INTRODUCTION TO ECOLOGY

Ecology deals with the relationships living things have to each other and to their environments (surroundings). Scientists who specialize in studying these relationships are called ecologists.

No living thing—plant or animal—lives alone. Every living thing depends in some way on certain other living and nonliving things. Animals and plants that live in the same area, or community, depend on each other in some way. For example, an elephant must have plants for food. If the plants in its environment were destroyed, the elephant would have to move to another area that had plants, or it would starve to death. Plants depend on such animals as the elephants for the nutrients (nourishing substances) they need to survive. Animal wastes and the decaying bodies of dead animals and plants provide many of the nutrients that plants need.

The study of ecology increases people's understanding of the world and all its creatures. This is important because humanity's survival and well-being depend on relationships that exist on a worldwide basis. Change in distant parts of the world—even outer space—affect us and our environments.

One goal of ecologists is to intelligently manage and control the living and nonliving things in the world. Many ecologists study air and water pollution and how dirty air and water affect life. Ecologists try to foresee possible environmental problems, such as crop losses or losses in animal life that building a dam or straightening a river channel may cause. They study such things as insect pests, including the beetle that carried the Dutch elm disease from Europe to the United States where it killed millions of trees.

Ecologists are concerned about the rate at which people are using up such natural resources as coal, gas, and oil. Along with many other scientists, they are searching for ways to use sunlight and atomic energy for fuel and power. Ecologists also are concerned about the world's increasing population and its decreasing food supply. For example, along with marine biologists, they are trying to find new ways of producing food from the sea.

Ecologists use knowledge from many different fields of study including physics, chemistry, mathematics, and computer science. They also rely on other sciences, such as climatology, meteorology, geology, and oceanography, to learn about air, land, and water environments.

Adapted from *World Book Encyclopedia*

In The Know

OBJECTIVES:

The student will be able to:
1. Define the term "ecology".
2. List the three main levels of ecology.
3. Explain why a proper balance between plants and animals is needed to maintain life.

Grades:
3-5

Subjects:
Science, Art

Time Needed:
Three class periods and two weeks of observation of jar

Materials:
construction paper
notebook paper
gallon jar
pond plant (elodea)
pond snails
two guppies
plastic wrap
guppy food

BACKGROUND:

Ecology deals with the relationships living things have to each other and to their environment. No organism lives alone. Everything depends in some way on other living and nonliving things within its surroundings. For example, a deer needs certain plants for food. If the plants in its environment disappeared, the deer would have to move to another area or starve. Likewise, plants depend on animals, such as deer, for the nutrients they need to live. The decay of dead animals, plants. and animal waste provide many of the nutrients plants need.

Ecology has three main levels: populations, communities, ecosystems. A population consists of a group of the same species that live in a certain place. A species is a group of organisms that has the same characteristics.

A community consists of all the populations living together in the same place. A forest community might have foxes, squirrels, bears, and oak and pine trees. An ecosystem consists of all the communities that live in an area together. A community of plants and animals that covers a wide geographical area is called a biome. The main biomes of the world include deserts, forests, rain forests, grasslands, tundra, and saltwater and freshwater ecosystems. An ecosystem is a community and its nonliving environment. This includes climate, soil, water, air, food, and energy. In summary, no living thing exists alone.

VOCABULARY:

biome - a community of plants and animals that covers a wide geographical area
community - all the populations living together in the same place
ecology - the relationships living things have with each other and their environment
ecosystems - all the communities that live together in an area including water, soil, and climate
nutrients - substances that provide nourishment and promote growth
population - a group of the same species living in a certain place
relationship - how one thing or things interact with another thing or things
species - a group of organisms that have the same characteristics and are able to reproduce
tundra - a cold, windy, dry area just south of the polar ice caps in Alaska, Canada, Greenland, Iceland, Norway, and Asia.

ADVANCE PREPARATION:

1. Direct students to prepare a booklet from construction paper and notebook paper. This should be labeled *Science Journal*. Students will use this to record definitions and observations.
2. Purchase guppies, elodea, and snails from a local pet supply store.

PROCEDURE:

Setting the stage

Discuss with students the meaning of ecology.

- List the three main levels of ecology.
- Encourage students to brainstorm components of a population, community, and ecosystem.
- Have students record the definitions of these components in their science journals.

Activities

1. Take the class outside on the school ground.
   - Tell students they should take pencils and their science journals.
   - Give students 20 minutes to list, illustrate, or describe as many different populations as they can locate. (Each student or small group should go to a different area of the school ground.)
   - Return to the classroom and have them share and compare their information.
   - Think of why some populations were found in one part of the school ground and not another.
2. Put students in small groups.
   - Have the groups discuss how cutting down a tree might affect the ecosystem of an area.
   - Have the groups share their ideas with the class.
   - Stress that the actions in one part of the ecosystem affect many others. Cutting down a large tree would affect the food supply and living space for birds and squirrels in the area. Changes in the amount of shade and sunlight would affect the grass growth near the tree.
3. Fill a gallon jar almost to the top with water.
   - Add elodea, snails, and guppies.
   - Put the jar near a sunny window or a bright light.
   - Cover the top tightly with plastic wrap.
   - Feed the guppies for the first few days. (Do not add water or anything else.)
   - Observe what happens.
   - Record observations in the science journals.
   - Observe for two weeks.
   - Help students to draw conclusions about how the plants and animals stayed in the jar.

Follow-Up

Observe gallon jar for a few minutes each day for two weeks.

- Record observation in science journals.

EXTENSIONS:

1. Make a pictorial record of the kinds of organisms the students observe living on or near a tree. (Field guides of birds, insects , and fungi can be used to identify and study each species.)
2. Create a mural of a biome.
   - Research characteristics of biomes prior to creating the mural. (Illustrations drawn by students or magazine pictures could be used.)
3. Suggest that students use reference encyclopedias online to learn what foods animals in a forest community eat.
   - Ask students to use this information to make a chart (food web) showing how each population affects the others. (Squirrels eat acorns, raccoons eat fish, large fish eat small fish, and owls eat mice.)

ORIGINAL DEVELOPMENT RESOURCES:

Ecology. *World book encyclopedia*. (1989). (Volume E, pp. 50-51). Chicago, IL: World Book, Inc.

Carruth, G. (Ed.) (1983). *The volume library I*. (3-34). Nashville, TN: The Southwestern Company.

Guy, Robert G., et al. (1989). *Discover science*. Glenview, IL: Scott Foresman and Company.

No Salt, Please

OBJECTIVES:

The student will be able to:
1. Define freshwater.
2. List at least three examples of freshwater sources.
3. Name at least three animals that can live in a freshwater ecosystem.

BACKGROUND:

Almost three-fourths of the Earth's surface is covered by water. Without water all plants and animals would die. Oceans and seas make up most of the world's salty water.

Freshwater is water that is not salty, comes from rain that fills ponds, streams, lakes, and rivers.

Streams and rivers have the power to change the shape of the land. In addition to water, boulders, pebbles, and grains of sand carried by the water help to give a river its cutting force. Freshwater can support many types of life. Rivers can support freshwater fish, plants, birds, freshwater clams, snails, salamanders, and frogs.

River ecosystems vary depending on the type of landscape they pass through and the climate. Even a single river does not have the same ecosystem its entire length. A small stream could support fewer than ten fish species, while the larger river may support 50 to 100 species.

River ecosystems do share some characteristics. All rivers erode their channels and carry the material worn away downstream. All rivers have natural cycles of flow from high to medium to low. These cycles depend on the amount of rainfall.

Rivers flow through most every part of Alabama. (See attached "Rivers of Alabama" sheets, which include a map and an explanation of the rivers.) The Mobile River System is the most important river system in Alabama because most of the state rivers run together and empty into Mobile Bay. This system brings many minerals and nutrients along with it to help support and replenish the environment along the way. The Alabama and the Tombigbee are Alabama's longest rivers. The Tennessee River is the most important river in north Alabama and the Chattahoochee River forms much of the border between Alabama and Georgia.

There are no large natural lakes in Alabama, but dams on rivers have formed many artificial lakes. Lake Guntersville is the largest of these. Other large artificial lakes include Wheeler, Martin, Smith, and Weiss.

Grades:
3-5

Subject:
Science

Time Needed:
Three class periods, additional time for constructing pond and/or aquarium, observation time

Materials:
sand
pebbles
mud
spade
large sheet of plastic
stones
hay or straw
old carpet or rags
pond plants and weeds
plenty of water
a bucket of water, weeds, and mud from another pond
soil: enough to cover a 4" layer pond
3-10 gallon fish tank
water (let it sit for a day in open container)
sterilized sand or gravel
water plants (elodea or eelgrass)
snails
guppies or tadpoles
pH strips

VOCABULARY:

ecosystem - all the communities that live together in an area including water, soil and climate
erode - wear away
freshwater - water that is not salty
lake - a large standing body of water
river - a large natural stream of fresh water that flows across land in a definite channel

ADVANCED PREPARATION:

1. Assemble necessary items for activities.
2. Ask for students to volunteer to get certain items.

PROCEDURE:

Setting the Stage

Ask students to discuss the types of freshwater ecosystems found locally

- Think of the organisms living around or near the ecosystem.
- Identify the ecosystem as a river, lake, pond, or stream.

Activities

1. Make rivers to see how a river can carve out a path downhill.
   - Build a sloping mountain out of damp sand, pebbles, and mud.
   - Slowly pour a steady stream of water over the top of the mountain.
   - Observe the path the water takes down the slope and how much sand and pebbles it takes along the way..
2. Build a pond for the classroom.
   - Obtain permission to build a pond on the school grounds.
   - Build the pond away from trees.
   - Build the pond close to a flower bed or hedge, if possible, as this will give frogs and toads some protection.
   - Design the shape of the pond.
   - Dig a hole at least six feet across and one and one-half feet deep.
   - Slope the sides gently.
   - Remove all the stones that stick out of the bottom and the sides.
   - Cover the bottom with old carpets or rags.
   - Wash the plastic thoroughly to get rid of any chemicals.
   - Lay the sheet of plastic in the hole.
   - Secure the sheet with large stones around the edges.
   - Place a four inch layer of soil over the bottom of the pond. (Use some of the earth that was dug up.)
   - Use a hosepipe or bucket to fill the pond with water to about 2 1/2” to 5” from the top.
   - Add water, weeds, and mud from another pond.
   - Place plants in the pond.
   - Let the mud and soil settle.
   - Place some larger stones on the bottom of the pond.
   - Control murkiness in the pond by putting in plenty of pond snails to clean the water and eat the algae.
   - Adding fish to the pond will cause the smaller pond life to dwindle as the fish will eat it.
   - Observe activities in the pond. Record those observations in the science journals.
   - Add water if the level drops.
3. Set up an aquarium to observe a freshwater ecosystem.
   - Cover the bottom of the aquarium with sand to a depth of one inch.
   - Add a few small rocks or stones.
   - Fill aquarium with water to about 1 1/2” from the top.
   - Add the water plants and anchor the roots in the sand. (Put about five plants per gallon of water.)
   - Let the aquarium settle for a day.

- Add snails and leave aquarium for a day.
- Add two fish per gallon of water the next day.
- Place the aquarium in north or west light.
- Have students observe the aquarium.
- Add dechlorinated water if the water level drops.
- Feed the fish a small amount of food each day.
- Have students keep a log of what they observe in the aquarium over several weeks.

4. Collect samples of local freshwater.
   - Test samples to find out if water is acidic, basic, or neutral.

Follow-Up

1. Ask students to define freshwater.
2. Instruct students to record in their science journals at least five facts learned from this lesson.

EXTENSIONS:

1. Creative writing - Ask student groups to imagine they are fish or snails living in water. Have students write and produce skits or multimedia presentations based on their reflections.
2. Begin a webpage or other multimedia file about rivers.
3. Plan a field trip to a local pond or river. Make pictures or let students illustrate what they observe.
4. Have students make a diorama showing the plants and animals in a freshwater ecosystem.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama. (1989). *World book encyclopedia*. (Volume 1). Chicago, IL: World Book, Inc.

Badders, W. et al. (1996). *Discovery works.* Parsippany, NJ: Silver Burdette Ginn Science.

Gregory, S. (1995). The cost of taming a river. *Science Year.* Chicago, IL: World Book, Inc.

Marhmaltchi, V. (1992). *Hands-on science activities.* Troll Associates.

Snowball, D. (1994). *Freshwater habitats*. Greenvale, NY: Mondo Publishing.

Taylor, B. (1992). *Rivers and oceans*. Kingfisher, NY: Mondo Publishing.

ADDITIONAL RESOURCES:

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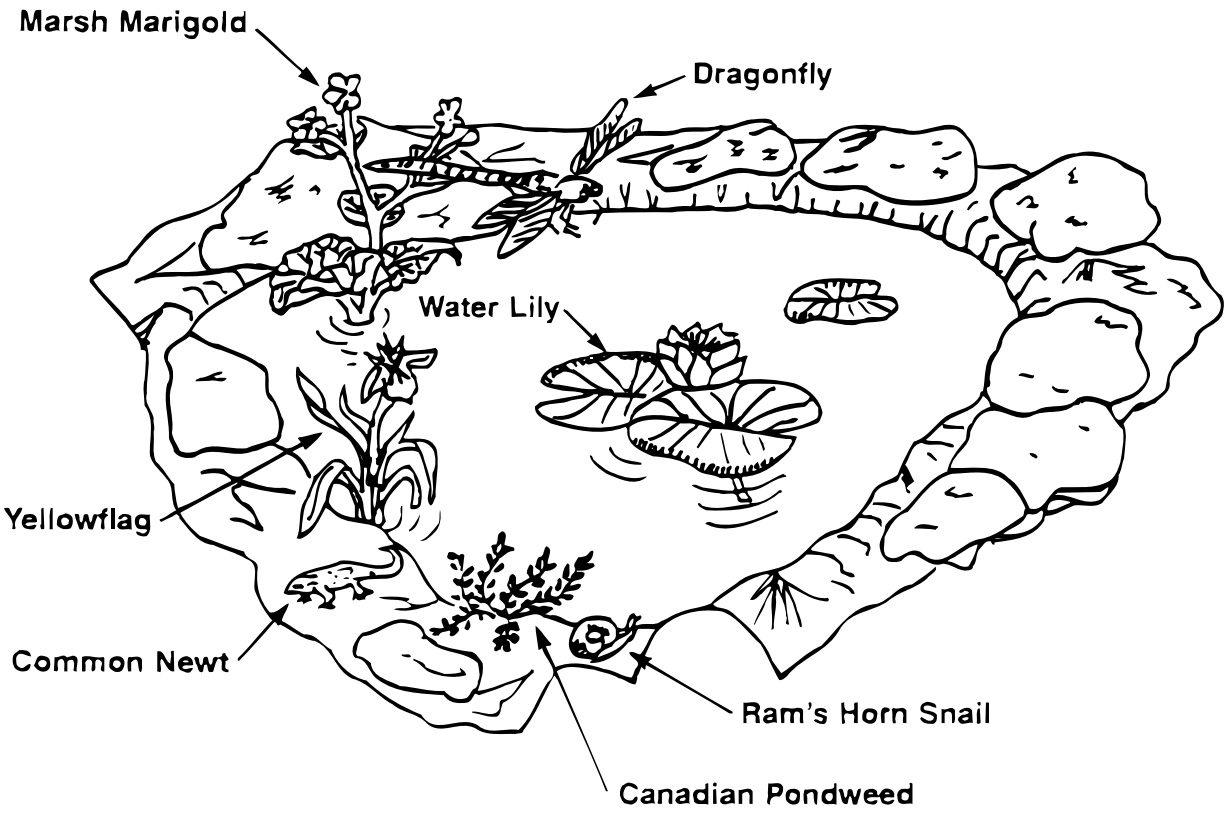
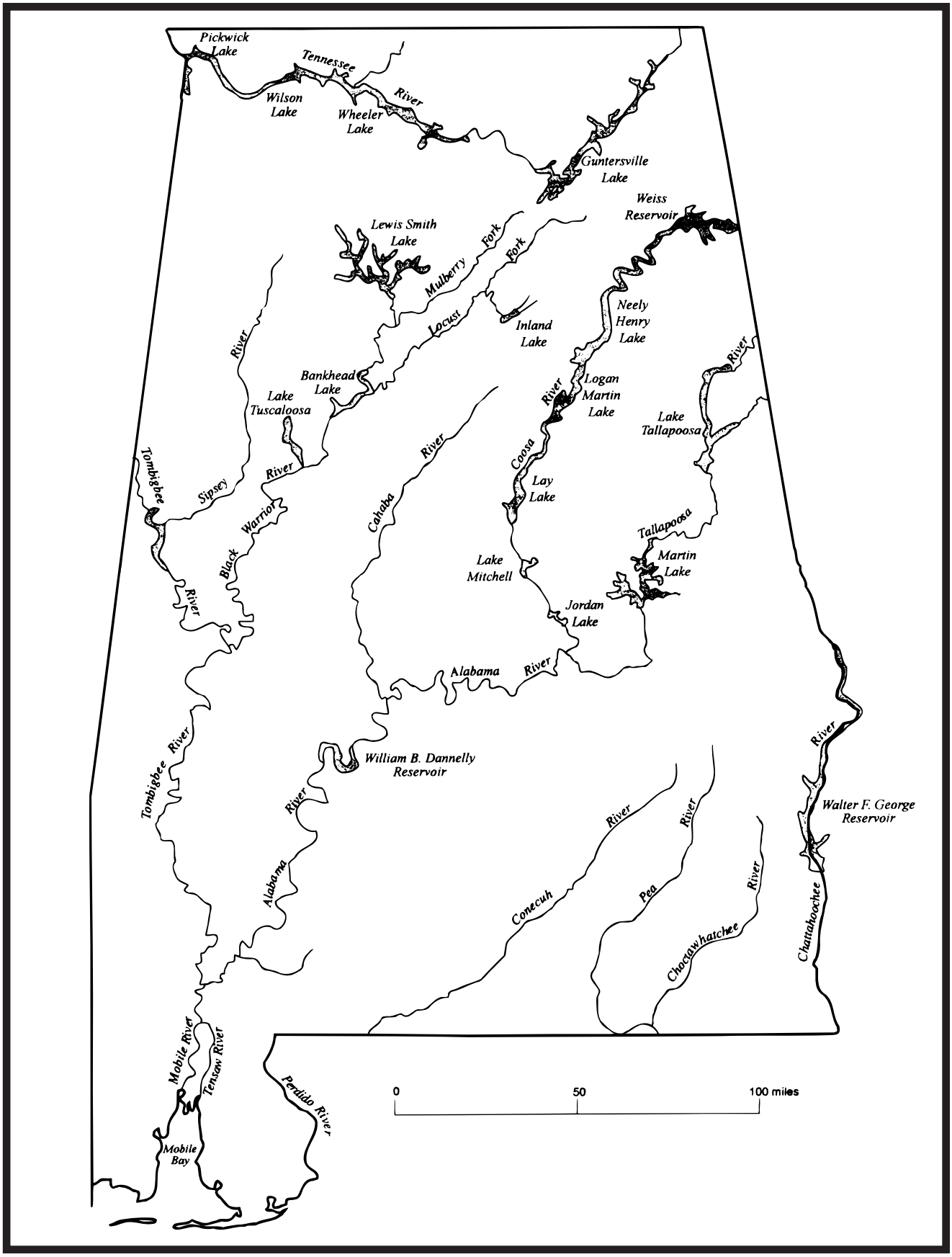
A Man-Made Pond



Alabama Rivers



Coosa
The Coosa River begins in Georgia and enters Alabama in Cherokee County. This river has a watershed that includes much of Georgia and 10 counties in Alabama. The Coosa is 275 miles long and is used for power and transportation. The Coosa joins with the Tallapoosa to form the Alabama River at Wetumpka.

