the roots of plants and they allow these plants to grow. They come from the Decomposers or from the Legumes. The Nitrates believe they can make a difference. Cheer these guys and gals on.

(Figure out where you are coming from, where you are going and how you will act out your job at role-play time.)

- -

GROUP # 3 - THE NITROGEN-FIXING PLANTS
The **Legumes** are a very select group; kind of snooty and they like to toot their own horns. The Legumes can take nitrogen from the atmosphere and turn it into nitrates. It's a comfortable and quick way to do the cycle, a lot quicker than going through decomposers. If you're a lucky nitrogen molecule, you can make your way past the **yuck**, via the Legumes.

(Figure out where you are coming from, where you are going and how you will act out your job at role-play time.)

- -

GROUP # 4 - DENITRIFYING BACTERIA

The **Denites** are like special agents. They're here to find decaying and dead matter. They process it quickly and put nitrogen back into the atmosphere.

(Figure out where you are coming from, where you are going and how you will act out your job at role-play time.)

GROUP # 5 - GREEN PLANTS

The **Green Machines** gather in nitrates through their extensive root systems. They sort and mix nutrients like a factory and are very organized and slick. They deliver shining and polished products -- plants. Everyone wants their leaves, fruits and seeds. It's a great life, but it has to end eventually. Some of them get weak, lose their grip, fall to the ground. If they're not careful, along come the Animals with their huge appetites. Either way, they end up back in the ground.

(Figure out where you are coming from, where you are going and how you will act out your job at role-play time.)

GROUP # 6 - ANIMALS

The **Animals** consume just about everything. They particularly need the nutrients in plants. They eat plants, digest them, incorporate the nutrients into their systems, and then discard some matter as waste ... without even a thought. Eventually the animals die.

(Figure out where you are coming from, where you are going and how you will act out your job at role-play time.)

GROUP # 7 - NITROGEN GAS

The **Floaters** cannot do much up there in the atmosphere to help the plants and animals above ground. These rich gases wander around looking for something to do until the legumes convince them to hop a quick cycle for a change of routine. The less fortunate nitrogen gases just get zapped by lightning every now and then, and fall to the Earth to join in with the Nitrates. Some of the floaters are captured by fertilizer manufacturers and made into nitrates. Once they get into the cycle, they usually have a pretty good time.

(Figure out what path each nitrogen gas molecule (each student in this group) will take through the cycle -- some will be captured by bacteria in legumes, others made into fertilizers, some will be zapped by lightning and some will act out your roles.)

Gr 2-3 Activity

NAME _____

Soil, Senses & Earthworms

What do you think life is like in the soil? We use our five senses every day, they help us know things about the world around us. Some organisms that live in the soil, like earthworms, have senses also and use them to survive in the soil.

Write a sentence about why you think earthworms like living in the soil.

_____

_____

Our Five Senses

Draw a line to match the sense we use to the body part.

sight	ear
smell	eye
taste	skin
touch	nose
hearing	tongue

EARTHWORMS & SENSES

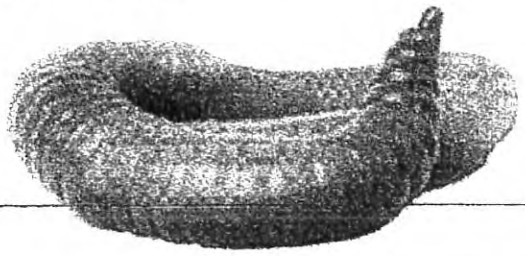
SIGHT Earthworms don't have eyes like we do, they have organs that help them sense whether they are in the light or in the dark.

SMELL Earthworms don't have a sense of smell or a nose to breathe with like we do, but they do have to breathe! Earthworms breathe by absorbing oxygen through their skin.

TASTE Worms have sense organs in the front end of their body which help them find food.

TOUCH Earthworms do have a sense of touch and like us they can feel it anywhere on their skin.

HEARING Vibrations on our ear drums help us hear. Earthworms don't have ears, but they can sense vibrations in the soil.



EARTHWORMS & SOIL

Earthworms make their homes <u>IN</u> the soil. We make our homes <u>ON</u> the soil. We "need" certain "conditions" in our environment to survive. Earthworms "need" certain "conditions" in the soil to survive. Draw lines to match the earthworms "need" on the left with the "soil condition" in the middle and the "explanation" on the right.

NEED	SOIL CONDITION	EXPLANATION
temperature	organic matter	sense a predator, like a mole or bird, nearby
food	carry vibrations	food comes from organic nutrients found in soil
breathing	moist soil	heat and light cause dryness, if skin dries worm suffocates
feel	dark & cool	skin must be moist to absorb oxygen

Interesting Earthworm Facts For Kids

- The length of an adult earthworm ranges from 10 mm to 3m. These lengths are entirely depends upon the species. One of the species named, Lumbricus terrestris can grow to length of about 360 mm.
- The width of these species ranges from 1 mm to 25 mm.
- The earthworms are cylindrical in shape. There are Grooves that separates the segments of its body.
- There are hairs on each segment that are known as setae. These hairs aid these animals to move. The segments on an adult earthworm's body are the same as it were when it was born.
- Earthworms play a pivotal role in enhancing the fertility of soil by altering large organic leaves into rich humus.
- These animals are also capable to digest small soil particles that measures around 1/20 of an inch crosswise.
- There are around 6,000 earthworm species, but only 150 of them are extensively distributed across the world. Some of these types are cosmopolitan and peregrine earthworms.
- These animals tend to take a trip underground by way of their muscular tightening that ultimately stretches and contracts its cylindrical body.

Reproduction | Facts about Earthworms For Kids

There is a couple of testes' pairs enclosed inside the sacs. Earthworms have 2 – 4 seminal vesicles pairs that generate and discharge the sperm through the male pores. The cocoon develops in about 2 – 3 months period. They will grow to the full size after one year. On an average, the lifespan of earthworms is about 4 – 8 years. However, some species that are often lives in garden varieties survive no longer than couple of years.

Where Do Earthworms Live

The earthworms are basically ground-dwelling animals and they are mostly found underground. However, not all species reside in soil; earthworms habitat depends upon the type of species. The Eisenia fetida can be found in decaying plants and manure; the Arctiostrotus vancouverensis that belongs to Vancouver Island, is known to survive on conifer logs. There are few species that lives in mud or streams. There are some that are regarded as aquatic, some littoral, and some arboreal.

The population of earthworms is entirely depends on the physical as well as chemical properties of the soil. These properties also affect earthworms diet and food availability. Nearly all species likes to live in slightly acidic soil.

Earthworms Natural Predators | Facts about Earthworms For Kids

There are a large number of earthworms' predators. These include several types of birds such as gulls, European Robins, crows, American Robins, Starlings, thrushes. They are also preyed upon by snakes and mammals including hedgehogs, foxes, bears, and moles. The invertebrates include ground beetles, slugs, snails, and other beetles.

Know Your Worms

1. Worms eat

a. plastic
b. glass
c. organic waste

2. Earth worms do not mix the soil.

a. True
b. False

3. Waste from worms is called

a. compost
b. castings
c. food

4. Organic matter is material which comes from something which was once alive.

a. True
b. False

5. Earthworms have mouths.

a. True
b. False

6. Earthworms can see

a. in color
b. light and dark only
c. black and white only

How We Use The Land For Fun And Profit

Question Cards

I work the land every day. It is something I do for a living. I plant, tend, and harvest my crops. Is this an occupation or a recreation?

I am a cotton farmer. Last year I made $0.75 for each bag of cotton sold. The first week I made $3.75 profit. How many bags did I sell? Would you say it is for fun or profit when you earn money for your work?

I cut down trees every day. I send the trees to a company which will make paper for you to write on. Is this an occupation or would this be for recreation?

I earned $0.50 for each tree I cut down. The first day I earned $10.00. How many trees did I cut that day? I got paid for my work so was it for fun or for a profit?

I climb mountains every chance I get. I like to hike up the tall, giant mountains. I was trained by a coach. Do you think I do this exercise for fun or profit?

I climbed 5 miles the first day. I climbed only 4 miles the second day. How many miles did I climb in 2 days? Do you know if a mountain climber does it for fun or profit? I didn't say I earned any money.

I bought myself some very good hiking boots. I go on very long hikes at least once a month. I love to do this activity but it is very hard work. Do you think this is an occupation for me or a recreational activity?

I hiked a total of 10 miles the first day but my friend hiked 15 miles. How many more miles did my friend hike than I did? Do you think my friend and I are doing this for fun or profit?

I raise cattle on a farm. I must get up at 5:00 am every day of my life. I take care of the cattle until they are old enough to sell. People buy my cattle to sell for food. Is this an occupation or recreation?

I am a cowboy on this cattle ranch. I counted 25 cows at first but on the second try I only counted 19. How many more cows did I count on the first try? Is this an occupation or recreation?

My family and I go camping in a tent. We do this several times a year. We have a great time on our trips. Do you think I do this for fun or for a profit?

I put up tents for everyone last night. The rule for camping was three people to a tent. There were 15 people in all so how many tents did I set up? This sure was a lot of work. Did I do this for fun or profit?

I am a cotton farmer. Last year I made $0.75 for each bag of cotton sold. The first week I made $3.75 profit. How many bags did I sell? Would you say it is for fun or profit w_ n you earn money for your work?

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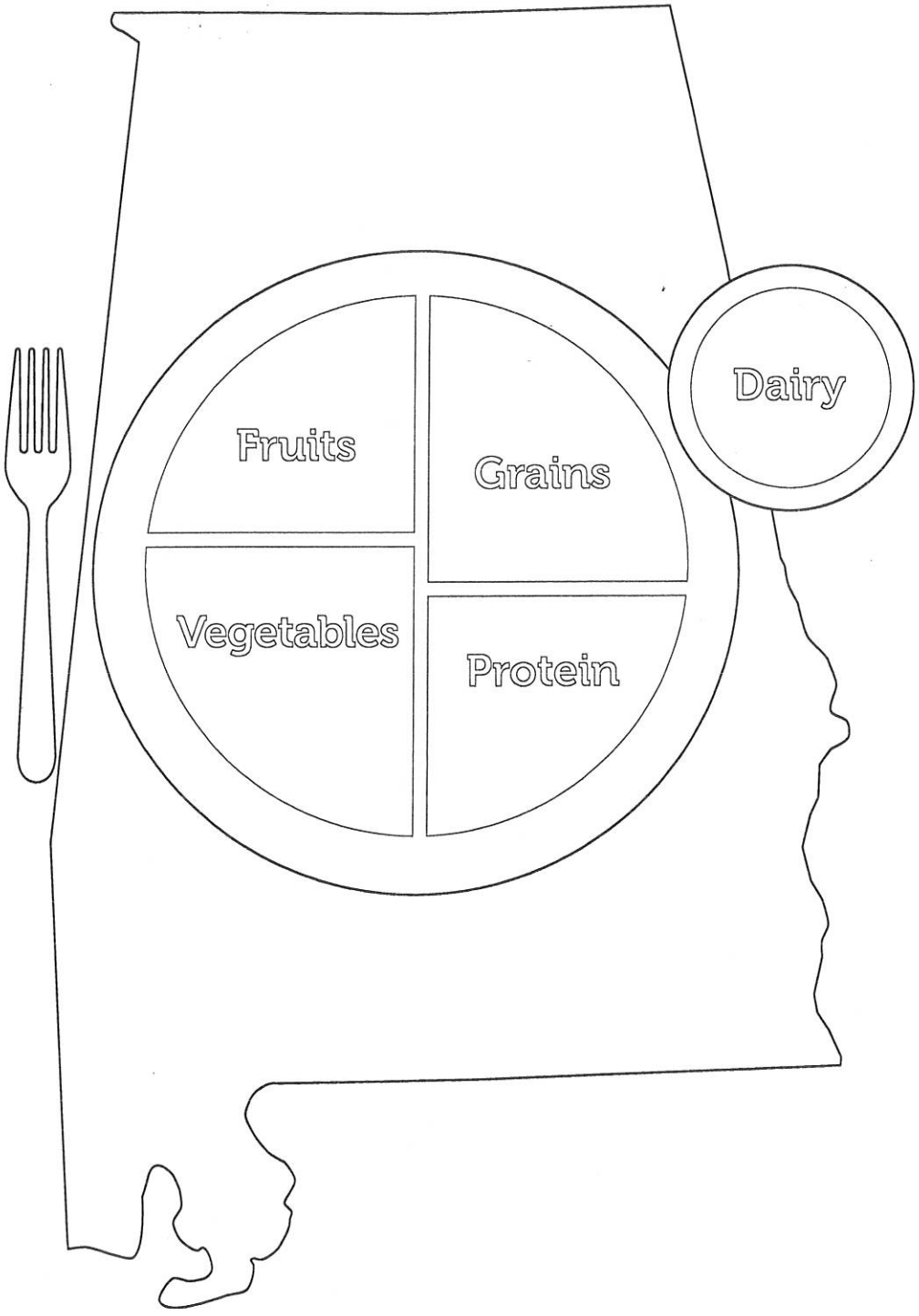
My family and I go camping in a tent. We do this several times a year. We have a great time on our trips. Do you think I do this for fun or for a profit?

#MyPlateMyState

ALABAMA



What foods are grown, raised, or produced in your State/Territory?

_____

_____

_____

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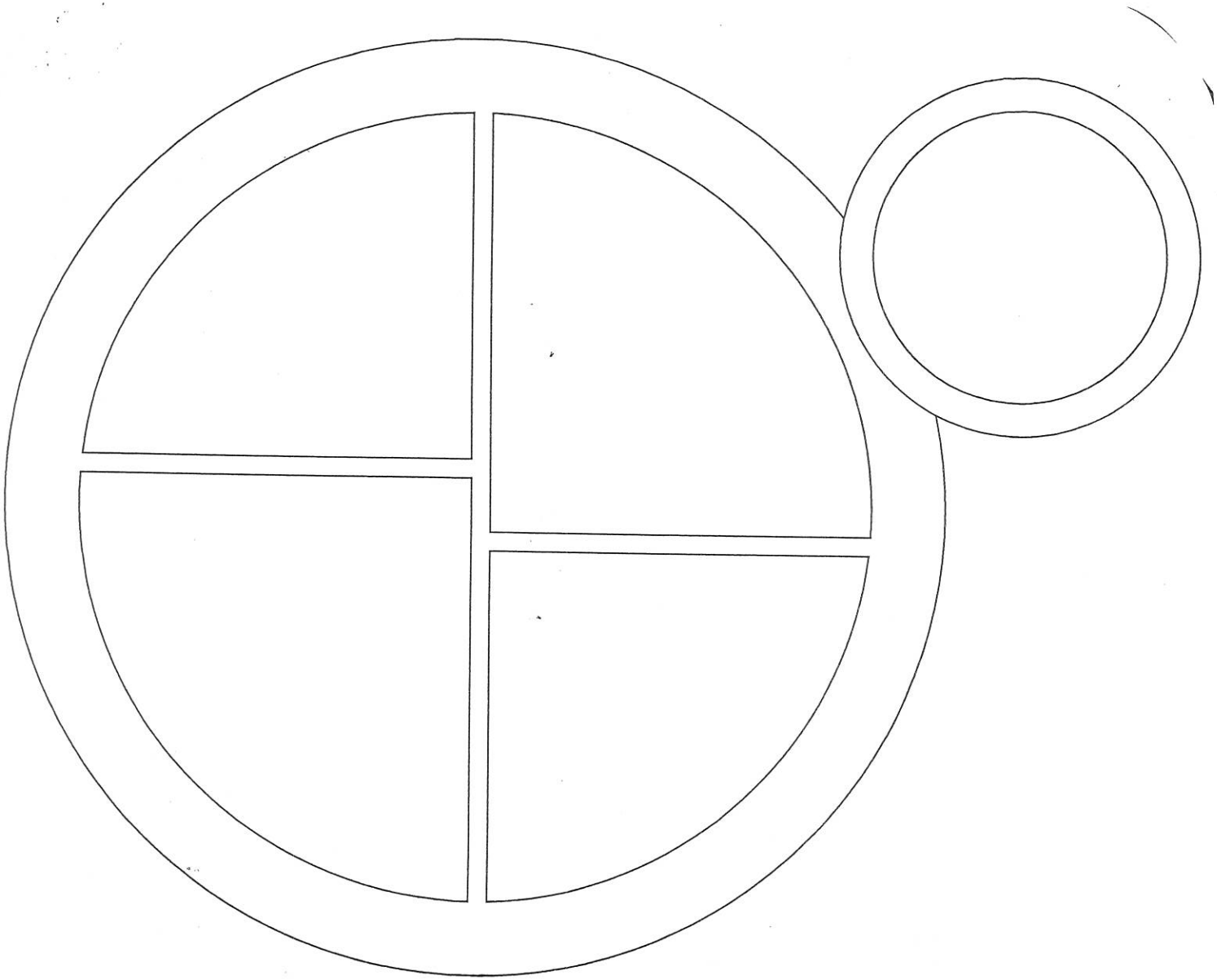
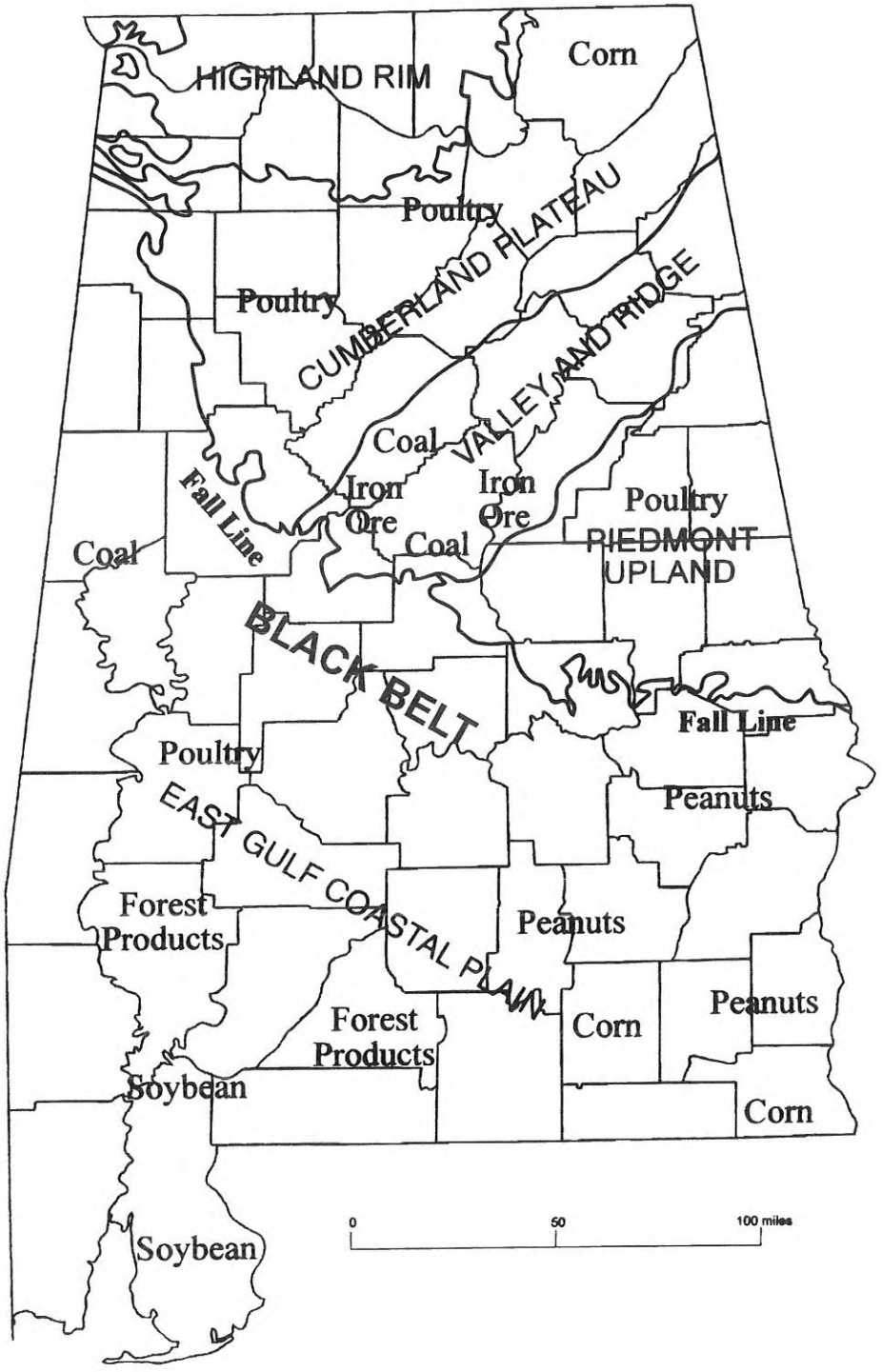
ChooseMyPlate.gov/MyState



MyPlate

Regions And Products Of Alabama



FOOD PYRAMID BEAD ACTIVITY

3 White Beads	this equals 3 cups or equivalent of milk or dairy products
2 Green Beads	this equals 2- cups of green vegetables needed daily
1 Orange Bead	this equals 1 cup of orange or yellow vegetables needed
1 Red Bead	Cups of fruit (apples)
1 Yellow	Banana
2 Cream Beads	Grains (6 Servings Daily)
2 Tan Beads	Grains
2 Rust Color	Grains
5-1/2-6 Brown	Meat, beans Protein (See below)
2 Brown	2 **Black** 2 **Pink** (Salmon)
1 Yellow Bead	Oils is not a food group but we need some for good health. Fish, nuts, corn oil, soybean oil or canola oil

National Agriculture in the Classroom

Relevancy and Engagement: agclassroom.org

Give Me Five!

Grade Level(s)

3 - 5

Estimated Time

45 minutes

Purpose

Students learn about the five food groups and what state-grown foods fit into each group. This lesson makes a local connection to good nutrition and a healthy lifestyle.

Materials

- *Give Me Five!* Hand Template, one for each student
- Agricultural Commodities List
- Popsicle sticks
- Scissors
- Glue or Masking Tape
- Crayons and Markers

Essential Files (maps, charts, pictures, or documents)

- Give Me Five! Worksheets

  [http://naitc-api.usu.edu/media/uploads/2014/07/30/giveme_fiveworksheets.pdf]

Vocabulary

commodity: a raw or primary agricultural product that can be bought or sold, such as hay, eggs, or cattle

Interest Approach or Motivator

1. Begin by asking students if they have heard of food groups and if so, to raise their hand and share what they know.
2. Project the Food Group Puzzle on the board and complete it as a class. Alternatively, you can print the puzzle for smaller groups of students to complete.
3. As the students help you complete the puzzle, review the concepts taught. (There are 5 food groups, where each food is produced, common foods in each food group, and nutrients received.)

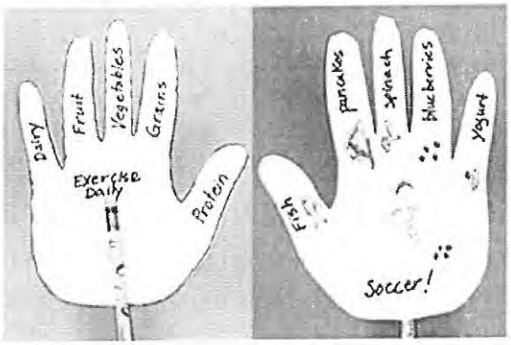
Background - Agricultural Connections

The five dietary food groups are the building blocks for a healthy diet. Recommendations are set forth by the U.S. Department of Agriculture. Food group guidelines were first introduced in 1916. As our knowledge of healthy diets has increased, dietary recomendations including caloric intake and essential nutrients has evolved as well.

The 5 dietary food groups include: fruits, vegetables, grains, protein foods, and dairy.

Procedures

1. Explain that food groups are collections of foods with similar nutritional benefits. Nutrition guidelines recommend daily servings from each group for a healthy diet.
2. Ask students to name any food groups they know. List answers on the board. Fill in any of the five groups that are not mentioned.
3. When all five groups are on the board, review them and discuss how each makes our bodies healthy.
4. Ask students to name foods they like to eat in each group. Record answers on the board. In the end, there should be a list of the five food groups and foods in each group.
5. Go over the *Agricultural Commodities List* worksheet and star or circle with a bright color all the foods grown in your state (or region).
6. Tell students that farmers and ranchers in our state grow thousands of different types of crops and many of them are food we eat. If there are additional commodities grown or raised in your area add them to the list, or list them on the chalkboard.
7. Tell students that each day they should eat from the five food groups for a healthy diet – fruits, vegetables, grains, protein and dairy. Have them hold up one hand and list the five groups, one for each finger. After they list off the five groups, have them turn to a partner and give each other a high five. To help them remember the five food groups, students will be making a *Give Me Five*! hand.
8. Each student will need to have a paper hand, a popsicle stick (pencils work too), tape and crayons or markers.
9. On one side of the hand, students write the name of a food group on each finger. In the center of the palm they write "Exercise Daily." (*see example below*).
10. On the other side of the hand students should write/draw a state-grown food for each food group in the corresponding finger area (*Ex: fruits/picture of blueberries*).
11. Have them write/draw their favorite exercise in the palm area. (*See example below).*
12. Students cut out the hand then tape on a popsicle stick at the wrist area.
13. When they are done, as a group repeat the five food groups.
14. Have students take turns sharing their favorite local foods with the class.



Concept Elaboration and Evaluation

After conducting these activities, review the following key concepts:

- The greatest health benefits are received when all five dietary guidelines are followed.
- A balanced diet includes all five food groups.
- Exercise is also important to good health.
- Some foods are produced locally. Other foods are produced in more ideal climates and shipped to local grocery stores.

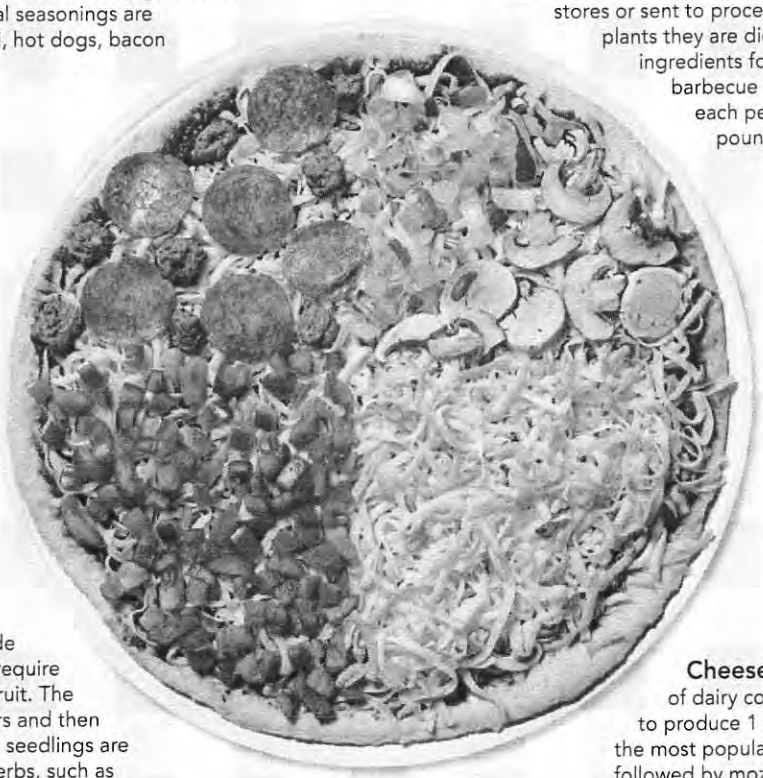
PIZZA

VARIETIES: sausage, pepperoni, peppers, tomatoes, onions, mushrooms, cheese, pineapple, ham, chicken

PIZZA TOPPINGS

Pepperoni and Sausage: Pepperoni and sausage are meats that are typically made from pork. The animals are fed a special blend of ground corn, soybeans, vitamins and minerals. The hogs go to market in five to six months when they weigh 240-250 pounds. The meat from pigs is called pork. It is ground up and special seasonings are added to make sausage, salami, hot dogs, bacon and pepperoni.

Onions: There are about 1,100 onion farms in the United States. Onion bulbs are raised either from seeds or from "sets." Onion bulbs grow underground and have long green tops. They may be picked by hand or machine and are then cleaned before shipping. Onions are either sold at grocery stores or sent to processing plants. At processing plants they are diced or processed to become ingredients for foods such as spaghetti, barbecue sauce and pizza. On average, each person in the U.S. eats almost 19 pounds of onions each year.



Peppers: There are many varieties of garden peppers, but the large-fruited sweet bell pepper is the favorite of most Americans and a popular pizza topping. Peppers grow on small bushy plants. They are usually eaten in their immature green stage, but they are also delicious after they have fully ripened and turned red or yellow.

Mushrooms: There are close to 2,500 types of mushrooms throughout the world, but the United States only has about 275 commercial mushroom growers. Mushrooms grow in cool, dark places. They lack chlorophyll, the green substance used by plants to make food, so they survive by soaking up nutrients from organic matter.

Tomatoes: Pizza sauce is made from tomatoes. Tomato plants require 75 to 85 days to produce ripe fruit. The seeds are usually started indoors and then transplanted outdoors after the seedlings are four to six weeks old. Special herbs, such as oregano, dill, and garlic, are added to tomatoes to give pizza sauce its special taste.

Cheese: Cheese is made from the milk of dairy cows. It takes ten pounds of milk to produce 1 pound of cheese. Cheddar is the most popular cheese in the United States, followed by mozzarella, which is popular on pizza. We all have our favorite pizza toppings, but chances are everyone likes cheese.

VOCABULARY

BULB — usually underground and often globular bud having fleshy leaves emergent at the top and a stem reduced to a flat disk, rooting from the underside, as in the onion.

FUNGUS — plant-like organisms, such as mold or mushrooms, that absorb their food from other living or dead organisms.

PASTEURIZATION — process of heating and cooling milk to kill bacteria and protect its purity and flavor.

PROCESSING — taking a raw commodity and turning it into something usable (wheat to flour).

