Life Lab Science
Preview Sampler

Fourth Grade Edition

An Introduction
to the
Life Lab Science Curriculum

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Module 3

Water Interactions

Grade 4

LIFE LAB SCIENCE CONNECTIONS

Developed by Life Lab Science Program

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Grade 4: Connections

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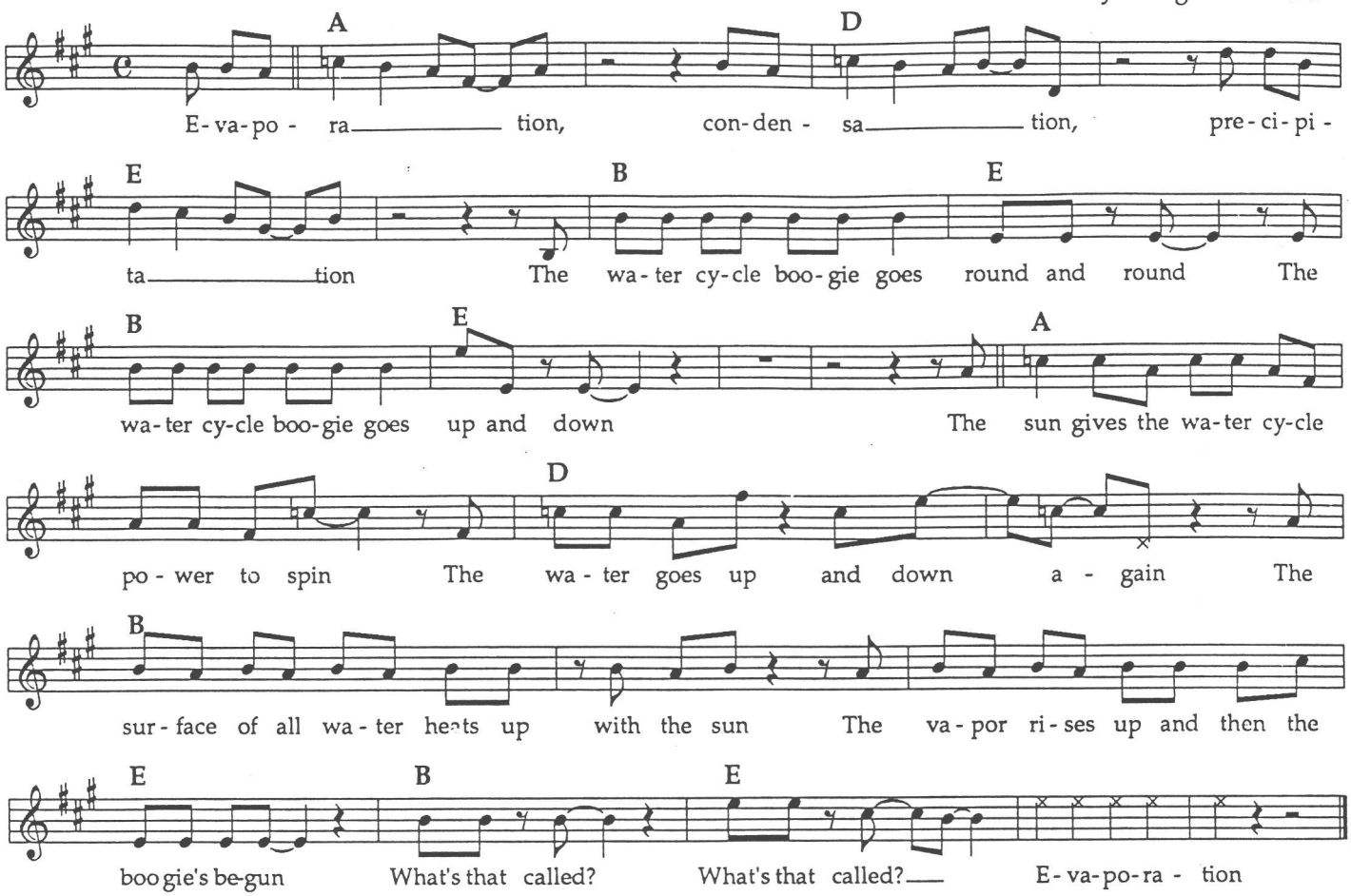
Water Cycle Boogie

Written by Doug Greenfield



CHORUS: Evaporation, Condensation, Precipitation
Water cycle boogie goes round and round
Water cycle boogie goes up and down