Tallapoosa
This river forms in Georgia and enters Alabama in the northeastern part of the state. It is 200 miles long and drains seven counties. The Tallapoosa joins the Coosa to form the Alabama River.

Cahaba
The Cahaba River is 200 miles long and drains four counties. It flows into the Alabama River.

Tombigbee
The Tombigbee River begins in Mississippi and enters the state of Alabama in Pickens County. It is about 300 miles long and drains seven counties of Alabama and part of Mississippi. It flows into the Mobile River. It connects to the Tennessee River by the Tennessee-Tombigbee Waterway. This helps transportation.

Sipsey
The Sipsey River flows into the Tombigbee. It is only 170 miles long, but it drains seven counties.

Buttahatchee
The Buttahatchee River is a small river that begins in Alabama, drains two counties, and then joins the Tombigbee River in Mississippi.

Tennessee
The Tennessee River begins in the state of Tennessee and then dips into northern Alabama. It ultimately flows into the Ohio River at Paducah, Kentucky. From there it flows through the Ohio River and into the Mississippi and out into the Gulf of Mexico. It is an important trade route. The Tennessee is over 200 miles long in Alabama and powers dams controlled by TVA. The Tennessee drains nine counties in Alabama.

Black Warrior
The Black Warrior River begins in northeastern Alabama and flows into the Tombigbee at Demopolis. The Black Warrior is 175 miles long and drains seven counties. It has several locks and dams and is a busy river. Tuscaloosa is the river's Indian name, and the city sits on her banks.

Mobile
The Mobile River is made from the Alabama and the Tombigbee. It flows into Mobile Bay and connects Alabama to the world's oceans. The Mobile is only 50 miles long and drains three counties.

Tensaw
The Tensaw is a historically important river because it has been the main channel of the Alabama or Mobile Rivers. It helps distribute traffic from both rivers. It is only 50 miles long.

Chattahoochee
The Chattahoochee River begins in Georgia and forms part of the Alabama border. The river offers electrical power to Alabama and Georgia. In Alabama it is about 170 miles long and drains six counties.

Choctawhatchee
The Choctawhatchee River is about 86 miles long and flows through Dale County. It drains five counties and a large part of Florida. It joins the Pea River at Geneva and flows to Florida and to the Gulf of Mexico.

Pea River
The Pea River, called Talakhatchee by the Indians, flows through Dale and Coffee counties. It is 120 miles long and has a six county watershed. The Pea River flows into the Choctawhatchee.

Escambia
The Escambia River is formed by the converging of two large creeks. It is 50 miles long, draining three counties and part of Florida. The Escambia flows into Pensacola Bay.

Conecuh
The Conecuh River is 175 miles long and drains six counties. It flows into the Escambia River.

Perdido
The Perdido River is short but important. It is 50 miles long and drains two counties and part of Florida. It flows into Perdido Bay.

Alabama
Two important rivers, the Coosa and the Tallapoosa, join to form the Alabama River just north of Montgomery. It is 315 miles long and drains eight counties. It joins to form the Mobile River and enters the sea at Mobile Bay. Selma and Montgomery are cities on the banks of the Alabama River.

Habits Of Habitats

OBJECTIVES:

The student will be able to:
1. Define the term habitat.
2. List the four elements of a habitat.
3. Describe an appropriate habitat for a given animal.

Grades:
3-5

Subjects:
Science, Language Arts

Time Needed:
Two class periods

Materials:
pictures of native Alabama wildlife
glue
markers
crayons or pencils

BACKGROUND:

A habitat is described as the area where an animal lives. The four basic elements of a habitat are food, water, shelter, and space. If any of these elements are lacking, the animals will be forced to find other areas more suitable or die. In Alabama, the habitats of the native animals vary greatly. Habitats range from a forested mountain top to a sandy beach. Habitats can also be a farm, a vacant lot, or a garden spot. Habitats can fluctuate between semi-arid and watery, as with beach areas. Creatures adapt to these particular changes in habitat so that reproduction of their species occurs. A habitat usually has numerous organisms of the same species that live and reproduce there. This is called a population. A habitat may have more than one population. For example, a garden spot would contain several different animal populations: worms, beetles, ladybugs, butterflies, spiders. It could also contain different plant populations: weeds, beans, corn, tomatoes, cucumbers.

VOCABULARY:

arid - very dry, without enough rainfall to support vegetation
habitat - the area in which an animal resides
population - a group of the same species living in a certain place

ADVANCE PREPARATION:

Provide pictures of Alabama wildlife for each student. See attached sheet.

PROCEDURE:

Setting the Stage
1. Guide students to brainstorm things needed in order to live or survive.
   - List these on the board.
   - Have students group words that are related and form categories.
   - Distinguish between necessary and unnecessary things.
2. Introduce the term “habitat.”
   - Have students describe it as the place where an animal lives.
3. Guide students to list the four needs that every living thing must have.
4. Continue to guide the discussion so that students include the categories that relate to the four elements of a habitat (food, water, shelter, and space).

Activities
1. Provide each student with a picture of an animal native to Alabama.
   - Instruct students to glue the picture to the center of a sheet of paper.
   - Students should draw an appropriate habitat for that specific animal.
   - Habitats should contain all four of the necessary components.

- After students complete the activity, have them describe and explain their work to the class.
- Display work in a class big book.

2. Individual work of students may be displayed instead of a big book.

EXTENSIONS:

1. Have students design habitats for animals in other parts of the world.
2. Have students plot on a graph the types of animals and plant habitats located throughout Alabama.
3. Students may choose an animal or plant and depict its habitat by making a diorama.
4. Read aloud to the class the book *Little Turtle's Big Adventure* by David Harrison.

ORIGINAL DEVELOPMENT RESOURCES:

Cohen, M. (Ed.) (1989). *Discover science*. Glenview, IL: Scott, Foresman and Co.

Makhmaltchi, V. (1992). *Hands on!* Troll Associates.

Alabama Wildlife

RABBIT

SAND CRAB

FOX

SHRIMP

RACCOON

SEA TURTLE

DEER

DOLPHIN

OPOSSUM

BOBCAT

WILD TURKEY

CARP

SQUIRREL

HAWK

PELICAN

QUAIL

EAGLE

YELLOW HAMMER

OWL

GULL

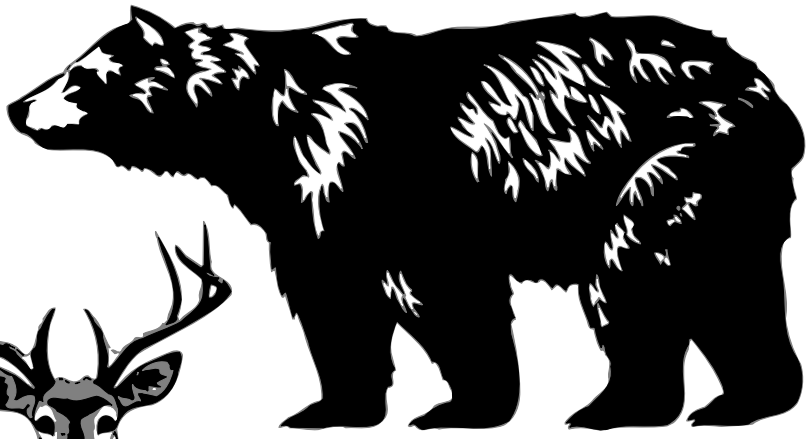
BEAVER

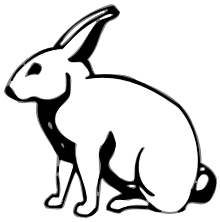
CATFISH

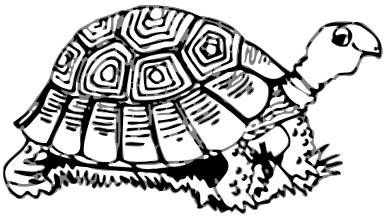
BREAM

BASS

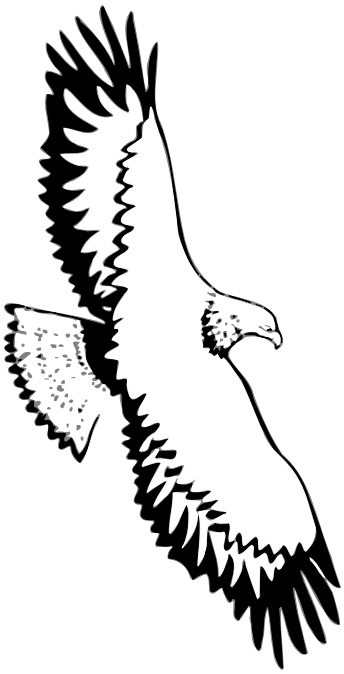
Alabama Wildlife

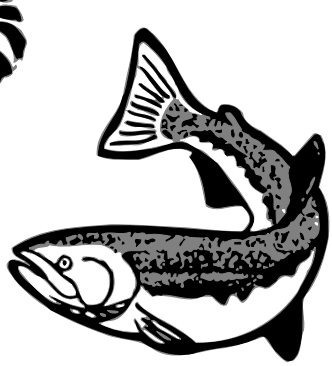






Alabama Wildlife





Notes

A Spider Sat Down Beside Her

OBJECTIVES:

The student will be able to:
1. Describe the body of a spider.
2. Name two places where spiders live.
3. Name some foods that spiders eat.
4. State two ways spiders differ from insects.
5. Name at least three types of spider webs.

BACKGROUND:

A spider is an arachnid that has eight legs and two body parts. Spiders are found in abundance all over the world, except for very high elevations and the Antarctic. Spiders have fangs that give out poison used to kill prey. Most arachnids live on land, but a few spiders live in water. They use their fangs, poison, or webs to catch insects and very small animals for food. Spiders are helpful to humans because they eat insects. Some spiders also eat tadpoles, small frogs, small fish, mice, and birds. Spiders live anywhere they can find food (fields, woods, swamps, caves, and deserts). Spiders are often lumped into the same invertebrate class with insects, but they are not insects. Spiders have two body parts whereas insects have three. Spiders have eight legs and insects have six. Not all spiders are web builders, but each species of the web-building spiders makes a characteristic kind of web. By observing webs, students can identify the type of spider that created the observed web.

Grades:
3-5

Subjects:
Science, Art, Geography

Time Needed:
One class period

Materials:
black enamel spray paint (one can)
white paper
black or brown pipe cleaners
red pipe cleaners
string
copy of spider web page for each student
copy of spider parts page for each student
spray bottle

VOCABULARY:

arachnid - classification for spiders, mites, ticks, harvest men, scorpions, and king-crabs, all of which have four pairs of walking legs
elevation - the height above sea level

ADVANCE PREPARATION:

1. Purchase one can of black enamel spray paint.
2 Have black or brown pipe cleaners and a half piece of red pipe cleaner for each student.
3. Discuss with students the importance of not touching a spider or breaking a web.

PROCEDURE:

Setting the stage
Students illustrate their idea of a spider.
- Include body parts.
- Review students' work and discuss spider body parts.

Activities
1. Take students for a walk around the school and school grounds.
   - Look for spider webs on this walk.
   - Have students look for webs near the ground and in taller weeds and bushes.

- Gently touch the web with a pencil or a stick. Observe what the spider does. Does the web move? Do not break the web.
- Mist the web lightly with water, and the spider will come out.
- Record observations in the science journals.

2. Locate a good spider web.
   - Stand three to four feet from the web.
   - Quickly spray both sides of the web with a thin coat of black enamel spray.
   - Quickly put a sheet of white paper against the web.
   - Curve the paper first in the middle of the web.
   - Straighten out the paper carefully along the sides of the web.
   - Let the design dry.
   - Study the shape and design of the web.
3. Write a description about a day in the life of a spider.
4. Include locations of a spider web.
5. Include food the spiders eat.
6. Make a spider.
   - Cut the brown/black pipe cleaners into four equal parts.
   - Hold the four pieces together evenly.
   - Wrap the red piece of pipe cleaner around the middle of the black or brown pipe cleaners.
   - Spread the black or brown pieces apart to make the spider's legs.
7. Determine how a spider knows the size of an intruder.
   - Stretch the string between two stationary objects.
   - Gently place your finger tips on one end of the string.
   - Have your partner pluck the opposite end of the string while you look away.
   - Decide that the web acts like a telegraph line.
   - When the web shakes the spider senses it.
   - Weak vibrations are usually ignored by the spider.
   - Medium vibrations let a spider know it probably has a meal.
   - Large vibrations let a spider know that it could be in danger.
   - Record observations in science journals.
8. Match the web to its spider.
   - Study the spider web illustration and description sheet.
   - Match the web design from the activity, to the correct spider on the "Spectacular Spider Webs" page.

Follow-Up

1. Have students label the body parts of a spider.
2. Name two places where spiders can live.
3. Identify two ways spiders differ from insects.

EXTENSIONS:

1. Read *Charlotte's Web* by E.B. White to the class.
2. Write a newspaper article about different types of spiders native to Alabama.
3. Draw pictures to show the webs made by different spiders native to Alabama.
4. Research the following:
   - Where in the world are there no spiders?
   - What is the largest spider? What is the smallest spider?
   - Which spiders in Alabama do not make webs?
   - What spiders in Alabama are dangerous to people?
5. Math problems can be written on a sheet printed with spider patterns. Have students write and solve story problems about spiders.
6. Read *Spider* by Stephen Savage (life cycle of a garden spider).

7. Read *Someone Saw a Spider - Spider Facts and Folktales* by Shirley Climo.

ORIGINAL DEVELOPMENT RESOURCES:

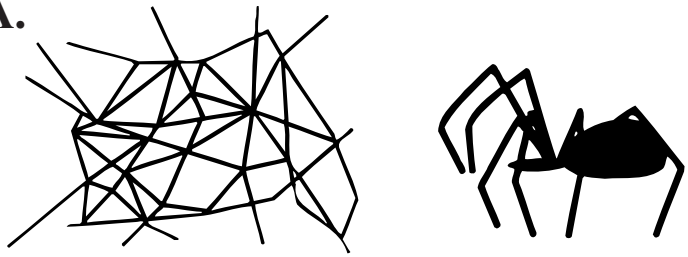
Guy, R. et al. (1989). *Discover science*. Glenview, IL: Scott, Foresman and Company.

Van Cleave, J. (1994). *201 Awesome, magical, bizarre, and incredible experiments*. New York, NY: John Wiley and Sons, Inc.

World book encyclopedia. (Vol 18). (1985). Chicago, IL: World Book, Inc.

Spectacular Spider Webs

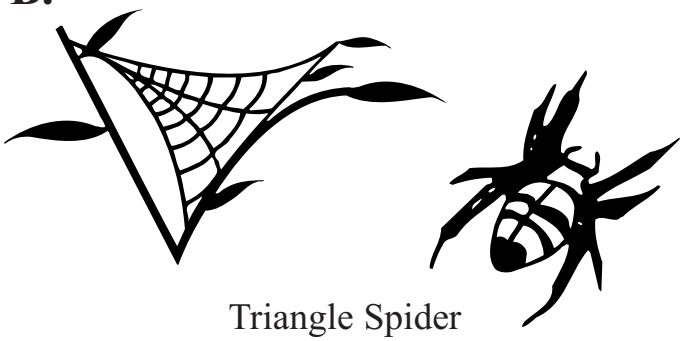
A.



House Spider

(Loose tangled web. The middle of the web catches the prey.)

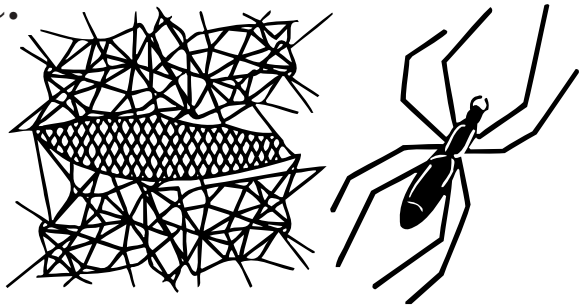
B.