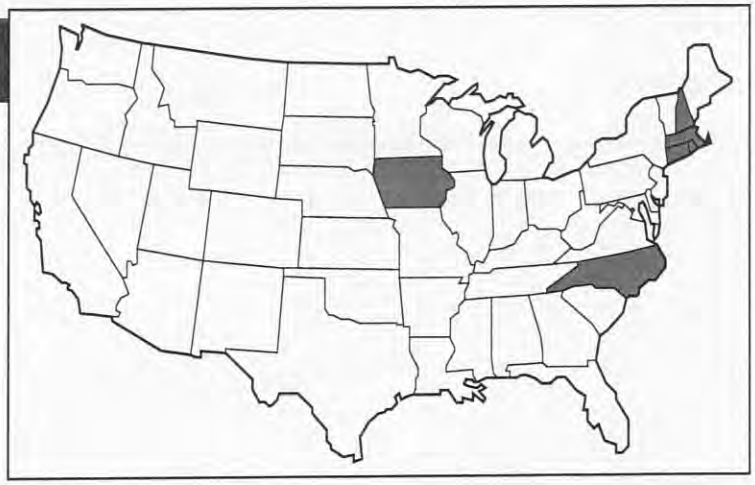
SEEDLINGS — a plant or tree grown from a seed.

YEAST — a leavening agent, which rises when baked.

PIZZA

UNITED STATES PIZZA RESTAURANTS

Top 5 U.S. States with the most pizza restaurants per capita — New Hampshire, Massachusetts, Connecticut, Rhode Island, Iowa



PIZZA TIMELINE

4000 BC — Egyptians began making bread with yeast.

425 BC — Egyptians traditionally celebrated the Pharaoh's birthday with flat bread seasoned with herbs.

.. AD — The first signs of pizza were found in Pompeii, Italy, which was destroyed by the eruption of Mt. Vesuvius. Marble slabs and other tools of the trade resembling a modern day pizzeria were found in some of its shops.

600 AD — Originally, mozzarella cheese was made from the milk of water buffalo. Today, pizzerias in Naples, Italy still make it this way!

1522 — Tomatoes were introduced to Europe when they were brought back from the New World (Peru). They were added to yeast dough to make the first pizza as we know it today.

17TH CENTURY — Naples, Italy was the place to go for good pizza. It was made by peasant men, known as "pizzaioli." To this day, Naples is known as the "Pizza Capital of the World."

1889 — While visiting Naples, Umberto I, King of Italy, and his wife, Queen Margherita, had the most famous pizza maker, Raffaele Esposito, prepare them his dish. He prepared a pizza with mozzarella, basil and tomatoes to represent the colors of the Italian flag (red, green and white). The Queen loved it so much that Esposito named it "Pizza Margherita," a name we still call it today.

LATE 19TH CENTURY — Italian immigrants brought pizza to America. In Chicago, a peddler walked up and down Taylor Street (in the South Side's Italian Village) carrying a metal washtub of pizzas on his head. He charged two cents per chew. (This was how pizza was sold in Naples). Charcoal from the pizza ovens was used in the bottom of the washtubs to keep the pies warm, and boys were hired to help sell them.

1905 — The first U.S. pizzeria was opened in New York City. It was opened by Gennaro Lombardi, America's "Patricia dela Pizza" or "Father of Pizza."

1943 — The first deep dish pizza was made by Ike Sewell at his Chicago restaurant, "Pizzeria Uno." Also known as "Chicago-style," this pizza has a flaky crust and rises an inch or more around deep piles of toppings.

1945 — While stationed in Italy during World War II (1941-1945), American soldiers fell in love with pizza. When they returned from the war they still craved it, so the popularity of pizza in America grew.

1948 — The first commercial pizza-pie mix was produced in Worchester, Massachusetts by Frank A. Fiorello.

1950's — Pizza was a favorite food of celebrities of Italian origin like Frank Sinatra and Joe DiMaggio. It is also said that the line in the song from famous singer Dean Martin, "When the moon hits your eye like a big pizza pie, that's amore," got Americans singing and eating pizza.

1957 — Frozen pizzas were introduced and found in local grocery stores. The first was marketed by the Celentano Brothers. Pizza soon became the most popular of all frozen food.

2009 — There are over 67,000 pizza stores in the United States.

DID YOU KNOW?

Each American eats 22.5 pounds of pizza a year!

Soybean oil is used to make pizza dough.

The first known pizzeria, Antica Pizzeria Port'Alba, opened in Naples, Italy, in 1738.

PIZZA

CAREERS: Agricultural Economist, Nutritionist/Dietitian, Food Process Engineer, Food Safety Specialist, Food Scientist

SPOTLIGHT ON CAREERS:

FOOD PROCESS ENGINEER — Food Process Engineers research and develop new and existing products and processes. They also design processing, handling and packaging equipment. Food process engineers work in food, chemical, biochemical and pharmaceutical industries. They work with processors, equipment suppliers, design and consulting firms and ingredient suppliers.

NUTRITIONIST/DIETITIAN — Nutritionists/Dietitians advise on matters of food and nutrition impacts on health. They can be healthcare workers, researchers, managers or educators. To be a nutritionist/dietitian you must enjoy working with people and have a strong interest in food and nutrition. You should be able to work independently to identify and solve problems.

PIZZA IN JUST 30 MINUTES?

Next time you order a pizza, think about how long it really took to make!

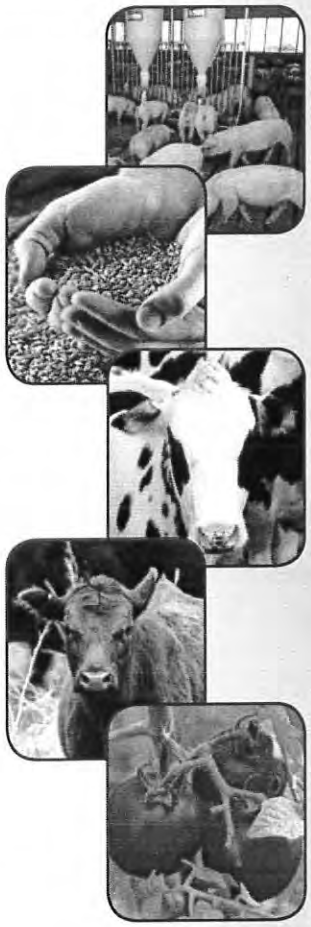
Pigs (from birth to processing):
6 months
Iowa is the #1 state in pork production

Wheat (from planting to harvest):
8-10 months
Kansas is the #1 state in wheat production

Dairy Cows (from birth to milk production):
2-3 years
Wisconsin is the #1 state in cheese production

Beef Cattle (from birth to processing):
14-16 months
Texas is the #1 state in beef production

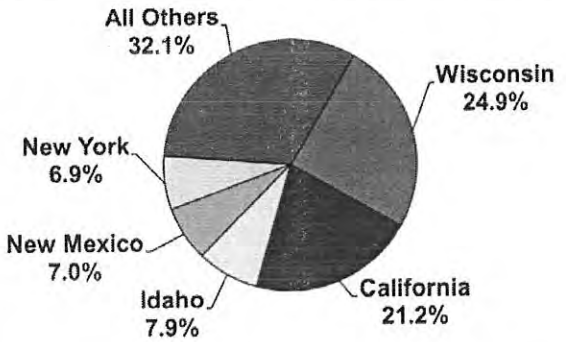
Vegetables (from planting to processing):
3-6 months
(depending on vegetable type)
California is the #1 state in tomato production
Pennsylvania is the #1 state in mushroom production



After production and processing, pizza toppings must be transported to pizza parlors, store and restaurants. Without truck, rail, barge and air transportation, these goods would not make it onto your pizza. So how long does it take to make a pizza?

U.S. Cheese Production, Top 5 States, 2011*

Total U.S. Production: 10.60 Billion Pounds



* Preliminary estimate; † Excludes Cottage Cheese

Source: USDA, Dairy Products Annual Summary

Wisconsin Milk Marketing Board

PIZZA FUN FACTS:

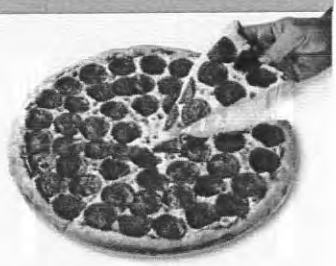
Pepperoni is the most popular pizza topping in America.

Cheese wasn't added to pizza until the late 1800's.

The largest pizza chain in the United States is Pizza Hut.

SALES OF THE 10 LEADING FROZEN PIZZA BRANDS OF THE U.S. IN 2011

(IN MILLION U.S. DOLLARS)



722.10	DiGiorno
332.10	Private Label
263.90	Red Baron
231.30	Tombstone
172.10	Totino's Party Pizza
138.30	California Pizza Kitchen
130.70	Freschetta
127.70	Jack's Original
104.90	Tony's
80.20	Stouffer's Lean Cuisine Casual Cuisine

SCIENCE AT HOME

IT'S A PEPPERONI PIZZA WRAP!

Ingredients

1 stick of string cheese
1 medium flour tortilla
2 tablespoons pizza sauce
Dash of Italian seasoning, garlic powder & onion powder
1 teaspoon of parmesan cheese
6 pieces of pepperoni

Directions:

1. Set toaster oven to highest setting (or you can use the microwave).
2. Break string cheese into smaller pieces and set aside.
3. Place tortilla on a microwave safe plate and microwave for 10 seconds, or until just warm.
4. Evenly spread sauce onto the center of the tortilla, and sprinkle with a dash of each spice. Top with the parmesan cheese, pepperoni and string cheese pieces.
5. Wrap tortilla up like a burrito, folding the sides in first, and then rolling it up from the bottom. Place wrap on a microwave-safe plate, seam side down, and warm in the microwave for 30 seconds.
6. At this time, you can transfer the wrap to the toaster oven and cook until hot on the inside and slightly crisp on the outside. About 3 minutes.

http://www.foodnetwork.com

Agriculture in the Classroom USDA

THE UNIVERSITY OF ARIZONA. Cooperative Extension

www.agclassroom.org / www.agintheclassroom.org / http://cals.arizona.edu/agliteracy

How long does it take to make a pizza?

It may only take 15 minutes to bake a pizza in the oven or 30 minutes to get one delivered from your favorite restaurant, but a lot of time and work went into the production of your pizza. Using the information from the pizza clock, calculate in months how long it really takes to make a pizza. Remember, there are 12 months in a year.

Ingredients	Time	Ingredients	Time
Crust		Cheese	_____
wheat	_____		
oil	_____	Toppings	
		mushrooms	_____
Sauce		olives	_____
basil	_____	pepperoni	_____
garlic	_____	peppers	_____
onions	_____	pineapple	_____
tomatoes	_____		

_____ is the ingredient that takes the longest to produce.

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tomatoes	_____		

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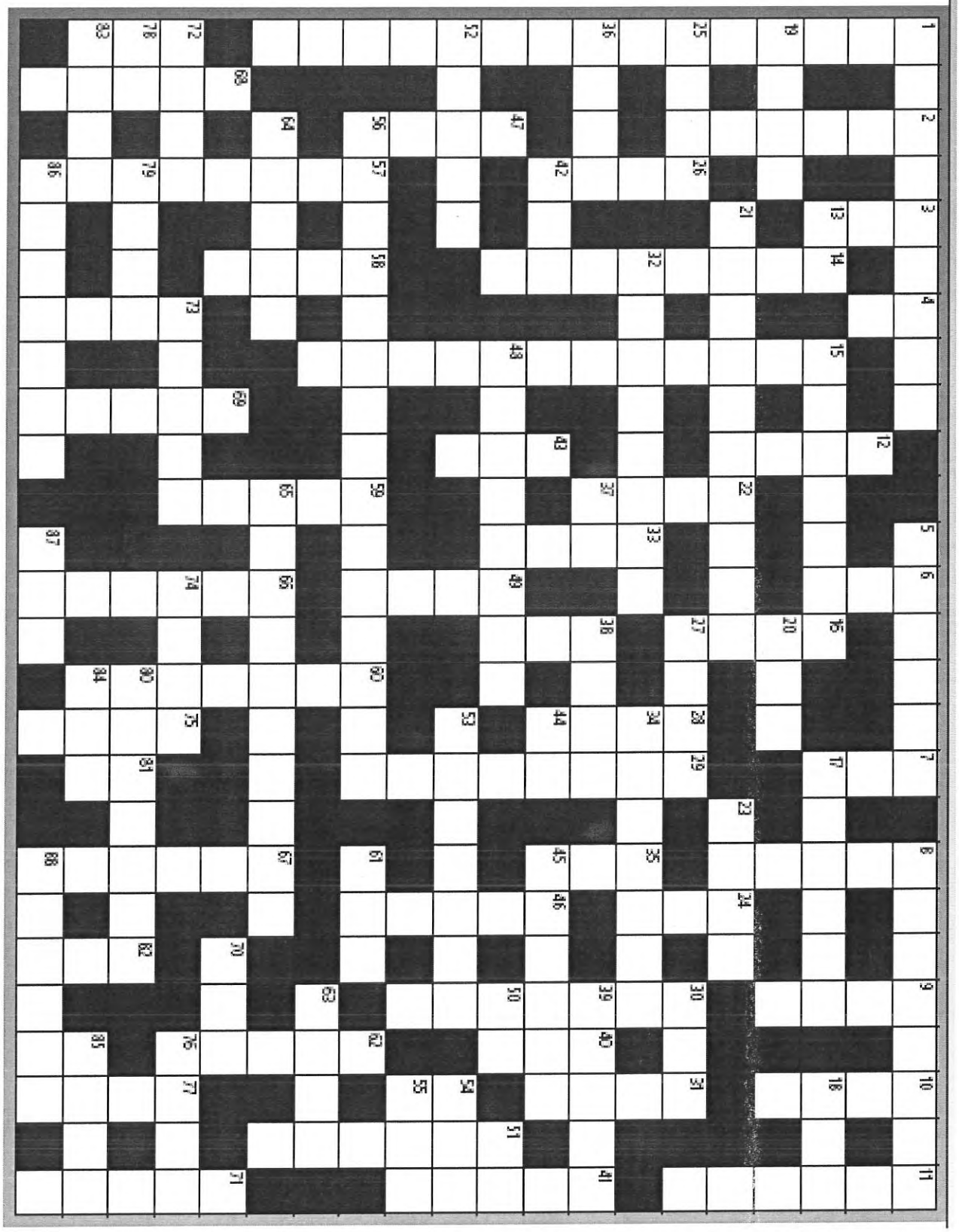
Beef Crossword Puzzle



Have students visit www.teachfree.com to help find answers to the crossword puzzle.

Beef Crossword Puzzle

Across

1 This little oven is a big convenience.
5 Vitamin that contributes to healthy skin and good appetite.
8 When complete, these help build body tissues.
13 "Pound," abbreviation.
15 Beef cut used for corned beef.
17 Also called a wholesale cut.
18 Another term for "also."
19 From its head to its ____ , a beef animal provides valuable by-products.
20 ____ a variety of foods for good health.
21 The arm and shoulder and the foot are examples of ____ (two words).
23 Moist or dry, it's essential to cookery.
25 Back of your foot.
27 At football games, it's fun to root for the home ____ .
30 Droop.
32 An identification method that tells shoppers what's in a meat package.
34 Expresses the energyproducing value of foods.
36 Ground beef patties should never be eaten ____ (degree of doneness).
37 Ground beef should be stored in the refrigerator no longer than 1____ 2 days.
38 Two of a kind.
39 To act in response to an event.
42 Another word for family "relatives."
44 Abbreviation for "decibel."
45 What's added by herbs and spices.
48 ____ beef in a frying pan adds good color.
50 Opposite of "out."
51 Spanish for "yes."
52 Heat methods used for less-tender cuts.
53 ____ steak comes from the loin.
54 Abbreviation for "et cetera."
55 Noah's ____ .
56 A method that can shorten beef cooking time. (two words)
61 In ____ minutes you can cook a stir-fry beef meal.
63 Vegetable sometimes served with carrots.
64 The type of farm that produces milk.
65 The beef grade ____ contains less marbling than USDA Choice (two words).
70 Is beef an important source of iron?
72 Beef is one type.
73 Rib-eye or T-bone ____ .
74 What you see out a window.
76 The freezer can be used for long-____ beef storage.
78 Two letters that follow hours of the morning.
79 Short for "information."
80 This should be done across the grain.
83 A vegetable that's also used in making a type of yellow bread.
84 Holds cookies.
85 Lima, navy, kidney, string or pinto.
86 Done to indicate beef cut quality.
87 Stir ____ can be a quick Chinese-style beef meal.
88 An old phrase is that "silence is ____ ."

Down

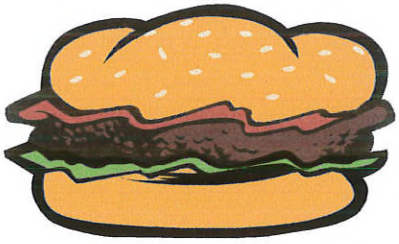
1 Best implement for measuring roasts' doneness (two words).
2 The USDA beef grade with less marbling than prime.
3 Adding a little bit of this to frying pans can prevent foods from sticking.
4 Beef ____ jus means "served with natural juices."
6 Added to picnic coolers, helps keep foods cold.
7 A short sleep.
8 USDA beef grade that contains the most marbling.
9 Kitchen show and ____ is a good way to learn recipes.
10 Spring turns ____summer.
11 This flavorful type of beef should not be frozen for long periods of time.
12 Someone who does not tell the truth is a ____ .
14 A dry heat cooking method used for tender steaks.
15 A dish cooked outside over an open fire, served with tangy sauce (two words).
16 Inspection is a federal ____ for beef wholesomeness.
22 A word that means "leave out."
24 Exposure to this changes beef's color from purplish to red.
26 A relative of the onion, this looks like a giant scallion.
28 Marinades contain a food ____ such as vinegar or citrus, to soften meat fibers and add flavor.
29 Flecks of fat throughout the lean.
30 To compare meat prices, determine cost per ____ .
31 Another word for "equipment."
33 Lunch time.
35 The opposite of "on."
38 A wide, shallow container used for frying meat.
40 Two or more eras.
41 A 3-ounce cooked serving of ground beef is about 3 inches wide and a half-inch ____ .
43 A female beef animal.
46 A wrapping job that's not good for beef stored in the freezer.
47 A word meaning "soggy" or "wilted" when describing vegetables.
49 Beef can be prepared ____ many different ways (two words)!
51 Emotional pressure that can result from doing too much at one time.
54 Abbreviation for "each."
57 A dry heat method that uses a rack and open pan.
58 To separate into different categories.
59 Shoulder area of the beef animal.
60 Federal officials ____ beef for wholesomeness.
62 A sumptuous spread.
66 To eat entirely and with gusto.
67 A tenderizing process done by machines at meat counters, to break down beef's tough fibers.
68 Juice from this yellow citrus fruit can be used in marinades.
69 The number after six.
71 ____ acids are proteins' building blocks.
72 Short for macaroni.
73 Something that's been bought has been ____ .
75 Another word for "delay" or "postpone."
77 In a microwave oven, uniformly-shaped roasts help make cooking more ____ .
81 Abbreviation for Registered Nurse.
82 What pudding and some pies must do.
85 Nutrients help people ____ active and alert.

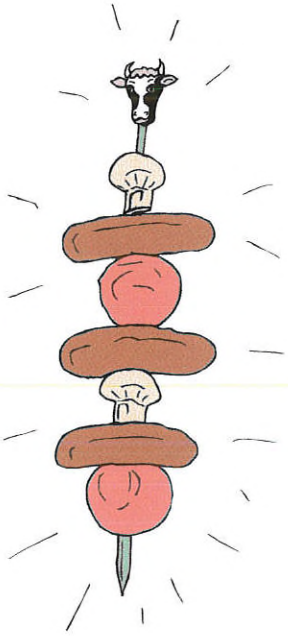
Beef Crossword Puzzle

Answer Key

ACROSS- 1 microwave, 5 niacin, 8 proteins, 13 lb, 15 brisket, 17 primal, 18 too, 19 tail, 20 eat, 21 bone groups, 23 heat, 25 heel, 27 team, 30 sag, 32 labeling, 34 calorie, 36 rare, 37 to, 38 pair, 39 react, 42 kin, 44 DB, 45 flavor, 48 browning, 50 in, 51 si, 52 moist, 53 sirloin, 54 etc, 55 ark, 56 pressure cooking, 61 ten, 63 peas, 64 dairy, 65 USDA Select, 70 yes, 72 meat, 73 steak, 74 view, 76 term, 78 am, 79 info, 80 carving, 83 corn, 84 tin, 85 bean, 86 grading, 87 fry, 88 golden

DOWN- 1 meat thermometer, 2 Choice, 3 oil, 4 au, 6 ice, 7 nap, 8 prime, 9 tell, 10 into, 11 smoked, 12 liar, 14 broiling, 15 beef barbecue, 16 test, 22 omit, 24 air, 26 leek, 28 acid, 29 marbling, 30 serving, 31 gear, 33 noon, 35 off, 38 pan, 40 eon, 41 thick, 43 cow, 46 loose, 47 limp, 49 in so, 51 stress, 54 ea, 57 roasting, 58 sort, 59 chuck, 60 inspect, 62 feast, 66 devour, 67 cubing, 68 lemon, 69 seven, 71 amino, 72 mac, 73 sold, 75 wait, 77 even, 81 RN, 82 gel, 85 be



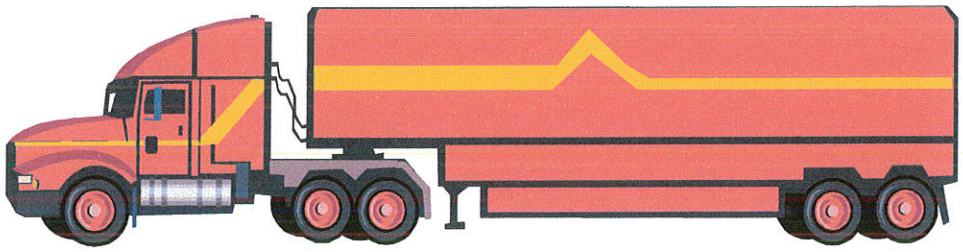


Name_____

Vocabulary Match-Up

Directions: Match the vocabulary word to the correct definition. Write the correct letter in the blank before the vocabulary word.

1.	_____Agriculture	a. to rely or support one another
2.	_____Consumer	b. the process of selling and making goods available
3.	_____Food Processors	c. companies that sell and market goods
4.	_____Producer	d. the science of producing crops and raising livestock
5.	_____Interdependent	e. a person who buys and uses goods
6.	_____Distributors	f. a person who grows agricultural products
7.	_____Marketing	g. companies that change raw products (tomatoes, wheat, milk) into other products (sauce, flour, cheese)



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1. __D__ Agriculture
2. __E__ Consumer
3. __G__ Food Processors
4. __F__ Producer
5. __A__ Interdependent
6. __C__ Distributors
7. __B__ Marketing

a. to rely or support one another

b. the process of selling and making goods available

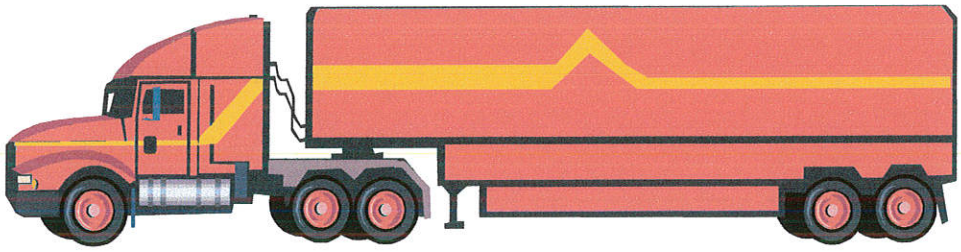
c. companies that sell and market goods

d. the science of producing crops and raising livestock

e. a person who buys and uses goods

f. a person who grows agricultural products

g. companies that change raw products (tomatoes, wheat, milk) into other products (sauce, flour, cheese)



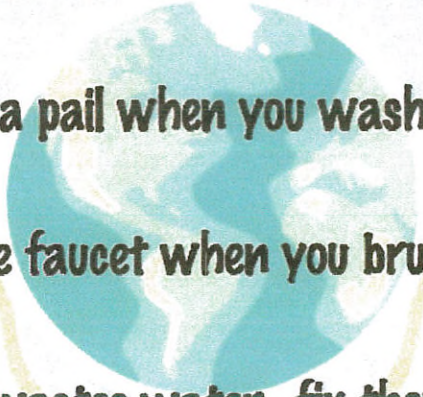
Wait until night to water your lawn

Always use a pail when you wash the car

Turn off the faucet when you brush

Every leak wastes water- fix them

Rain barrels save water



Water

Everything relies on water to stay alive
Without it nothing would survive
In oceans, lakes, rivers, and seas
Water is vital for you and me
The water cycle is easy to understand
Water goes up and comes down again
In your sink, the photosynthetic zone, and the abyss
Water is something that you can't miss
It is a part of your everyday routine
And everybody's fancy dinner cuisine
If we aren't using water as we should
Soon it will disappear, and yes it could.

By: Agnes Klimek 218

In The Water -World

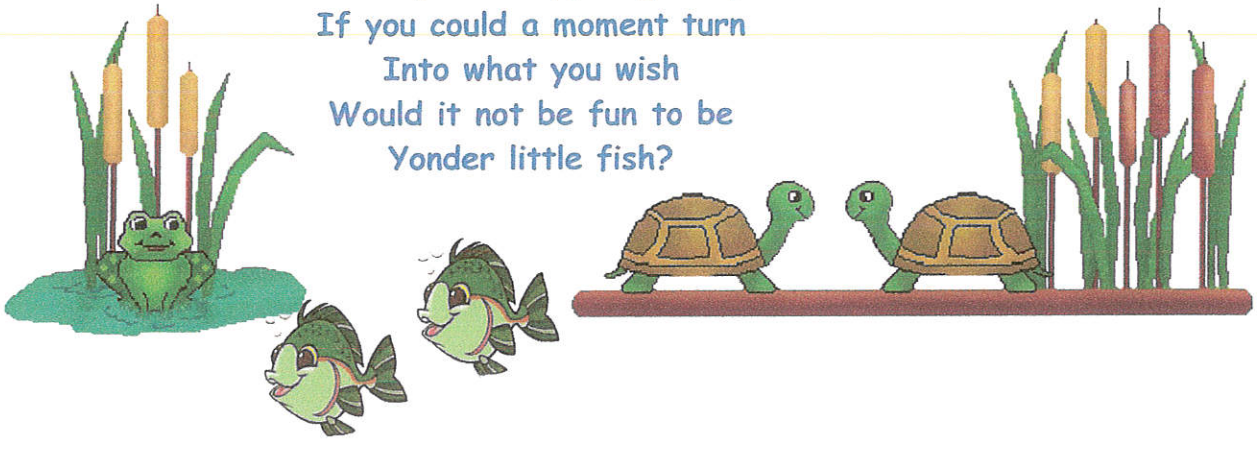
By Evateen Stein

Down among the waterweeds,
Darting through the grass,
Round about the tasseled reeds,
See the minnow pass!
See the little turtles there,
Hiding, half asleep,
Tucked in tangled mosses where
Tiny crayfish creep!

Watch the trailing grasses string
Strands of purple shells
That the lazy ripples ring,
Sweet as silver bells;
Watch the sunshine sift and drift
Down the eddy whirls,
Whence the laden white-weeds lift
Loads of blossom pearls;

While the limpid shadows slip
Softly in between,
And the pussy-willows dip
Lightly in the green
Of the mocking trees that grow
Down the water sky,
Flecked with fleecy clouds that blow
Where the reed-birds fly.

Oh such marvels manifold
Fill the summer stream,
Such enticing things untold
Through the ripples gleam,
If you could a moment turn
Into what you wish
Would it not be fun to be
Yonder little fish?



Water Jokes and Water Humor

A man goes to his doctor because he's been feeling very ill for days.
The doctor gives him several sets of pills.
The doctor instructs; "Take the green pill with two big glasses of water when you get up.
An hour later, take the white pill with another glass of water.
Take the blue pill with a big glass of water after lunch.
Mid afternoon, take the orange pill with plenty of water, and repeat that at dinner.
Then, just before going to bed, take the red pill with several big glasses of water."
The man is alarmed at huge volume of medicine he has been given to take,
and nervously asks, "What's the diagnosis? What's wrong with me?"
The doctor says, "You're dehydrated."

What did the sink say to the water faucet?
You're a real drip.

Why is the letter T like an island?
Because it's in the middle of water!!!

Your girlfriend is so ugly, when she gets in the tub, the water jumps out.

Patient: Doctor, I think that I've bitten by a vampire.
Doctor: Drink this glass of water.
Patient: Will it make me better?
Doctor: No, I but I'll be able to see if your neck leaks

Why did the kid dump a bucket of water off the school roof?
He wanted to make a big splash in front of his class.

Glenn sends his son, Evan to bed. Five minutes later, Evan screams downstairs,
"Dad! Can you get me a glass of water?"
Glenn says, "No. You had your chance."
After a minute Evan screams again, "Dad! Can you get me a glass of water?"
Glenn says, "No. I told you, you had your chance.
If you ask one more time, I'll come up there and spank you."
After a short silence, the father hears, "Dad!
When you come up to spank me, can you bring me a glass or water?"

George went to visit his elderly cousin Darrel and while eating the breakfast
of eggs and bacon prepared for him, he noticed a film-like substance on his plate.
So he says, "Cus, are these plates clean?"
Darrel replies, "Those plates are as clean as cold water can get them."
That afternoon, while eating the hamburgers Darrel made for lunch,
he noticed many little black specks around the edge of his plate so again he asked,
"Are you sure these plates are clean?" Without looking up from his burger Darrel says,
"I told you those dishes are as clean as cold water can get them."
Later that day, they were on their way out to get dinner.
As George was leaving the house,Darrel's dog who was lying on the floor
started to growl and would not let him pass.
" Darrel, your dog won't let me out
" Without diverting his attention from the football game he was watching,
Darrel shouted, "Coldwater, get out of the way!"

One day, Little Bruce's grandmother sent him to the water hole
to get some water for cooking dinner.
As he was dipping the bucket in, he saw two big eyes looking back at him.
He dropped the bucket and ran back to grandma's house as fast as he could.
"Where's my bucket and my water?" She asked.
"I can't get any water from that water hole, there's a mean ol' alligator down there!"
"Now don't you mind that ol' alligator, Johnny. He's been there for years,
And he's never hurt no one. Why, he's probably as scared of you as you are of him!"
"Well, Grandma," replied Johnny, "if he's as scared of me as I am of him,
then that water ain't fit to drink!"

A Mr. Charly, a chemistry teacher,
decided to instruct his 5th grade class a lesson about the evils of liquor,
so he designed an experiment that involved a glass of water, a glass of whiskey, and two worms.
"Now, class, observe closely the worms," said the teacher first putting a worm into the water.
The worm in the water writhed about, happy as a worm in water could be.
The second worm, he put into the whiskey.
It writhed painfully, and it quickly sank to the bottom, dead as a doornail.
"Now, what lesson can we derive from this experiment?" Mr. Charly asked.
Little Terry raised his hand and wisely responded; "Drink whiskey and you won't get worms!"

100 Amazing Water Facts You Should Know

by Seametrics Blog

Water is the most important resource in the world. Here are 100 amazing facts about water that you may not know.

68.7% of the fresh water on Earth is trapped in glaciers.[1]

30% of fresh water is in the ground.[1]

1.7% of the world's water is frozen and therefore unusable.[1]

Approximately 400 billion gallons of water are used in the United States per day.[1]

Nearly one-half of the water used by Americans is used for thermoelectric power generation.[1]

In one year, the average American residence uses over 100,000 gallons (indoors and outside).[1]

Water can dissolve more substances than any other liquid including sulfuric acid.[1]

The freezing point of water lowers as the amount of salt dissolved in at increases. With average levels of salt, seawater freezes at -2 °C (28.4 °F).[2]

About 6,800 gallons of water is required to grow a day's food for a family of four.[3]

To create one pint of beer it takes 20 gallons of water.[3]

780 million people lack access to an improved water source.[4]

In just one day, 200 million work hours are consumed by women collecting water for their families.[4]

1/3 what the world spends on bottled water in one year could pay for projects providing water to everyone in need.[4]

Unsafe water kills 200 children every hour.[4]

Water weighs about 8 pounds a gallon.[5]

It takes 120 gallons of water for one egg.[5]

A jellyfish and a cucumber are each 95% water.[5]

70% of the human brain is water.[5]

80% of all illness in the developing world is water related.[6]

Up to 50% of water is lost through leaks in cities in the developing world.[6]

In Nairobi urban poor pay 10 times more for water than in New York.[6]

In some countries, less than half the population has access to clean water.[7]

$260 billion is the estimated annual economic loss from poor water and sanitation in developing countries.[7]

40 billion hours are spent collecting water in Africa alone.[7]

The average cost for water supplied to a home in the U.S. is about $2.00 for 1,000 gallons, which equals about 5 gallons for a penny.[8]

A person can live about a month without food, but only about a week without water.[8]

Water expands by 9% when it freezes.[8]

There is about the same amount of water on Earth now as there was millions of years ago.[9]

The length of the side of a cube which could hold the Earth's estimated total volume of water in km = 1150.[10]

Children in the first 6 months of life consume seven times as much water per pound as the average American adult.[11]

Americans drink more than one billion glasses of tap water per day.[11]

The United States draws more than 40 billion gallons (151 million liters) of water from the Great Lakes every day—half of which is used for electrical power production.[12]

85% of the world population lives in the driest half of the planet.[13]

Agriculture accounts for ~70% of global freshwater withdrawals (up to 90% in some fast-growing economies).[13]

Various estimates indicate that, based on business as usual, ~3.5 planets Earth would be needed to sustain a global population achieving the current lifestyle of the average European or North American.[13]

Thirty-six states are anticipating water shortages by 2016.[14]

300 tons of water are required to manufacture 1 ton of steel.[15]

1 in 6 gallons of water leak from utility pipes before reaching customers in the US.[15]

American use 5.7 billion gallons per day from toilet flushes.[15]

Refilling a half-liter water bottle 1,740 times with tap water is the equivalent cost of a 99 cent water bottle at a convenience store.[15]

It takes about 12 gallons per day to sustain a human (this figure takes into account all uses for water, like drinking, sanitation and food production).[16]

Each day, we also lose a little more than a cup of water (237 ml) when we exhale it.[17]

By 2025, water withdrawals are predicted to increase by 50 percent in developing countries and 18 percent in developed countries.[18]

By 2025 half the world's people will live in countries with high water stress.[19]

A water-efficient dishwasher uses as little as 4 gallons per cycle but hand washing dishes uses 20 gallons of water.[20]

The average family of four uses 180 gallons of water per day outdoors. It is estimated that over 50% is wasted from evaporation, wind, or overwatering.[20]

It takes more than twice the amount of water to produce coffee than it does tea.[21]

Chicken and goat are the least water intensive meats to consume.[21]

There have been 265 recorded incidences of water conflicts from 3000 BC to 2012.[21]

Hot water can freeze faster than cold water under some conditions (commonly known as the Mpemba effect).[22]

If the entire world's water were fit into a 4 liter jug, the fresh water available for us would equal only about one tablespoon.[23]

Over 90% of the world's supply of fresh water is located in Antarctica.[23]

Water regulates the Earth's temperature.[23]

On average, 10 gallons per day of your water footprint (or 14% of your indoor use) is lost to leaks.[24]

The average pool takes 22,000 gallons of water to fill.[24]

It takes about 70 gallons of water to fill a bathtub.[25]

Flying from Los Angeles to San Francisco, about 700 miles round-trip, could cost you more than 9,000 gallons of water.[25]

Water use has grown at more than twice the rate of population increase in the last century.[26]

Only 0.007 percent of the planet's water is available to fuel and feed its 6.8 billion people.[26]

Three quarters of all Americans live within 10 miles of polluted water.[27]

A swimming pool naturally loses about 1,000 gallons (3,785 liters) a month to evaporation.[28]

Producing a gallon (3.79 liters) of corn ethanol consumes 170 gallons (644 liters) of water in total, from irrigation to final processing. On the other hand, the water requirement to make a gallon of regular gasoline is just five gallons (19 liters).[28]

40% of freshwater withdrawals in the United States are used for agriculture.[29]

65% of freshwater withdrawals in China are used for agriculture.[29]

Freshwater withdrawals for agriculture exceed 90% in many countries: Cambodia 94%, Pakistan 94%, Vietnam 95%, Madagascar 97%, Iran 92%, Ecuador 92%.[29]

If everyone in the US flushed the toilet just one less time per day, we could save a lake full of water about one mile long, one mile wide and four feet deep.[30]

If everyone in the US used just one less gallon of water per shower every day, we could save some 85 billion gallons of water per year.[30]

Over 42,000 gallons of water (enough to fill a 30×50 foot swimming pool) are needed to grow and prepare food for a typical Thanksgiving dinner for eight.[31]

An acre of corn will give off 4,000 gallons of water per day in evaporation.[31]

In a 100-year period, a water molecule spends 98 years in the ocean, 20 months as ice, about 2 weeks in lakes and rivers, and less than a week in the atmosphere.[31]

Water is the most common substance found on earth.[31]

In Washington state alone, glaciers provide 1.8 trillion liters (470 billion gallons) of water each summer.[32]

Water makes up about 66 percent of the human body.[33]

There are no scientific studies that support the recommendation to drink 8 glasses of water per day.[33]

Drinking too much water can be fatal (known as water intoxication).[33]

There is more fresh water in the atmosphere than in all of the rivers on the planet combined.[34]

If all of the water vapor in the Earth's atmosphere fell at once, distributed evenly, it would only cover the earth with about an inch of water.[34]

It takes seven and a half years for the average American residence to use the same amount of water that flows over the Niagara Falls in one second (750,000 gallons).[34]

263 rivers either cross or demarcate international political boundaries.[35]

Of the estimated 1.4 billion hectares of crop land worldwide, around 80 percent is rainfed and accounts for about 60 percent of global agricultural output (the other 40% of output is from irrigated crop land).[36]

Household leaks can waste more than 1 trillion gallons annually nationwide. That's equal to the annual household water use of more than 11 million homes.[37]

Ten percent of homes have leaks that waste 90 gallons or more per day.[37]

A leaky faucet that drips at the rate of one drip per second can waste more than 3,000 gallons per year.[37]

Each cubic foot of Martian soil contains around two pints of liquid water, though the molecules are not freely accessible, but rather bound to other minerals in the soil.[38]

There is an estimated 326 million trillion gallons of water on earth.[39]

NASA has discovered water in the form of ice on the moon.[40]

A 2.6 billion year old pocket of water was discovered in a mine, 2 miles below the earth's surface.[41]

Two-thirds of the world's population is projected to face water scarcity by 2025, according to the United Nations.[42]

1 pound of beef requires 1,799 gallons of water.[43]

1 gallon of wine requires 1,008 gallons of water.[43]

A 0.3 pound burger requires 660 gallons of water.[43]

1 slice of bread requires 11 gallons of water.[43]

1 apple requires 18 gallons of water.[43]

1 pound of chocolate requires 3,170 gallons of water.[43]

500 sheets of paper requires 1,321 gallons of water.[43]

Ground water occurs almost everywhere beneath the land surface. The widespread occurrence of potable ground water is the reason that it is used as a source of water supply by about one-half the population of the United States.[44]

Hydrologists estimate, according to the National Geographic Society, U.S. groundwater reserves to be at least 33,000 trillion gallons — equal to the amount discharged into the Gulf of Mexico by the Mississippi River in the past 200 years.[45]

At any given moment, groundwater is 20 to 30 times greater than the amount in all the lakes, streams, and rivers of the United States.[45]

About 27 trillion gallons of groundwater are withdrawn for use in the U.S. each year.[46]

The High Plains Aquifer covers eight states and 175,000 miles.[46]

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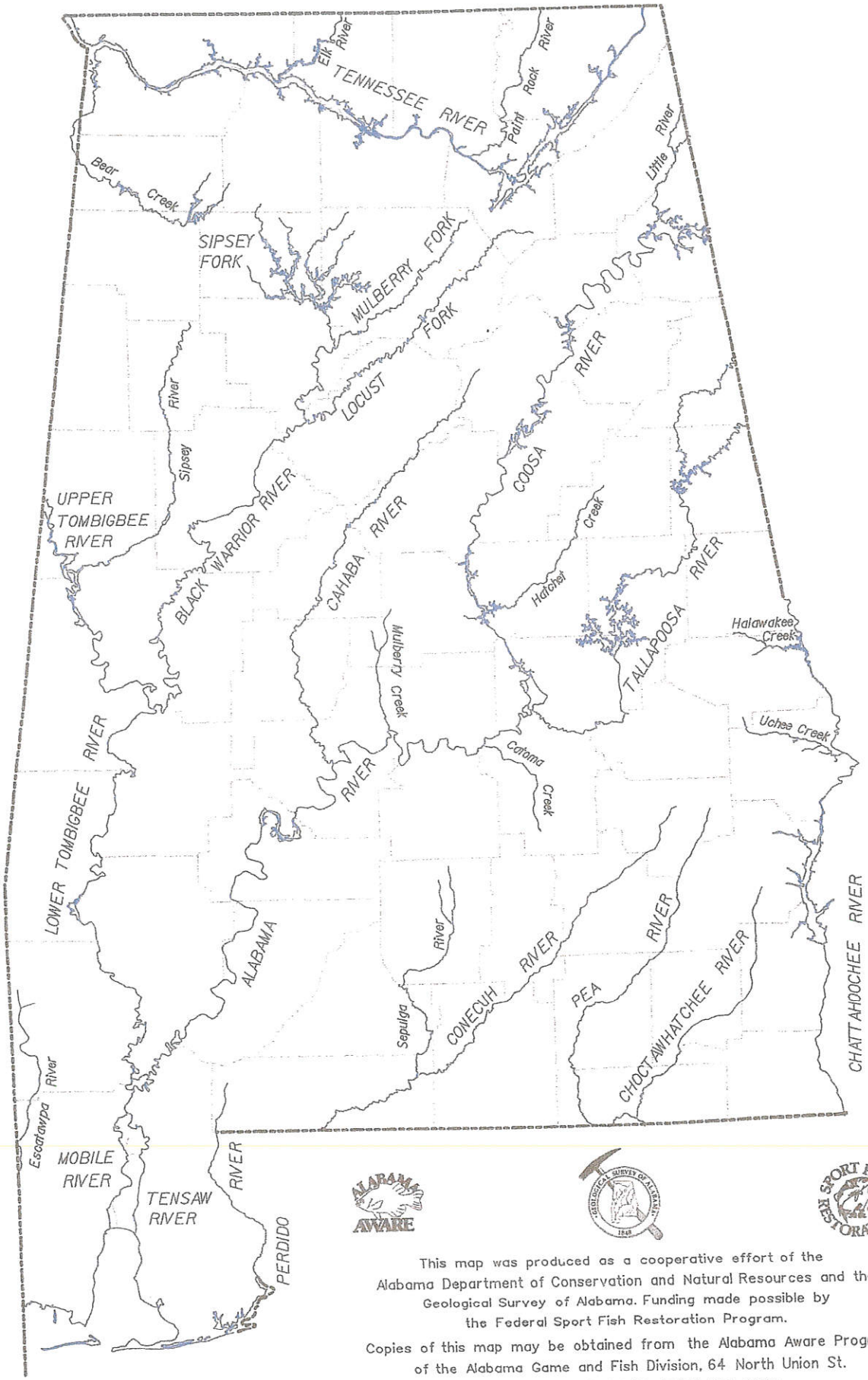
Update: Five facts have been removed as they were pointed out to be inaccurate or redundant.

RIVERS OF ALABAMA

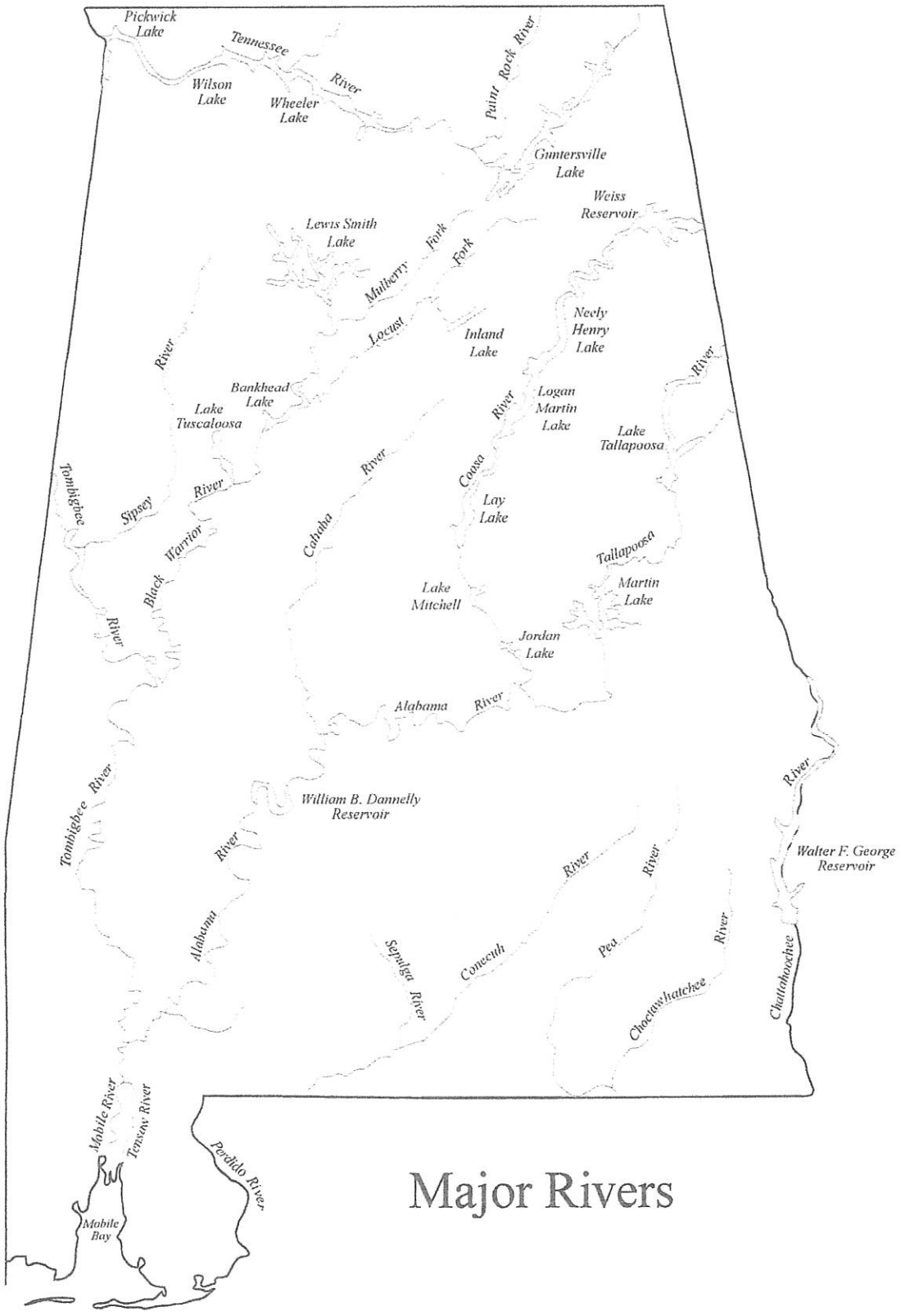


ALABAMA AWARE

SPORT FISH RESTORATION

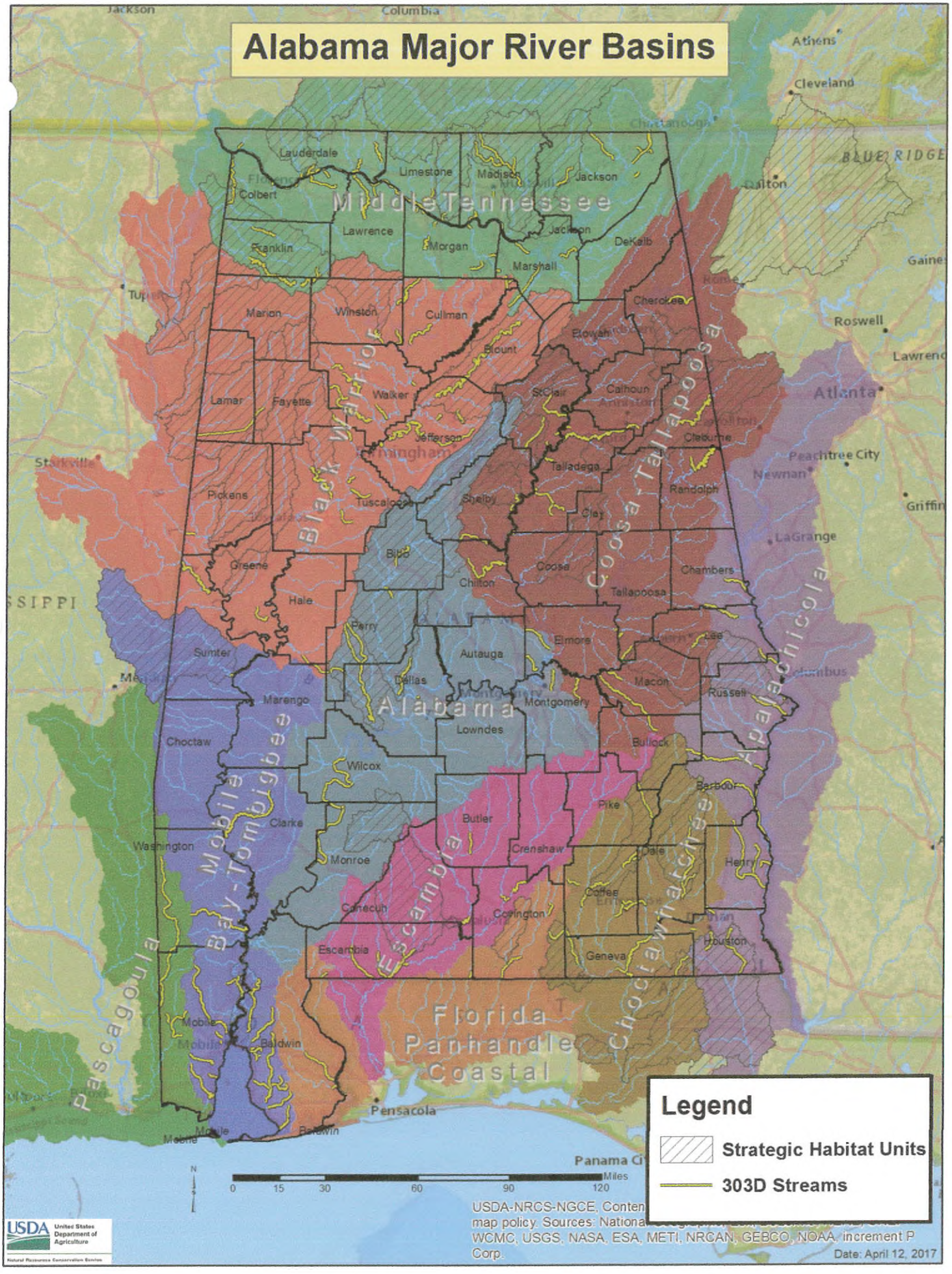
This map was produced as a cooperative effort of the Alabama Department of Conservation and Natural Resources and the Geological Survey of Alabama. Funding made possible by the Federal Sport Fish Restoration Program.

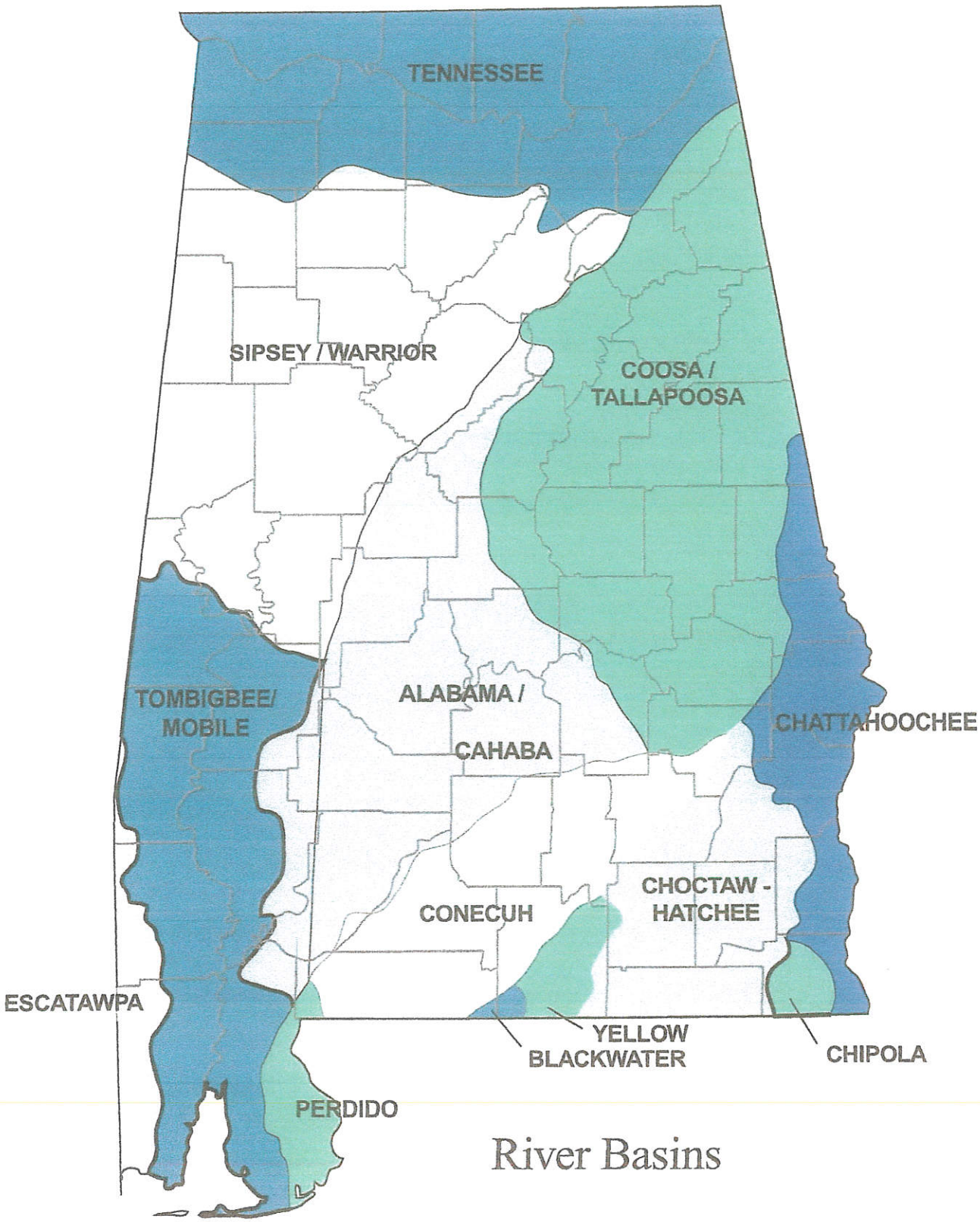
Copies of this map may be obtained from the Alabama Aware Program of the Alabama Game and Fish Division, 64 North Union St. Montgomery, Al. 36130, (205) 242-3628.



Major Rivers

Produced by the Dept. of Geography
College of Arts and Sciences
The University of Alabama


Alabama Major River Basins
Middle Tennessee
Black Warrior
Coosa-Tallapoosa
Mobile Bay-Tombigbee
Escambia
Chocta-whatchee-Apalachicola
Pascagoula
Alabama
Florida Panhandle Coastal
Legend
Strategic Habitat Units
303D Streams
0 15 30 60 90 120
Miles
USDA United States Department of Agriculture
Date: April 12, 2017



River Basins

Produced by the Dept. of Geography
College of Arts and Sciences
The University of Alabama

MAKE YOUR OWN RAIN STORM

HAVE YOU EVER MADE A RAIN STORM? LET'S WORK TOGETHER TO MAKE A RAIN STORM.

RUB YOUR HANDS TOGETHER GENTLY - WIND

SNAP YOUR FINGERS - DRIZZLE

SLAP YOUR HANDS ON YOUR THIGHS – HARD RAIN

KEEP SLAPPING YOUR HANDS ON YOUR THIGHS AND STAMP YOUR FEET - THUNDER

RETURN TO JUST SLAPPING YOUR HANDS ON YOUR THIGHS – HARD RAIN

SNAP YOUR FINGERS - DRIZZLE

RUB HANDS GENTLY – GENTLE BREEZE

STOP ALL MOVEMENTS – THE STORM HAS GRADUALLY MOVED AWAY

EXPLAIN WHAT EACH MOVEMENT REPRESENTS!

THIS IS A GOOD LEAD IN TO MOST WATER RELATED LESSON PLANS. I USE IT AT WATER FESTIVAL PRESENTATIONS AND IT REALLY BREAKS THE ICE.

WHAT YOU NEED FOR THIS DEMONSTRATION:

Clear water bottles – Make sure they are the same kind and size

FINISH FILLING WITH WATER AT THE SCHOOL (A lot less weight to have to haul to the school)

Bottle #1 add 3Tbsp dirt (not potting soil)

Bottle #2- add 2 Tbsps White Vinegar

Bottle #3 – Fill with clean water from the school

Shake the soil and water bottle up very well to make a really disgusting bottle of water. (It even helps to have a little bit of trash in the dirt) Ask the teacher if she or he were really thirsty and asked you for some water and you offered them Bottle #1 – What would be their answer? Usually "NO THANKS"...ask students if this water is suitable for cooking, bathing, swimming, etc.

Ask the teacher if Bottle #2 looks any better. Usually the answer is "Yes"...then you have them smell the water to see if it smells okay...The vinegar is not seen but it is in there. Usually they jump back in surprise. Tell the students that they should never drink water from a stream, etc., while they are outside playing. Many times the water can be polluted by run-off from all kinds of places...use imagination...like dog pooped in the stream further up the hill...yuck...

Ask the teacher if Bottle #3 looks okay. By this time they are paranoid! Just tell them that you filled that bottle right out of the faucet at their school so it really is perfectly fine. Many times the water from our faucet that has been treated at the local water treatment facility, is cleaner than the bottled water that we purchase. Thank the teacher for being such a great sport!

BUSY WATER

WATE. DOES A LOT MORE THAN JUST KEEP ME W_T! WATER IS ONE OF THE MOST IMPORTANT THINGS IN OUR WORLD! LOOK AT ALL THESE WAYS THAT WATER HELPS US! AS YOU COLOR THE PICTURE, THINK OF OTHER WAYS THAT WATER HELPS US ALL EVERY DAY!

GROWING FOOD

FIZZ POP!

FIZZ POP

MAKING THINGS

MOVING THINGS

DRINKING

HAVING FUN

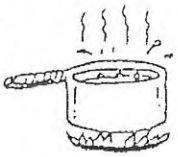
COOKING

CLEANING

WATER FACT CARDS

1

WATER WILL BOIL AT 180°F



TRUE OR FALSE

2

STEAM IS INVISIBLE.

TRUE OR FALSE

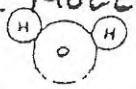
3

YOUR BODY IS ABOUT 75 % WATER

TRUE OR FALSE

4

ONE OXYGEN ATOM AND TWO HYDROGEN ATOMS CAN FORM A WATER MOLECULE



TRUE OR FALSE

5

TAKING A SHOWER USES ABOUT 8-10 gallons of water.

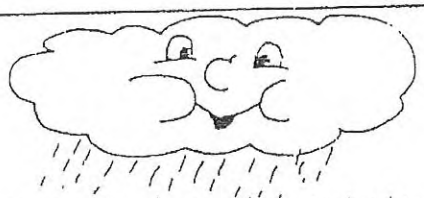
TRUE OR FALSE

6

A Person needs to take in 2½ quarts of water a day.

TRUE OR FALSE

7



Water is the only substance on Earth that is naturally present in 3 forms - SOLID, LIQUID, GAS.

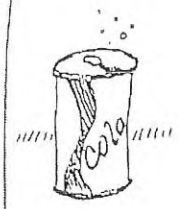
TRUE OR FALSE

8

85% of the water on Earth is in the salty oceans.

TRUE OR FALSE

9



IT TAKES 10 GALLONS OF WATER TO PRODUCE 1 can of COLA

TRUE OR FALSE

10

THE TOILET TANK USES 30% of your home's water.

TRUE OR FALSE

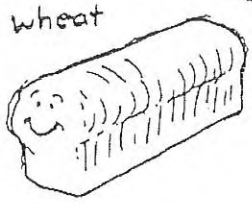
11

WATER IS THE MOST COMMON SUBSTANCE ON EARTH.

TRUE OR FALSE

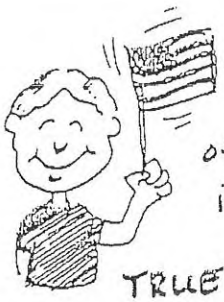
12

It takes 115 gallons of water to grow enough wheat to make a loaf of BREAD.