Triangle Spider

(Web forms a triangle connected between twigs. The sticky bands catch the prey

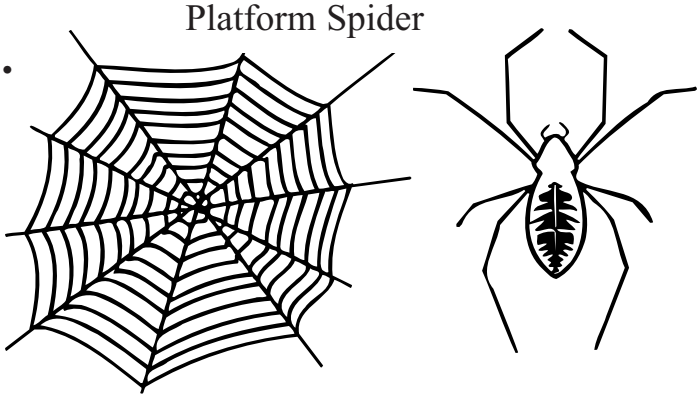
C.



Platform Spider

(Web forms a sheet below a net of crisscrossed threads. The prey falls from the net onto the sheet.)

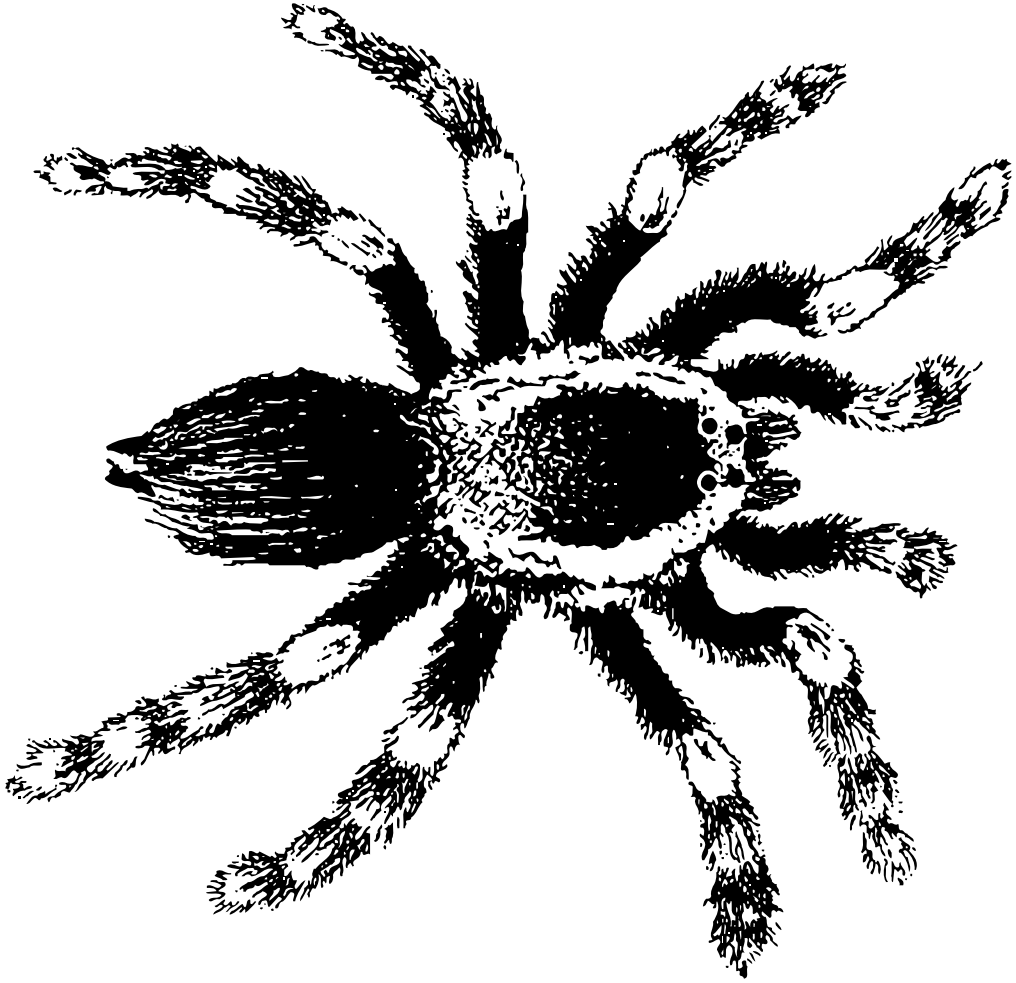
D.



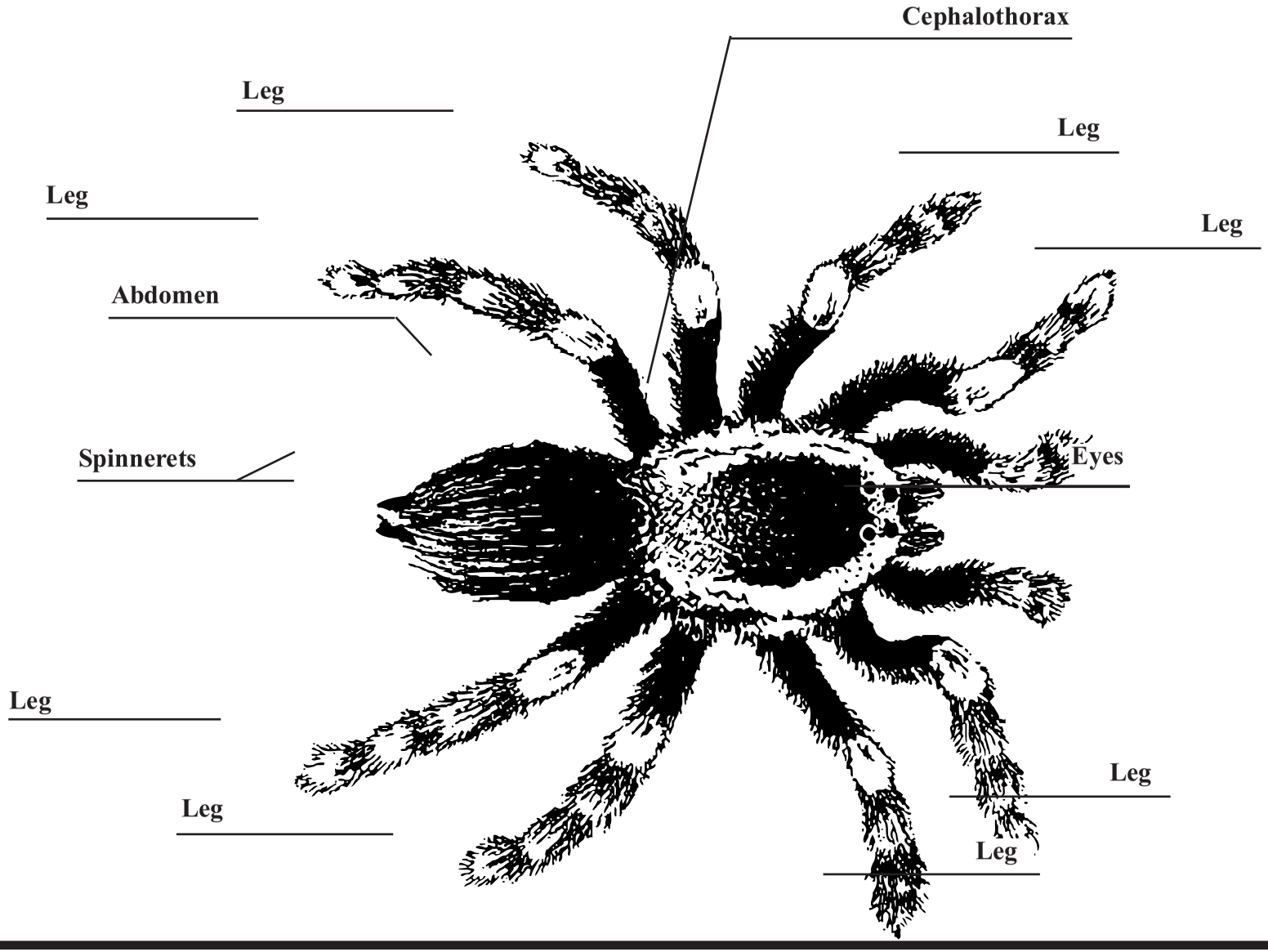
Orange Garden Spider

(Spins a large orb web. The prey is captured by sticky threads.)

Spider Parts



Spider Parts



Boning Up On Biomes

OBJECTIVES:

The student will be able to:
1. Define biome.
2. Make a model of a biome.
3. Identify the six major land biomes of Earth.

BACKGROUND:

A biome is a community of plants and animals that covers a wide geographical area. Specific plants have adapted to living in certain climates. These plants have created a certain kind of environment along with the climate and other habitat factors in which only certain types of birds, animals, and insects can gather food, have shelter, and raise their young. The greater the number of different plants in a biome, the greater the number of different animals found in that biome.

The six major biomes of the world are the tundra, taiga, deciduous forest, tropical rain forest, grassland, and desert. Alabama's main biome is the deciduous forest. Deciduous forests have earthworms, fungi, small plants, ground birds, mice, shrews, squirrels, and rabbits. These smaller animals are food for larger animals such as foxes, raccoons, bobcats, deer, black bears, and wolves. Song birds also visit during the year. The decomposing leaves serve as food for many plants, especially mushrooms. The most prevalent trees are oak and birch. The Earth is made up of six main land biomes and the saltwater and freshwater ecosystems.

Grades:
3-5

Subjects:
Science, Geography, Math

Time Needed:
Two class periods, small groups

Materials:
broadleaf plants
potting soil
several large plastic jars
activated charcoal
water in a spray bottle
journal
world atlas
biome map
graph paper (three sheets for each small group of students)
colored pencils

VOCABULARY:

biome - community of plants and animals that covers a wide geographical area
deciduous - trees that shed leaves during a particular season
ecosystem - all the communities that live together in an area including water, soil, and climate
fungi - large groups of plants not containing chlorophyll, roots, stems, or leaves; important as decomposers - includes molds, mildews, mushrooms, and bacteria
taiga - a swampy coniferous subarctic forest extending south from the tundra
tundra - a cold, windy, dry area just south of the polar ice caps in Alaska, Canada, Greenland, Iceland, Norway, and Asia

ADVANCE PREPARATION:

Prepare for biome experiment.
- Purchase broad-leaf plants. The number depends on how many students are in a small learning group.
- Place charcoal, plastic jars, and potting soil in a central location.
- Fill spray bottle with water.

PROCEDURE:

Setting the stage

1. Display the map of the major land biomes in the world.
   - Have students identify the biome occupied by Alabama.
   - Tell students that the Earth has six major land biomes as well as saltwater and freshwater ecosystems. Find them on the map.
   - Discuss with students how human activities can change a biome.
2. Read this excerpt from the *The Roadside* by David Bellamy: "Farther on where the old track goes through the woods, ferns and mosses nestle in the damp coolness beneath the trees. A toad sits motionless on a stone. The fallen trunk of a silver birch is full of holes made by woodpeckers searching for insects, and clusters of bracket fungi are growing on the dead wood. Just beyond the woods, the foxes have their den under a hedge row of sweet chestnut and rose bushes".

Activities

1. Make a model of a biome. Students do this in small groups.
   - Give each small group a broad-leaf plant.
   - Students should cover the bottom of a jar with a layer of activated charcoal a half centimeter thick.
   - Place a layer of potting soil (three centimeters thick) on top of the charcoal.
   - Take the plant out of its pot and place the roots in the soil. Be sure the roots are covered and the bottom of the plant is firmly covered.
   - Put the mini-biome in a sunny place. Use a spray bottle to moisten the soil every two to three days.
   - Observe the mini-biome daily. Record the observation in the journals.
   - Lead students to identify the needs of this particular biome.
2. Compare temperature and precipitation among biomes.
   - Set up a graph (as shown on Figure A) for each small group on three separate pieces of graph paper. (Note: ^{o}C = temperature, cm = precipitation)
   - Label one graph "desert," one graph "deciduous forest," and one graph "tropical rain forest."
   - Use the table (Figure B) and one colored pencil to make a bar graph of the monthly temperature for each biome studied.
   - Use another colored pencil to make a line graph of the monthly precipitation for each biome studied.
   - Decide which biome has a steady temperature throughout the year.
   - Determine where the highest average temperature for a single month occurs.
   - Decide which of the biomes studied has the least yearly precipitation. Which has the most?
   - Have students average their results and compare them with Figure B.
2. Ask students to brainstorm a list of four cities and countries.
   - Have them use an atlas to determine their exact locations.
   - Have students locate the approximate position of each city or country (Figure B) on the world biome map.
   - List each city or country and its primary biome.

Follow-Up

Have students list the six major biomes of the Earth.

EXTENSIONS:

1. Have students work in small groups to research any of the six biomes of the Earth. Use websites or nature magazines for pictures and facts. Research about the animal life, plant life, rivers. Make a booklet to show the information.
2. In small groups or individually, have students design a travel brochure about Alabama's biome. This brochure should be informative and colorful.
3. Think about Alabama's biome. Write a descriptive paragraph about what it would have been like 100 years ago.

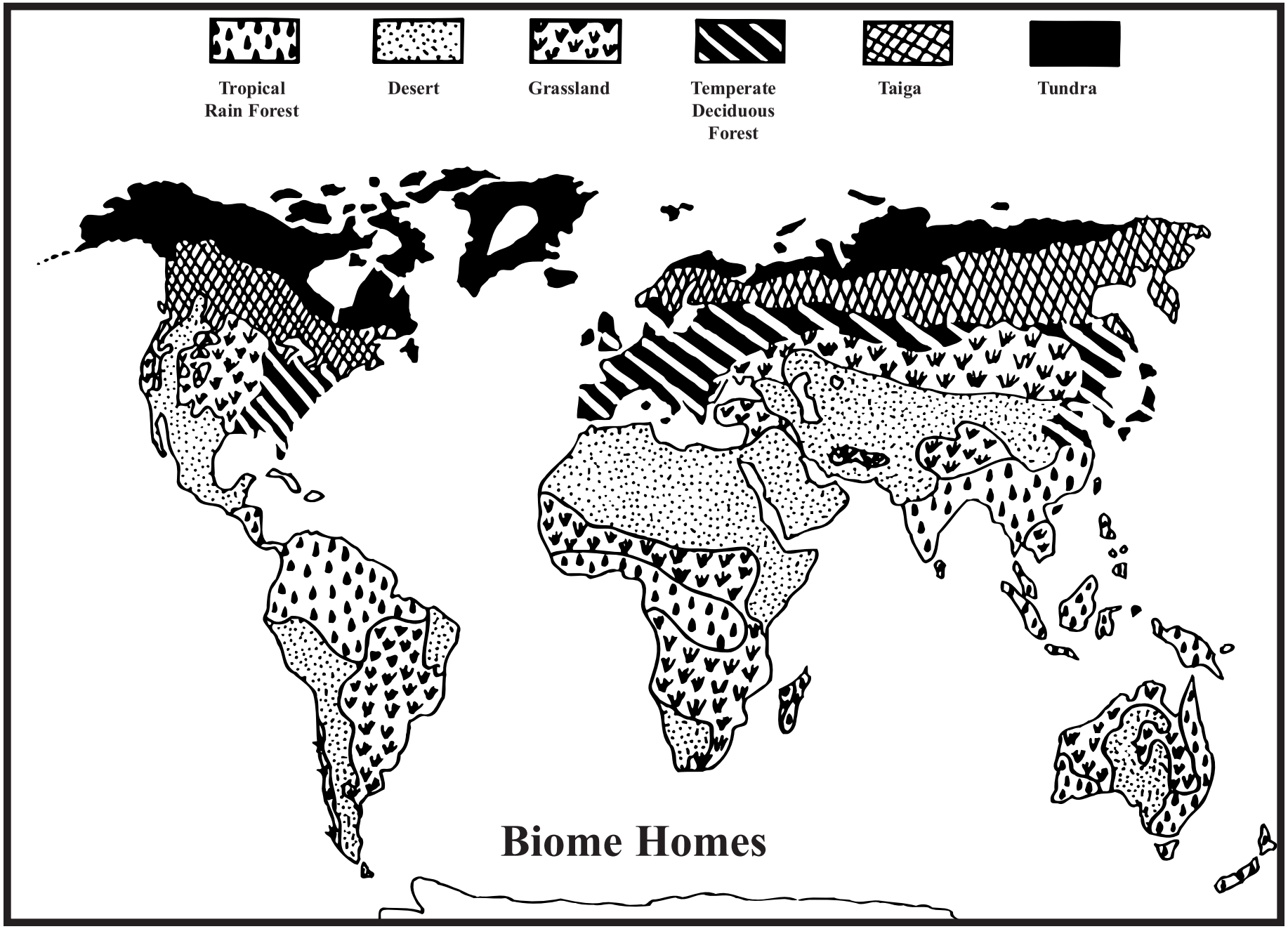
ORIGINAL DEVELOPMENT RESOURCES:

Badders, W. et al. (1996). *Discovery works.* Parsippany, NJ: Silver Burdett Ginn.

Billington, E. (1971). *Understanding ecology*. New York, NY: Frederick Warner and Co., Inc.

Bryant, N., Jr., et al. (1995). *Science anytime*. Orlando, FL: Harcourt, Brace and Company.

Mallinson, G. (1984). *Science*. Morristown, NJ: Silver Burdette Company.


Tropical Rain Forest
Desert
Grassland
Temperate Deciduous Forest
Taiga
Tundra
Biome Homes

Boning Up On Biomes

Average Temperature and Precipitation in the Biome

Figure A

°C													CM
36													36
32													34
28													32
24													30
20													28
16													26
12													24
8													22
4													20
0													18
-4													16
-8													14
-12													12
-16													10
-20													8
-24													6
-28													4
-32													2
-36													0
	J	F	M	A	M	J	JU	A	S	O	N	D	

Average Temperature and Precipitation of Biomes

Figure B

Tundra	[illegible]	[illegible]
Taiga	-10˚C to 14˚C	35 cm
Deciduous Forest	6˚C to 28˚C	115 cm
Tropical Rain Forest	25˚C to 27˚C	223 cm
Grassland	0˚C to 25˚C	90 cm
Desert	24˚C to 32˚C	16 cm

Notes

Worming Out Of It

OBJECTIVES:

The student will be able to:
1. State the life cycle stages of a mealworm (grain beetle).
2. Conduct an experiment to observe the life cycle of a mealworm.
3. Record observations about the growth stages of a mealworm.

BACKGROUND:

Each living thing goes through stages of growth and change. These stages are called the life cycle. The mealworm (grain beetle) is one of the easiest insects to keep and to observe. It has a four-stage metamorphosis. The name mealworm is given to the larva stage. Mealworms shed their skin anywhere from 10 to 20 times during the four or five months of the larva stage. Mealworms are often found in rotting grain or flour supplies. They may be bought at pet stores.

The entire life cycle of the grain beetle consists of the egg, larva, pupa, and adult beetle. The entire metamorphosis takes from six to nine months. The egg stage is the hardest to observe. The mealworm is harmless to handle at any stage.

Remind students to treat these animals humanely. Remind them to use gentle touches.

Grades:
3-5

Subjects:
Science, Math

Time Needed:
One class period for three weeks (observations daily)

Materials:
plastic gloves
five mealworms
dry sugar-free cereal
thin pieces of apple or potatoes
dish with a cover (with holes in top)
hand lens
metric ruler
science journal

VOCABULARY:

life cycle - the stages of growth and change in an organism
metamorphosis - series of changes that occur as an egg develops into an adult including the four stages of egg, larva, pupa, and adult

ADVANCE PREPARATION:

1. Obtain mealworms from a pet shop.
2 Place mealworms in covered dish along with some dry cereal.
3. Slice apple or potato.

PROCEDURE:

Setting the stage
1. Discuss and guide students to identify mealworms and their needs for survival.
2. Predict what mealworms need in order to live.
   - List supplies for the mealworm habitat.
   - Determine if the supplies will provide for the needs of a mealworm's habitat.
3. Instruct students to illustrate their interpretation of a mealworm's habitat.

Activities
1. Assemble materials to prepare a ventilated home for the mealworms.
   - Ask students to describe the home in their science journals.

- Put the mealworms in the home with the dry cereal and apple or potato pieces.
- Clean the home every other day by replacing old cereal with fresh dry cereal and give the mealworms fresh food.
- Observe the mealworms under a hand lens every day for three weeks.
- Measure with a ruler the changes in their size.
- Record any noted changes.

2. Find out how cold temperature affects the mealworm's life cycle.
   - Use two mealworms.
   - Keep one cold and the other at room temperature.
   - Observe the differences.
   - Draw conclusions about how cold temperatures affect the life cycle of a mealworm.
   - Record any observations in science journals.
3. Observe methods that might influence a mealworm's behavior.
   - Touch the mealworm gently to see if it backs up.
   - Blow air gently through a straw to see if it backs up.
   - Test for moisture preference by sticking one moist and one dry cotton swab into the mealworm's home.
   - Use a flashlight to determine if a mealworm prefers light or dark places.
   - Record all observations in science journals.
   - Treat all mealworms gently.

Follow-Up
Ask students to identify the stages in the life cycle of a mealworm.

EXTENSIONS:

1. Illustrate each stage in the life cycle of a mealworm.
2. Add 10-12 pupa in a dish and cover.
   - Watch for 7-10 days to see adults emerge, mate, and lay eggs.
   - Place a slice of apple or other fruit as soon as the adults appear.
   - Put the colony in a safe place and leave undisturbed for one week.
   - Flip the colony upside down to find the eggs.
   - Observe eggs more closely with a hand lens.
   - Observe the life cycle as the eggs hatch and the larvae develop.

ORIGINAL DEVELOPMENT RESOURCES:

Badders, W. et al. (1996). *Discovery works.* Parsippany, NJ: Silver Burdett Ginn Science.

Gega, P. (1982). *Science in elementary education.* New York, NY: John Wiley and Sons.

Simonet, Carissa and Kramer, D. (1996). *Finding mealworm eggs, science and children*. (Volume 33, Number 4) p. 31.

The Chain Gang

OBJECTIVES:

The student will be able to:
1. Understand the meaning of the term food chain.
2. Name the components of several different food chains.

BACKGROUND:

Plants, animals, and other living things existing in one place make up a community. In communities the food chain begins with plants, which are the producers. Animals eat these producers or some other animal. Even meat-eating animals (carnivors) eat animals that eat these plants. A food chain is the transfer of food energy from the plants through a series of animals with repeated eating and being eaten behaviors. For example, a green plant, a leaf-eating insect, and an insect-eating bird would be a simple food chain. All living things make food chains.

Plants need the sun to grow. Many insects eat plants, many toads eat insects, many snakes eat toads, and many hawks eat snakes. This is another example of a food chain. Whenever we eat food, we are members of a food chain.

Grades:
3-5

Subject:
Science

Time Needed:
Two class periods; or 60 - 90 minutes

Materials:
six cards
six pins
tags marked grasshopper, snake or hawk
science journal
construction paper for each student
student activity page for each student
information sheets copied

VOCABULARY:

community - plants, animals, and other living things existing in one place
food chain - the sequence in which energy is transferred from one organism to the next as each organism eats and is eaten by another
producer - an organism that makes its own food and is the beginning of a food chain

ADVANCE PREPARATION:

1. Make six cards with one of these words on each card: sun, plant, insect, toad, snake, and hawk.
2 Label tags with grasshopper, snake, or hawk.
3. Instruct students to have science journals on hand.
4. Copy or make an overhead transparency of the Energy Pyramid and Food Chain Sheets.
5. Copy for each student the Food Chain Review page.

PROCEDURE:

Setting the stage
1. Ask students if they are a member of a food chain.
2. Lead students to understand they are a member of a food chain whenever they eat food.
3. Explain to students how every food eaten by them has energy stored earlier by other living things.
4. Ask students on which energy source does every living organism depend.
   - Accept various responses.
   - Lead students to understand that the sun is the main source of energy upon which all food chain members depend.
   - Display picture of the Energy Pyramid.

Activities

1. Have students perform a food chain simulation to determine what happens when a food chain is broken.
   - Pin a card labeled sun, plant, insect, toad, snake, or hawk on six students.
   - Stand in a line and hold hands in this order: sun-plant-insect-toad-snake-hawk.
   - Ask the following questions:
     What animals would die if there were no snakes to eat? (The snake person drops hands)
     What animals would die if there were no toads to eat? (The toad person drops hands)
     What animals would die if there were no insects to eat? (The insect person drops hands)
     What animals would die if there were no plants to eat? (The plant person drops hands)
     What would happen if there were no sun to let plants grow?
2. Reproduce the information sheet, Food Chains.
   - Have students cut out the food chain parts.
   - Instruct students to glue these in proper order onto a piece of construction paper.

Follow-Up

1. Have students make up two food chains and display in a diagram of their own creation.
2. Ask students to write meaningful definitions for the vocabulary terms.
3. Complete the Food Chain Review Sheet.

EXTENSIONS:

1. Read aloud to class *Chipmunk Song* by Joanne Ryder.
2. Ask students to work in small groups to write a song or a poem about a food chain.
3. Use the book *Biology: Plants, Animals, and Ecology*. by Ifor Evans to help students better understand the structures of life.
4. Additional books to read:
   Who Eats What? Food Chains and Food Webs by Patricia Lauber
   The Magic School Bus Gets Eaten: A Book About Food Chains by Joanna Cole (3rd Grade)

ORIGINAL DEVELOPMENT RESOURCES:

Bernstein, L.et al. (1996). *Environmental science*. Menlo Park, CA: Addison-Wesley Publishing Company.

Bryant, A. Jr. et al. (1995). *Science anytime*. Orlando, FL: Harcourt Brace and Company.

Butzon, C. & Butzon, J. (1989). *Science through children's literature*. Englewood, CA: Teacher Ideas Press.

Gega, P. (1982). *Science in elementary education*. New York, NY: John Wiley and Sons, Inc.

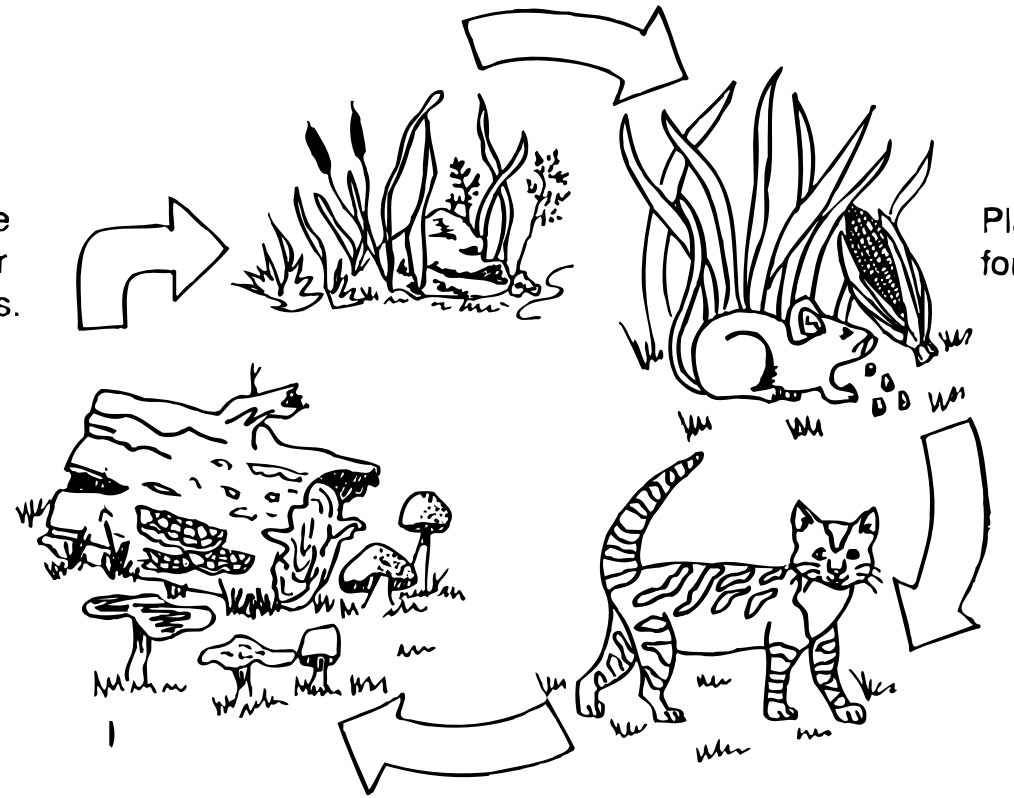
FOOD CHAIN REVIEW

Plants and animals depend on each other. Microorganisms, insects, and fungi are decomposers. They provide chemicals for green plants. Plants are the food for plant eaters. The plant eaters are food for the meat eaters. These all provide waste materials for the decomposers.

DIRECTIONS: Use the above information to complete the diagram.

Green plants are the _____ for _____ eaters.

Decomposers make _____ for _____ plants.



Plant _____ are food for _____ eaters.

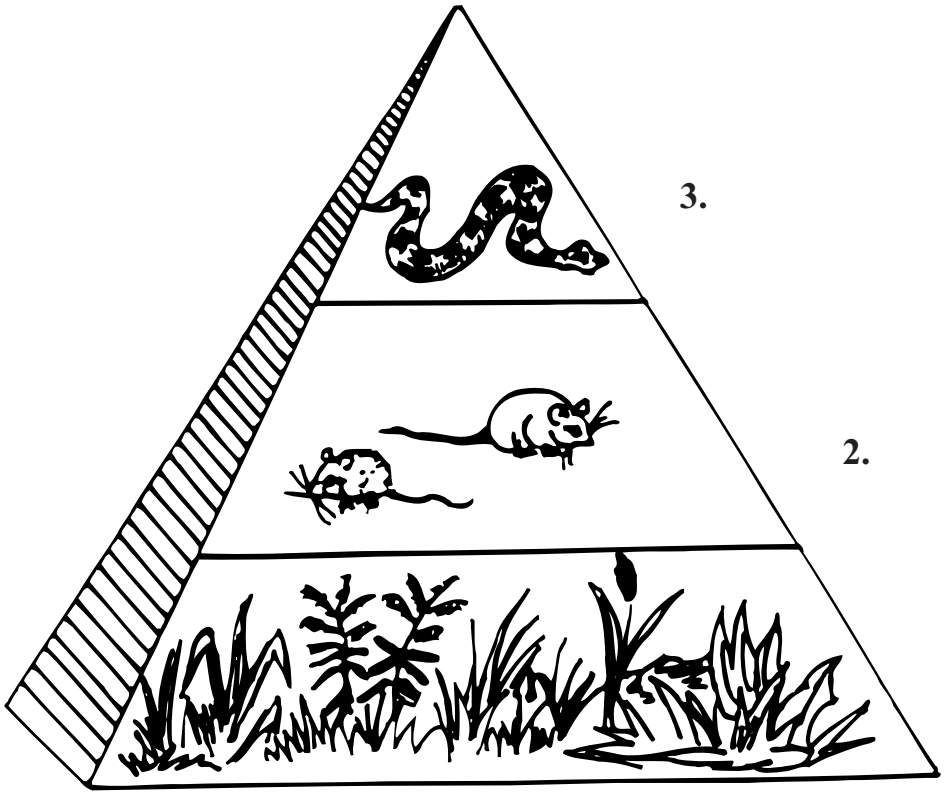
Meat eaters supply _____ materials for the _____ .

Energy Pyramid

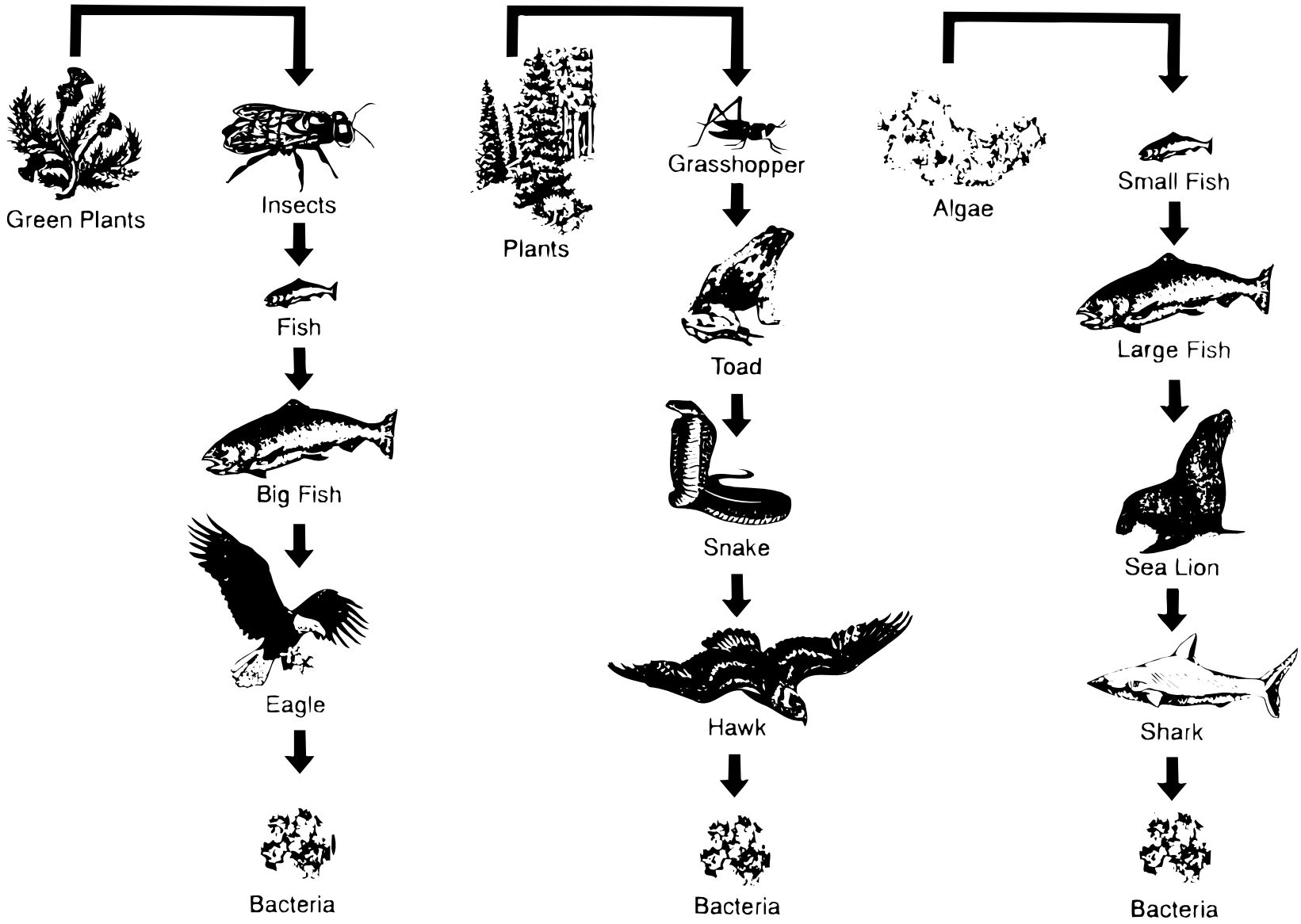
3. Energy used by primary carnivores comes from the animals in level 2.

2. Energy used by herbivores comes from producers in level 1.

1. Energy for this level comes from the sun.



FOOD CHAINS


Green Plants
Insects
Fish
Big Fish
Eagle
Bacteria
Plants
Grasshopper
Toad
Snake
Hawk
Bacteria
Algae
Small Fish
Large Fish
Sea Lion
Shark
Bacteria

Notes

The Web Of Life

OBJECTIVES:

The student will be able to:
1. Define the term food web.
2. Explain what happens when food chains overlap in an ecosystem.
3. Name the three components of a food web in an ecosystem.

BACKGROUND:

Almost everything in nature works in a cycle. Plants and animals live, die, and decompose only to be recycled again. In nature the plants, or producers, make the food. Animals eat the producers or other animals. An animal that eats only other animals is called a carnivore. Animals that eat only plants are called herbivores. Omnivores are animals that consume both plants and animals. As each living thing eats another, energy and materials are passed among them. The path that passes this energy and material is called a food chain.