TRUE OR FALSE

13



Every AMERICAN uses 30 gallons of water a day in their home.

TRUE OR FALSE

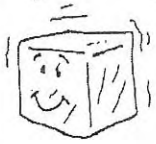
14

SNOW is a form of PRECIPITATION

TRUE OR FALSE

15

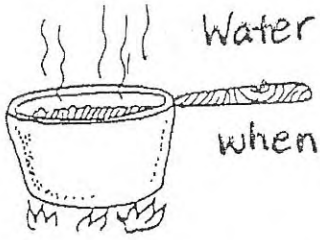
BR-R-R!!



WATER WILL FREEZE AT 32° C.

TRUE OR FALSE

16



Water will expand when heated.

TRUE OR FALSE

17

WATER IS A GOOD CONDUCTOR OF ELECTRICITY.

TRUE OR FALSE

18

WATER CONTRACTS WHEN FROZEN.

TRUE OR FALSE

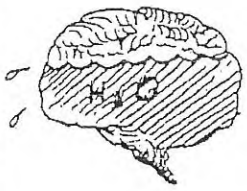
19

ANIMALS CANNOT WALK ON LIQUID WATER.

TRUE OR FALSE

20

YOUR BRAIN IS 3/4 WATER.



TRUE OR FALSE

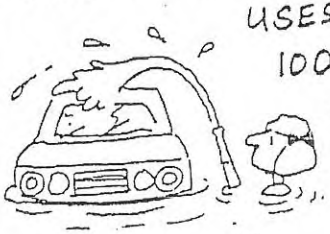
21

WHILE FALLING, A DROP OF WATER IS SHAPED LIKE A TEARDROP.

TRUE OR FALSE

22

WASHING A CAR USES ABOUT 100 GALLONS OF WATER.



TRUE OR FALSE

23

THE PREFIX "HYDRO" means "WATER."

TRUE or FALSE

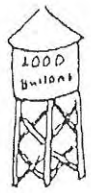
24

A GALLON OF OIL IS HEAVIER THAN A GALLON OF WATER.

TRUE OR FALSE

25

IT TAKES 2000 gallons of water to MANUFACTURE a Car.

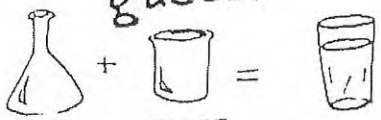


TRUE OR FALSE

29

26

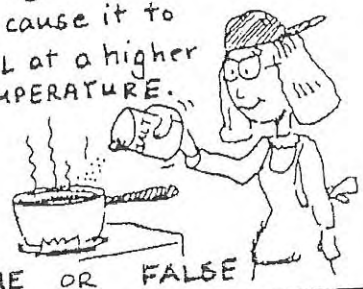
WATER IS MADE UP OF TWO COLORLESS AND ODORLESS gases.



TRUE OR FALSE

30

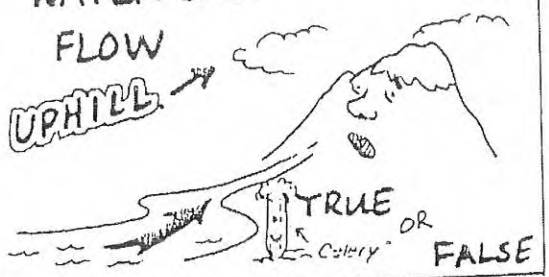
Adding salt to water will cause it to BOIL at a higher TEMPERATURE.



TRUE OR FALSE

27

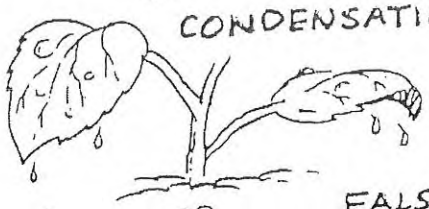
WATER CAN FLOW UPHILL.



TRUE OR FALSE

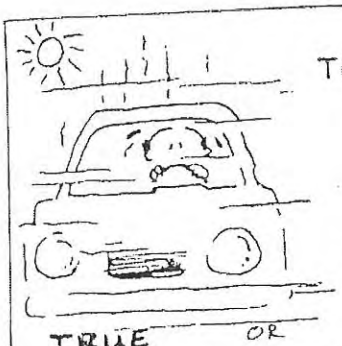
31

DEW IS A FORM OF CONDENSATION



TRUE OR FALSE

28



THE AMOUNT OF WATER VAPOR IN THE AIR IS CALLED HUMIDITY.

TRUE OR FALSE

32

A PERSON COULD LIVE WITHOUT WATER FOR ABOUT A WEEK.

TRUE OR FALSE

WATER FACTS

Answer Key

1. False* — at sea level water boils at 212°F. The boiling point of water decreases as air pressure decreases. High in the mountains water will boil at a lower temperature.
2. True — steam is invisible. The vapor seen is condensed water. Steam would be the invisible portion of the air between the tea kettle and the vapor cloud.
3. True or false — books list the percentage anywhere from 60% to 90%.
4. True — H_2O - However it is very rare to find a single water molecule.
5. False — 15-30 gallons are used.
6. True
7. True
8. False — 97% is in the salty oceans.
9. True
10. False — 40% is used.
11. True
12. True
13. False — 70 gallons per day.
14. True
15. False — 32°F or 0°C.
16. True
17. False — water itself is not a good conductor. When a person is wet the person loses his resistance and becomes a good conductor.
18. False — it expands - it is rare for a substance to expand when frozen.
19. False — due to surface tension, many insects can.
20. True
21. False — due to surface tension, a free falling drop is round.
22. True* — if you leave the hose running.
23. True
24. False — water is denser than oil, and an equal volume is heavier.
25. False — it takes 100,000 gallons to manufacture a car.
26. True — hydrogen and oxygen - H_2O.
27. True — in capillary action in plants, water molecules are attracted to one another and are pulled up to the top of the plant.
28. True
29. False — much of the water will evaporate and the water will not reach the plant's roots.
30. True — this is why you add salt to water when boiling pasta.
31. True
32. True* — however this depends on the temperature of the environment.

*Accept answers, true or false, if the answer is based on some logical explanation.

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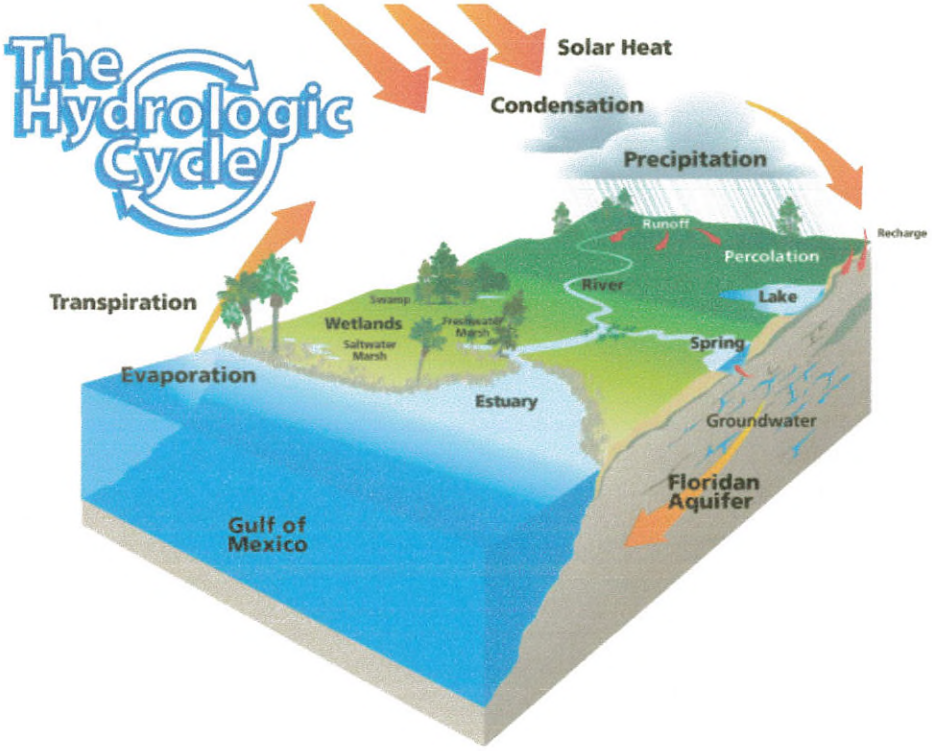
The Water Cycle

Water is restless; it likes to move. *Gravity makes it flow downhill, off your roof, into creeks, down rivers and even over giant waterfalls. Some water sinks into the ground, but most of it ends up filling the oceans, which cover over two-thirds of the planet.*



The water cycle doesn't end in the oceans though. Water at the sea's surface is able to defy gravity and climb back up into the sky. How? Because water isn't always a liquid. You know that in really cold weather, or your freezer, water can freeze into a solid that we call "ice." But in warm or dry weather, water can evaporate into an invisible gas. We call that gas "water vapor." When the air has a lot of water vapor in it, we say it is humid. Florida is humid most of the year!

Water vapor can rise up and then condense into tiny droplets that form clouds. From those clouds, water can fall back to the ground as rain or snow, which keeps the restless water cycle flowing.

What's the invisible part of the water cycle that's important to people all over the world? Read on: The Hidden Water

THE AMAZING, DISAPPEARING HAND EXPERIMENT

When the sun shines on water, water slowly begins to disappear. When this happens, it is called **evaporation** (ee-vap-uh-rey-shun). Evaporation happens when the sun takes the water and turns it into vapor. Try this experiment so you can see evaporation for yourself.

You will need:

A bowl of water
A sunny sidewalk
A shady sidewalk

Begin the experiment:

1. Dip your hand in the bowl of water and make a handprint on a sunny sidewalk. Count how long it takes to disappear. Write the number that tells how long each handprint lasted.

2. Now go to a shady sidewalk and make a water handprint there. Count how long it takes to disappear. Write the number that tells how long each handprint lasted.

Sunny Sidewalk

My handprint lasted

_____seconds.

Shady Sidewalk

My handprint lasted

_____seconds.

Make discoveries: Did one handprint last longer than the other? If so, why do you think that happened?

Free school tours: The Springs Preserve offers free, interactive tours for school groups year-round. Teachers, please call **822-7744** for details.

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Desert Discovery is a publication of the Southern Nevada Water Authority. Learn more about water and your desert environment at our Web sites.

SOUTHERN NEVADA WATER AUTHORITY
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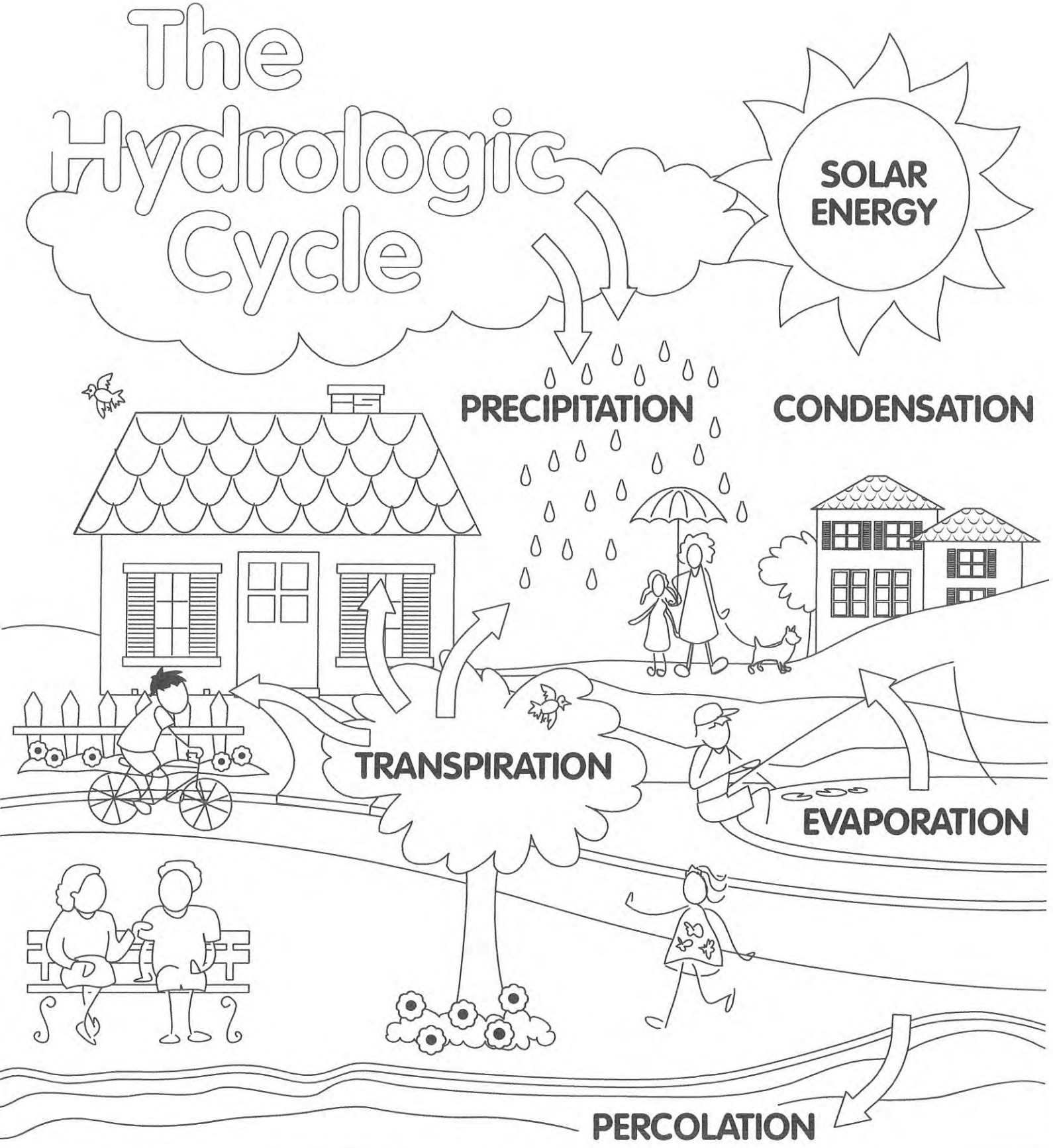
Learn more

Read: "Big Rain Coming" by Katrina Germain. In this picture book, everyone and everything in the Australian outback waits for rain.

"Down Comes the Rain" by Franklyn Branley. Where does rain come from? Learn about the water cycle in this book.

The Hydrologic Cycle



Solar energy: energy provided by the sun for the never-ending water cycle

Evaporation: vapor created when the sun heats water in lakes, streams, rivers or oceans

Transpiration: vapor created when plants and trees give off moisture

Condensation: tiny droplets of water formed when water vapor rises into the air and cools

Precipitation: moisture released when clouds become heavy and form rain, snow and hail

Percolation: movement of water through the ground

Southwest Florida
Water Management District
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VISAY 03-10

WATER CYCLE BRACELETS

Materials:
Multicolor beads, 14" strands of leather of twine, fish bead in baggie

Representation of Beads:
Blue - Precipitation
Brown - Infiltration
Green - Transpiration
Yellow - Evaporation
White - Condensation

Concepts:

- The water, or hydrologic, cycle is nature's recycling system
- Processes or steps include transpiration, evaporation, condensation, precipitation, and infiltration
- The many forms that water takes on are proof to us that the water cycle exists, is successful, & never-ending

Activity

1. Ask the students to raise their hands if they think the water that they drink and use today (for cooking, bathing, etc.) is the same water that the dinosaurs used millions of years ago. Tell the students that whoever raised their hand is correct - the water we use today IS the same water that the dinosaurs used. this is due to the water cycle. The water on earth today has been here for millions of years. Because of the water cycle, water moves from the earth to the air to the earth again. It changes from a solid to liquid to gas, over and over again. Tell the students that they are going to learn about the hydrologic cycle in this activity. In the word "hydrologic", "hydro" means water and "logic" is how events, situations, objects interact.

2. Explain to them what the **HYDROLOGIC CYCLE** is- a perpetual motion - a natural process of water molecules recycling from the land, to the air, and back to the land (use the poster of the Water Cycle as a visual aid). Not all water goes through the cycle together. Some of it stays in certain processes longer than the remainder. You might want to also explain other types of cycles that we have - seasons of the year, the lunar cycle, planetary cycle, etc. - and how they are also a part of our daily life. Have helpers/assts. pass out baggies, one per student.

3. Tell the students that the hydrologic cycle does not have a beginning or an end, however, in today's lesson you will begin with **PRECIPITATION**. Ask the students, "Who can name a kind of precipitation?" - (rain, snow, sleet, and hail). Explain that precipitation happens when water falls to the earth. Whether or not it hits the earth as a raindrop, snow crystal, piece of hail or whatever depends on the temperature, season, and location. When the humidity is low the air is very dry and the rain will not reach the ground. It will evaporate on the way down. Use the poster to point out precipitation. Tell the students that they will use the blue bead to represent precipitation. Have everyone tie a knot in their leather strand about 2 inches from the end (or have it already tied). Take 1 blue bead out of the baggie and feed the longest section of the leather strand from the knot through the hole in the bead.

4. Ask the class if anyone knows what the next part of the hydrologic cycle is? **INFILTRATION**. Infiltration happens when water fills the pore spaces between individual soil particles. It is kind of like when dirt becomes mud. Not all water gets infiltrated, some runs off across the land surface (called runoff) or falls into a body of water. Some also seeps into the ground and becomes groundwater, which is

where many of you receive your drinking water. Think of groundwater as water that fills the spaces between rocks and soil particles underground, in much the same way as water fills a sponge. Groundwater begins as precipitation and soaks into the ground where it is stored in underground geological water systems called aquifers. Sometimes groundwater feeds springs, lakes, and other surface waters or is drawn out of the ground by humans (via wells). Ask the class if they know what the word "recharge" means. Explain that recharge is when water falls directly into a body of water (river, lake, etc) and fills it up/replenishes it, or when water seeps into the ground and travels into an aquifer or when it travels over the ground surface eventually landing in a river or lake. Use the poster to show/explain recharge. When water becomes "runoff", it is caught by dams or grassy patches and collected. Many farmers build "terraces" or dig trenches or ditches to catch runoff to use for growing plants and food. Have the students feed a brown bead onto their leather strand to represent infiltration.

5. Now tell the students that once water is infiltrated into the soil, it can be sucked up by plants and used to keep the plants alive. It's like their roots drink it up. Once they've used all the water they need, they give it off through their leaves as water vapor or gas. This process is called **TRANSPIRATION**. Have the students feed a green bead through the leather strand for transpiration.

6. Ask the class if they know the next part of the hydrologic cycle? **EVAPORATION**- Explain evaporation. If the water that goes through the soil is not sucked up by a plant, it will move slowly through this rock you see on the poster until it reaches the surface again in the form of a "seep", spring, or artesian well (water from an aquifer that rises above the ground). Once it reaches a surface body of water again like a lake or ocean storage, the sun heats it up and it evaporates. So, we have reached the point of EVAPORATION. The sun makes water evaporate from building, land, people, and bodies of water. When it evaporates, it leaves behind minerals like salts (such as you find in oceans), but this is a natural process - fish and plants in the ocean are made to survive in the salt water. Have the students feed a yellow bead onto their bracelet to show evaporation.

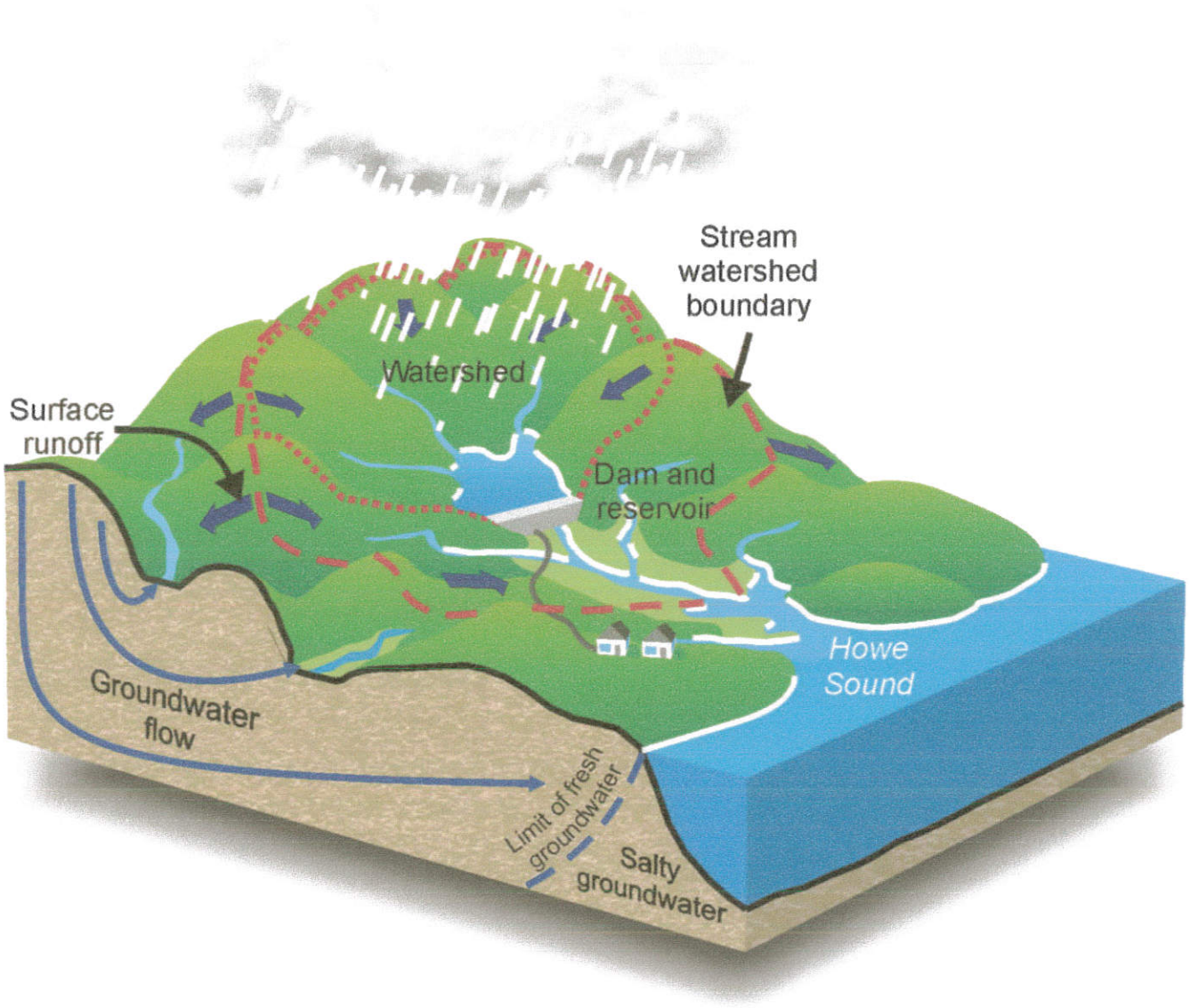
7. When the water gets up high in the earth's atmosphere, it condenses together to form clouds. That's why we call it **CONDENSATION**. Condensation occurs when water vapor rises until it reaches cold air. It then changes to a liquid, condenses and attaches to particles (dust, smoke, smog, etc) to form drops. The drops join to form clouds. As the drops get bigger, the clouds get darker. A cloud turns dark because light hits the cloud and is absorbed making the cloud dark. Have the students feed a white/clear bead onto their bracelet to show CONDENSATION.

8. Explain to the students they have finished 1 complete cycle and next you will review the water cycle again to finish making their bracelets. Have the students feed a fish bead through the leather strand. Explain that the fish represents life, and good clean water. Next, start with CONDENSATION and ask a student to briefly explain condensation. Have them put a clear/white bead on the bracelet. Ask the students what part of the cycle is next? EVAPORATION-Have them place a yellow bead on the bracelet. Keep asking the students to name the next cycles (TRANSPIRATION, INFILTRATION, PRECIPITATION) until their bracelets are finished. Have them help each other and ask asst/helpers to help tie the strings around their wrists. Remind them to show their bracelets to their family and friends and explain to them the water cycle.

Please clean and straighten your room. It is important we leave the room as clean as when we entered.

What in the World is a Watershed?

Watershed Diagram



From: http://geoscape.nrcan.gc.ca/h2o/bowen/images/watershed_e.jpg

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We All Live in a Watershed

Land is very important to the water cycle. A WATERSHED is any area of land that water flows across or through. Where is the water going? Downhill of course. Water in a watershed trickles and flows toward a common body of water, such as a stream, river, lake or coast. Watersheds can be big or small, but they usually have high points (like ridges) as their upper boundaries. So watersheds capture water, store it and eventually release it farther downhill.

What sort of land is your watershed made of? It's easy to find out. First you need to know if the land where you live is steep or flat.

- Steep land makes water run off in fast-moving creeks and rushing rivers.
- Flat land allows water to collect into lakes, ponds and swamps.

Now think about what happens when you dig a small hole. Do you find solid rock, fine silt or dirt that is loose and sandy?

- Loose ground (like gravel or sand) is POROUS, which means it has lots of little gaps that water can easily sink into. When water sinks into the ground, we call it GROUND WATER, and it fills an underground water supply called an AQUIFER.
- Tightly packed ground, like clay or solid rock, isn't very porous at all, so it's hard for water to move through. Layers like that can trap water at the surface or below ground.

Read on: Green and Leafy and Important

Building Your Own Watershed

Grade Level: 5-8
Subject Areas: Physical Science, Life and Space Science
Duration: two-three class periods
Setting: classroom/lab
Skills: organizing, analyzing, and interpreting information
Vocabulary: watershed, nonpoint source pollution

Related State Content Benchmark Objectives

- **Describe how rainwater in Alabama reaches the oceans**
- **Describe and identify surface features using maps**

Objectives

Students will:

- construct a model watershed made out of clay; and,
- predict how water will move off "the land" and where it will end up.

Materials

- 2 lbs. of modeling clay
- miscellaneous items like flexible plastic straws and tongue depressors
- food coloring or granulated jello mix
- sprayer

Background

A watershed is defined as the land area that drains water towards a common channel or body of water. For younger students, the concept of a watershed is fairly abstract and embodies such concepts as topography and energy potential. To help make the concept of a watershed more concrete for younger students, it is helpful to link an outdoor activity, with hands-on/constructive type activity. For the Grand Traverse Bay watershed, it is important that students make the connection between the relatively still waters of the bay and the moving waters of rivers that flow into the bay. It is also important that students understand that we are part of a much larger basin (the Great Lakes) that sends water through the St. Lawrence River to flow into the North Atlantic.

The Activity

1. To introduce this activity, and to assess prior knowledge, take students outside during, or immediately after a rain. Have students observe how water flows off parking areas or paved areas around the school. Where do these little rivers go? Do they ever flow uphill?

2. Give each student a piece of paper. Ask them to crumple up the paper into a ball, and then to gently undo the ball. Students will discover a piece of paper with little valleys and hills when they lay it on their desks. Students may place their pieces of paper on a waterproof tarp or plastic sheet, and spray their pieces of paper with water. Observe the routes the water takes as it flows "uphill". Talk about a watershed and introduce the clay watershed activity.

3. Inside the classroom, divide the class into small groups. Each group should have one lump of clayabout the size of a softball. Explain that this will become their watershed. Students can form valleys and hills in the clay that look like the crumpled paper.

4. Once students have molded the clay into valleys, hills, mountains, rivers, and lakes remind them that they can use the tongue depressors to build bridges, or houses, or any structure they might see in their community. The food coloring or granulated jello mix can be applied to the surface of the model to highlight the flow of water from the sprayer.

5. As an extension activity, the flexible straws can represent sewers that students embed into their clay model. The food coloring or granulated jello mix represents pollutants on the land that are carried away by the rainfall (nonpoint source pollution).

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Is Your Watershed Healthy?

Healthy watersheds keep recycling clean, fresh water, over and over again. How do they do it? Swamps, marshes and other wetlands can filter polluted water and make it cleaner. Other parts of a watershed, like streams, GROUND WATER and even the beach, are important as well. That's one reason why we need to make sure to leave enough wetlands and other natural areas in each watershed. **Sometimes it's tricky to balance the needs of people with the needs of their watershed, but we sure have to try.** If we do it right, there's still room for plants and animals to live and everybody gets an endless supply of clean water.

Why should you care if your watershed is healthy or not?

Did you use water today? How many times?

Everyday Use

- Did you drink water, or something with water in it like juice or soda?
- Did you brush your teeth?
- How about taking a bath or shower?
- Maybe you helped wash the car?
- Or gave some water to your pets or plants?

We use water plenty of times, each and every day. Over half your body is water! **Living in a healthy watershed means you have a never-ending supply of the clean water that you need every day.**

Why else should you care about your watershed? How about:

Food

Farms need clean water for their crops and animals. You don't want to eat food that was grown with polluted water do you?

Business

Many businesses and industries need a lot of water to operate, so a healthy watershed means jobs. Did you know it takes about 1,800 gallons (6,840 liters) of water to make a pair of cotton jeans? How about 32,000 gallons (121,600 liters) to make the steel in a car?

Recreation

Do you like to go swimming? Or boating? Do you like to canoe, fish or

water-ski? *You wouldn't want to do these things in polluted water.* Everybody loves floating down the river, boating at the lake or swimming at the seashore. But if we use too much water or carelessly develop too much of the watershed, then we lose our natural water parks, the best places to play. We have to be careful not to pollute as well, or beaches and rivers will make people sick and end up being closed.

It's a privilege to live in a healthy watershed, and people are willing to pay for it. Property near a clean beach, river or lake is very valuable. And not just to us!

Wildlife

Though they can't tell us directly, plants and animals need healthy watersheds just like we do, maybe even more. A healthy watershed means a healthy environment for them to live and grow in.

Read on: Gross or Good?

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Gross or Good?

Sometimes pollution is easy to see. Garbage and oily chemicals make water look nasty, but pollution can also be invisible. So how do you know if a pond, lake or river is healthy? Scientists test the water to help them find out — and so can you.

With a water testing kit and some help from an adult, you'll be able to test TEMPERATURE, TURBIDITY, DISSOLVED OXYGEN and pH. Wondering what those are? Check the glossary, or follow this link to the water quality monitoring pages...

http://www.swfwmd.state.fl.us/education/kids/watermonitoring/index.html

Read on: Is Your Yard Florida-Friendly?

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Stormwater Runoff

What Is Stormwater Runoff?

In Florida, stormwater runoff occurs after a rainfall. Storm water flows over impervious (unable to penetrate) surfaces like driveways, sidewalks, streets, parking lots and roofs and is unable to percolate (filter or seep) into the ground. This unfiltered water reaches our neighborhood streams, ponds, lakes, bays, wetlands and oceans and can eventually make its way into our ground water. (Water beneath the earth's surface)

Why Is Stormwater Runoff a Problem?

Stormwater runoff can collect many different types of pollution before it reaches a body of water, including debris, dirt and chemicals. The storm water collects these materials and flows directly into a body of water like a stream or lake. These water bodies may be used for swimming, fishing and may even provide some of us with drinking water!

How Do Different Types of Pollution Affect My Watershed?

There are two basic types of pollution: point source and non-point source. Point source pollution is easy to understand because it can be traced directly to its source. Think of it like this: if a sewage plant has a broken pipeline that leaks raw sewage into a river, you can "point" your finger at the exact source of the pollution. Point source pollution was a big concern in the past, but today stricter laws and regulations have drastically decreased the problem.

Non-point source pollution is a little more difficult to understand. Stormwater runoff pollution is a type of non-point source pollution. This means that the pollution cannot be traced back to a specific source, but instead comes from many different sources throughout the environment. Non-point source pollution is the primary cause of watershed pollution today. Non-point source pollution occurs when small amount of pollution from a large variety of sources is picked up by stormwater runoff and carried into water bodies. You can't point to the specific origin of the contamination; it comes from too many places and is difficult to trace.

Stormwater runoff can carry many different types of non-point source pollution. Each can affect your watershed in a different way. Sediment (dirt, soil, sand) can increase the turbidity (a measure of water cloudiness) of a water body. Turbidity can block sunlight from reaching aquatic plants, making it impossible for them to grow. Without plants, animals lose a food source and it is more difficult to filter pollutants from the water. Instead, pollutants collect in the bottom of the water body and remain there indefinitely.

Excess nutrients carried in stormwater runoff can also negatively affect our water supply. These nutrients, primarily nitrogen and phosphorus, can come from lawn fertilizers or natural sources, such as manure. Nutrients can cause algal and bacterial blooms, which proliferate (reproduce) rapidly. Algae will consume oxygen, increase turbidity in the water body and eventually die along with the fish and other aquatic life that need oxygen to live.

Pathogenic (capable of causing disease, especially in humans) bacteria and other pathogenic microorganisms can be carried by storm water into a water body. This creates health hazards and can cause lakes and beaches to close.

Debris such as plastic bags, bottles and cigarette butts can wash into a water body and interfere with aquatic life. It also isn't very pretty. Other hazardous wastes can be carried into a water body. These include insecticides, (chemicals used to control or kill insects) herbicides, (chemicals used to kill unwanted plants) paint, motor oil and heavy metals. All of these items can cause illness not only to aquatic life, but also humans.

REMEMBER: All of these pollutants can make it into our drinking water through the hydrologic cycle.

What Can You Do?

Now you know that pollution from stormwater runoff can contaminate our water supply. So what can you do to prevent this problem? Here are some tips to help you on your way to a pollution solution:

- Never Dump Anything Down Storm Drains
- Use Florida-Friendly Landscaping (Link)
- Use Fertilizers Sparingly
- Control Soil Erosion by Planting Over Bare Spots in Landscape
- Collect Rainwater in Rain Barrels for Lawn Use
- Sweep Driveways, Sidewalks and Roads Instead of Using Hose
- Compost Yard Waste
- Properly Dispose of Hazardous Household Chemicals
- Avoid Pesticides
- Direct Downspouts Away From Paved Surfaces
- Use Car Wash Instead of Washing Car in Driveway
- Check Car for Leaks and Recycle Motor Oil
- Properly Dispose of Pet Waste
- Inspect and Pump Septic Tank Regularly
- Protect Wetlands that Serve as Natural Buffers to Pollution, Soil Erosion and Flooding
- Join Adopt-a-Watershed (EPA Link)
- Educate Friends, Family, Neighbors (EPA Link for brochures, or for materials we can send)
- Recycle
- Contact the SWFWMD for Special Projects and Additional Information

Life In A Fishbowl

OBJECTIVES:

The student will be able to:

1. Locate his/her hometown on a map of Alabama.
2. Describe sources of water pollution in Alabama rivers, lakes, and streams.
3. Recognize the importance of keeping water clean.

BACKGROUND:

Fish and other water organisms need oxygen to live. Pollutants take away the oxygen in water that these organisms need. Thus the more pollutants there are, the less likely fish will survive. A few pollutants that can be found in Alabama's rivers, lakes, and streams are detergent, motor oils, and fertilizer. This activity will let students see the effects pollutants and a lack of oxygen can have on fish.

VOCABULARY:

decompose - to decay or rot from a process of microbial action
eroding - land that is worn away or washed away
fertilizer - chemical applied to crops and lawns that can be washed out of the air and soil and into the water supply
pollutant - a substance that can harm water, air, land, or living organisms

ADVANCE PREPARATION:

1. Locate a map of Alabama. Have a sticker to place on map for locating hometown.
2. Make fish and fishbowl (as stated in procedure).
3. Gather all ingredients and place in film canisters.
4. Locate overhead projector or flashlight. (Note: There is a danger of the water weight breaking the glass on an overhead.)

Grades:

K-2

Subjects:

Science, Language Arts, Geography, Social Studies

Time Needed:

50 minutes

Materials:

map of Alabama
stickers
glass fishbowl or similar container
fish made from construction paper with contact paper and one paperclip for a weight
overhead projector or flashlight
nine empty film canisters with tops
liquid dish detergent (1 tbs)
red food coloring with water (1 tsp)
1/4 cup of each ingredient:
soil
cooking oil
salt
paper confetti
powdered detergent
hot water

PROCEDURE:

Setting the Stage

1. Show map of Alabama.
   - Instruct students to locate their hometown.
   - Allow a student to place sticker on correct spot.
2. Locate the closest body of water.
   - Ask students to name things that live in the water.
   - Have students come up with a name for the fish in the activity. (Use the name of closest body of water for story.)
   - Explain to students they will be shown a demonstration of what can happen to fish when people pollute the water.

Activities

1. The fishbowl can be made from a glass or plastic fishbowl, a pickle jar, a three-liter clear soft drink bottle

(remove plastic container from bottom and cut off the tapered top), or any similar container. The fish can be cut from construction paper, covered with contact paper or any other waterproof item.
- Place fish on a stick or tape to front of bowl.
- Put the bowl on an illuminated overhead projector or use a flashlight behind the "river."

2. Read and adapt narrative. Ask individual students to add the ingredients in the film canisters as indicated to represent pollution.

Teacher's Note: Teachers should review the narrative in advance and adapt the language to the students' level.

Narrative: Imagine a river as it meanders through the countryside, past the farmers' fields, widening into a lake, but narrowing again as it passes through the city. In this river named _____ lives a fish. Its name is _____. (Point to the fish in the clear water in the fishbowl). **Ask: How does it feel to be this fish?**

(This question should be asked repeatedly throughout the story and should generate an enthusiastic response from the students. Let students respond aloud.)

The fish swims down the river past an eroding bank. An eroding banks is where soil sometimes gets washed into the river. When it rains, what will happen to the bank? What if it rains a great deal? (Have student pour soil from the container into the water.) **Ask: How does it feel to be this fish?**

Suppose part of the soil eroding into the water came from farmland. The farmer has just put fertilizer on the field. Instead of staying on the field to help the crops grow, some of the fertilizer may ride "piggy-back" on the eroding soil and go into the river. (Add sand to simulate fertilizer.) What effect will the fertilizer have on the plants in the river? (It will make plants grow.) If the plants grow too abundantly and too fast, the river can't continue to support them. They die, fall to the bottom, and start to decompose. Decomposing things use oxygen. What else in the river needs oxygen? (the fish) **Ask: How does it feel to be this fish?**

Farm fields aren't the only source of fertilizer that can flow into a river. Homes may also be a source. Where the river has widened into a lake, several families have built their homes. Perhaps their septic tanks drain into the water, or some of the fertilizers they've put on their lawns have washed into the water. (Add liquid dish detergent to represent pollution from homes. Detergents have some of the same chemicals in them as fertilizers.) As the lake narrows into a river, our fish continues downstream past the city. Even though the city people don't pollute the water directly, what they do at their own homes or subdivisions can affect the quality of the river's water. Have you ever seen a car leaking oil? Where does the rain wash this oil? Oil covers the top of the water so oxygen cannot get in. (Put the oil into the fish bowl.) **Ask: How does it feel to be this fish?**

In the winter when it gets icy and snows, what do we put on our roads to make it easier to drive? (Salt or sand. Put salt into the water.) When you eat or drink something salty, what do you do? (You get something else to drink.) Can this fish get fresh water to drink? (No.) **Ask: How does it feel to be this fish?**

Suppose the city has a park next to the river. People litter the park, and some of it blows into the water. (Put pieces of paper into the fishbowl.) **Ask: How does it feel to be this fish?**

As the river leaves the city, there are several factories that are located along it. Although regulations are strict, if the factory's control equipment is not working properly, some chemicals or heated water may flow into the river. (Put powdered detergent into the fishbowl and stir for effect.) **Ask: How does it feel to be this fish?**

The waste water treatment plant for the city is also located along this section of the river. The plant does its best to clean out impurities, but some polluted water gets into the river. The river has a large volume of water though, and the plant only puts a small amount of pollution into it. It shouldn't cause too much of a problem. Right? It would be like putting two drops of this food coloring into this jar of water. (Put in food coloring and stir it.) **Ask: How does it feel to be this fish?**

Follow-Up

1. Ask students if they have ever seen a river, lake, or beach closed for swimming.
2. Ask students if they would like to swim in a river like the one in the story.
3. Review story and discuss ways the students could help solve some of the problems mentioned.

EXTENSIONS:

1. Have students draw pictures of how fish and other water organisms would look if they lived in polluted waters. Allow them to draw new pictures in which the fish live in clean water and discuss the differences in the pictures. Display on bulletin board to show contrast.
2. Read or improvise as a blues tune.
3. Ask a local fish expert to come and speak with the class. Have students create questions ahead of time and send these to the guest speaker.

THE DIRTY WATER BLUES

Pure water gurgles
and splashes along
until pollution
flows into the song:
oil, tar, paint, dye,
mud and muck
come splashing by.
Cans, jars, bottles,
Old shoes, old news--
that's the dirty water blues.
Sweet fresh water
rolls away from this song,
while dirt and pollution
keep flowing along,
and along, and along.

ORIGINAL DEVELOPMENT RESOURCES:

Miles, B. (1988). *Save the Earth! An ecology handbook for kids*. New York, NY: MacMillan Publishing Co.

South Carolina Department of Health and Environmental Control, *Action for a cleaner tomorrow*. (used by permission). Call 1-800-768-7348 for trainings and workshops.

(*Point to the fish in the clear water in the fishbowl*). **Ask: How does it feel to be this fish?** (*This question should be asked repeatedly throughout the story and should generate an enthusiastic response from the students. Let students respond aloud.*)

The fish swims down the river past an eroding bank. An eroding bank is where soil sometimes washes into the river. When it rains, what will happen to the bank? What if it rains a great deal? (*Have student pour soil from the container into the water.*) **Ask: How does it feel to be this fish?**

Soil
Fertilizer
Seed

Suppose part of the soil eroding into the water came from farmland. The farmer has just put fertilizer on the field. Instead of staying on the field to help the crops grow, some of the fertilizer may ride "piggy-back" on the eroding soil and go into the river. (*Add sand to simulate fertilizer.*) What effect will the fertilizer have on the plants in the river? (*It will make plants grow.*) If the plants grow too abundantly and too fast, the river can't continue to support them. They die, fall to the bottom, and start to decompose.

Berry
Kool-aid
Pesticide
Ants

Decomposing things use oxygen. What else in the river needs oxygen? (*the fish*) **Ask: How does it feel to be this fish?**

Salt
Sand

Farm fields aren't the only source of fertilizer that can flow into a river. Homes may also be a source. Where the river has widened into a lake, several families have built their homes. Perhaps their septic tanks drain into the water, or some of the fertilizers they've put on their lawn have washed in the water. (*Add liquid dish detergent to represent pollution from homes. Detergents have some of the same chemicals in them as fertilizers.*)

Choc
Oil

As the lake narrows into a river, our fish continues downstream past the city. Even though the city people don't pollute the water directly, what they do at their own homes or subdivisions can affect the quality of the river's water. Have you ever seen a car leaking oil? Where does the rain wash this oil? Oil covers the top of the water so oxygen cannot get in. (*Put chocolate syrup, representing oil, into the fish bowl.*) **Ask: How does it feel to be this fish?**

In the winter when it gets icy and snows, what do we put on our roads to make it easier to drive? (*Salt or sand. Put salt into the water.*) When you eat or drink something salty, what do you do? (*You get something else to drink.*) Can this fish get fresh water to drink? (*No.*) **Ask: How does it feel to be this fish?**

Litter
Oats

Suppose the city has a park next to the river. People litter the park, and some of it blows into the water. (*Put pieces of paper into the fishbowl.*) **Ask: How does it feel to be this fish?**

Clear
Equipment
Pond
Net
Polluted
water

As the river leaves the city, there are several factories that are located along it. Although regulations are strict, if the factory's control equipment is not working properly, some chemicals or heated water may flow into the river. (*Put powdered detergent and hot water into the fishbowl and stir for effect.*) **Ask: How does it feel to be this fish?**

1 drop
food color

STIRRING UP TROUBLE IN OUR WATERSHED

What is the difference in Point and Non-Point Pollution?

Can I point my finger at any one source…or can I point my finger at a whole group of sources that are causing the pollution.

Does Water flow upstream or downstream?

Downstream

Show Map – Indicate how water flows from state to state…

If water is polluted upstream, it will flow on downstream as polluted water!

ITEMS FROM BAG:

LITTER – Oatmeal

PARKING LOT DRIPS make beautiful toxic rainbows

DISTURBED TOPSOIL - money lost and streams polluted

COW POOP – Chocolate sprinkles – Veternarians even agree that it is not good for cows to drink their own waste.

SEPTIC TANK FAILURE – Yellow dish Detergent and chocolate sprinkles.

FERTILIZER – Good stuff in the right amounts and in the right place.

ICE & SNOW ON ROADS – What effect does SALT/SAND have on melting snow and ice...what about the effect of runoff in our streams?

PESTICIDES GOOD OR BAD – Bugs, ants, boll weevils...follow label directions and use the safest method possible.

FACTORY EMISSIONS – Air pollution blows around in the air and can still pollute wind up in our streams.

Do You Get My Point?
Point And Nonpoint Source Pollution

OBJECTIVES:

The student will be able to:

1. Observe the relationship between groundwater and surface water.
2. Simulate the effects of nonpoint source water pollution.
3. Experience the difficulty of cleaning up polluted waters.

Grades:
3-5

Subjects:
Science, Art

Time Needed:
One class period
small groups of two to four

Materials: (per group)
266 ml plastic cup or plastic 2-liter soda bottles
clean pea-size gravel to fill each cup 3/4 full
three small paper cups (app. 240 ml)
water
one bottle of red food coloring
pump dispenser from soft soap or hand lotion containers

BACKGROUND:

Although about 80 percent of the Earth is water, only about one percent of this water is available for our use. About 90 percent of the water we use each day is stored in aquifers.

Water contaminants come from a variety of sources. The massive extent of the underground water system makes contamination difficult to trace. There are two ways to categorize sources of pollution: point and nonpoint sources.

Point sources are easily identified. These might be industrial waste, municipal waste, manufacturing waste, or household waste. Nonpoint sources are not easily identified. They come from agricultural runoff, logging, leaking pipes, underground storage tanks, sewer systems, septic tanks, and chemical discharges.

Surface waters and underground waters are connected in many areas. What affects surface water also invades aquifers. Polluted groundwaters may also discharge to the surface and enter clean streams. Because everything is interconnected, it becomes much harder to clean up the results of pollution.

VOCABULARY:

aquifer - the underground body of porous sand, gravel, and fractured rock filled with water and capable of supplying useful quantities of water to a well or spring
groundwater - water found in the porous spaces of soil and rock
surface water - water on the Earth's surface such as rivers, streams, and oceans

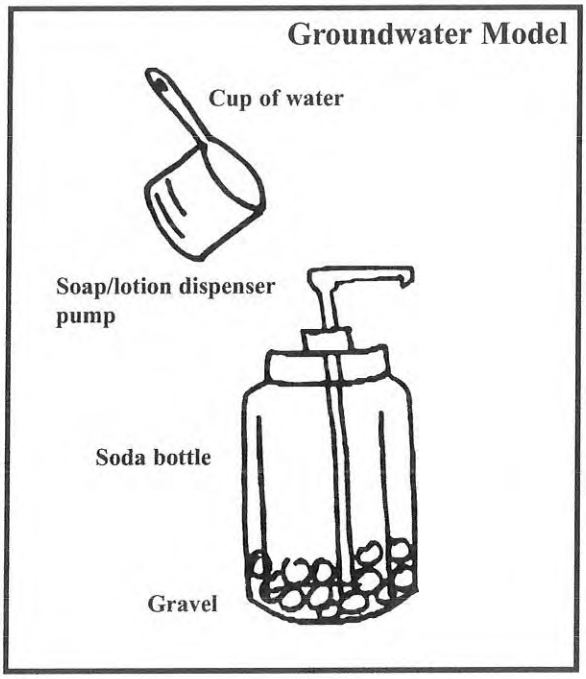
ADVANCE PREPARATION:

1. Punch 8-10 small holes in the bottom of one of the paper cups for each group.
2. Provide each group a 266 ml plastic cup or cut the tops off 2-liter soda bottles (about 1/2 of the bottle) for each group.
3. Provide each group with enough pea-sized gravel (#2) to fill each of the containers 3/4 full. Gravel can usually be purchased where pet or aquarium supplies are sold.
4. Provide each group with one paper cup with no holes, one paper cup 3/4 full of water, and one pump dispenser.
5. Make a transparency of the water cycle (hydrologic cycle).

PROCEDURE:

Setting the Stage

1. Have students illustrate the hydrologic cycle; include the surface water, groundwater, and aquifer. Emphasize the interconnectedness of the entire system.
2. Discuss point and nonpoint sources of pollution. Use the background information as a basis for discussion.



Activity

Simulation

- Hold 240 ml cup with holes over the cup containing the gravel. Add the water to the top cup to simulate rain.
- Explain that rain enters the gravel and becomes groundwater. This process is called infiltration.
- Make a hole in the center of the gravel to make a lake or a pond. What happens to the water level in comparison to the water in the ground?
- Add pollution (food coloring) to each pond (about 1-2 drops).
- Insert the pump into the ground and pump out water. What do you notice about the color of the water? Why?
- Begin adding clean water while the pump continues to work. Keep pumping and adding clean water until the pump water is clear.

Follow-Up

1. What happened to the groundwater?
2. Was the pollution easy to clean up?
3. How are sink holes related to underground water supplies? Research to find the answer.

EXTENSIONS:

Create a mural of a small city showing the water table, the aquifer, the water systems, and pollution contributors.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama Cooperative Extension System. (Undated). *Nonpoint pollution of Alabama waters.* (Circular ANR-319). Auburn University, AL.

American Institution of Professional Geologists. (1984). *Ground water: Issues and answers.*

Mikel, W. & Hariston, J. (Circular HE-620). (1974). *Water, our most valuable resource: Keeping it clean.* Auburn University, AL: Alabama Cooperative Extension System.

Vandas, S. (Undated). *Water quality . . .potential sources of pollution.* U.S. Department of the Interior.

Savan, B. (1991). *Earthcycles and ecosystems.* Toronto: Kids Can Press Ltd.

FANTASTIC FILTRATION

CONCEPTS

- Various pollutants enter our water supply via nature or man.
- We must use various filtering techniques to remove these pollutants.
- Some pollutants cannot be removed by filters and must be treated chemically or otherwise.
- Some pollutants cannot be removed by any methods and the water supply is no longer useable.
- It is usually easier to KEEP our water clean than MAKE our water clean.

MATERIALS

Small mesh strainer –1 per group
Coffee filters – 1 per group
Cheesecloth – 1 per group
Confetti paper to represent trash, leaves, floatables, etc.
Potting soil to represent soil, dirt.
Vinegar to represent pollutants such as fertilizers, pesticides, and herbicides.
Vegetable Oil to represent motor oil.
Small Dixie cups – 2 per group
4 Clear plastic cups (8oz. wide top)

SETUP

1. If you are teaching this activity in a classroom with movable desks/chairs, arrange the room so students can work in groups of four or five (usually, 5-6 groups of 4 kids will be fine).
2. Place one plastic cup 2-3 oz. of water and 3 empty plastic cups on each work station
3. Place several paper towels at each work station as well.
4. Choose a staging area at which to prepare the other materials.
5. At your staging area, place "pollutants" in Dixie cups –a teaspoon or so of soil and just a TINY amount of confetti is plenty for each cup. The oil & vinegar will be in plastic bottles with sports lids for easy dispensing. You may have your helper dispense a LITTLE bit directly into each group's water as you are teaching, or squeeze a LITTLE bit into the paper cups for each group. (All the cups of dirt & confetti can be prepared before the first session; oil & vinegar will soak through the paper, so fill them during the 5-minute break between classes.) Each group of students will get each type of pollutant. Leave the pollutants at the staging area & pass them out one at a time as they are needed.
6. Look over the questions on the activity sheet ("Let's Clean Up Our Act") so you can go through the answers as your are talking to the kids. <u>There will not be enough time to have each group fill out the sheet</u>

This activity is really a lot of fun to do. You can incorporate any aspect of water pollution methods you can think of into it and as they work, the kids will give you some good ideas of how to pollute the water as well. I usually tell the kids up front that everyone will get to do something during this activity and then I choose the starting person for each table (the person in the upper right corner, for instance) and have them do whatever step we're on & then pass the cup to the person on their left.

IF things get too rowdy for you one of these two things will usually quiet everyone down quickly:

1. A 5-clap rhythmic clapping pattern: Clap Clap Clapclapclap
2. Hold your hand up in the air with the index finger extended and be silent

Before you begin teaching:

- **introduce yourself & your assistant(s) and welcome the students to the water festival.**
- **find out which activities they have already done & ask what they learned there**
- **assure them that everyone will get to do <u>something</u> during your activity & that they must remember that each group is team, working together. I usually start at one corner of each group & have them pass things**

DOING THE ACTIVITY

1. Discuss with the students the fact that things get into our water supply. Have the students think of many substances that get into water – some natural, some placed there by humans or animals. Try to cover garbage, sewage, animal wastes, dead animals and plants, runoff from roads and parking lots, fertilizer pesticide and herbicide runoff, oil from boats on the water, etc.
2. Ask how we get these substances out of the water so that it is safe to drink or use. Lead the students to the concept of using a filter.
3. As a class, discuss the first question on the sheet (what is the clean water like) while looking at the clean water at their stations.

4. Give each group the cup of confetti and explain that the confetti represents pollutants such as grass, leaves, garbage, tires, etc. Discuss how such things might get into the water (throwing trash – like candy wrappers or fast food wrappers – on the ground; not paying to dispose of old tires; not taking old appliances to the dump; a neighborhood dog (or cat or raccoon) getting into your garbage after you have taken it to the curb for pick-up and then not cleaning it up). Have one student pour the confetti into the clean water.

5. Give each group the cup of soil and explain that this pollutant represents soil, dirt, etc. After discussing how dirt might get into the water (hard rain after construction has begun, when flood waters – like from Village Creek - recede, etc) have a student pour the pollutant into the cup of water.

6. Give each group the cup of vinegar and explain that it represents chemical pollutants such as fertilizers, pesticides, paint, etc. Again – how does such stuff get into our water? (Using more than the label says, using the wrong chemicals too close to the water, using them too close to a rain event, etc). Have a student pour the pollutant into the cup of water OR have your helper(s) dispense it while you talk.

7. Finally, give each student that last cup of oil and explain that the oil represents motor oil from cars or oil that has run off from parking lots. Have a student pour the pollutant into the

cup of water. (Or show them your bottle of oil & have your helper "pollute" everyone's water)

8. Now their clean water has become contaminated. Discuss the answer to question 2 on the activity sheet describing the contaminated water.

9. Review with the students how in order to clean the polluted water we will need to use a filter. Pass out the three filters – strainer, coffee filter and cheesecloth. Have the students predict what pollutants each filter will remove. **During the filtering, one kid needs to hold the cup while the other holds the filter & pours.** Have each table pour all of the polluted water through the strainer and into a clean cup. Did the filter work? What is still in the water? Repeat the filtering process using the cheesecloth as a filter. Lastly, have them pour the water into the third clean cup using the coffee filter. **NOTE - push the coffee filter a little way down in the cup & crimp the overlapping part around the edges of the cup so it doesn't collapse into the cup when the water is poured through it.**

10. Go over a few of the student's results. Make sure to cover each pollutant and which filters worked and didn't work and possible reasons why. Have the students compare the descriptions of the polluted water with the clean water.

11. THE LAST QUESTION IS THE MOST CRITICAL. Discuss which pollutant could not be removed (vinegar) and how we can tell it was not removed (we can smell it). Ask the students if they would want to drink that water? (No, since it still has a pollutant in it.) Ask them how we get rid of this pollutant. (Water treatment plant must treat/clean the water to make it safe to drink and use). Water treatment plants disinfect the water with chlorine or other chemicals to kill any germs in the water and keep the water safe as it travels to the public. The water is sampled and tested throughout the treatment plant. Sampling is performed to make sure the processes are working and that the water is safe before it leaves a treatment plant, it is clean or cleaner that n required by these standards.

12. Discuss the fact that since it can be very difficult to clean polluted water, it is important that we do not pollute our water supply.

AFTER THE ACTIVITY

1. Have your helper (or a student) go around to each group and have them dump their liquid into the bucket in your room; solids should go in the trash can.
2. One student at each table may use a paper towel to wipe out any plastic cups with solids in them. The plastic cups are being collected for recycling…please deposit them in the clear-plastic trash bags provided.
3. Wipe down the tables with the Windex provided.

LET'S CLEAN UP OUR ACT!

Lots of things can get into our water. Some are natural, such as grass, leaves, and dirt. Man or animals put other contaminants, such as sewage, pet waste, garbage, chemicals and more, in our water. How do we clean our water so that it is safe to drink and swim?

1. Describe the water in your container.

How does it look?_____
How does it smell?_____
How does it feel?_____

2. Send each member of your team to get a pollutant sample. Put the samples into your clean water. Now, what do you observe about the water?

How does it look?_____
How does it smell?_____
How does it feel?_____

3. What can you use to clean this water? On this table the type of filter is written in the first column. Decide which pollutants this filter works best for. Then write if the filter worked. Under proof, tell how you know if it worked (look, smell, feel).

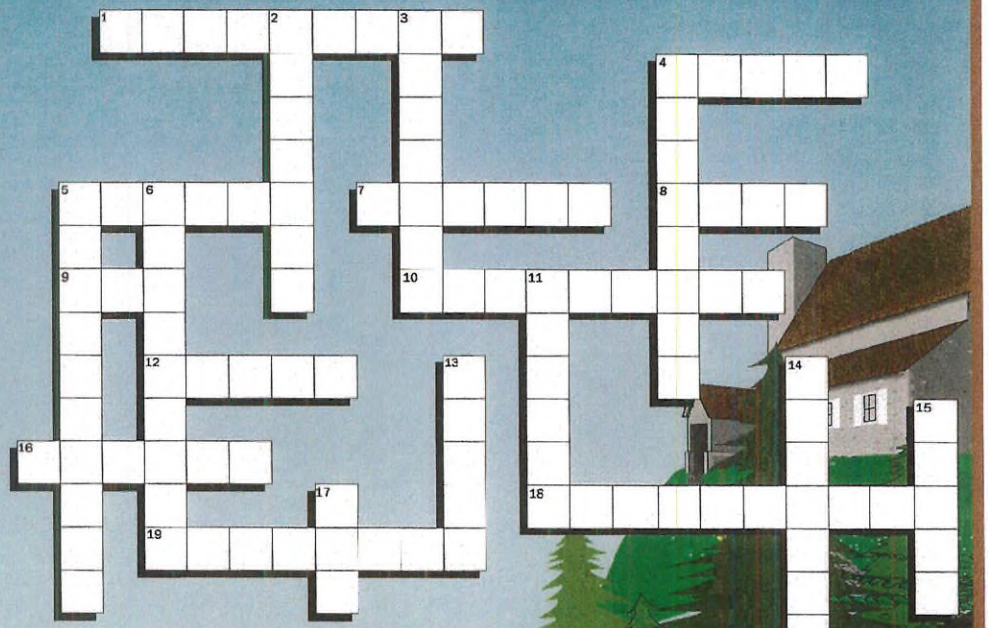
Take the Stormwater Runoff Challenge

Across:

1) The area of land that drains into an estuary, lake, stream, or groundwater is known as a _____.
4) The _____ of speeding boats can erode shorelines.
5) Maintaining your _____ tank will help to prevent bacteria and nutrients from leaking into groundwater and surface waters.
7) Wetland plants act like a natural water _____, removing harmful pollutants from stormwater runoff.
8) Leave your grass clippings on your _____ to reduce the need for commercial fertilizers.
9) A single quart of motor _____, if disposed of improperly, can pollute 2 million gallons of water.
10) Fertilizers and animal wastes contain _____ that "feed" algae and other aquatic plants harmful to water quality.
12) Polluted runoff from both rural and _____ sources has a significant impact on water quality.
16) Storm _____ don't always connect to sewage treatment plants, so runoff can flow directly to rivers, lakes, and coastal waters.
18) Follow directions carefully when applying _____ on your lawn—more isn't always better.
19) Polluted runoff (also called _____ source pollution) comes from so many places that it's hard to "pinpoint" a source.
20) Yard and vegetable food waste are suitable additions to a _____ pile.

Down:

2) Don't dump used motor oil into storm drains. _____ it!
3) _____ of soil from barren land can cloud nearby streams.
4) _____ prevent flooding, improve water quality, and provide habitat for waterfowl, fish, and wildlife.
5) Marking "Do Not Dump, Drains to Bay" on a _____ is one way to educate people about polluted runoff.
6) Excess sediment, nutrients, toxics, and pathogens are all types of runoff _____.
11) Polluted _____ is the nation's #1 water quality problem.
13) The cattail is one wetland _____ that helps purify polluted runoff.
14) Too much _____ in water can harm aquatic life.
15) Proper crop and animal management on _____ helps to control water pollution.
17) _____ impact development helps control stormwater pollution through conservation approaches and techniques.