Since most animals eat more than one specific food, they belong to more than one food chain. When two or more food chains overlap, they connect plants and animals by the plants and animals they eat. This is known as a food web. Within a food web, each member depends on another member. If one member changes, then the rest of the web will change in some way. Every part of the web depends on decomposers to return materials to the soil, air, water, and start the cycle over.

Grades:
3-5

Subject:
Science

Time Needed:
One class period

Materials:
construction paper
markers
scissors
tape
string or yarn
science journal
cards for each group with the following words: birds, dragonfly, frog, mosquito, water plants, minnows, molds, bacteria

VOCABULARY:

carnivore - an animal that eats only other animals
consumer - an organism that obtains energy by eating other living things
decomposer - an agent that breaks down the bodies of dead organisms
ecosystem - all the communities that live together in an area including the water, soil, and climate
food web - two or more food chains that overlap, connecting plants and animals through the plants and animals they eat
herbivore - a plant-eating animal
omnivore - an animal that eats both plants and animals
producer - an organism that makes its own food and is the beginning of a food chain

ADVANCE PREPARATION:

Prepare cards with the following words for each group: bird, dragonfly, frog, water plants, mosquito, minnow, bacteria, molds, and sun.

PROCEDURE:

Setting the stage

1. Guide students to discuss the meanings and differences of producers, herbivores, carnivores, omnivores, and decomposers that represent populations in a community.

2. Ask students to predict what would occur if two food sources disappeared in a food web.

Activities

1. Using the cards:
   - The student with the sun card holds the end of a ball of yarn.
   - The student with the water plant card takes the yarn.
   - Each organism in turn takes the yarn from the food it can eat until a food web is intertwined.
   - Other cards that may be used to produce food web: plants, mouse, grasshopper, wolf, raccoon, snake, hawk, toad.
2. Prepare a hanger web.
   - Provide a coat hanger for each student or small group.
   - Cover and decorate the body of the hanger to represent the environment in which the members of this food web would be found.
   - Hang the food web stages from the bottom of the hanger. Use different lengths of string, wire, or thread.
   - Display each model.
3. Have students in small groups place the cards marked with different components of a food web in order on a piece of poster board.
   - Place arrows for the steps of a food web in the proper arrangement.

Follow-Up

Ask students to brainstorm why food webs are usually more stable than food chains.

- Lead them to conclude that predators in a food web would have other food sources if one food source became less abundant or extinct.
- Have students work in small groups to design a web drawing to summarize the concept of a food web.

EXTENSIONS:

1. Make a poster of a food web that is local to the area.
2. Read *Why Save The Rain Forest?* by Donald Silver.
3. Have students read about life downtown and in a city park in *The City Kid's Field Guide* by Ethan Herberman.
   - Then have students classify things found in each area.
   - Classify organisms as producers, decomposers, herbivores, carnivores, omnivores.
4. Read *Who Eats What? Food Chains And Food Webs* by Patricia Lauber.

ORIGINAL DEVELOPMENT RESOURCES:

Badders, W. et al. (1996). *Discovery works*. Parsippany, NJ: Silver Burdett Ginn.

Cornell, J. (1979). *Sharing nature with children*. Ananda Publications.

Ecology. (1989). *World book encyclopedia.* (Volume E, p. 51). Chicago, IL: World Book, Inc.

Gega, P. (1982). *Science in elementary education*. New York, NY: John Wiley and Sons, Inc.

Guy, R. (1989). *Discover science*. Glenview, IL: Scott Foresman and Company.

An Ant Can

OBJECTIVES:

The student will be able to:
1. Explain how ants communicate.
2. Conclude how a change in the food source affects ants' behaviors.
3. Name the body parts of an ant.

BACKGROUND:

Humans rely on sight and sound to convey messages. Many animals, however, rely on chemical messages. Chemical communication is based on the production and secretion of a chemical, called a pheromone. This chemical can be detected by animals.

Ants communicate with one another when they look for food. When an ant finds food, it may carry it back to its nest. On its way, it leaves a pheromone trail that other ants can follow. Before long, other ants are traveling the trail to and from the food. Once the food is gone, the pheromone is no longer secreted. As the trail begins to vanish, the movement of the ants becomes less uniform, and they leave the area. Ants live in communities and are social insects.

VOCABULARY:

colony - a community of social insects
community - all the populations living together in the same place
pheromone - chemical secreted by an animal to communicate
secretion - substance produced by some part of an animal or plant

Grades:
3-5

Subject:
Science

Time Needed:
One or two class periods

Materials:
ants from a pet specialty store or trapped from their natural environment
stopwatch
magnifying glasses
paper cup
paper plate
small part of a piece of bread
one half teaspoon sugar
diagram sheet labeled "Parts of an Ant"
modeling clay
pipe cleaners

ADVANCE PREPARATION:

1. Purchase or collect ants. (If collecting ants, remember to return them to their natural habitat. Use caution not to collect fire ants. Warning: some students are allergic to ants.)
2. Copy the illustration of the ant's body.

PROCEDURE:

Setting the Stage
1. On a walk outside, have students search for ant hills and ant trails. Discuss the dangers for ants as they move around the Earth.
2. Discuss with students where they have observed ants around their homes.

Activities
1. Conduct an experiment to demonstrate how ants can communicate about food.
   - Using very small pieces of bread, chips or other foods, make a trail along the ground (1/2 teaspoon).
   - About one foot away from these crumbs make another trail of crumbs (1/2 teaspoon).
   - Use magnifying glasses to observe if the ants find the crumbs.
   - Observe the ants moving the crumbs toward the colony.
   - Use a stick to wipe out a section of the crumb trail. Observe and discuss changes in the ants' behaviors.

2.. Divide students into groups of four to five.
   - Have each group of students time how far an ant can walk in a minute when heading toward a food source. Each group might use different types of foods.
3. Direct students to look at ants by using a magnifying glass.
   - Instruct students to describe (see unlabeled sheet, Parts of the Ant) and illustrate the shape of the body of an ant.
   - Using a pipe cleaner or modeling clay, students should make a model of an ant's body.
   - Distribute labeled sheet, Parts of an Ant, and have students compare the body parts of an ant with their models.
   - Discuss where the pheromone is produced. See diagram sheet of labeled parts of the ant.

Follow-Up
Tell students to describe to a partner how ants communicate with each other.

EXTENSIONS:

1. Ask students to research details of an ant habitat. Students can then illustrate the ant habitat.
2. Instruct students to write a skit based on the different jobs that ants have within their colony.
3. Purchase an ant farm for observation.
4. Read the book *Two Bad Ants* by Chris Van Allsburg. If this book is not available, any literature selection containing a similar theme can be used to enhance the lesson.

ORIGINAL DEVELOPMENT RESOURCES:

Ants. *World book encyclopedia*. (1988). Chicago, IL: World Book, Inc.

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

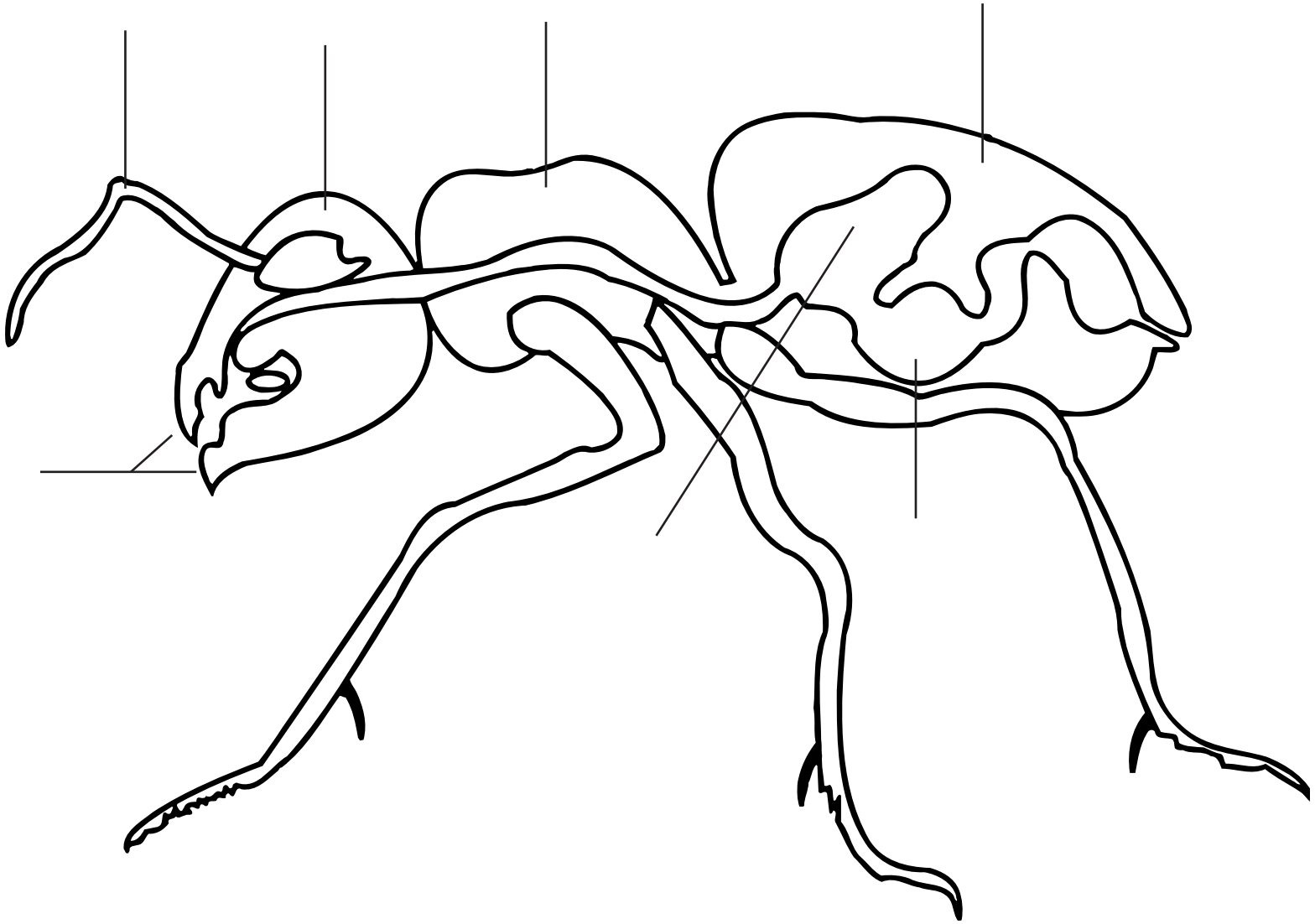
Chapman, E. (Undated). *A teacher's manual for outdoor classrooms*. Auburn, AL: U.S. Department of Agriculture.

Greenland, Caroline. (1986). *Nature's children ants.* Danbury, Connecticut: Grolier Educational Corporation.

Cole, Joanna. (1996). *Magic school bus gets ants in its pants*. New York. Scholastic, Inc.

Dorros, Authur. (1987). *Ant cities*. New York, NY: Harper Collins Publishers.

Parts Of An Ant



Parts Of An Ant

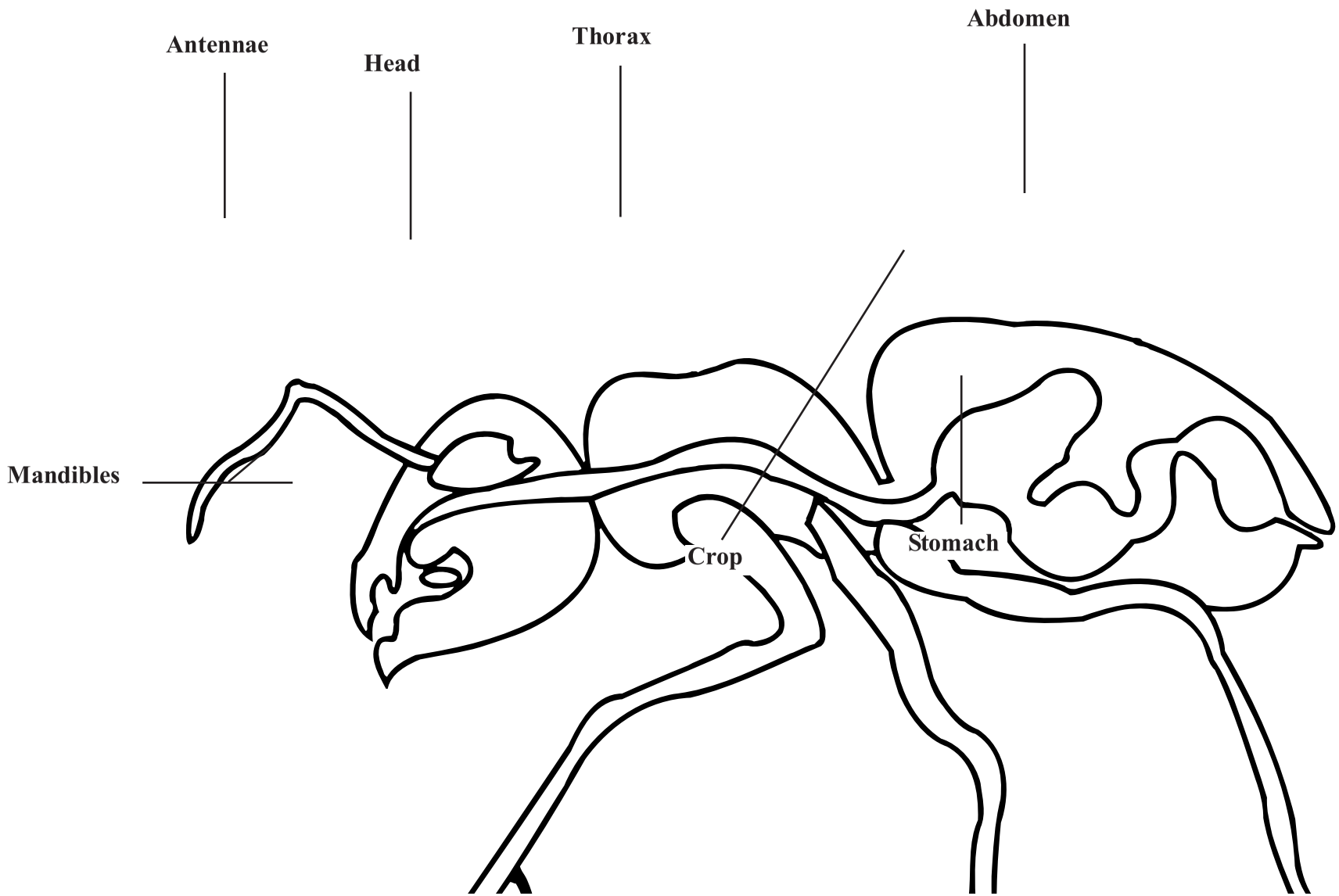
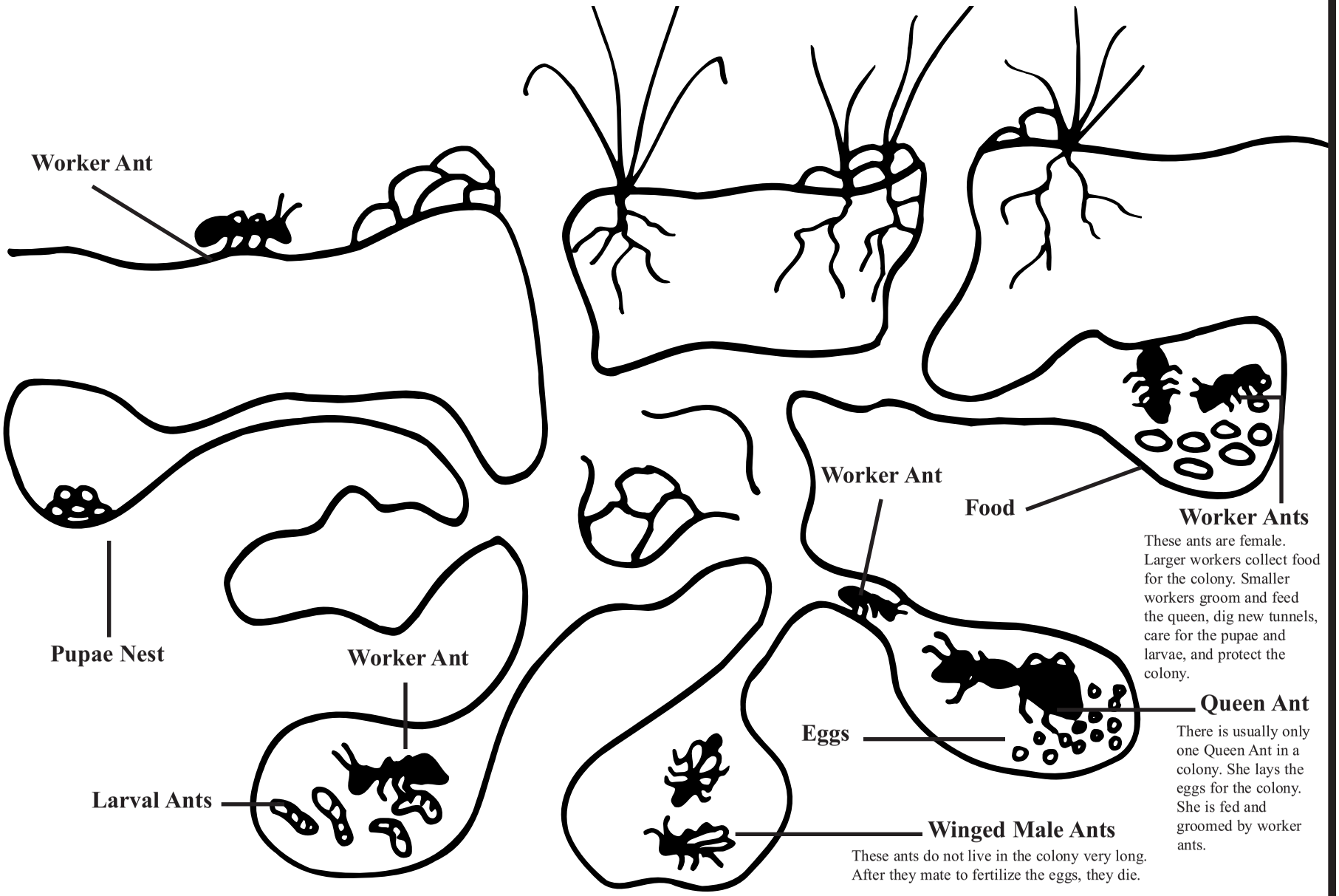


Illustration of an Ant Colony



Notes

Adaptations Help Stop Limitations

OBJECTIVES:

The student will be able to:
1. Define the term adaptation.
2. Name at least three ways animals have adapted to their environments.
3. Define the term camouflage.
4. Describe differences in bird beaks.

BACKGROUND:

Ecosystems change over time. Due to this, animals must respond to these changes in their environment. Animals make adaptations to their environments so that they may continue to survive. Adaptation is the behavior or the part of a living thing that helps it live in a certain environment.

Certain traits, such as body coloring and markings, special body parts, and specific actions, help an animal to adapt better to its environment. Some adaptations in animals help the animal to see its surrounding better. For instance, dragonflies have compound eyes with thousands of separate lens in each eye. Using the wider field of vision helps the dragonfly see movement up to 12 meters away. Some falcons can see their prey 800 meters away. Rabbits and mice have eyes set on both sides of their heads to give them a wider range of vision.

There are hundreds of places where living things are found. The places may differ from each other in a number of ways. In each place, the organisms found there are especially suited for living there. They have adapted to their environment.

VOCABULARY:

adaptation - the behavior, or the part, of a living thing that helps it live in a certain environment
camouflage - the ability to blend in with the surroundings
ecosystems - all the communities that live together in an area including the water, soil, and climate

Grades:
3-5

Subjects:
Science, Art

Time Needed:
Three class periods

Materials:
several sheets of wrapping paper: one patterned, two different solid colors
scissors
timer
red transparent plastic folder
light yellow crayon
white paper
cotton balls
petroleum jelly
tub of water
tools: tweezers, soda straws, eye droppers, tongs, pliers, chopsticks
bird food
walnuts or other nuts in shells
candy worms
red food coloring for nectar
jelly beans
rice
puffed cereal
marbles
oatmeal
student activity sheets

ADVANCE PREPARATION:

1. Secure patterned and plain paper.
   - Duplicate a butterfly-shaped pattern for students.
   - Have timers or watches with second hands for each cooperative learning group.
2. Assemble petroleum jelly, cotton balls, and water for Activity 4.
3. Assemble materials needed for Activity 5.
4. Make nectar for Activity 5 by mixing water and red food coloring.

PROCEDURE:

Setting the Stage

1. Ask students to share times they have seen animals use their different senses to find food and water.
2. Ask students to share different survival behavior they have noticed in animals.

Activities

1. Demonstrate animal camouflage. (Do this in pairs of students.)
   - Have students cut out 12 butterfly shapes from the patterned paper and 12 from each of the solid papers.
   - Have one student in each pair put one full piece of patterned paper on the floor.
   - Place the 36 butterflies, color, or pattern side up.
   - Have the partner cover his or her eyes.
   - Set the timer to ten seconds.
   - Tell the partner to uncover his/her eyes and pick up, one at a time, as many butterflies as possible.
   - Have pairs count the number of butterflies of each type collected.
   - Repeat the experiment, substituting solid-colored wrapping paper for the background.
     Note: Newspaper can be substituted for wrapping paper.
2. Encourage students to work in pairs to write a story about an animal character whose adaptations are important in the story.
   - Tell students that stories can be funny or adventurous.
   - Have students illustrate their stories.
3. Ask students to create a hidden picture of an animal to demonstrate camouflage.
   - Draw a bird using the yellow crayon on the white paper.
   - Cover the drawing with the red plastic folder.
   - Encourage students to brainstorm why the bird seems to disappear. (A possible idea could be that the yellow bird and the red folder are both reflecting light to your eyes.)
4. Invite students to demonstrate how oil in the feathers of water birds, such as ducks, helps them to keep dry and to stay afloat. Ask students if they think birds that do not get in the water have as much oil.
   - Instruct students to coat a cotton ball thoroughly with petroleum jelly.
   - Have them place the ball in the container of water.
   - Direct them to put an uncoated cotton ball in the water.
   - Observe what happens to each cotton ball.
   - Encourage students to conclude that because the oil and water do not mix, the oil keeps the water from getting into the cotton, thus into the birds.
5. Have students do the following activity to learn about birds' beaks.
   - Read the story "Dear Diary" to the class.
   - Explain that different types of birds have different beak types that determine what they eat.
   - Prepare six containers each with a different type of bird food (See Teacher Key).
   - Divide students into groups.
   - Explain to students what each container of bird food represents (See Teacher Key).
   - Allow students to select tools to use to capture and eat each type of bird food.
   - Use the tool as a beak to gather food.
   - Have students compare the tool they used to the pictures on the Beak Illustration Sheet and determine which one they had.

Follow-Up

1. Have students write examples of animal adaptations.
2. Instruct students to complete the Student Activity page for follow-up.
3. Have students complete the Bird Beaks Page.

EXTENSIONS:

1. Encourage students to work in groups to research animals that have adapted to living in very harsh climates.
2. Have students create a class big book illustrating animals native to Alabama and list their adaptations to their environment.
3. Have students choose a favorite animal and make a model of it using clay or play dough. Ask students to list adaptations of their animal on an index card.

ORIGINAL DEVELOPMENT RESOURCES:

Badders, W. et. al. (1996). *Discovery works*. Parsippany, NJ: Silver Burdette Ginn.

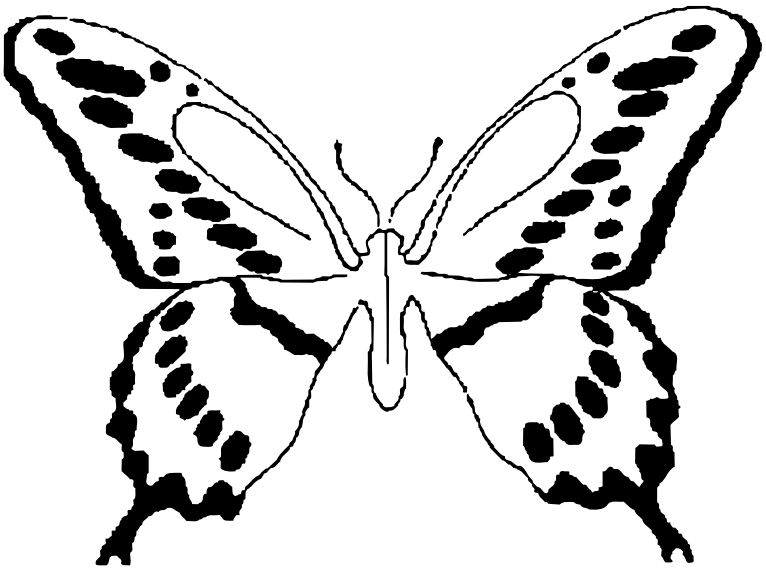
Makhmaltchi, V. (1992). *Hands-on science activities*. Troll Associates.

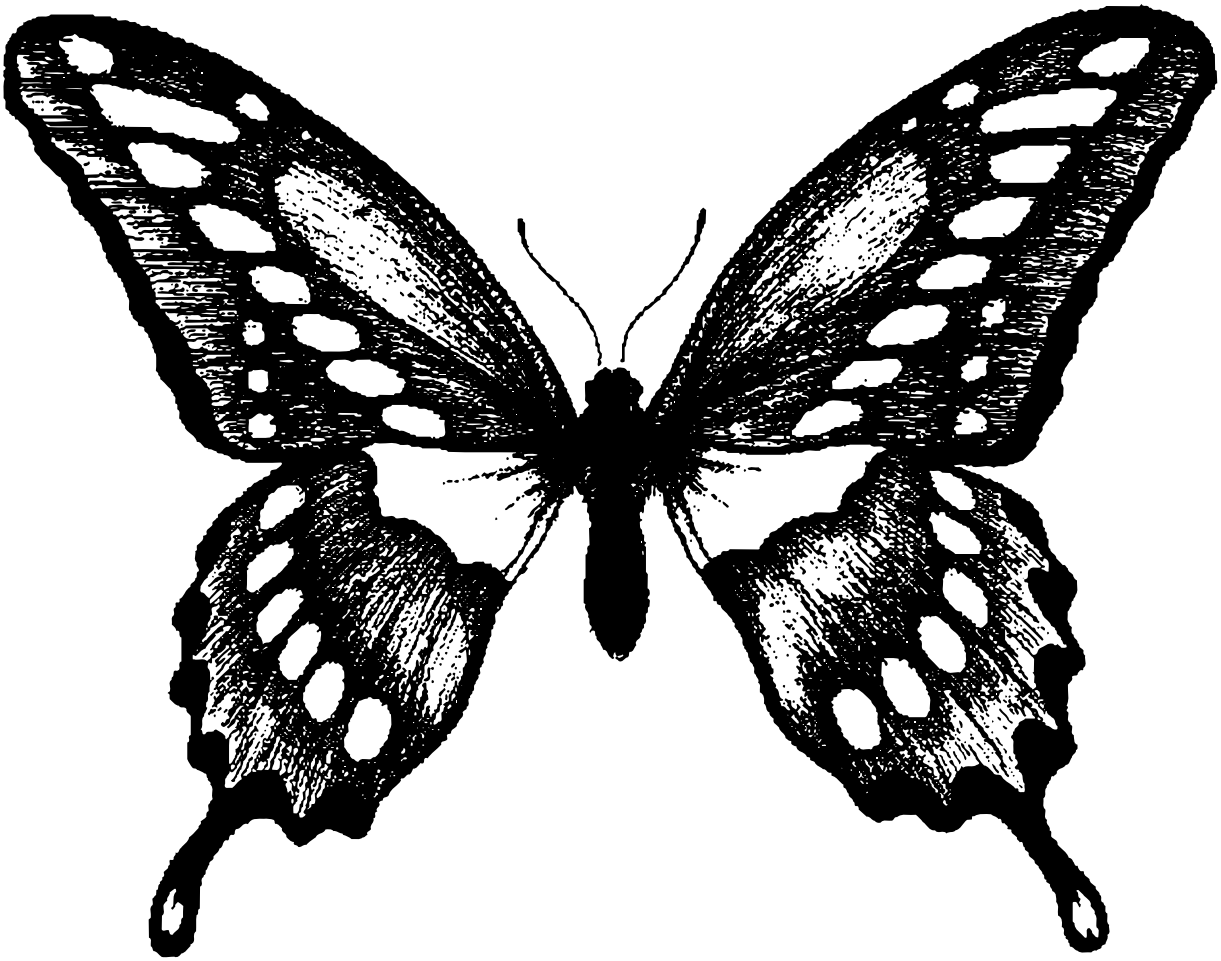
Van Cleave, J. (1990). *Biology for every kid*. New York, NY: John Wiley and Sons Inc.

Gill, P. (1990). *Birds*. The Nature Club. U.S.A. Troll Associates.

Mason, H. (1992). *Life in a forest*. Niagara Falls, New York: Durkin Hayes Publishing Ltd.

Butterfly Pattern





“Dear Diary”

Dear Diary,

Today was my birthday, and I invited all of my bird friends for a birthday dinner. I served insect casserole and seed cakes. We washed this down with sparkling rainwater. For entertainment I warbled my song, “Rockin Robin.”

What a disaster I had! Having birds over for dinner can be tricky since we don’t have teeth. I discovered that if you don’t have exactly the kind of food they are used to eating, they’ll go hungry. Here’s a list of the birds I invited to my party.

The toucan, who favors the parrot with his beautiful bright feathers, lives in the jungle. He informed me that he eats papayas, mangoes, and bananas. I was so embarrassed. Those weren’t on my shopping list.

Mrs. Woodpecker, my next door neighbor, also came. She lives in the hollow tree. She was in luck! I was able to find her some earthworms, bugs, and spiders.

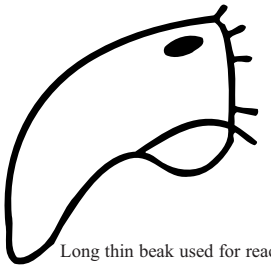
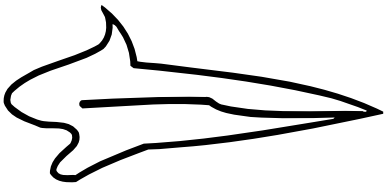
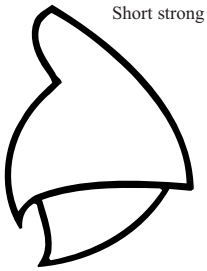
Sally Pelican only eats things that come from the sea. I knew this, so I had prepared a tuna “special.”

The hawk and the owl arrived together. They are really fond of rats, snakes, and sometimes other birds. I had to watch my back feathers all night! They left early and hungry. They went to hunt.

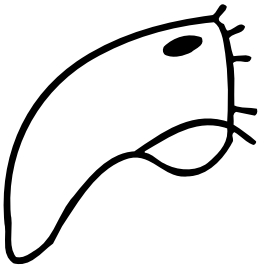
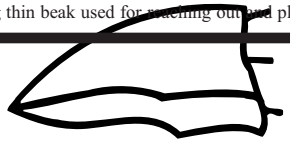
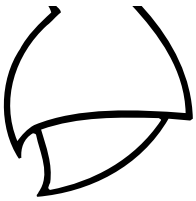
I have learned a lesson. You should always be prepared!

Love,
Ima Sparrow

Which Type Of Beak Do You Have?

BEAKS	TOOLS	BIRD TYPES
1.  Long thin beak used for reaching out and plucking fruit.		
2.  Small sharp beak for picking insects from leaves, logs, and dirt.		
3.  Long beak used to probe for worms and other small animals in the water.		
4.  Bill that acts as a strainer to filter out tiny plants and animals.		
Short strong beak used for breaking open seeds. 5. 		
Long hollow beak used to probe for nectar. 6. 		

Which Type Of Beak Do You Have?

BEAKS	
1.  Long thin beak used for reaching out and plucking fruit.	**Toucan** Tongs are the best instrument. Use marbles or jellybeans to represent fruit.
2.  Small sharp beak for picking insects from leaves, logs, and dirt.	**Warbler** Forceps or tweezers are the best instruments. Use rice to represent small insects.
3.  Long beak used to probe for worms and other small animals in the water.	**Snipes, Kiwis, Curlews** Chopsticks are the best instrument. Use candy worms in dry oatmeal to represent worms in mud.
4.  Bill that acts as a strainer to filter out tiny plants and animals.	**Flamingos and some Ducks** A strainer is the best instrument. Use worm candy in water. Also add puffed cereal to represent plants.
Short strong beak used for breaking open seeds. 5. 	**Cardinals, Sparrows, Grosbeaks, and other Finch-like birds** Nutcrackers or tongs are the best instruments. Use walnuts and other nuts in bird seed.
Long hollow beak used to probe for nectar. 6. 	**Hummingbirds** An eyedropper or straw is the best instrument. Use red food coloring and water to make nectar. Place in a bud vase.

Animal Adaptations

A body part or a behavior that helps an animal to survive in its environment is called adaptation.

Wings, large ears, feathers, and fat are all adaptations that help an animal keep its body temperature.

An elephant's tusks or a dog's long tongue helps it to obtain water.

Bears' heavy claws or a snapping turtle's sharp beak helps it to get food.

A snail's hard shell or the shell of an oyster provides it with shelter.

Some animals use color adaptations called camouflage for protection in their environment.

Use the underlined words to make up questions. Ask your questions to a partner.

Necessary Changes

OBJECTIVES:

The student will be able to:
1. Define the term adaptation as it relates to plants.
2. Conclude how plants adapt to changes in amount of light.
3. Develop a list of at least two ways plants have adapted to their environment.

Grades:
3-5

Subjects:
Science, Language Arts

Time Needed:
One class period plus three days of observation

Materials:
three tiny plant seedlings each growing in a paper cup
shoebox with a lid
plastic wrap
invisible tape
duct tape
journal

BACKGROUND:

Plants grow in almost every part of the world. They grow on the tops of mountains, in the ocean waters, in the desert, and in polar lands.

People must have plants to live. The oxygen we breathe comes from plants. Our food comes from plants or from the animals that eat plants. Many homes are built from plant material. Many of our clothes come from cotton plant fibers.

We can find plants in different types of places. These places can be hot, cold, dry, or wet. Plants growing in these places have different needs. Their adaptations help them to meet their needs in each place.

Alpine plants are adapted to live in cold places. They adapt by growing close to the ground and close to each other. This helps the plants to survive the cold winds. These plants also have special adaptations for collecting water. They are provided with shallow spreading roots to collect the melting snow.

Stems and leaves are covered with a coat of wax and fine hairs to assist in retaining the water. A cactus is an example of a plant with adaptations for surviving in the desert. It has shallow spreading roots to collect rain water. It has stems and spines that are coated with wax to retain the water.

Many trees in areas that have cold winters will adapt by losing their leaves. This keeps the tree from losing water through its leaves. A pine tree does not shed its leaves in winter. Its leaves consist of needles with a thick covering that helps retain water.

Plants growing in forests have adaptations for getting sunlight. Some plants climb to reach the sunlight, while others grow along the branches of tall trees to get sunlight.

Geotropism is a type of adaptation that plants undertake due to gravity. The roots of the plant will turn downward in response to gravity.

VOCABULARY:

adaptation - the behavior, or the part, of a living thing that helps it to live in a certain environment
environment - all the surrounding living and nonliving things that affect another living thing
geotropism - a bending movement of living things due to gravity
species - a group of organisms that have the same characteristics and are able to reproduce

ADVANCE PREPARATION:

1. Purchase three small seedlings and plant each seedling in a separate paper cup.
2. Obtain a shoebox and cut a small hole in the lid.
3. Purchase clear plastic wrap and tape.