Choices:

compost	nonpoint	sediment
drains	nutrients	septic
erosion	oil	storm drain
farms	plant	urban
fertilizer	pollution	wakes
filter	recycle	watershed
lawn	runoff	wetlands
Low		

EPA United States Environmental Protection Agency

For more information, please visit EPA's Polluted Runoff web site at www.epa.gov/nps

Printed with soy based inks on recycled paper.

SETTLING THE WASTEWATER PROBLEM

OBJECTIVES

The student will do the following:

1. Name models that are representations of larger objects.
2. Suggest ways that industry, agriculture, and mining affect water quality.
3. Demonstrate the use of lagoons for treating wastewater.

SUBJECTS:
Science, Language Arts

TIME:
90 minutes

MATERIALS:
3 large jars
charcoal
6 smaller containers (such as small buckets)
ammonia
funnel or liter bottle with bottom cut off
pieces of wood
soil
paper towels
coffee grounds (or sterile gardening manure)
nylon hosiery
flour
medium rocks
vegetable oil
cotton balls
bleach
sand
iron filings
3 paper or plastic cups
small rocks
vinegar

BACKGROUND INFORMATION

Water pollution remains a serious problem in most parts of the United States. Sediment, nutrients, bacteria, and toxic material still find their way into the nation's waters where they damage ecosystems, cause health hazards, and prevent the full use of water resources.

In agriculture, all livestock operations face the growing concern of animal waste disposal. Animal wastes pollute the environment when not disposed of properly. Because of its nutrient value, animal waste should be viewed as a resource rather than as a waste. It provides the producer with a valuable soil conditioner and source of fertilizer. Animal waste doesn't have to be a pollution problem. A well designed and maintained waste management system benefits not only the producer, but the community as well.

Pollutants carried by runoff from such urban features as streets and roadways, commercial and industrial sites, and parking lots affect between 5-15 percent of surface waters. Urban runoff contains salts and oily residues from road surfaces and may include a variety of nutrients and toxic material as well.

Higher temperatures associated with industrial wastewater can result in "thermal pollution." Up to 10 percent of surface waters are adversely affected by acid drainage from abandoned mines, pollution from mill tailings, mining waste piles, and pollution from improperly sealed oil and gas wells.

All of these kinds of wastewater can be treated by allowing them to rest in settling/treatment ponds to clean the water for discharge.

Terms

groundwater: water that infiltrates into the earth and is stored in usable amounts in the soil and rock below the earth's surface; water within the zone of saturation.

lagoon: an animal waste treatment method which uses a deep pond to treat manure and other runoff from a livestock operation. Lagoons can be aerobic or anaerobic. Both use bacteria to break down materials.

model: a small representation of a larger object.

surface water: precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration, and is stored in streams, lakes, wetlands, reservoirs, and oceans.

water treatment: the conditioning of water to make it acceptable for a specific use.

ADVANCE PREPARATION

A. Fill the 3 large jars (use gallon jars from the lunchroom) with clean water.

B. During the demonstration you will create models of agricultural, industrial, and mining wastewater by "dumping" the waste substitutes into the appropriate jar. Gather the following materials for the demonstration:

1. To simulate agricultural wastewater, obtain 1 cup (250 mL) ammonia, 2 cups (500 mL) soil, and 2 cups (500 mL) used coffee grounds or sterile gardening manure for the substituted waste.

2. To simulate industrial waste, obtain 1 cup (250 mL) flour, 1 cup (250 mL) vegetable oil, and 1 cup (250 mL) bleach.

3. To simulate mining wastewater, obtain 2 cups (500 mL) soil, 1 cup (250 mL) iron filings, 1 cup (250 mL) small rocks, and 1 cup (250 mL) vinegar (for acidic smell). (NOTE: Iron filings are readily available from auto parts stores where they work on brakes; these are usually free.)

NOTE: Take extra care to make sure ammonia and bleach aren't accidentally mixed. Mixing them can release poisonous chlorine gas.

C. Gather the other materials. Try to avoid giving the students glass containers.

PROCEDURE

I. Setting the stage

A. Divide the class into 6 teams. Tell members of the first two teams they represent farmers; the third and fourth teams represent manufacturers; and the fifth and sixth teams represent miners.

B. Each group should have a funnel and several items available to them to attempt to purify the wastewater. Suggested items might include charcoal, pieces of wood, paper towels, nylon hosiery, rocks (small and medium size), moss, cotton balls, or sand.

C. You will divide the 3 wastewater supplies in half. Each group should have a large jar or pitcher (or a small bucket) of its own.

D. Tell the teams not to touch the jars until they are ready. This helps avoid spills and accidents.

II. Activity

A. Explain and give examples of a model representing a larger object. (globe = earth, model car = vehicle, doll = baby)

1. Tell the students that it is sometimes impossible to show real objects (like the earth) because of their size.

2. Have them cite other examples to show comprehension.

B. Show one of the jars of clean water. Tell the students that this jar is a model that represents 1 million gallons of water that falls on a large farm with fields and cattle operation.

1. Ask the students to suggest ways the water could become polluted. (runoff from animal waste, fertilizer, etc.)

2. Simulate the agricultural wastewater by "dumping" in the agricultural pollutants to make wastewater.

3. Explain what each pollutant represents: The ammonia represents animal urine. The soil represents eroded topsoil, and the coffee grounds or gardening manure represents solid animal waste.

4. Divide the agricultural wastewater between the 2 groups of "farming representatives," leaving about 1/3 of it for a further demonstration.

C. Select another jar of clean water. Tell the students that this jar is a model that represents 1 million gallons of water that flows from a manufacturing plant.

1. Ask the students to suggest ways the water could become polluted. (dumping, cleaning, mixing chemicals)

2. Simulate the industrial wastewater by "dumping" the industrial pollutants into the second jar. Explain what each pollutant represents: The flour represents biological wastes like paper pulp; the oil represents wastes like lubricating (motor) oil; and the bleach represents, and is very similar to, chemicals used by many factories.

3. Divide the industrial wastewater between the 2 groups of "manufacturing representatives," leaving about 1/3 of it for a further demonstration.

D. Select the third jar of clean water. Tell the students that this jar is a model that represents 1 million gallons of water that flows from a mine.

1. Ask the students to suggest ways the water could become polluted. (runoff, washing equipment, washing work clothes, etc.)

2. Simulate the mining wastewater by "dumping" the mining pollutants into the jar. Explain what each pollutant represents: The soil and rocks obviously represent the tons of earth material disturbed by mining; the iron filings represent the minerals exposed by mining; and the vinegar represents the acids that can leach from rocks dug up by mining.

3. Divide the mining wastewater between the 2 groups of "mining representatives," leaving about 1/3 of it.

E. Explain that the different land uses represented are necessary for us to live our lives the way we do, but the by-products of the activities represented in each of the three jars is the same: it is called "wastewater."

1. Ask that students the following questions. (NOTE: Remind the students that their jars each represent 1/2 million gallons of water.)

a. Would you drink this water?

b. Would you dump this water into the river or lake?

c. If you dumped this water down a drain, where would it go?

2. Tell the teams they must find a way to make the wastewater reusable since there is so much of it. Take the class outside; this is a messy process.

a. They are to use the materials available and attempt to remove as much of the odor and pollutants as possible using paper cups and smaller containers provided. (CAUTION: Containers may become slippery when wet.)

b. Allow the students to work on their own in their teams for about 15-20 minutes. Supervise for safety.

F. Let representatives from each team explain their processes and results.

G. Explain that there is another treatment method (if no one mentions it) that is less expensive and more feasible called a "holding pond" or lagoon.

H. Label each jar (agriculture, mining, and industry). Demonstrate the lagoon by allowing each jar to sit undisturbed overnight. (This allows settling to occur.)

1. Allow the students to observe and smell each jar after 24 hours.

2. Discuss the differences in the appearance of the wastewater.

III. Follow-Up

A. Compare the various methods the groups used to treat wastewater with the lagoon method.

1. Ask which method would be less expensive to treat large amounts of wastewater. (lagoon)

2. Ask which method would be easier to use with large amounts of wastewater. (lagoon)

3. Ask the students what else needs to be considered before the wastewater could be of better quality. (get rid of pollutants that did not settle—like smell and color)

4. How could the water from lagoons be used? (irrigation, discharge into streams, etc.)

B. Have each group write a report of their wastewater treatment results.

1. What products did not settle?

2. Which team's jar settled the most?

3. Which group would benefit the most from using a lagoon as a water treatment process?

4. How could the processed water be used?

C. Dispose of the simulated lagoons by pouring the water off the settled solids. Allow the jars to dry and, then dispose of the dry material in the trash, and wash out the jars for reuse.

IV. Extension

A. Visit a wastewater treatment plant.

B. Plan a field trip to a large farm, manufacturing plant, or a mining area that utilizes a lagoon.

C. Have a representative from each category above visit the classroom and discuss using a lagoon as a treatment method.

RESOURCES

Environmental Resource Guide: Nonpoint Source Pollution Prevention (Grades 6-8), Air & Waste Management Association, Pittsburgh, Pennsylvania, 1992.

EPA Journal Vol. 17, No. 5, U.S. Environmental Protection Agency, Washington, DC, November/ December 1991.

Leopold, Luna, Water Use and Development, U.S. Government Printing Office, Washington, DC, 1960.

"Nonpoint Source Pollution" (Water Quality Factsheet #4), Tennessee Valley Authority, 1988.

SETTLING THE WASTEWATER PROBLEM

Agricultural Wastewater

¼ Cup of Ammonia
½ Cup of Soil
¼ Cup of Used Coffee Grounds

Industrial Wastewater

¼ Cup of Flour
¼ Cup of Vegetable Oil
¼ Cup of Bleach

Mining Wastewater

½ Cup of Soil
¼ Cup of Iron Filings
¼ Cup of Small Rocks
¼ Cup of Vinegar

BE EXTREMELY CAREFUL THAT AMMONIA AND BLEACH DO NOT ACCIDENTLY GET MIXED! MIXING THEM CAN RELEASE A POISONOUS GAS!!!!!

Let's Clean Up Our Act!

Lots of things can pollute our water. Some pollution is natural (grasses, leaves, and dirt). However, a lot of contamination comes from man or animals (sewage, pet waste, garbage, chemicals and more). How do we clean our water so that it is safe to drink?

1. Describe the water in your container:

- How does it look? _____
- How does it smell? _____
- How does it feel? _____

2. Examine the pollutant samples provided to you. Put the samples, one at a time as instructed, into your clean water. Describe the changes to the water.

- **Confetti:**
  - How does it look? _____
  - How does it smell? _____
  - How does it feel? _____
- **Soil**:
  - How does it look? _____
  - How does it smell? _____
  - How does it feel? _____
- **Vinegar:**
  - How does it look? _____
  - How does it smell? _____
  - How does it feel? _____
- **Oil**:
  - How does it look? _____
  - How does it smell? _____
  - How does it feel? _____

U.S. Environmental Protection Agency
Office of Science and Technology
EPA-823-E-05-002
August 2005

Healthy Waters start with WATER QUALITY STANDARDS

Did you know that federal and state laws require streams, rivers, lakes and wetlands to meet certain standards of cleanliness? These are called *water quality standards*.

To find out more, visit: www.epa.gov/waterscience/standards

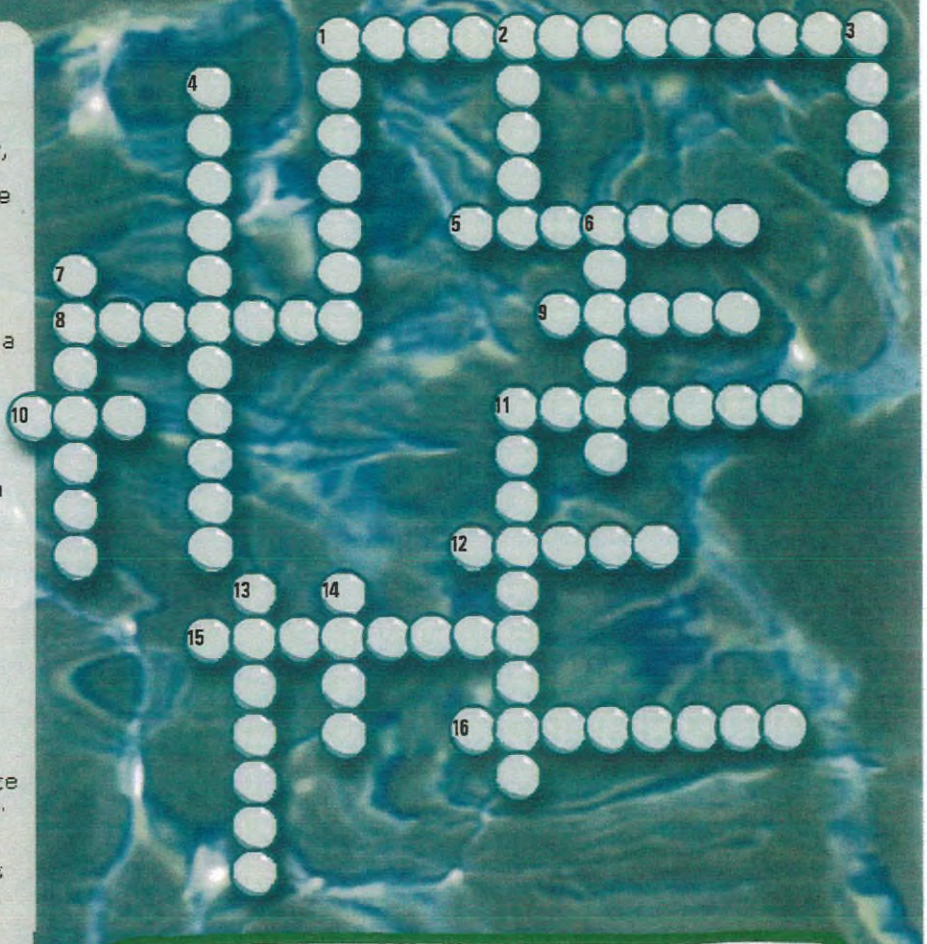
CLUES

ACROSS

1. The U.S. _____ Protection Agency, also known as the US EPA, is the federal government office in charge of taking care of the environment.
5. _____, the action of water washing away pieces of dirt and rock, is sped up when plants that hold soil in place are removed.
8. Water _____is a measure of how clean a stream's water is. It is poor for polluted streams and good for clean streams.
9. Every living thing needs clean food, _____, and air to survive.
10. The Clean Water Act is a ___ passed in 1972 that helps keep our waterways from being polluted.
11. Like forest fires, only you can _____ water pollution.
12. Looking at the number of fish and other organisms in a stream and how healthy they are helps scientists get an idea of how _____ the water is.
15. Erosion causes the build up of _____, sometimes called silt, in the bottom of streams and lakes.
16. The Clean Water Act, a law passed by _____, gives US EPA the power to make and enforce rules to protect water quality.

DOWN

1. _____ is a branch of science that looks at the relationships between living things and their environment.
2. A _____ is a natural stream of water larger than a brook or creek.
3. A _____ is large body of water surrounded by land.
4. The pesticides and _____ used on your lawn and garden can cause water pollution.
6. Each of the 50 _____ has a government agency that helps keep water clean.
7. _____ plants and animals live in the water.
11. _____ is anything added to water that harms the things that live there.
13. US EPA and states set limits on the amount of pollution allowed in water. Limiting water pollution helps keep the plants, animals, and fish that use the water _____.
14. Swimming in polluted water can make you _____.



WORD LIST

Clean	Water	Healthy
Congress	States	Fertilizers
Aquatic	Quality	Sick
Environmental	Prevent	Law
Erosion	Sediment	River
Ecology	Pollution	Lake

WATER QUALITY STANDARDS are important because they tell us how clean we want our waters to be. Water quality standards are set by the government.

Water quality standards include:

- The uses of the water—for example, do we want to be able to swim in it or just use it to irrigate crops?
- The limits on the amount of pollution that can be in the water—for example, we do not want too much of a chemical.
- Controls to prevent the water from getting dirtier.

ACROSS: 1. Environmental 5. Erosion 8. Quality 9. Water 10. Law 11. Prevent 12. Clean 15. Sediment 16. Congress DOWN: 1. Ecology 2. River 3. Lake 4. Fertilizers 6. States 7. Aquatic 11. Pollution 13. Healthy 14. Sick

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

The Hidden Water

Do you know where your drinking water comes from? *You might have poured it from a tap or bought it at the store, but it had to come from somewhere before that. Any guesses?*

The ocean? That would be a good guess because the oceans contain most of earth's water, about 97%! But would you drink a glass of seawater?

No! The salt would make you sick.

We need fresh water. Not just any fresh water though. Did you know most of the world's fresh water is frozen solid? Nearly 80% is locked up in ice sheets and glaciers. We can't drink that.

So where do you get your drinking water from? In Florida, lakes, rivers and swamps all contain water that isn't frozen or too salty. So do ditches and retention ponds. But would you drink from the ditch near your house?

NO!

Why not? Because most of the world's surface water might be polluted, so it could make you sick. Sometimes we treat this water to make it safe — with chemicals or filters or even ultraviolet light. But there's a better way to get fresh, clean water. This hidden place is where most people in the world get their drinking water.

Where is this mystery place?

> **It's water that's hidden below our feet.** Some rainwater seeps into the ground. This GROUNDWATER becomes part of an AQUIFER, which is an underground water supply. Water in an aquifer is usually cleaner than surface water, especially if it's deep or has been underground a long time.

Sometimes it comes to the surface in springs, but most people get it by digging holes called WELLS. We put pipes in the holes and pump up the good water. So the water you drink every day probably comes from under the ground — the hidden part of the water cycle.

Read on: Danger Down Below

USGS science for a changing world

The USGS Water Science School

Search... Search

← Back to previous page

Groundwater

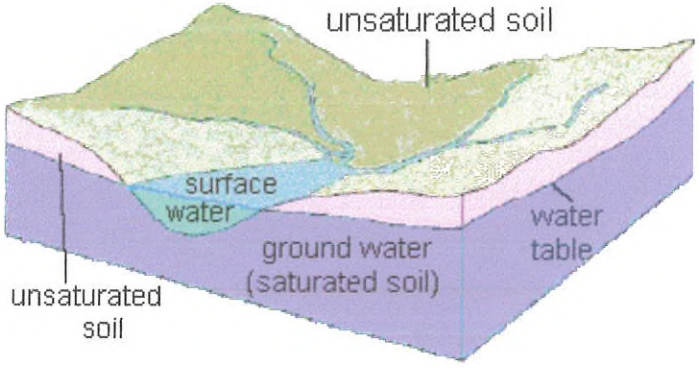
What is groundwater?

These kids probably think there is some kind of magic happening here ... they pull down a lever and out of the ground below their feet comes clear, cool freshwater. They (and maybe you) may not realize that there is an immense amount of water in aquifers below the earth's surface. In fact, there is a hundred times more water in the ground than is in all the world's rivers and lakes.

Some water underlies the Earth's surface almost everywhere, beneath hills, mountains, plains, and deserts. It is not always accessible, or fresh enough for use without treatment, and it's sometimes difficult to locate or to measure and describe. This water may occur close to the land surface, as in a marsh, or it may lie many hundreds of feet below the surface, as in some arid areas of the West. Water at very shallow depths might be just a few hours old; at moderate depth, it may be 100 years old; and at great depth or after having flowed long distances from places of entry, water may be several thousands of years old.

Groundwater is a part of the water cycle. Some part of the precipitation that lands on the ground surface infiltrates into the subsurface. The part that continues downward through the soil until it reaches rock material that is saturated is groundwater recharge. Water in the saturated groundwater system moves slowly and may eventually discharge into streams, lakes, and oceans.

Here is a simplified diagram showing how the ground is saturated below the water table (the purple area). The ground above the water table (the pink area) may be wet to a certain degree, but it does not stay saturated. The dirt and rock in this unsaturated zone contain air and some water and support the vegetation on the Earth. The saturated zone below the water table has water that fills the tiny spaces (pores) between rock particles and the cracks (fractures) of the rocks.



Why is there groundwater?

A couple of important factors are responsible for the existence of groundwater:

(1) Gravity

Nothing surprising here - gravity pulls water toward the center of the Earth. That means that water on the surface will try to seep into the ground below it.

(2) The Rocks Below Our Feet

The rock below the Earth's surface is the bedrock. If all bedrock consisted of a dense material like solid granite, then even gravity would have a hard time pulling water downward. But Earth's bedrock consists of many types of rock, such as sandstone, granite, and limestone. Bedrocks have varying amounts of void spaces in them where groundwater accumulates. Bedrock can also become broken and fractured, creating spaces that can fill with water. And some bedrock, such as limestone, are dissolved by water -- which results in large cavities that fill with water.

In many places, if you looked at a vertical cross-section of the earth you would see that rock is laid down in layers, especially in areas of sedimentary rocks. Some layers have rocks that are more porous than others, and here water moves more freely (in a horizontal manner) through the earth. Sometimes when building a road, the layers are revealed by road cuts, and water can be seen seeping out through the exposed layers.

Try as it might, gravity doesn't pull water all the way to the center of the Earth. Deep in the bedrock there are rock layers made of dense material, such as granite, or material that water has a hard time penetrating, such as clay. These layers may be underneath the porous rock layers and, thus, act as a confining layer to retard the vertical movement of water. Since it is more difficult for the water to go any deeper, it tends to pool in the porous layers and flow in a more horizontal direction across the aquifer toward an exposed surface-water body, like a river.

Visualize it this way: get two sponges and lay one on top of the other. Pour water (precipitation) on top and it will seep through the top sponge downward into the bottom sponge. If you stopped adding water, the top sponge would dry up and, as the water dripped out of the bottom sponge, it would dry up too. Now, put a piece of plastic wrap between the sponges, creating your "confining layer" (making the bottom sponge an impermeable rock layer that is too dense to allow water to flow through it). Now when you pour water on the top sponge, the water will seep downward until it hits the plastic wrap. The top sponge will become saturated, and when the water hits the plastic wrap it won't be able to seep into the second sponge. Instead, it will start flowing sideways and come out at the edges of the sponge (horizontal flow of groundwater). This happens in the earth all the time -- and it is an important part of the water cycle.

Edible Aquifers

www.groundwater.org

What is groundwater?

Groundwater is the water we drink and the water that grows our food. It is found underground in the cracks and spaces between sand and soil. These underground formations are called aquifers.

This activity is a fun and easy way to understand the geology of an aquifer. You will build your own edible aquifer and learn about confining layers, contamination, recharge, and water tables.

Key Topics: Aquifer, Earth science/geology, Groundwater, Wells, Contamination/pollution prevention

Grade Level: This activity can be adapted for many age groups

Duration: 20 - 30 minutes

Objectives:

Learn about the geologic formations in an aquifer, how pollution can get into groundwater, and how pumping can cause a decline in the water table.

Items Needed:

- Clear plastic cups
- Ice cream scoop
- Spoons
- Drinking straws
- Blue/red food coloring
- Vanilla ice cream or fruity sorbet
- Clear soda pop
- Small gummy bears, chocolate chips, crushed cookies, breakfast cereal, or crushed ice
- Variety of colored cake decoration sprinkles and sugars

Activity Steps:

1. Begin to construct your edible aquifer by filling a clear plastic cup 1/3 full with gummy bears, chocolate chips, or crushed ice (represents sand/gravel).
2. Add enough soda (represents water) to just cover the candy/ice.
3. Add a layer of ice cream to serve as a "confining layer" over the water-filled aquifer.
4. Then add more "sand/gravel" on top of the confining layer.
5. Colored sugars and sprinkles represent soils and should be sprinkled over the top to create the porous top layer.
6. Add the food coloring to the soda. The food coloring represents contamination. Ask the students to come up with examples of contamination (motor oil, fertilizers, road salt, etc.).
7. Watch what happens when it is poured on the top of the aquifer. Point out that the same thing happens when contaminants are spilled on the earth's surface.
8. Using a drinking straw, drill a well into the center of your aquifer.
9. Slowly begin to pump the well by sucking on the straw. Watch the decline in the water table.
10. Notice how the contaminants can get sucked into the well area and end up in the groundwater by leaking through the confining layer.
11. Now recharge your aquifer by adding more soda which represents a rain shower.
12. Review what you have learned as you enjoy eating your edible aquifer.

Warning:

Check with participants before conducting this activity to see if anyone is diabetic, lactose intolerant, or has other food allergies. Make substitutions if needed.

DEQ in the Classroom:

The Incredible, Edible Aquifer

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

1410 North Hilton
Boise, ID 83706
(208) 373-0502

www.deq.idaho.gov

Grade Level:

Any; best fits grades 4–8

Time Required:

30 minutes (can be longer or shorter depending on discussion)

Objective:

To illustrate the geologic formation of an aquifer, how pollution can get into ground water, and how this pollution can end up in drinking water wells. Students will come to understand how our actions can affect ground water and drinking water.

Meets Idaho State Standards:

Grade 4: 4.S.1.2.3, 4.H.1.1.10

Grade 5: 5.SS.3.1.2, 5.SS.2.2.1, 5.S.1.2.3, 5.S.5.1.1, 5.H.1.1.8

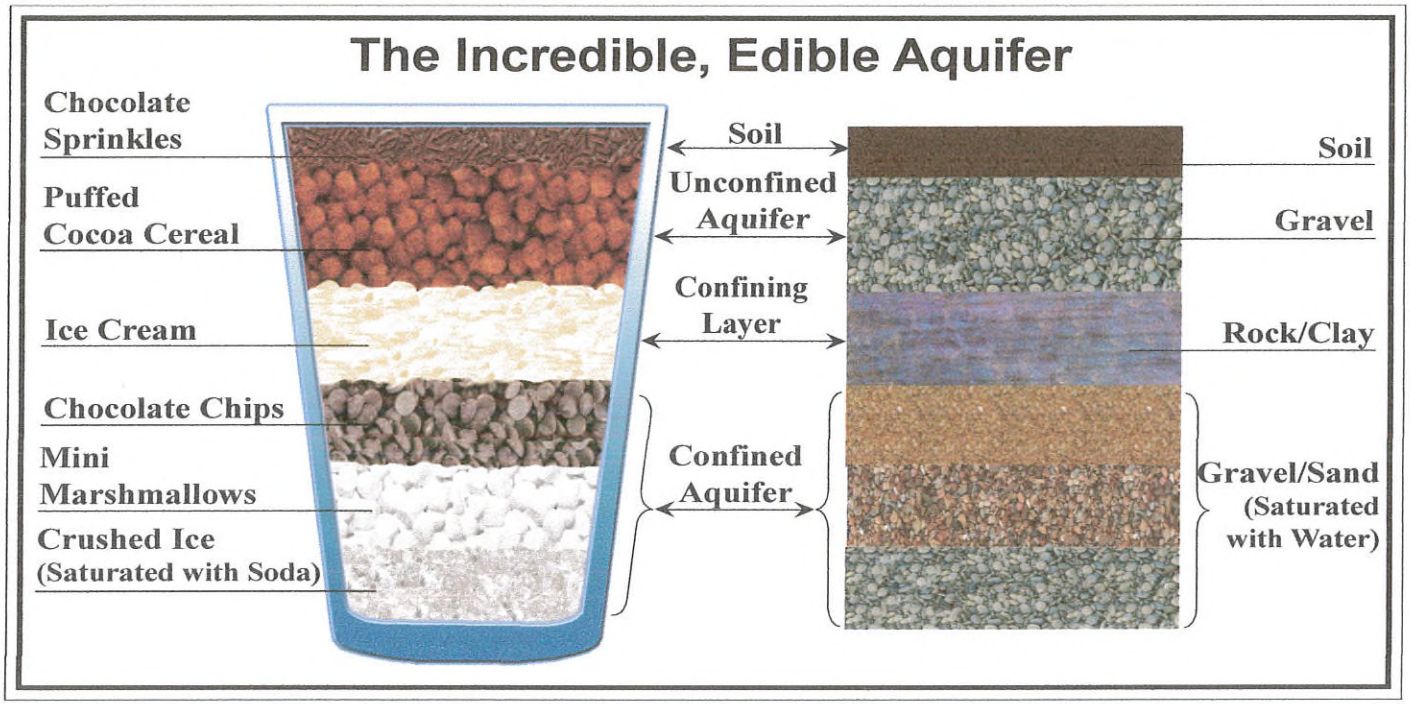
Grade 6: 6-9.WHC.2.5.4, 6-9.GWH.2.5.2, 6-9.GWH.2.5.6, 6.S.1.2.3, 6.S.5.1.1, 6.H.1.1.10

Grade 7: 6-9.WHC.2.5.4, 6-9.GWH.2.5.2, 6-9.GWH.2.5.6, 7.S.1.2.3, 7-8.H.1.1.9

Grade 8: 6-9.WHC.2.5.4, 6-9.GWH.2.5.2, 6-9.GWH.2.5.6, 7-8.H.1.1.9

Focus:

Students will build their own edible aquifers and learn about different geologic layers, different types of aquifers, how aquifers become contaminated, and the need to protect and conserve ground water resources.



Materials: (Class of 25)

- Chocolate sprinkles: 2 (3 oz.) containers
- Clear plastic cups: 25–30 (12 or 16 oz.) cups
- Clear soda (e.g., lemon-lime): 4 liters
- Crushed ice (the smaller the better): ≈1 bag
- Mini marshmallows: 1 (16 oz.) bag
- Chocolate chips: 4 (12 oz.) bags
- Puffed cocoa cereal: ≈1/4 cup per student
- Red Kool-Aid® (sweetened and dry): 4 small pkgs.
- Spoons: 25–30
- Straws (preferably clear): 25–30
- Vanilla ice cream: 25–30 single serving cups

Background:

Ground water supplies 95% of the drinking water in Idaho. Wells are drilled through soil and rock into ground water aquifers to supply drinking water. Unfortunately, ground water can become contaminated by improper use or disposal of chemicals such as fertilizers and household cleaners. These chemicals can percolate down through the soil and rock into an aquifer and eventually into drinking water wells. This contamination can pose a significant threat to human health.

Vocabulary:

Aquifer: A natural underground area where large quantities of ground water fill the spaces between rocks and sediment.