PROCEDURE:

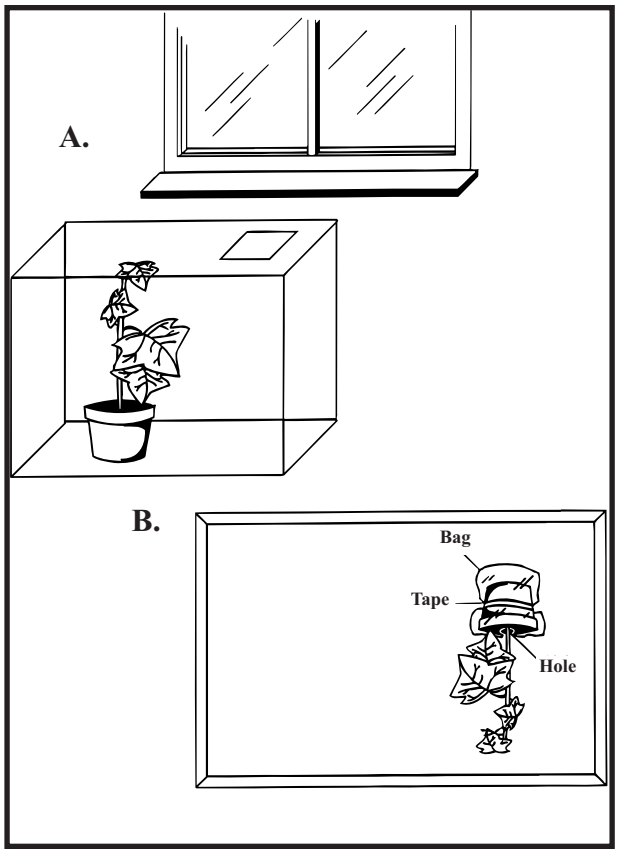
Setting the Stage

Discuss with students what we do when we walk into bright light. (Lead them to determine that we squint.)

- Have students cover their eyes with their hands.
- After two minutes, instruct students to uncover and open their eyes.
- Talk about what happens when they uncover their eyes.
- Talk about how this is a way they adapt to a changing environment.

Activities

1. Demonstrate how plants respond to changes in their environment (see illustration A).
   - Place a seedling into a box. Cut a small hole in the lid and then cover the box. Be sure that the seedling is away from the hole in the box top.
   - Place another seedling in a paper cup (see illustration B). Cut a tiny hole (just big enough for the seedling to fit) in a piece of plastic wrap. Tape the plastic wrap tightly to the cup.Turn the cup upside down. Attach the upside down cup to a window so that the plant is hanging upside down. (Use duct tape.)
   - Put the third seedling on a flat surface so it can receive light.
   - Instruct students to predict what will happen to each of the three plants.
   - Students should record predictions in their journals.
   - Wait at least three days and then observe the seedlings.
   - Any changes should be recorded in their science journals.
   - Compare the final observations with predictions and record any changes noted. (Students should conclude that plants respond to light by growing toward the light.)



2. Demonstrate how a growing root will respond if the tip is pointed upward.
   - Fold a paper towel and put it in a plastic bag.
   - Place the plastic bag on a table.
   - Put three seeds on the paper towel.
   - Staple through the bag and the towel below the seeds.
   - Staple the sides of the bag.
   - Add a small amount of water to the bag. (The water must be in contact with the paper towel but not above the staples.)
   - Tack the bag to a bulletin board.
   - Observe the seed each day.
   - Watch for the roots to get two to three centimeters long and remove the bag form the board.

- Using tweezers, turn the seeds so that the roots point upward.
- Have students predict what the roots will do.
- Observe the roots for the next few days and record observations in science journals.
- Have students explain why the roots turned (roots respond to gravitational pull - geotropism.)

Follow-Up
Have students describe how a plant might adapt to changes in its environment. (Use the Plant Adaptations Sheet to begin a discussion.

EXTENSIONS:

1. Read to the class *A Tree in the Forest* by Jan Thornhill. If this book is not available, any literature selection containing a similar theme can be used to enhance the lesson.
2. Use dried beans and ask students to invent a way for that seed to be carried by attaching art scraps or cotton to the bean. Write a descriptive story about the adventures of the seed. Discuss adaptations some seeds have that help them be transported (stickers, maple seed "wings").
3. Write a poem or a rap about the protective devices of a plant.

ORIGINAL DEVELOPMENT RESOURCES:

Badders, W. et al. (1996). *Discovery works.* Parsippany, NJ: Silver Burdett Ginn.

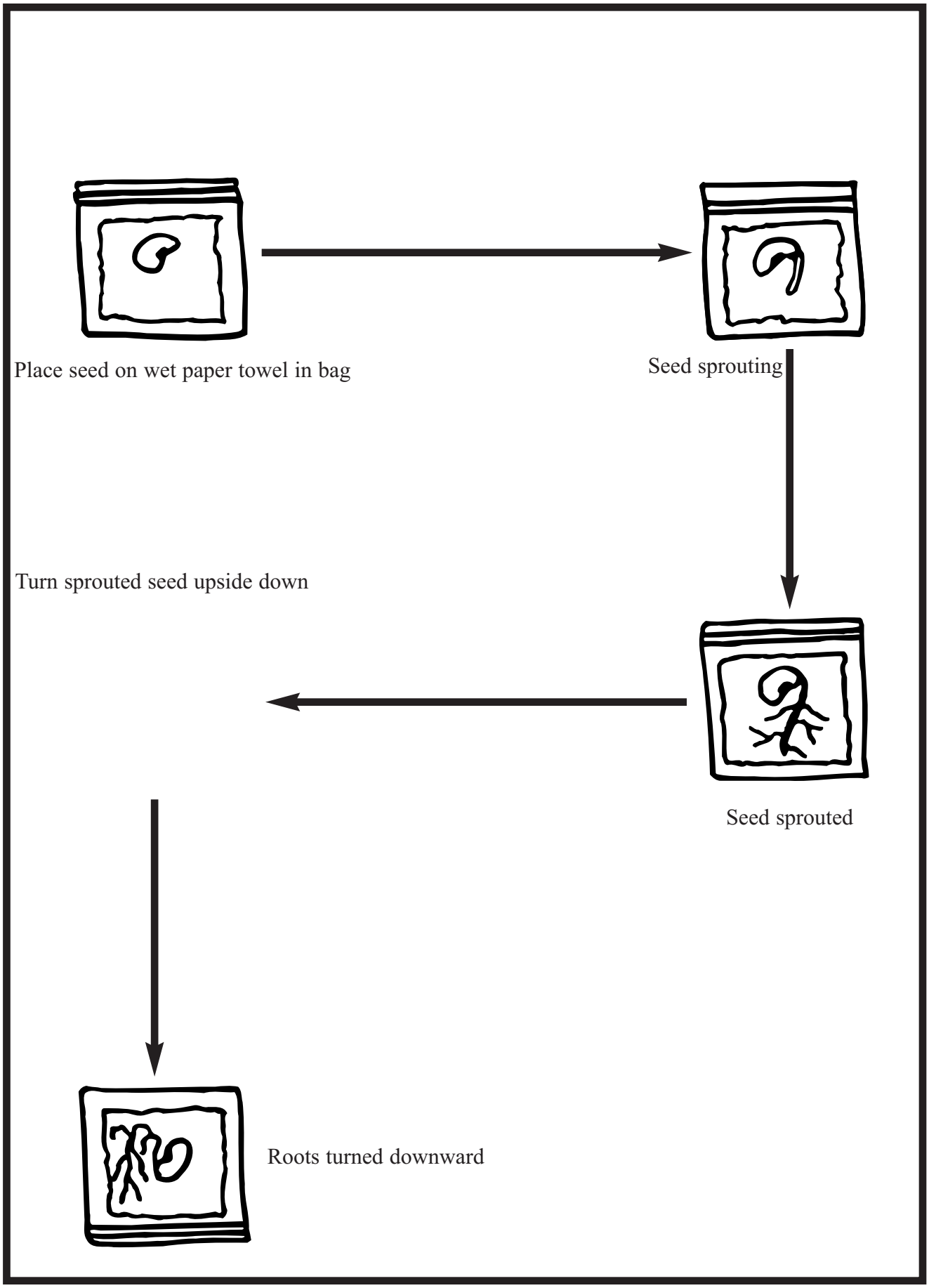
Butzon, C. & Butzon, J. (1989). *Science through children's literature*. Englewood, CO: Teacher Ideas Press.

Mallison, G. (1984). *Science*. Morristown, NJ: Silver Burdett Company.

Savan, Beth. (1991). *Earthcycles and ecosystems.* Toronto: Kids Can Press Ltd.

Donahue, Mike. (1988).*The grandpa tree*. Niwot, Colorado: Roberts Rinehart, Inc. Publishers.

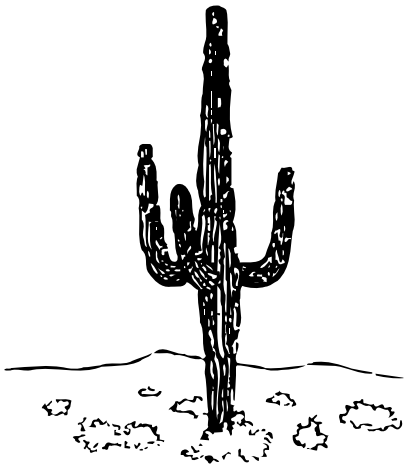
Jaspersohn, William. (1980). *How the forrest grew*. New York: Mulberry Books.


Place seed on wet paper towel in bag
Seed sprouting
Turn sprouted seed upside down
Seed sprouted
Roots turned downward

Plant Adaptations

CACTUS

Spines help the cactus to adapt to the hot sun. A spine is a type of leaf that does not let water escape through it. The cactus has shallow spreading roots to quickly absorb more water over a larger area.



IVY

Some plants climb to get the sunlight. Ivy adapts by climbing up trees, fences, houses, and other available structures.

ALPINE FLOWERS

These mountain flowers grow in high elevations. They adapt to the strong light and decreased amount of water by growing waxy leaves and shallow roots.

Notes

To Transpire Or Perspire . . . That Is The Question

OBJECTIVES:

The student will be able to:
1. Explain the process of transpiration.
2. Trace the process of transpiration on the Student Information Page.
3. Observe that plants transpire.

BACKGROUND:

The process of transpiration moves water up from a plant's roots. In the process of transpiration, a plant loses water through tiny openings in the underside of the leaves (stomata) and pulls up more water from the roots.

Water moving up the stem of a plant to its leaves accounts for 90 percent of the water lost through the pores of the leaf. Some trees can lose up to 15,000 pounds of water during a 12-hour period. The openings in the leaves that provide for the loss of water and the exchange of gases are adapted to different climates. Water's upward climb is the result of the pull at the top. As water is lost through the stomata, more water is pulled up from the leaf veins, the stems, and the roots, thus producing long columns of water in the plant.

Grades:
3-5

Subject:
Science

Time Needed:
Two class periods

Materials:
one cut flower such as a carnation
food coloring
bud vase
four growing plants
plastic sandwich bags
clear tape
student activity pages for each science journal
petroleum jelly

VOCABULARY:

stomata - tiny openings in the underside of leaves on a plant that control the amount of water in a plant's tissues by releasing water vapor into the air.

transpiration - the loss of water through openings in a leaf (stomata) through which gases and water enter and leave

ADVANCE PREPARATION:

1. Assemble items necessary for experiments.
2. Copy Student Activity Pages for each student.

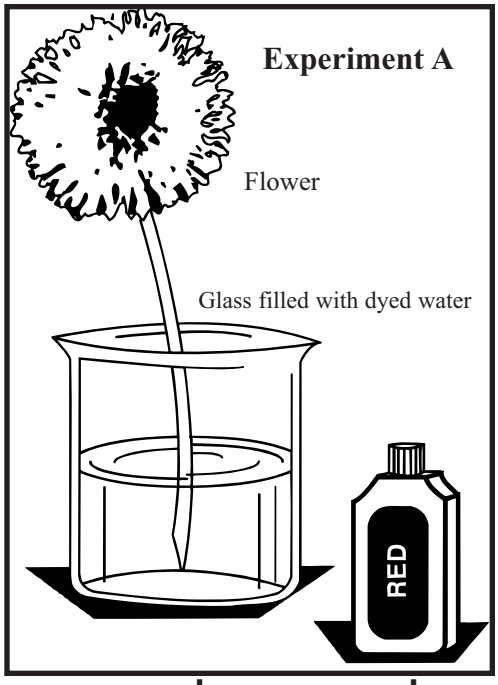
PROCEDURE:

Setting the Stage

1. Discuss with students that plants usually take in more water than they can retain. Ask what happens to the water.
2. Ask students what the dew is on plants (the result of condensation on the leaves).

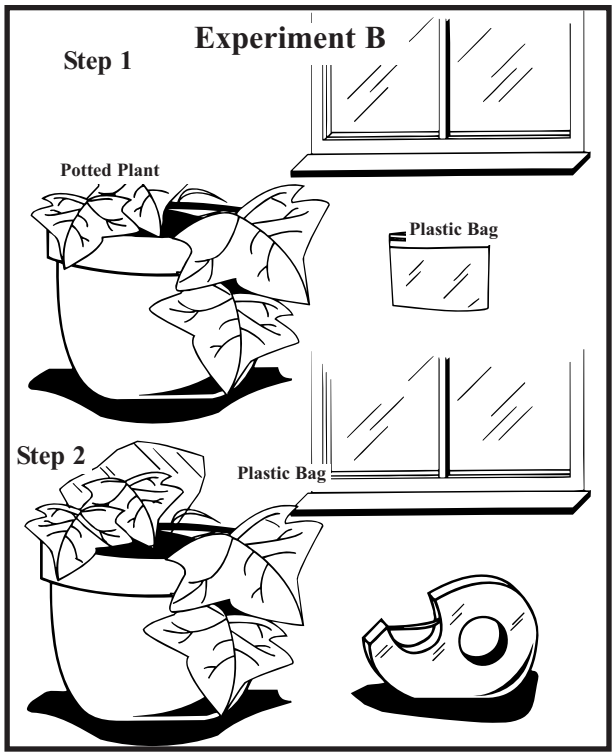
Activities

1. Demonstrate how water moves through a plant (see Experiment A illustration).
   - Place a cut flower, such as a white carnation, in a bud vase containing water.
   - Pour a few drops of food coloring into the water in the vase.



• Explain to students that tubes in the stem pull the colored water up through the plant to the petals.

2. Show how transpiration occurs (see Experiment B illustration).
   - Put a sandwich bag over a leaf on a plant.
   - Tape the bag to the stem so no air can get in.
   - Do not put the plant in sunlight.
   - Observe the inside of the bag.
   - Help students correlate the accumulation of water in the bag to the transpiration process.
3. Compare the amount of water transpired from four different plants.
   - Place plastic bags over each of four different types of potted plants and close tightly with tape.
   - Observe the amount of water droplets that collect on the inside of each glass.
   - Compare the results of transpiration for each of the four plants.
4. Repeat Experiment B but place each plant in:
   - A a cool place; a dark closet; a very warm place, a room but not in the sun.
   - Compare the results for the amounts of water transpired from all four plants.
   - Ask students if light and temperature have any effect on the amount of water transpired. If so, what?



Follow-Up

1. Have students define stomata and explain their role in transpiration.
2. Ask students to label transpiration steps on the Student Activity Page, "Transpiration".
3. Record in science journals any observations made during the experiment.

EXTENSIONS:

1. Conduct an experiment with two plants.
   - Coat one plant's leaves with petroleum jelly.
   - Leave the other plant's leaves natural.
   - Cover both plants with plastic bags.
   - Observe and compare water vapor that collects on the sides of the plastic bags.

ORIGINAL DEVELOPMENT RESOURCES:

Badders, W. et al. (1996). *Discovery works*. Parsippany, NJ: Silver Burdett Ginn.

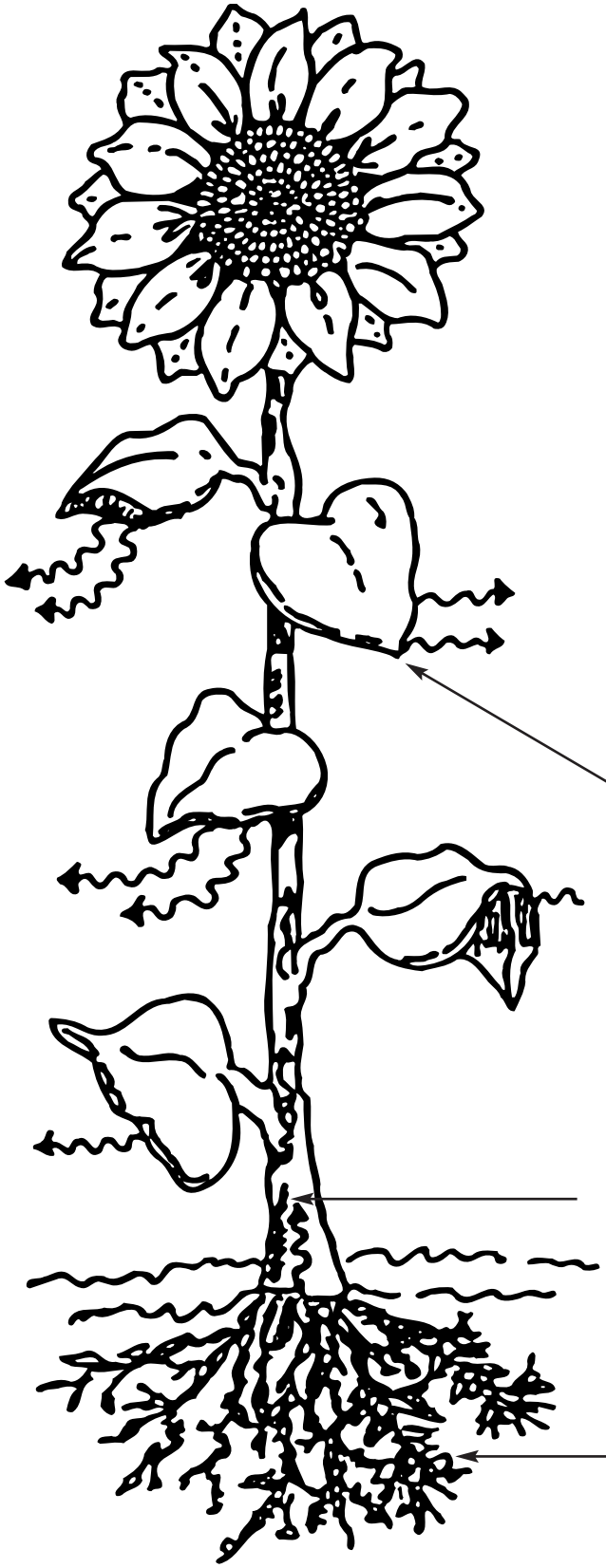
Guy, R. et al. (1989). *Discover science*. Glenview, IL: Scott, Foresman and Company.

Plants (1987). *The world book encyclopedia*. (Volume 19). Chicago, IL: World Book, Inc.

Van Cleave, J. (1990). *Biology for every kid*. New York, NY: John Wiley and Sons, Inc.

Savan, B. (1991). *Earthcycles and ecosystems*. Toronto: Kids Can Press Ltd.

Transpiration



Steps of Transpiration

1. Plants absorb water from the soil through their roots.

2. The water and minerals move up the stem to the leaves.

3. The stomata on the underside of the leaves release the water.

Notes

Over And Over Again

OBJECTIVES:

The student will be able to:
1. Describe the stages of succession in the forest.
2. Illustrate the stages of succession.

BACKGROUND:

Succession is a regular pattern of changes in the plants and animals in an area. This process may take hundreds or even thousands of years. Changes may be started by enriched soil, greater moisture, loss of moisture, intervention of humans, and numerous other conditions. New organisms that can adapt and thrive in the new conditions will emerge.

A climax community is reached when the plant life is fully adapted to the existing conditions of soil content, water supply, and organic environment. This community is considered stable. Although it may change in small ways, its major characteristics remain the same.

Floods, fire, or human intervention may reverse this process. Succession that takes place where an ecosystem has previously existed is called secondary succession.

Grades:
3-5

Subject:
Science

Time Needed:
One class period, on-going observation

Materials:
two-liter plastic bottle
soil
aquatic plant
two cups bird seed
scissors
sunflower seeds

VOCABULARY:

succession - the process of continuous change

ADVANCE PREPARATION:

Each student should bring a plastic soda beverage bottle to school. Use scissors to cut off the top. Add to each jar five centimeters (approximately two inches) of soil and seven centimeters (approximately three inches) of water. Stir and allow to stand overnight.

PROCEDURE:

Setting the Stage
1. What does a mature forest (climax community) look like? (little undergrowth, canopy)
2. Discuss what happens to a forest when ravaged by a fire. Which plants emerge first? What happens to the wildlife?

.5 liter of water
5 cm. of soil

Day 1

About 3-4 weeks later

Activities

Experiment: Succession from pond to forest.

1. Using the prepared bottle, add an aquatic plant and place bottle in a window or beneath a grow lamp for three to four weeks. Do not replace water that evaporates.
2. Put observations on the chart. Once or twice each week, have students add three or four bird seeds to the bottle and make a drawing of the bottle and its contents. (Note: While there is water in the jar, the seeds will sprout and then rot. As the water evaporates down to the soil, the aquatic plant will die, but the bird seeds will now find a suitable environment.)
3. If the soil dries out too much, add a little "rain" occasionally. Add sunflower seeds in the third week to represent "trees."
4. Have students work in groups or four or five to make a poster of what they saw happen to their community and list what they learned about succession. Allow each group to present its findings.

Follow-Up

1. Using the recorded observations, illustrate the succession of the forest.
2. List the stages of succession in the forest.

EXTENSIONS:

1. Read *The Hatchet* by Gary Paulsen. If this book is not available, any literature selection containing a similar theme can be used to enhance the lesson.

ORIGINAL DEVELOPMENT RESOURCES:

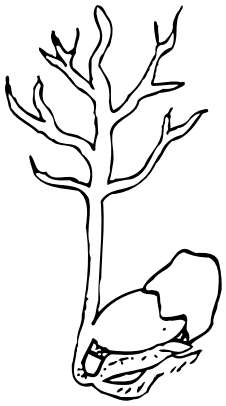
Gates, J. (1989). *Consider the earth*. Englewood, CO: Teacher Idea Press.

TVA - A world of resources. (November 1986): TVA/ONRED/L&ER/86/52.

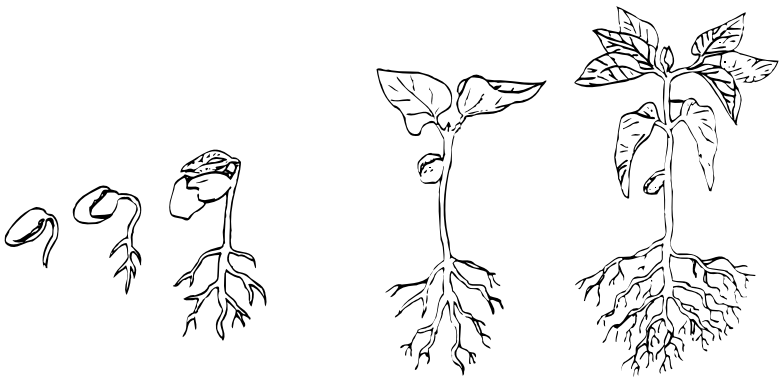
Jaspersohn, William.(1980). *How the forest grew*. New York: Mulberry Books.

Donahue, Mike. (1988). *The grandpa tree*. Niwot, Colorado: Roberts Rinehart, Inc. Publishers.

Mason, Helen. (1992). *Life in a forest*. Niagara Falls, New York: Durkin Hayes Publishing Ltd.



Description	Drawing
Week 1	
Week 2	
Week 3	
Week 4	



Notes

Backyard Composting

OBJECTIVES:

The student will be able to:
1. Explain composting.
2. Identify compostable types of solid waste.
3. Create rich, odor-free compost.
4. Record temperatures on a chart.
5. Identify compost inhabitants.
6. Construct a compost food web.
7. List changes that occur within a compost over a period of time.

Grades:
3-5

Subjects:
Science, Math

Time Needed:
One class period to set up; daily maintenance and observation

Materials:
soil thermometer
compost ingredients (leaves or straw and grass in a 2:1 ratio)
tools for shredding
watering can
partially decayed compost pile
plastic specimen dishes
forceps
stereoscopes
flashlights

BACKGROUND:

In the near future, landfills in the U.S. may stop accepting "yard waste." Compost piles are an alternative disposal method for leaves and grass clippings.

Compost is dark, earthy-smelling, crumbly material. In a compost pile, a large number of microscopic organisms call a compost heap "home." The movement of these organisms within the heap helps to aerate it. These compost residents break up and decompose the dead organic matter to help create humus. Humus slowly releases small amounts of plant nutrients when added to soil. Humus is an excellent soil-building material.

In a compost pile, decomposers, such as bacteria and fungi, thrive on dead tissue. The amount of moisture, air, temperature, light, and the nature of the decomposing material affect the composting process. To form a good compost, a carbon/nitrogen ratio of 30:1 must exist. Composts deficient in nitrogen may not decompose for at least a year. Too much nitrogen will produce a strong ammonia smell. The compost heap must be damp, not soggy. It must be turned to ensure proper ventilation. Turning exposes all parts of the heap to the heat that is produced during decomposition. Compost piles should be less than one meter high. They can be contained or out in the open. Done correctly, compost will form in about two weeks.

Modern landfills seal garbage deep in the earth, keeping out air and moisture. This prevents microorganisms from doing their work. Therefore, even biodegradable products do not readily decompose when placed in a landfill.

Composting is a solution to some of the solid waste disposal problems. It helps dispose of waste material in an efficient and sanitary manner. It produces humus, which has beneficial properties for growing plants. Experts say that composting can keep up to 60 percent of all solid waste out of the landfills.

VOCABULARY:

aerate - to expose to the circulation of air
aerobic - requires oxygen to live
arthropods - invertebrate organisms that include insects, spiders, and crustaceans
bacteria - living organisms so small they need magnification to be observed
biodegradable - a compound that can be broken down into simpler compounds by microorganisms

carbon - a substance that occurs in any living organisms.
composting - collecting and layering organic material, such as lawn clippings, leaves, kitchen scraps, and manure, in order to decompose into fertile humus
decomposer - an agent that breaks down the bodies of dead organisms
humus - decayed organic material used to improve gardening and soil
microscopic - exceedingly small, minute; too small to be seen with the naked eye
nitrogen - a substance plants need to survive.

ADVANCE PREPARATION:

1. Gather materials.
2. Copy Student Handouts.
3. Collect a sample of partially decayed compost material.

PROCEDURE:

Setting the Stage

1. Give the journal prompt "Describe life in a compost pile."
2. Share student responses and discuss using background information.

Activity I

1. Create rich, odor-free compost.
   - Combine material by weight.
   - Shred compost material to increase surface area and speed by decomposition.
   - Sprinkle the compost materials with water to dampen. Avoid using too much!
   - Assemble a heap no more than one meter high.
   - Take the temperature at the center of the compost pile, then five centimeters below the surface.
     Record the temperatures on the Backyard Composting chart.
     Repeat this procedure every 24 hours.
   - Cover the compost pile.
   - Turn the heap with a pitch fork as soon as the temperature of the compost drops slightly (every 48-72 hours).
2. Graph the recorded daily temperature.

Activity II

1. Observe compost debris in small groups.
   - Place a handful of decomposing compost material in a specimen dish.
   - Focus a light on the sample.
   - Turn the debris over with a pair of forceps and look for compost inhabitants.
   - Examine it under a stereoscope.
   - Identify as many compost arthropods as possible using the Student Activity Page. The hairlike organisms are nematodes.
2. Construct a food web by drawing arrows from the predator to the prey or vegetation on the Student Activity Page.
3. Compare the compost created and the compost collected.

Follow-Up

1. Discuss the temperature increases and decreases.
   - Inform students that temperature increase due to the heat released during the respiration process of decomposers. Temperatures decrease due to a lack of oxygen or a decrease in organic matter.
   - Calculate the temperature ranges recorded.
2. Graph data using pictures obtained from observations.

3. Draw or explain the kinds of materials that can be composted.
4. List the steps of the composting process.

EXTENSIONS:

1. Conduct a school-wide survey to find out how many families have a compost pile. Graph the results.
2. Use the compost to fertilize a garden planted by the students.
3. Plant a seed in only compost, a seed in only soil, and a seed in mixed compost and soil. Compare the results.
4. Visit a composting facility.
5. Use craft supplies to construct an original compost critter.
6. Write a story about life in the compost.

ORIGINAL DEVELOPMENT RESOURCES:

Alabama Cooperative Extension Service. *Backyard composting*. (Circular No. ANR-638). Auburn University, AL: Auburn University. http://www.aces.edu/pubs/docs/A/ANR-0638/ANR-0638.pdf

Cooperative Extension Service. (1989). *Lessons in solid waste management: 3 - R's*. Manhattan: Kansas State University.

Kraft General Foods. (June, 1993). *Solid thinking about solid waste.*

Swarthout, F. L. (September 1993). The science of composting. *The science teacher.* 60(6), pp. 27-29.

Swarthout, F. L. (October 1993). The compost community. *The science teacher.* 60(7), pp. 45-47.

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

Savan, B. (1991). *Earthcycles and ecosystems.* Toronto, Canada: Kids Can Press Ltd.

Glaser, L. (1996). *Compost! Growing gardens from your garbage.* Brookfield, Connecticut: The Millbrook Press.

Backyard Composting

Record the compost pile's temperature.

Time (hours)	Temperature	
	At center	Near surface
0		
24		
48		
72		
96		
120		

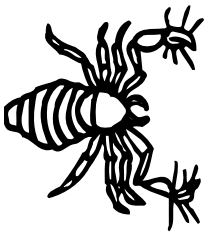
List any changes you observe here:

Date	Change

Name _____

Backyard Composting

Directions:
1. Place a check in the box if the arthropod can be seen in your compost sample.
2. Write the total number of each kind of organism you see.
3. Construct a food web by drawing arrows to each item that an organism consumes.



☐ **pseudoscorpions**

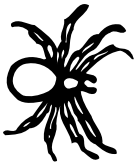
- vicelike front claws
- poisonous glands
- eat nematodes, mites, earthworms, and larvae

☐ # found

☐ **springtails**

- wingless insects
- springlike structure on stomach
- jump a few inches high
- eat nematodes, fungi, leaves

☐ # found



☐ **compost mites**

- smaller than a grain of sand
- resemble red-orange droplets
- prey on nematodes, insect eggs, mite larvae

☐ # found

☐ **earwigs**

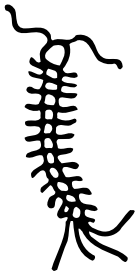
- pair of pinchers
- release smelly liquid
- eat fruit, moss, lichen, and grass

☐ # found

☐ **sowbugs**

- slow moving
- crustaceans
- eat decaying vegetation

☐ # found



☐ **centipedes**

- fast moving
- poisonous claw behind head
- eat arthropods and worms

☐ # found

☐ **millipedes**

- slower
- cylinder shape
- eat vegetation

☐ # found

☐ **nematodes**

- look like fine hair
- eat decaying vegetation and fungi

☐ # found

Notes

Vermi-Village

OBJECTIVES:

The student will be able to:
1. Construct a vermi-compost pile.
2. Observe the behaviors of a worm.
3. Record the reaction time of a worm.

BACKGROUND:

Composting is an important way to reduce garbage. Composting with worms is called vermi-composting.

Worms have well-developed noses and great senses of smell. They do not have eyes or ears. The skin of a worm is sensitive to moisture, temperature, touch, and light. Worms breathe through their skin, taking air out of the moist soil. Their skin is tender. Worms are nocturnal.

VOCABULARY:

composting - collecting and layering organic material, such as lawn clippings, leaves, kitchen scraps, and manure, in order to decompose into fertile humus
nocturnal - active at night
vermi - indicates a worm or worms

ADVANCE PREPARATION:

Poke holes in the bottom of the bin.

PROCEDURE:

Setting the Stage
1. Create a concept map about worms.
2. Discuss the benefits and uses of worms to the environment.
3. Provide each student with a gummi worm and a gummi worm sheet.

Activities
1. Construct a vermi-compost pile.
   - Place the bin on a tray so that water can drain out.
   - Put the bedding in the bottom of the bin and dampen it thoroughly.
2. Observe the worms.
   - Divide students into groups of four.
   - Guide students to complete the Student Activity Page, “Squirmy Vermi”.
3. Add the worms. Cover with the lid.
   - Place in a cool, dark spot. Do not allow it to freeze.
   - Feed the worms organic wastes such as vegetable and fruit leftovers, dust balls, and egg shells (not meats or fatty foods).
   - Gently mix the contents periodically. Be careful not to harm the worms.

Follow-Up
Share worm observations.

Grades:
3-5

Subjects:
Science, Math

Time Needed:
Two class periods

Materials:
one pound red worms (purchased from a bait shop)
one large plastic bin
one lid and tray
bedding made of an organic mix (straw, chopped plants, leaves, and shredded cardboard or newspaper)
three to four worms per group
hand lens
one flashlight per group
one cup of sand per group
one cup of potting soil per group
timing device per group
tape measurers
gummi worms

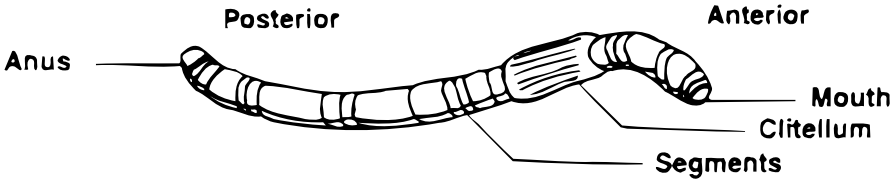
EXTENSIONS:

1. Test the worms' reactions to light or smell. Soak a cotton ball in ammonia or vinegar and place it near the worms.
2. Write a song about worms.
3. Create a squirm dance.
4. This activity could be extended to predict and record how long it takes for original bedding to become compost.
5. Read *Earthworms, Underground Farmers* by Patricia Lauber.
6. Read *Squirmy Wormy Composters* by Bobbie Kalman.

ORIGINAL DEVELOPMENT RESOURCES:

Kalman, B. (1991). *Reducing, revising, and recycling*. New York, NY: Crabtree Publishing.

Squimy Vermi



1. Observe your worms with a hand lens. What do you see? . . . . . .

. . . . . .

. . . . . .

. . . . . .

2. Can you tell which is the front end of the worm? Draw the difference in the front and the tail.

3. How do worms move? . . . . . .
4. Measure a worm. . . . . cm
5. Place your worm on a moist paper towel. Gently touch it and record your observations on the chart below.
Shine a light on your worm and record your observations on the chart below.

Touch	Light

Allow your worm to burrow down into the cups. Time how long it takes in each type of soil.

	Prediction				Actual			
	Potting soil		**Sand**		**Potting soil**		**Sand**	
Trial	**min.**	**sec.**	**min.**	**sec.**	**min.**	**sec.**	**min.**	**sec.**
Trial 2	**min.**	**sec.**	**min.**	**sec.**	**min.**	**sec.**	**min.**	**sec.**
Average	**min.**	**sec.**	**min.**	**sec.**	**min.**	**sec.**	**min.**	**sec.**

Wormy Worksheet

Draw your Gummi Worm.

Gummi Worm is the common name for this worm. What is the scientific name?
(Make one up)._____

Describe your worm Length _____ Width _____
Colors _____ Number of segments_____ Smell _____

How can you tell the anterior (head) end from the posterior (tail) end?_____
_____

Compare your Gummi Worm to other Gummi Worms. How are they alike? How are they different?_____
_____

Can your Gummi Worm be stretched? _____

Can it be compressed? _____

Does it return to its original shape? _____

What other tests could you perform to find out more about the worm? _____
_____
_____

Compare your worm to a real earthworm (from memory)
_____
_____

What does your Gummi Worm taste like? _____