Confined Aquifer: An aquifer overlain by one or more layers of impermeable rock or soil (aquitard/confining layer) that restrict water to within the aquifer.

Confining Layer: An underground layer over an aquifer that is impermeable or significantly less permeable than the aquifer below it. It helps protect the aquifer from contamination and is usually made of rock and/or clay. Also called an "aquitard."

Conserving Water: Not wasting water.

Porous: Full of pores (small spaces). Water can easily pass through it.

Protecting Water: Keeping water clean.

Saturated Zone: An underground layer or area where water fills most of the pores (spaces) in the soil and rock.

Unconfined Aquifer: An aquifer that is not overlain by a layer of impermeable rock or soil.

Unsaturated Zone: An underground layer or area where air fills most of the pores (spaces) in the soil and rock.

Water Table: The top of an unconfined aquifer.

Procedure:

Step 1. Fill a clear plastic cup 1/3 full (total) with a layer of crushed ice followed by a layer of each like the picture shows of mini marshmallows and chocolate chips.

These represent gravels and sands that make up the aquifer. Notice the different sizes and shapes and how the pieces have spaces or "voids" between them.

Step 2. Add enough soda to almost reach the top of the layer.

The soda represents ground water. Notice that the soda fills all of the spaces among the marshmallows, chocolate chips, and ice. The aquifer is now saturated with soda; it is a "saturated zone." In an unconfined aquifer (see Step 3), the top of the saturated zone is called the "water table."

Step 3. Add a layer of ice cream. (Optional.) (For a tight seal, gently spread out the ice cream to the inside edges of the cup and slightly up the sides using the back of a spoon.)

This layer, called a "confining layer" or an "aquitard," is impermeable or significantly less permeable than the aquifer below it (it is difficult for water to soak through). It helps protect the aquifer from contamination and is usually made of rock and/or clay. An aquifer under a confining layer is called a "confined aquifer." An aquifer without a confining layer or above a confining layer is called an "unconfined aquifer."

Some aquifers, such as the Spokane Valley-Rathdrum Prairie Aquifer in north Idaho, do not have a confining layer. If your local aquifer does not (or even if it does) have a confining layer, consider omitting the ice cream or having half the class use ice cream and half not to compare the results.

Step 4. Add puffed cocoa cereal (or use more crushed ice) on top of the confining layer/water table.

This represents the unsaturated zone, the area where air fills most of the pores (spaces) in the soil and rock.

Step 5. Scatter chocolate sprinkles over the top.

The sprinkles represent the soil, which is very porous.

The aquifer is now complete. Your aquifers will probably be messy and not look like the picture on the front page. That's OK! Real aquifers aren't neatly layered either. Next you will explore how contaminants and wells interact with your aquifer.

Step 6. Sprinkle Kool-Aid® over the top of the soil.

The Kool-Aid® represents contaminants on the ground (e.g., fertilizer). Does anything happen to the Kool- Aid® right away? (Usually nothing will happen.)

Step 7. Using a drinking straw, "drill" a "well" into the center of the aquifer.

Observe the aquifer and Kool-Aid®. What, if anything, happens when the well is drilled?

Step 8. Begin to "pump" the well by slowly sucking on the straw.

Watch the decline in the level of soda and observe what happens to the contaminants. Do contaminants (Kool-Aid®) leak through the confining area (ice cream) and get sucked into the well? If so, do more contaminants get into wells in confined or unconfined aquifers? (Applicable if your class made both; see Step 3.)

Step 9. Pour a small amount of soda over the top.

The soda represents precipitation. It recharges the aquifer (adds new water). Watch how the Kool-Aid® dissolves and moves into the aquifer. The same thing happens when contaminants are spilled on the ground. Do you think you could get the Kool-Aid® back out of the soda?

Review what you have learned and eat your aquifer! Use these questions to start the discussion.

Questions for Discussion:

1. What observations/results surprised you? What did not?
2. How did results compare among different aquifers? (Even if all students used the same option in Step 3, each aquifer will be somewhat different.)
3. What parts of the activity were most/least like what would happen with a real aquifer? Why?
4. What happens if all of the water is pumped out of an aquifer? Where does more ground water come from? How long do you think it would take? Is there always more ground water, or could we run out?
5. Do you think a contaminated aquifer can be cleaned? If so, how?
6. How can we conserve (save) ground water? What specifically can kids do?
7. How can we protect ground water (keep it clean)? What specifically can kids do?

Assessment/Follow-Up:

Before the Activity:

- Ask students to define "ground water" and "aquifer." Record their key words on a white board to compile relatively accurate definitions. Leave the definitions on the board.

After the Activity:

- Complete "Questions for Discussion," above.
- Refer back to the definitions students wrote before the activity. Ask if they would like to modify them.
- Have students list as many potential ground water contaminants as they can.
- Include vocabulary in spelling lists.
- Test on definitions of vocabulary.
- Have students research ground water and aquifers in your area and compile an oral or written report.

Additional Resources:

A Citizen's Guide to Ground Water Protection (US EPA website)
www.epa.gov/ebtpages/wategroundwaterprotection.html

DEQ Kids: Water Does a Lot for Us... What Can We Do For Water? (Publication on DEQ website)
www.deq.idaho.gov/media/570548-water_quality_kids_brochure.pdf

DEQ Kids: Water Quality in Idaho (Publication on DEQ website)
www.deq.idaho.gov/media/570573-water_kids_tips_fs_2006.pdf

Drinking Water and Ground Water Kids' Stuff (US EPA website)
www.epa.gov/safewater/kids/index.html

Eastern Snake River Plain Aquifer (Idaho State University website)
http://imnh.isu.edu/digitalatlas/hydr/snakervr/esrpa.htm

Ground Water in Idaho: Aquifers (DEQ website)
www.deq.idaho.gov/water-quality/ground-water/aquifers.aspx

Ground Water in Idaho: Overview (DEQ website)
www.deq.idaho.gov/water-quality/ground-water.aspx

The Groundwater Foundation: Get Informed
www.groundwater.org/gi/gi.html

The Groundwater Foundation: Kids Corner
www.groundwater.org/kc/kc.html

Spokane Valley-Rathdrum Prairie Aquifer (Eastern Washington University website)
http://web.ewu.edu/groups/geology/2003Newsletter.pdf

Water Quality: Educational Tools (DEQ website)
www.deq.idaho.gov/assistance-resources/educational-tools/teacher-resources.aspx

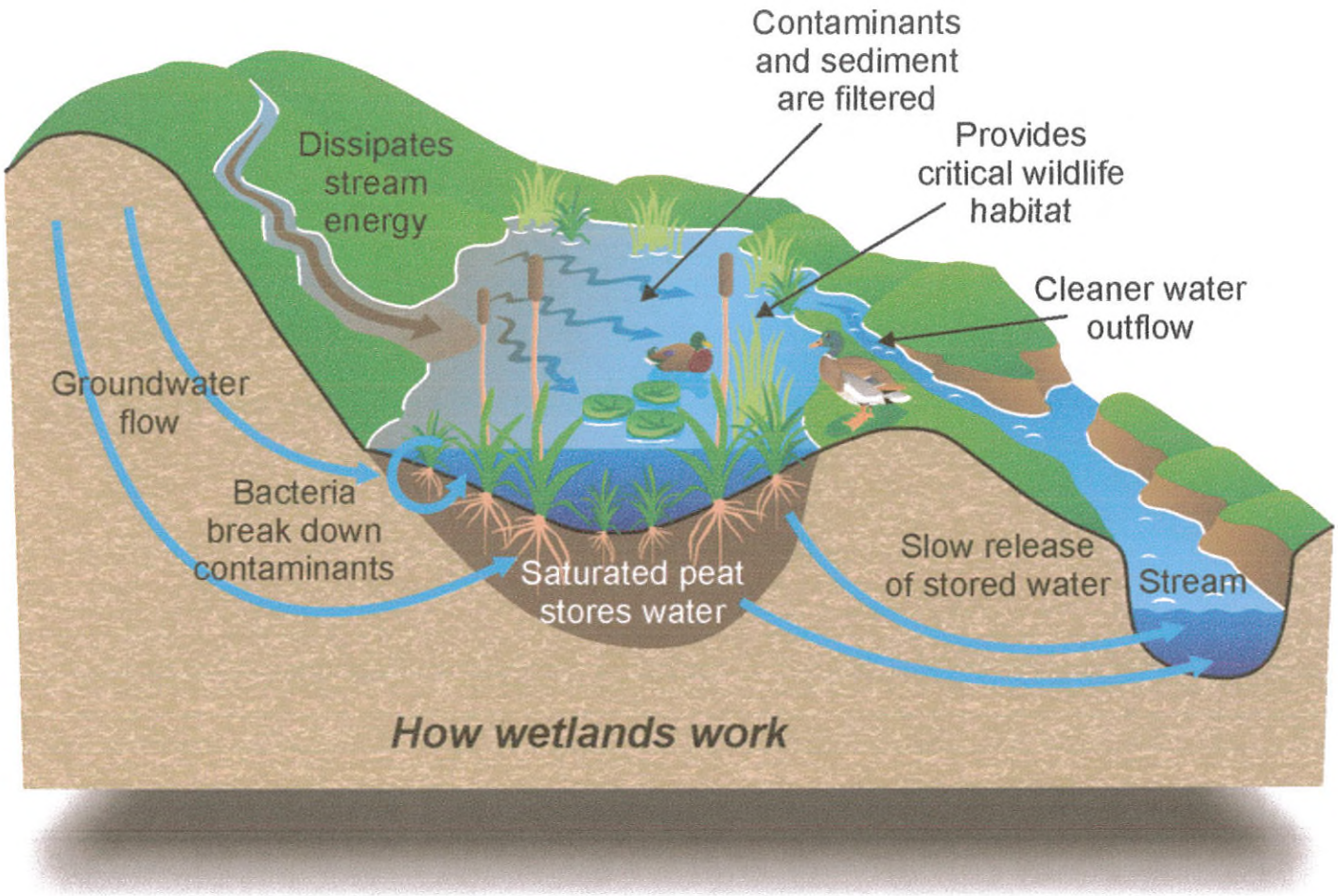
BASIC FACTS ABOUT WETLANDS

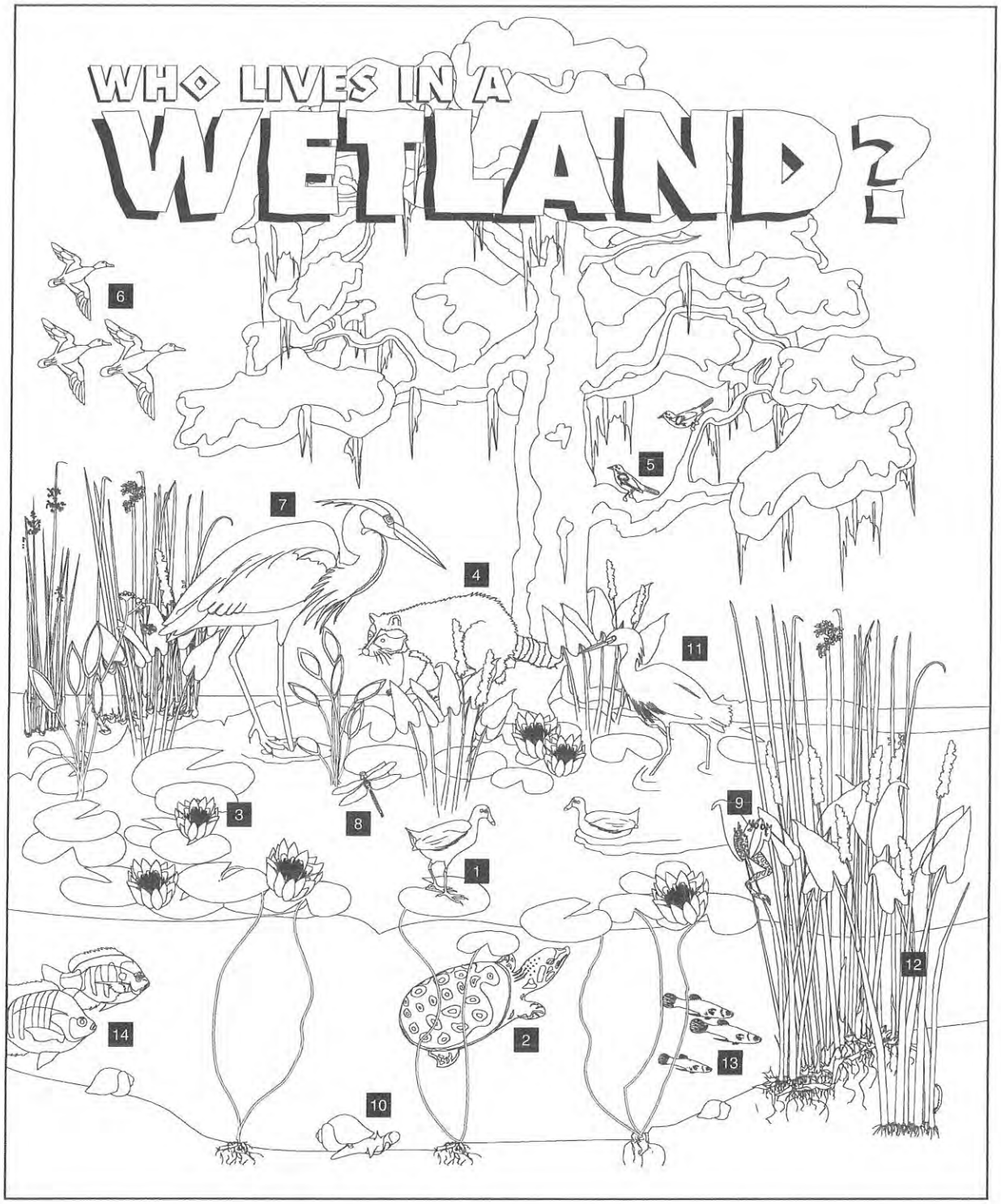
Wetlands are the link between land and water, and are some of the most productive ecosystems in the world. Some common *names for different types of wetlands are swamp, marsh* and bog. Depending on the type of wetland, it may be filled mostly with trees, grasses, shrubs or moss. To be called a wetland, an area must be filled or soaked with water at least part of the year. Some wetlands are actually dry at certain times of the year!

Wetlands have many important functions that benefit people and wildlife.

- Provide habitat for a wide variety and number of wildlife and plants.
- Filter, clean and store water - in other words, acting like kidneys for other ecosystems!
- Collect and hold flood waters.
- Absorb wind and tidal forces.
- Provide places of beauty and many recreational activities

Wetlands also act like sponges by holding flood waters and keeping rivers at normal levels. Wetlands filter and purify water as it flows through the wetland system. Plants found in wetlands help control water erosion.





WETLANDS — what are they? Wetlands are low-lying areas between dry land and aquatic systems such as rivers, lakes or oceans. Once thought to be useless, wetlands really do many important things, such as holding extra floodwater, purifying water and giving plants and animals a place to live. As you color this picture, see if you can name these plants and animals by matching the number to the correct name below.

___ Pickerelweed	___ Snowy egret	___ Great blue heron	___ Leopard frog	___ Dragonfly
___ White water lily	___ Mottled duck	___ Bluegill	___ Red-winged blackbird	___ Snail
___ Raccoon	___ Common gallinule	___ Softshell turtle	___ Mosquito fish	

Answers: 1. Common gallinule 2. Softshell turtle 3. White water lily 4. Raccoon 5. Red-winged blackbird 6. Mottled duck 7. Great blue heron 8. Dragonfly 9. Leopard frog 10. Snail 11. Snowy egret 12. Pickerelweed 13. Mosquito fish 14. Bluegill

Southwest Florida Water Management District
WATERMATTERS.ORG · 1-800-423-1476

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rev 4/06

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Water Conservation

BACKYARD CONSERVATION Tip Sheet

Save water with efficient systems and healthy plants.

In Your Backyard

Wise use of water for garden and lawn waterings not only helps protect the environment, but saves money and provides for optimum growing conditions. Simple ways of reducing the amount of water used for irrigation include growing xeriphytic species (plants that are adapted to dry conditions), mulching, adding water retaining organic matter to the soil, and installing windbreaks and fences to slow winds and reduce evapotranspiration.

Watering in the early morning before the sun is intense helps reduce the water lost from evaporation. Installing rain gutters and collecting water from downspouts also helps reduce water use.

Plant Needs for Water

Water is a critical component of photosynthesis, the process by which plants manufacture their own food from carbon dioxide and water in the presence of light. Water is one of the many factors that can limit plant growth. Other important factors include nutrients, temperature, and amount and duration light.

Plants take in carbon dioxide through their stomata--microscopic openings on the undersides of leaves. Water is also lost through the stomata in the process called transpiration. Transpiration, along with evaporation from the soil surface, accounts for the moisture lost from the soil.

When there is a lack of water in the plant tissue, the stomata close to try to limit water loss. Wilting occurs when the tissues lose too much water. Plants adapted to dry conditions have developed numerous mechanisms for reducing water loss, including narrow leaves, hairy leaves, and thick fleshy stems and leaves. Pines, hemlocks, and junipers are also well adapted to survive extended periods of dry conditions which they encounter each winter when the frozen soil prevents the uptake of water. Cacti, with leaves reduced to spines and having thick stems, are the best example of plants well adapted to extremely dry environments.

Choosing Plants for Low Water Use*

You are not limited to cacti, succulents, or narrow leafed evergreens when selecting plants adapted to low moisture requirements. Many plants growing in humid environments are well adapted to low levels of soil moisture. Numerous plants found growing in coastal or mountainous regions have developed mechanisms for dealing with extremely sandy, excessively well-drained soils, or rocky cold soils in which moisture is limited to months at a time. Following is a list of low water use plants from various parts of the country:

North West

- Saskatoon serviceberry (Amelanchier alnifolia)
- Blue grama (Bouteloua gracilis)
- Rocky Mountain Juniper (Juniperus scopulorum)
- Oregon white oak (Quercus garryanna)

South West

- Four-wing saltbush (Atriplex canescens)
- Fairy Duster (Calliandra eriophylla)
- Penstemon (Penstemon spp.)
- Pinyon pine (Pinus edulis)

North Central

- Aromatic aster (Aster oblongifolius)
- Sideoats grama (Bouteloua curtipendula)
- Bluegrama (Bouteloua gracilis)
- Pale purple coneflower (Echinacea pallida)
- Compass plant (Silphium laciniatum)

South Central

- Aromatic aster (Aster oblongifolius)
- Sideoats grama (Bouteloua curtipendula)
- Bluegrama (Bouteloua gracilis)
- Tall blasing star (Liatris aspera)
- Bur oak (Quercus macrocarpus)
- Aromatic sumac (Rhus aromatica)

North East

- Big bluestem (Andropogon gerardii)
- Eastern red cedar (Juniperus virginiana)
- Blazing star (Liatris spicata)
- Pitch pine (Pinus rigida)
- Beach plum (Prunus serotina)

South East

- Tall blazing star (Liatris aspera)
- Longleaf pine (Pinus palustris)
- Sand Live oak (Quercus germinata)
- Little bluestem (Schizachyrium scoparium)
- Compass plant (Silphium laciniatum)

*Always check with your local State extension service when selecting plants to avoid the potential of selecting a plant that is considered invasive in your particular location.

Efficient Watering Methods

Trickle irrigation and drip irrigation systems help reduce water use and meet the needs of plants. With these methods, very small amounts of water are supplied to the base of the plants. Since the water is applied directly to the soil, rather than onto the plant, evaporation from leaf surfaces is reduced. The water is also placed where it will do the most good, rather than sprayed over the entire garden.

Installing Irrigation Systems

An irrigation system can be easy to install. Numerous products are readily available for home use. The simplest system

consists of a soaker hose that is laid out around the plants and connected to an outdoor spigot. No installation is required and the hose can be moved as needed to water the entire garden. A slightly more sophisticated system is a slotted pipe system.

Slotted pipe system installation

1. Sketch the layout you will need. If you intend to water a vegetable garden, you may want one pipe next to every row or one pipe between every two rows.
2. Depending on your layout, purchase the required lengths of pipe. You will need a length of solid pipe the width of your garden. You will need lengths of perforated pipe the length of your rows (the laterals) times the number of rows.
3. Measure the distances between laterals and cut the solid pipe to the proper lengths.
4. Place t-connectors between the pieces of solid pipe.
5. Approximately in the center of the solid pipe, place a t-connector to which a hose connector will be fitted.
6. Cut perforated pipe to the length of the rows.
7. Attach perforated pipe to the t-connectors. Attach so that the perforations are facing downward. Cap the end of the pipe.
8. Connect garden hose to hose connector on solid pipe. Adjust water from the spigot until water slowly emerges from each of the laterals.

Drip or Trickle Irrigation

The basic elements of a drip or trickle system consist of the head, the tubing, and the emitters.

The head is the part of the system that connects to your water supply. The major components of this may include a pressure regulator, a filter, an anti-siphon valve, and an automatic timer. While this may sound complicated and expensive, it is not. Installation of these components will create a better operating system.

Consideration for the Head

1. Many drip systems are designed to be used with low water pressure, under 25 pounds per square inch (psi). Normal city water pressure is about 55 psi. Therefore, a pressure regulator should be installed.

2. Because of the small size of the openings in the emitters, they easily can become clogged by sediment in the water. A filter should be installed to keep openers operating freely.

3. Consider installing a back flow preventer. This is a valve that prevents the accidental backflow of water in the system getting into the water line. This may be required by city ordinance in some municipalities. Considering the minor cost, it is probably a wise investment for anyone considering a system.

4. A timing device can be added to automatically turn the system on and off. This can be as simple as a battery operated attachment or a more permanent timer that is wired into your electrical system.

Plastic tubing is used to get the water from the source to the garden. This comes in many sizes. A variety of fittings are available to go around corners and to connect pieces.

Plastic Tubing Considerations

1. Check with the supplier for the maximum length of tubing that can be run in any one direction. A general recommendation is that 400 feet is the maximum for 1/2 inch tubing.

2. Consider what you intend to water with the drip system. You may need several different systems to best meet the needs of various plants. Not all plants have the same water requirements, and soil conditions in various parts of your yard may vary. Trees, because of their large size and deep root systems, probably will require less frequent but longer waterings. Well mulched vegetable gardens high in organic matter or shady flower gardens probably will require shorter watering times than gardens with sandy soils or those in full sun.

Emitters deliver the small amounts of water to the plants. Depending on the design, emitters can either be attached directly to the pipe or attached to "spaghetti tube," a very small flexible tube that can be placed next to plants or in pots. Emitters can let water drip out very slowly, or small sprinkler emitters can be installed to provide a spray pattern similar to a lawn sprinkler. Sprinkler emitters may be appropriate for watering groundcover and lawns.

The size of the emitter will influence the amount of water delivered. Drippers vary in the amount of water delivered per hour. Some deliver as little as one half gallon of water per hour while others deliver up to 10 gallons per hour. Some emitters are adjustable to deliver different rates of water. Sprinkler emitters also are available in various flow rates as well as with different spray patterns and coverage areas.

While these systems need more planning, they are neither expensive or difficult to install. In most cases, no special tools or skills are needed. Plastic pipe is punched with an inexpensive tube punch that assures the proper hole size. Emitters or spaghetti tubes snap into the hole. No gluing or soldering is required. Because the holes are small, they can easily be plugged if you put one in the wrong place. Some systems come with pre-assembled emitters at regular intervals. Drip systems require periodic maintenance. You will also need to check emitters to make sure they are working properly as they can become clogged.

Once you have thought about your watering needs, discuss your ideas with a supplier. Most trickle irrigation suppliers will help you design a system to best meet your gardening needs.

On the Farm

Trickle irrigation systems are frequently used by farmers dealing in high value crops such as vegetables, and small fruits such as grapes and berries, where lack of moisture can mean the difference between a profitable harvest or costly failure. These systems are similar to those used by the home gardener.

High-efficiency irrigation systems for row crops use less energy to pump water and, since they spray water downward, less water evaporates before it reaches the crop.

Farmers implement other water management practices to reduce the amount of water used to produce a crop.

More About Backyard Conservation

The Natural Resources Conservation Service, National Association of Conservation Districts, and Wildlife Habitat Council encourage you to sign up in the "Backyard Conservation" program. To participate, use some of the conservation practices in your backyard that are showcased in this series of tip sheets -- tree planting, wildlife habitat, backyard pond, backyard wetland, composting, mulching, nutrient management, terracing, water conservation, and pest management. Then, simply fill in the Backyard Conservation customer response card, send a Backyard e-mail request to landcare@usda.gov, or call 1-888-LANDCARE.

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Backyard Pond

BACKYARD CONSERVATION Tip sheet

A pond or water garden will likely become the focal point for all your backyard conservation.

In Your Backyard

Backyard ponds and water gardens are for birds, butterflies, frogs, fish, and you and your family. These ponds are typically small, sometimes no larger than 3 to 4 feet in diameter. They may be built in barrels or other patio containers. Water is effective in drawing wildlife to your backyard. It is also a natural, relaxing, and scenic addition that can provide interest and enjoyment.

Where to Put a Backyard Pond

Consider locating your backyard pond where you can see it from a deck or patio. Have it blend in with its natural surroundings. Elevate the soil around the pond slightly so that excess water will flow away from the pond, not into it. Make sure that any drainage from the pond is away from your house. Plan to landscape around the pond to provide habitat for frogs and birds that need land and water. If you plan to use a pump to re-circulate water, use a filter, or light the area, be sure electrical service is available. There will be less maintenance if your pond is not under trees. Most aquatic plants will grow better in full sun.

If you do not have space in your yard for a built-in earthen pond, consider a "tub" pond or large water bowls. These can be placed on the patio and provide many of the same benefits as a built-in pond. There are numerous tub kits available that can be as simple as adding water, a pump, and some plants. They can also be moved inside in the winter as long as good lighting is provided for plants.

Pond Liners

Pond liners keep water from seeping into the soil. Even in heavy clay soils, a liner is necessary. You can buy rigid pond liners in a variety of shapes. These are durable and may include built-in waterfalls. Many are quite small. If you want a larger pool or would like to design your own shape, consider using a polyvinyl chloride (PVC) liner. Use a liner specifically designed for pools. While other plastics initially may be cheaper, many are not resistant to ultraviolet light and will break down quickly. Some plastics may also be toxic to fish. Liners also come in different thicknesses. A thicker liner tends to be more resistant to punctures. While expensive and requiring more expertise to install, cement is also an option as a pool liner.

If you use PVC, you will need to get a liner large enough for your pool. To determine how large a piece you will need, determine the maximum width, length, and depth of your pond. Multiply the maximum depth by 3. Then add this number to both the length and width. This will allow enough plastic to be securely held down around all pond edges.

Installing the Pond

You can put in a backyard pond anytime the ground is not frozen or overly wet. If using a pre-formed liner, dig a hole to the

correct depth and slightly wider. Insert the liner, making sure it is level and sits securely in the ground. Backfill around the sides. Add water, pump, and plants. Complete landscaping around the pool.

If you use a PVC liner, plan on at least a weekend to install and landscape. Steps to install a pond with a PVC liner:

1. Decide on your pond's location.
2. Using a hose or rope, lay out the shape of your pond on the ground.
3. Once you are happy with the shape, start digging. Stockpile your topsoil so you can use it to landscape around your pond.
4. Plan for part of your pond being at least 18 to 24 inches deep; 24 to 36 inches is even better. This will allow for a greater diversity of plants and fish to live in the pond. You may want to make tiers around the inside of the pond at various depths on which to place pots of different aquatic plants. Make tiers about 12 inches wide to accommodate the pots.
5. Remove any rocks from the excavated area.
6. To help prevent punctures in the plastic, put a one-inch layer of damp sand on the bottom of the excavated area.
7. Spread the plastic liner over the hole. Let it sag gently in the hole. Place a few rocks or bricks around the edge to hold in place.
8. Slowly start filling your pond. The weight of the water will help smooth out the liner. Remove rocks holding the edges to allow liner to conform to the edges of the hole. Smooth out wrinkles but do not pull too tightly. You can walk on the liner if you remove your shoes.
9. Finish off the pond by placing rocks around the edge to securely hold the liner in place.
10. Install pump and filter, if desired. Many smaller pumps have a built-in filter. For larger pools, a separate pump and filter may be necessary. Make sure the filter and pump are adequate for the volume of water in your pond. Pumps not only add interest, but are important in adding oxygen to the water. If you want a fountain or waterfall in your pond, you will need a pump to circulate the water.
11. Let the pond sit for a few days before adding fish and plants. This allows chlorine to evaporate from the water. Chemicals are also available that will quickly neutralize chlorine and other harmful compounds.
12. Place plants at various depths and add fish.

Establishing Plants

For ponds, consider a mix of emergent, submergent, and floating species. Emergent plants, those that have their roots in the water but their shoots above water, can be added to the margins of pools. These include cattails (Typha spp.), arrowhead (Sagittaria spp.), and water lilies (Nymphaea spp.). Submergent species, or those that remain under water such as elodea, are often used as oxygenators. These are plants that remove carbon dioxide from the water and add oxygen. These plants are essential in most ponds to keep the water clear. Floating species or those that are not anchored at all in the pond include plants such as duckweed (Lemna minor), water lettuce (Pistia stratiotes), and water hyacinth (Eichhornia crassipes). While attractive, water hyacinth and water lettuce can be serious weed problems in the south; however, since they are not winter hardy, there is no problem with them spreading in northern climates. While not as effective as oxygenators, these plants help keep the water clear by limiting the amount of sunlight that algae receive. In tiny ponds created in barrels and similar containers, these plants may be adequate to maintain clear water.

Choosing and Establishing Plants for Ponds

1. Consider the following when selecting plants:
    - How deep is the water? This will be a factor in establishing plants and their survival over winter if you live in colder regions. Some species need a minimum depth of 2 to 3 feet to grow well.
    - Is your pond permanently installed in the ground or is it a small tub that will be moved inside in the winter? In this case, even tropical plants may be an option.

- Will you drain your pond in the winter? If you intend to drain your pond, you should consider plants that can spend the winter in a basement in a dormant state.
- How much sunlight does your pond receive?
- How large is your pond? If your pond is small, consider dwarf species.

2. Purchase plants from a reliable vendor. Remember to include some oxygenator plants such as elodea.
3. Emergent and submergent plants should be planted into pots. A wide assortment of pots is available, from plastic baskets to pulp planters. Choose pots that are large enough for your plants.
4. If using baskets with numerous perforations, line the basket with burlap or 2 layers of newspaper to keep the soil from falling out of the holes.
5. Fill the container about half full with a mixture of good garden topsoil. Do not use potting mixes or peat moss. These are too light and will float out of the pot. Adding aquatic plant fertilizer to this bottom layer of soil is recommended for some species. Follow directions on the label for amount.
6. Place the plant on top of the soil and fill the container with topsoil within one inch of the top.\
7. When planting water lily rhizomes, make a mound of soil in the middle of the pot. Place the rhizome at a 45 degree angle. The crown of the rhizome should be toward the center of the pot. Cover the roots with soil, but not the crown.
8. In all cases, add a layer of gravel to the top of the pot. This will help keep the soil from floating out and prevent fish from digging in the soil.
9. Slowly place the pots in the pool to keep soil from floating out. Place pots on bricks to get the desired height.
10. Floating species can be placed directly into the pond with no other care needed.

Plants should cover 50 to 70 percent of the water surface. Native plants usually do not need fertilizer. For some exotic water lilies, limited fertilizing once yearly may be required. Check with your nursery on care of plants and how deep to place potted plants. Be aware that overfertilizing may cause unwanted algae blooms which can rob the water of oxygen.

Add Fish and Scavengers

Consider stocking your backyard pond with native fish. They are fun to watch and help keep the pond free of unwanted insects. Most small ponds will warm up quickly in the summer, so make sure you stock with fish that can tolerate elevated temperatures.

You'll also need scavengers, such as aquatic snails and tadpoles, to help control algae. In cold climates, a heater may be necessary for fish to survive the winter. However, this uses a significant amount of electricity and, in most cases, probably is not justified. A better option may be to set up an indoor aquarium in which to overwinter fish and plants.

Maintenance

Algae is a common problem in many newly established ponds. The water often becomes an unsightly green after a few days. While your first instinct is to drain the pond and start over, this only prolongs the problem. Once a pond is "balanced," algae usually are kept at an acceptable level. A balanced pond is one in which the nutrients are at the appropriate level for the plants present. Excess nutrients and light are needed for algae. Reducing the nutrients and decreasing the amount of light entering the water will help reduce algae. Floating plants or those with broad leaves such as water lilies will help reduce the amount of light available for algae and compete for available nutrients. Scavengers such as snails will help clean up wastes from the bottom of the pond.

Pond filters can help reduce algae, but require maintenance. Filters need to be cleaned frequently if algae is a problem. Chemicals can also be used to control algae. Use cautiously as they can be toxic to other plants and aquatic life. The need for

algaecides should decrease as plants become established.

Excessive plant growth, especially of free-floating plants, may be a problem. Periodically skim off excess growth of duckweed, water lettuce, and other floating plants. Monthly, prune dying plant material. Clean out some of the decaying plant material that has accumulated in the bottom of the pond in the spring. Remember: a natural pond is not a swimming pool and too much cleaning can do more harm than good.

Safety

Locate the backyard pond where it is unlikely to attract unattended children. Check local safety ordinances to determine if a fence is required for the specific depth and size of your pond. Check local building ordinances for depth and safety restrictions and permits. Equip outdoor outlets with a ground-fault circuit interrupter. Unplug the pump before cleaning the filter.

On the Farm

A properly located and maintained pond can reduce gully erosion and improve water quality. Ponds provide water for livestock, waterfowl, and fish; store water for emergencies; and add beauty to the landscape. Wildlife use ponds for water and habitat.

More About Backyard Conservation

The Natural Resources Conservation Service, National Association of Conservation Districts, and Wildlife Habitat Council encourage you to sign up in the "Backyard Conservation" program. To participate, use some of the conservation practices in your backyard that are showcased in this series of tip sheets -- tree planting, wildlife habitat, backyard pond, backyard wetland, composting, mulching, nutrient management, terracing, water conservation, and pest management. Then, simply fill in the Backyard Conservation customer response card, send a Backyard e-mail request to landcare@usda.gov, or call 1-888-LANDCARE.

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.

Daily Water Use at Home

Complete this survey to estimate how much water is used in your home daily.

Average Use: Write the number of times you and your family members do each activity in one day. Then multiply the number for **Water Used** by the **Number of Times** the activity is done. This will give you the number for the **Gallons Used** column.

Calculated Use: Record the number of total minutes used for each activity. Then multiply the number for **Water Used** by the number of **Total Minutes** to find the number for the **Gallons Used** column. For an activity you didn't do, place a 0 under **Gallons Used**. Add all the numbers under **Gallons Used** to find the **Total Gallons Used**.

AVERAGE USE

Activity	Water Used	Number of Times	Gallons Used
Dishwasher	12 gallons per load		
Toilet Flushing	4 gallons per flush		
Bathing	45 gallons (full tub)		
Laundry	43 gallons per load		

CALCULATED USE

Activity	Water Used	Total Minutes	Gallons Used
Garbage Disposal	4 gallons per minute		
Brushing Teeth	4 gallons per minute		
Washing Hands	4 gallons per minute		
Washing Dishes by Hand	4 gallons per minute		
Shower	4 gallons per minute		
Yard Watering by Hand	9 gallons per minute		
		Total Gallons Used	

Discuss ways to conserve water at home with your family. Write two of the ways on the lines provided. Decide how you will help each other practice your new habits. Share ideas with your classmates.

_____

_____

_____

Water-Saving Tips!

Garbage Disposal
A garbage disposal requires a lot of water to operate properly. Use a disposal only when necessary.

Dishwasher
Use your automatic dishwasher only for full loads.

Toilet Flushing
Avoid using your toilet as a wastebasket. Tissues, insects and other things belong in a trash can, not the toilet.

Bathing
Take only shallow baths.

Washing Dishes by Hand
When washing dishes by hand, fill one sink or basin with soapy water and fill the rinsing sink to one-third or one-half full — avoid letting the water run continuously in the rinsing sink.

Laundry
Run only full loads in the washing machine. Running the machine when it's full will save you time, energy and water.

Shower
Limit the time water runs while you're taking a shower. Install a low-flow showerhead.

Washing Hands
Don't let the water run while you are washing your hands.

Yard Watering
Water only on your watering day and only when 30 percent of the lawn shows signs of wilt: leaf blades folded in half, blue-gray color and footprints remain on the lawn for several minutes after walking on it.

Brushing Teeth
Turn off the water while brushing your teeth.

For additional information about our water resources, please contact the Communications Bureau of the Southwest Florida Water Management District at 1-800-423-1476, ext. 4757, or visit our website at ***WaterMatters.org***.

Southwest Florida
Water Management District

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VISAY 02-12

PLAYING IT SAFE

Game Cards

Instructions: Copy and cut one set of game cards for each group.

		You used a clean paper towel to wipe off the kitchen counter and then disposed of it properly. MOVE AHEAD 3 SPACES.
You washed your hands for 20 seconds with warm water and soap before helping make dinner. MOVE AHEAD 3 SPACES.	You pet your dog and let him lick your hand. Then you helped mom cut up lettuce for the salad without washing your hands. GO BACK 2 SPACES.	You used a scrub brush to wash under your fingernails before preparing dinner. MOVE AHEAD 4 SPACES.
You cooked your scrambled egg until all of it was firm. MOVE AHEAD 3 SPACES.	You washed your cutting board under hot soapy water after cutting the eggs, but before you started slicing the potatoes for the salad. MOVE AHEAD 3 SPACES.	You were tired, so you left the potato salad on the counter for 2 hours before putting it away. MOVE BACK 3 SPACES.
When your dad barbecued, you washed the raw meat juices off the platter with warm soapy water before he put the cooked meat back on it. MOVE AHEAD 3 SPACES.	You washed the plastic cutting board in the dishwasher after dinner. MOVE AHEAD 4 SPACES.	You washed your hands but a towel was not close by. You wiped them on the legs of your pants. MOVE FORWARD 2 SPACES, THEN BACK 3 SPACES.
You cut up the chicken for fajitas with a sharp knife and then cut your veggies without rinsing the knife or cutting board. MOVE BACK 4 SPACES.	Before talking on the phone, you helped your mom put the leftovers in the refrigerator as soon as dinner was over. MOVE AHEAD 3 SPACES.	You put your dish sponge in the microwave on high for one minute before you wiped off the counter. MOVE AHEAD 3 SPACES.
You asked the bag clerk at the supermarket to put the chicken in a separate bag from your fruits and vegetables. MOVE AHEAD 4 SPACES.	You cut up cheese slices but didn't clean the cutting board when you finished. MOVE BACK 3 SPACES.	You let the kitchen sponge soak in the dishwater overnight. In the morning you wiped down the counter with it. MOVE BACK 3 SPACES.
Mom called and asked you to put the ground beef out to thaw. You placed it on the counter top all day to defrost. MOVE BACK 3 SPACES.	As your chicken defrosted in the refrigerator, the juices dripped onto the refrigerator shelf. An apple rolled into the juices. MOVE BACK 3 SPACES.	Your steak was barely warm and looked under-cooked when you went out to dinner with your friends. You didn't want to say anything, so you ate it anyway. MOVE BACK 3 SPACES.
You dried the dinner dishes with the cloth that had been hanging all week on the refrigerator door. MOVE BACK 3 SPACES.	You remembered to tie back your hair while you were making a cake for your brother's birthday. MOVE AHEAD 3 SPACES.	You understand the importance of keeping hot foods hot and cold foods cold, and not cross-contaminating raw food with cooked food. MOVE AHEAD 4 SPACES.

ONCE THERE WAS A TREE
BY: NATALIA ROMANOVA

Once there was a TREE. It had grown for many years and now was growing very old.

Dark clouds swept across the sky. Rail fell, thunder roared, and a **LIGHTNING BOLT** split the tree in two.

A **WOODSMAN** came upon the broken tree and sawed it down so that only the trunk remained.

Soon a BARK BEETLE with long feelers settled in. The beetle loved the stump and laid her eggs under its bark.

The eggs hatched and tiny MAGGOTS emerged. All summer long they gnawed tunnels in the bark.

Winter came and they slept. When they awoke in the spring with long feelers of their own, it was time to fly away.

But the **STUMP** was not deserted for long. With all the entrances and exits that the maggots had made, here was the perfect place for **ANTS** to live. One ant brought a leaf, another a twig, and another a grain of sand. They cleared out the tunnels and made the stump their home.

A **BEAR** approached the tree stump, sniffed at it, and sharpened her claws on the bark. The stump was hers, like everything else around. Even the ants in the stump were hers, and no other bear around would dare to disturb them.

A titmouse (BIRD) flew down and landed on the stump. She spotted an ant dragging a caterpillar and pecked at it. Now the CATAPILLAR was hers. The Ants were hers too. So was the tree stump. No other birds would come near.

One rainy day a FROG found shelter in a hole in the tree stump. Time and weather had dug these holes, which would protect others who also passed by.

The warm sun dried the tree stump, and soon a new occupant had moved in – an EARWIG (**BUG**) liking nothing better than the shade, he crept under the bark to sleep.

A **MAN** was walking in the woods and saw the tree stump. He sat down on it to rest, and now the tree stump was his. The man thought he owned the forest and the earth – so why not the tree stump?

But who really owns the tree stump? The **BARK BEETLE** that gnaws the tunnels inside it?

The **ANTS** that travel through the tunnels inside it?

The EARWIG (**BUG**) that sleeps under its bark?

Or the **BEAR** that uses it to sharpen her claws?

Does it belong to the titmouse (**BIRD**) that flies down upon it?

The **FROG** that finds shelter in one of its holes?

Or the MAN who believes he owns the forest?

Maybe the tree stump belongs to all-the **BEETLE** the **ANTS**, the **BEAR**, the **BIRD**, the **FROG**, the **BUG** and even the **MAN**. All must live together.

Meanwhile the tree stump gets older and older. The sun warms it: the rain cools it. Soon it begins to rot. Night comes, and the forest is cast in moonlight. What remains of the tree stump glows in the dark?

Now the tree stump is gone. A new tree has grown in its place. A titmouse (BIRD) is perched in its branches – it is her tree.

An **ANT** crawls up high – on her tree.

A **BEAR** lumbers by and sharpens his claws on the bark. A MAN lies down to rest in its shade.

The TREE belongs to all, because it grows from the earth that is home for all.

TREE FACES

Contributed by Sharron Shepherd, Choctaw County

"At our Classroom in the Forest day I did an activity with the 5th grade students. It was called "Tree Faces". I mixed Flour, Water, Oil and Salt making a homemade playdough. The kids broke out in groups of 4-5. I gave them a zip lock bag with the homemade playdough and they formed a face on the side of a tree. They found stuff in the forest to decorate the face. It was really fun! I emphasized to them that you don't always have to get something at the store to have fun - you can use items you already have at home and items you find in the forest".

Home Made Playdough

2 cups flour
1 1/2 cups warm water
1 cup salt
2 Tablespoons vegetable oil

Mix together and place in sealed Ziploc bags for student teams. Depending on the number of students you may need more than one batch!

GARBAGE SHUFFLE

WE MAKE GARBAGE AND WE ALWAYS WILL! LET US LEARN FROM THE PAST!

PRE-HISTORIC HUNTER – WHAT DID HE DO WITH HIS GARBAGE…LIKE OLD TOOLS OF STONE AND THOSE OLD ANIMAL BONES…WELL HE TOSSED THEM, DROPPED THEM AT HIS FEET…THEN MOVED HIS CAMP AND WENT TO HUNT MORE MEAT!

ANCIENT GREEK – HE WAS A WISE ORATER, HE LOVED TO TALK… TO SPEAK… ABOUT GARBAGE…IT FILLED HIS ROADS… AND THEN HE TOOK IT IN LOADS… ABOUT A MILE BEYOND THE CITY LIMITS…AT LEAST HIS HOME WAS NOT BURIED IN IT!!!

BRITISH MAID – WHY WOULD THIS MAIDEN FROM THE MIDDLE AGES BE AFRAID OF GARBAGE…OUT THE WINDOW SHE WOULD THROW…HER GARBAGE TO THE STREET BELOW…HER CITY WAS SO CROWDED… ALL THAT GARBAGE MADE HER FAMILY SICK AND GAVE THEM RASHES…

SPANISH EXPLORER – HE LIKED A SHIP THAT WAS NOT FULL OF GARBAGE… BECAUSE A MESSY BOAT… IS TOUGH TO KEEP AFLOAT…SO HE TOSSED HIS GARBAGE INTO THE SEA…WHERE IT DISAPPEARED…AND IT NEVER BOTHERED HIM AGAIN!

IT IS THE 1860'S- HE WAS A GERM DETECTOR – A NEW YORK CITY HEALTH INSPECTOR…HE HATED GARBAGE…THE ALLEYS FLOWED WITH TRASH…THE WATER WAS FULL OF ASH…THOSE GARBAGE FUMES MADE HIM ILL…IT WAS TIME TO CLEAN UP WHAT THEY SPILLED!

ROARING TWENTIES – YOU TOO WOULD BE A GRUMP…IF YOU LIVED BY THE DUMP…FULL OF BUGS AND FLIES…EVEN THE RATS ARE MONSTER SIZE…THE TRASH IS SO HIGH… THE GARBAGE MOUNTAINS REACH THE SKY!

THE DEPRESSION – INCINERATORS ARE THE WAY TO DEAL WITH GARBAGE…IT GOES UP IN SMOKE…BUT THEN YOU COUGH AND CHOKE…OVER THE CLOUDY FUMES IN THE AIR…OH HOW EVERYONE WISHED THEY COULD MOVE AWAY SOMEWHERE…ANYWHERE…

Reduce, Reuse, and Recycle:
Suggestions for Children

The three R's always come in the same order.

Reduce always comes first because reducing what we use and what we waste means using fewer natural resources and less energy.

Reuse comes second because reusing items—using them twice or many times instead of just once—keeps them from becoming waste.

Recycle comes third, but not last. Recycling—converting used items back into raw materials, then making new products with them—conserves our valuable natural resources and reduces the need to put as much waste into our landfills.

Reduce

* When you go shopping, take along a bag and tell the cashier that you won't need a new one.

* Avoid buying fast food unless it is served in recyclable packages.

* Boycott products that are overpackaged. Choose items packaged in containers that are recyclable or made of recycled materials. Write to companies and tell them why you are making these choices.

* Don't buy or use disposable products. Switch to cloth napkins, carry drinks in refillable thermos bottles, and carry your lunch in washable, reusable containers. Instead of paper towels, use a cloth or sponge to clean up.

* Don't buy aerosol cans. They can't be recycled, and they contain ingredients which cause air pollution. Instead look for spray bottles or other alternatives.

* Try to avoid creating hazardous wastes. Many household cleaning products can be replaced with simpler, less hazardous materials.

* Reduce your use of batteries. They contain heavy metals that are toxic. Try to use mechanical objects, ones that plug in, or rechargeable batteries.

Reuse

* Donate outgrown toys and clothing to a worthy cause, rather than throwing them away. Even worn-out clothing can be used as rags for cleaning, car polishing, etc., rather than using disposable paper towels.

* Create a compost pile. With very little effort, yard wastes and food scraps can be made into compost, which will help your garden or yard to grow.

* Learn to fix things rather than throwing them away. When buying new objects, look for sturdy ones that will last for a long time.

* If you or your family have old magazines or books you want to get rid of, donate them to a hospital, nursing home, or waiting room rather than throwing them away. Share a subscription with a friend.

Recycle

* Find out what is recyclable in your community, and help your family to make whatever changes are necessary to recycle everything possible.

* Ask your parents to buy drinks in glass or aluminum containers instead of plastic, since glass and aluminum are easier to recycle. Avoid buying drinks in unrecyclable containers.

* Whenever possible, choose products made from recycled materials. Unless people want to buy recycled products, companies will not produce them.

Adapted from ***Trash Goes to School***, produced by the Cornell Waste Management Institute working with a team of people from Cornell Cooperative Extension and other agencies in New York State.

Have you ever wondered what the numbers or recycling symbols mean at the bottom of plastic bottles and containers?

Know Your Numbers

Most household plastic containers and bottles have a recycling symbol containing a number, ranging from 1 to 7. These markings provide information about the chemicals used in the plastic, such as how likely the plastic is to leach and how un-biodegradable the plastic is.

Recycling Symbol and Number Information

	1	2	3	4	5	6	7
ACRONYM	**PETE / PET**	**HDPE**	**V / PVC**	**LDPE**	**PP**	**PS**	**OTHER / MISC**
FULL NAME	Polyethylene Terephthalate	High Density Polyethylene	Vinyl	Low Density Polyethylene	Polypropylene	Polystyrene e.g. Styrofoam™	Plastics not in other categories
ORIGINALLY INTENDED USE OF BOTTLE OR CONTAINER	• Soda • Water • Beer • Salad dressing • Mouthwash • Peanut butter	• Milk • Household cleaner • Juice • Shampoo • Cereal (Liners) • Detergent • Motor oil • Yogurt • Butter • Toiletries	• Food wraps • Plumbing pipes • Detergent • Shampoo • Clear food • Cooking oil • Medical equipment • Piping • Windows	• Squeezable bottles • Shopping bags • Clothing • Carpet • Frozen food • Bread bags • Some food wraps	• Yogurt • Ketchup • Syrup • Medicine	• Compact disc cases • Egg cartons • Meat trays • Disposable plates • Disposable cups	• Sunglasses • iPod cases • Computer cases • Nylon • 3- & 5-gallon water bottles • Bullet-proof materials
RECYCLED USE	• Tote bags • Furniture • Carpet • Paneling • Fiber • Polar fleece	• Pens • Recycling containers • Picnic tables • Lumber • Benches • Fencing • Detergent bottles • And more!	• Paneling • Flooring • Speed bumps • Decks • Roadway gutters	• Compost bins • Paneling • Trash can liners • Trash cans • Floor tiles • Shipping envelopes	• Brooms • Auto battery cases • Bins • Pallets • Signal lights • Ice scrapers • Bicycle racks	• Egg cartons • Vents • Foam packing • Insulation	• Plastic lumber • Other custom products

The bottom line: Plastics are usually recyclable

While Plastics #1 and #2 represent the vast majority of household containers, check with your local department of public works to see which plastics are being recycled in your area, and then join the recycling movement to manage these resources wisely. If you have a choice, choose the product made with easy-to-recycle and safe packaging.

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ALABAMA NATIVE AMERICAN FACTS

INDIAN NAMES were often changed during one's lifetime because of events that happened in childhood, war service or retirement from active tribal life.

The CREEK and CHEROKEE tribes tattooed young boys when they were named and again when they became warriors.

Native Americans used PLANT ROOTS for food, medicine, dye, baskets, cloth, rope, salt, flavorings and just to chew. RED PAINT was made from red soil mixed with bear grease. YELLOW PAINT was made from the gall bladder of a buffalo. The paint was used to make themselves look scary or beautiful, to disguise themselves, or to protect their skin from sunburn or insect bites.

SACRED FIRE – Fires were extinguished and re-lit during the Green Corn Ceremony. After the fire was re-lit, every household fire was started anew from that sacred fire. The sacred fire was the earthly symbol of their god, the Breath Maker.

NUTS were extremely important to the Native American Diet. Chestnuts, pecans, hickory nuts, black walnuts and acorns could be cracked or stored in the shell for later use.

GAMES such as Lacrosse was played with webbed sticks and a ball. Sometimes SE Indians played the game to settle land disputes between tribes. Men's competition was usually followed by women's competition. CHOCTAW's called the game "little brother of war" because many players were injured, sometimes even killed, during play.

HEAD FLATTENING - The significance of this CHOCTAW custom remains unknown. Parents laid their babies in hinged cradle boards to press their skulls OR against boards with weighted leather strips!

GOURDS were grown in many different shapes. These were used for spoons, bowls, masks, rattles and even storage

FARMING Alabama Indians grew corn, beans, pumpkins, sweet potatoes, peas and sunflowers. Much was dried for winter use.

TOOLS AND WEAPONS were made from materials such as bone, reed, stone, wood, antlers, shell, metal or animal teeth (bear or beaver, etc.); knives were used as weapons but also creative handiwork.

Commodity Fact Sheet

Bees

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Bees are raised by beekeepers but also exist in the wild. A bee hive has a seasonal cycle that repeats from year to year. During the winter a hive is dormant. The worker bees and the queen spend the winter eating stored honey. When the weather gets warmer and spring flowers start to bloom the colony becomes more active. Worker bees start to leave the hive to collect pollen and nectar. In early summer the colony is very active. Workers leave the hive daily to forage and many new worker bees emerge. By late summer, the colony has grown very large and strong. In the fall, the flowers have stopped blooming and are producing fruit. The colony works on storing food and foraging for nectar slows down.

Honey bees live in colonies that are often maintained, fed, and transported by beekeepers. The modern beehive is made up of a series of square or rectangular boxes, without tops or bottoms, placed one on top of another. Inside the boxes, bees build up the wax honeycomb to raise bees and store honey. Modern hives enable beekeepers to transport bees, moving from field to field as the crops need pollinating and allowing the beekeeper to charge for the pollination services they provide.

History – The honey bees we are familiar with today originally came to the United States from Western Europe around 1622. It wasn't until about 200 years later that they came to California. Bees were finally introduced by using a sea route along the East Coast and crossing Panama, before using the Pacific Ocean for the final part of the journey. It was in 1853 that botanist C. A. Shelton used this route to introduce the first honey bees into California. Transporting colonies of bees either by sea or land in the 1700s and 1800s was not easy. The sea voyage from England lasted six to eight weeks, and it was not easy to keep bees alive for that time while confined. Many of the attempts to transport bees were unsuccessful. But now honey bees are an important part of the American pollination process.

Varieties – There are about 4,000 species of bees. Some species live in the ground, some live in trees, while others live in bee hives. Bees often seen in California are bumblebees, honey bees, carpenter bees, and digger bees. The common honey bee is most familiar to people. This is the bee whose hives are found in hollow trees and in the white wooden boxes managed by beekeepers for honey production and agricultural pollination. Each hive consists of the queen, drones, and thousands of female worker bees. Honey bees are the most important pollinating insect because they can be managed and transported to a pollinator dependent crop.

Commodity Value – A bee colony is worth several hundred dollars. In addition to gathering nectar to produce honey, honey bees perform a vital second function - pollination - making them a critical part of today's agricultural market. This includes products grown in backyard gardens, like apples and squash, but also products like alfalfa seed— creating food for America's meat and dairy industries. In fact, about one-third of the human diet is derived from insect-pollinated plants, and honey bees are responsible for 80 percent of this pollination. California almonds, which is a six-billion dollar industry, depend entirely on honey bees to pollinate their crops. According to a USDA report, in 2013 the annual value of direct honey bee pollination to U.S. agriculture was estimated at over $16 billion. Honey production in California ranked fifth in the country for 2013 at 10,890,000 pounds valued at $22,869,000.

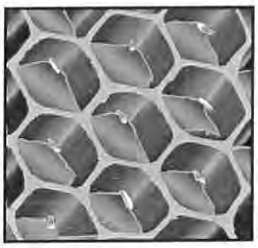
Top Producing Counties – Bees are raised by commercial operations and many small hobby beekeepers throughout California. Shasta County, Merced County, Colusa County, and Sutter County all have large operations that produce queen bees and packaged bees. Queen bee breeder operations tend to be in isolated areas. Major metropolitan areas with hobby beekeepers are in San Diego, Los Angeles, Sonoma, and the Bay Area. Bees are considered livestock!

Nutritional Value – Honey bees collect nectar and store it as honey in their hives. Nectar and honey provide energy for the bees. It also provides energy for humans. Honey is high in carbohydrates. Honey is the only sweetener that also contains B vitamins, minerals, and protein.

For additional information:
California State Beekeepers Association
(209) 545-5359
Website: californiastatebeekeepers.com

01/17 This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2300 River Plaza Drive, Sacramento, CA 95833-3293 (916) 561-5625 ✤ (800) 700-AITC ✤ Fax: (916) 561-5697
Email: info@learnaboutag.org ✤ Website: LearnAboutAg.org ✤

Bee Activity Sheet



1. The queen bee lays one egg in each cell.

2. After three days, eggs hatch into larvae.

3. After about six days, the eggs are capped and each larva spins itself a cocoon and becomes a pupa.

4. Another ten days later, an adult worker bee emerges.

5. After the new adult comes out, she spends her time with jobs in the hive. This includes cleaning hive cells, feeding the developing larvae, capping the cells with wax, and guarding the front entrance.

6. After about three weeks in the hive, each worker bee leaves her job in the hive to go out and collect food for the colony.

Lesson Ideas

- Research the history of bees and honey, write a report and give an oral presentation.
- Research Colony Collapse Disorder. Create a poster that explains the problem and offers possible solutions.
- Bee hives are built and consist of many hexagons fitting together. Create an art piece using math shapes.
- Do a taste test of honey from different regions and bees that pollinated different crops.
- Research the connection between bear population and beekeepers. Report to your class.
- Come up with a recipe using honey and share with your class.
- Study insects. Create an insect book of drawings and facts.

Fantastic Facts

- A ¼ cup of bees is about 200 bees.
- Bees have specific jobs. Some collect pollen and others collect nectar.
- Bees can only sting once and then they die.
- Bees are insects with three body parts and six legs.
- People who are allergic to bees may need to have an EpiPen injection used to assist against anaphylactic shock. It does not cure the reaction but provides time allowing the victim to get to the nearest hospital.
- Most beekeepers in the United States manage European honey bees.
- Bears do love honey and will raid apiaries.

Lesson Plan: Bee Hive Shapes (all about polygons)

Introduction: Each bee honeycomb is in the shape of a hexagon. Hexagons are one of the few regular polygons that can fit together perfectly without leaving any gaps. Repeating a shape to cover a surface without any gaps or overlaps is called tessellation. This activity will allow students to explore what shapes create tessellations.

Objective: Students will study geometric figures in nature and create tessellation art displays

California Standards: CC Math: 4.G.2, 5.MD.5, 5.G.4, 6.G.2, 7.G.6, 8.G.2, 3, 4, HS.G-CO.5; NGSS: 3-5-ETS1-1; Visual Arts Content: Grades 4-12, 1.0 Artistic Perception

Materials: Polygon stencils, notebooks, plain paper, pencils, colored pencils or markers

Procedure:

1. Show the class a picture of honeycomb to demonstrate how the hexagonal shapes fit together perfectly. Define the word tessellation and how honeycomb is an example of this.
2. Explain to the class that they will be looking for other geometrical shapes that can tessellate like the hexagon. Students can write a prediction in their notebooks of one or two shapes they think will fit together and why.
3. Give students time to find other polygons that can fit together without gaps or overlaps. Students will use stencils to draw one shape repeatedly to find this out. This can be done independently or in groups.
4. Discuss as a class what the students discovered. Students look back at their predictions and see if they were correct. Older students can discuss which shape is best for beehives and why, including which shape provides the most volume to store honey.
5. Conclude the lesson by allowing students to create and color their own repeating shapes. Display their tessellation art.

01/17

This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

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MONSANTO Fund

Major Man-Made Air Pollutants

Pollution	Description	Sources	Effects
carbon monoxide (CO)	• Colorless, odorless gas	• Vehicles burning gasoline • Indoor sources include: kerosene or wood burning stoves	• Headaches, reduced mental alertness • Heart damage
Lead (Pb)	• Metallic element	• Old paint • Metal refineries • Vinyl blinds	• Brain & kidney damage • Contaminated crops and livestock
Nitrogen Oxide (NO_x)	• Several gaseous compounds made up of nitrogen & oxygen	• Vehicles • Power plants burning fossil fuels • Coal burning stoves	• Lung damage • React in atmosphere to form acid rain • Deteriorates statues & buildings • Damage forests • Form ozone & other pollutants (smog)
Ozone (O_3)	• Gaseous pollutant	• Vehicle exhaust & certain other fumes • Formed from other air pollutants in the presence of sunlight	• Lung damage • Eye irritation • Respiratory tract problems • Damages vegetation • Smog
Particulate matter	• Very small particles of soot, dust, or other matter, including tiny droplets of liquids	• Diesel engines • Power plants • Industries • Windblown dust • Wood stoves	• Lung damage • Eye irritation • Damage crops • Reduces visibility • Discolors buildings & statues
Sulfur dioxide (SO_2)	• Gaseous compound made up of sulfur & oxygen	• Coal burning power plants and industries • Coal-burning stoves • Refineries	• Lung damage • Eye irritation • Kills aquatic life • Reacts in atmosphere to form acid rain • Damages forests • Deteriorates buildings and statues