Water holds together chemically
Hydrogen bonding is what you see
All those airborne vapors they squeeze together
To form a cloud that could change the weather

What's that called? What's that called?
(CONDENSATION)

CHORUS: Condensation, Precipitation, Evaporation
Water cycle boogie goes round and round
Water cycle boogie goes up and down

All those dark clouds can't hold together
Water boogies down bringing stormy weather
Fog, rain, hail, flurries, ice, and sleet
Splish, splash, and crunch underneath your feet

What's that called? What's that called?
(PRECIPITATION)

CHORUS: Precipitation, Evaporation, Condensation
Water cycle boogie goes round and round
Water cycle boogie goes up and down

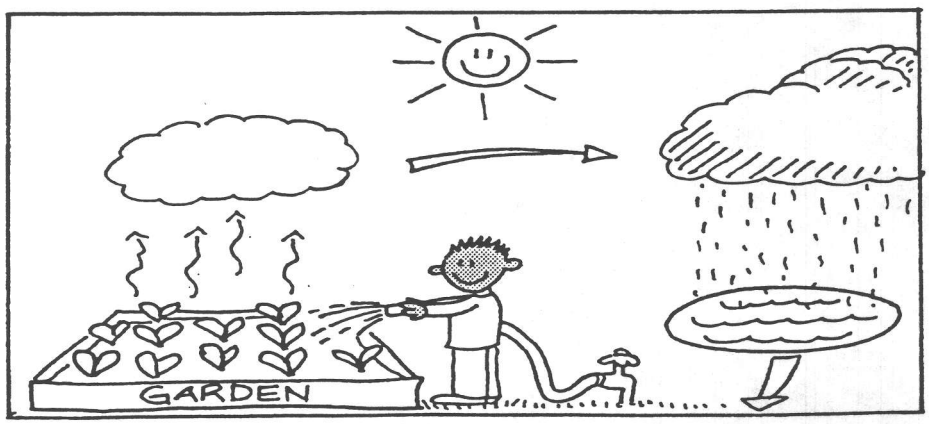
2/3rds of earth is water, it's true
Gives life to every plant and animal too
Respect water's power, only use your share
Don't waste a drop, there's none to spare
Let's do the water cycle boogie again
Let's gofor another spin! (REPEAT 1ST CHORUS)

Water Interactions

All living things depend on water. It is a key component of all habitats and can often be the limiting factor that determines what can live in an area. Plants and animals that survive in a dry habitat have adapted protective devices to conserve water: a cactus has thick waxy leaves to minimize transpiration; a camel can go a few days without water to drink.

Water is the natural world's magician; it is always present but wears different costumes, one of which is a cloak of invisibility. Water is the only substance on earth to exist as a solid, liquid, and gas at ambient temperatures. As a liquid, it is a major component of all Planet Earth: It is the chief constituent of cells, covers three–quarters of the world's surface, and is home to most of the world's lifeforms. As a solid, it is a reservoir: Fresh water is stored in ice caps, glaciers, and snow cover. As a gas, it disappears: Water becomes a vapor and is purified in the process; to concrete learners, this is the hardest disguise to penetrate. The activities and extensions in this unit give students many opportunities to explore all states of water in hands–on investigations that take students' own experiences as a starting point.

The study of water is ideal for expanding the garden's Living Laboratory to include the physical and earth sciences. The interactions of the water cycle also offer excellent data–collecting activities because students can easily control and measure variables such as temperature and water amounts at the start and finish of an experiment.



Student Goals

Theme: Students construct water's interactions as it cycles through habitats.

Science Explorations: Students experiment with the properties and states of water and begin to explore the water cycle.

Process Skills: Students use measuring and organizational skills to relate the properties of water to its role in the environment.

Science Concepts

Life Science: All living things need water. Plants transpire water into the air.

Earth Science: Water moves through the water cycle. It carries solutes and other materials necessary for life.

Physical Science: Water's chemical structure determines its unique properties. Water can exist as a solid, liquid, and gas at the temperatures that support life.

Science–Technology–Society: Humans have a responsibility to consider how their actions and wastes affect the water they and other organisms use.

Activity Chart

Unit Activity	Description	Process Skills	Instructional Model			Science Concepts				Related Subjects
			Preassessment	Exploration & Challenge	Application & Reflection	Life	Earth	Physical	STS	
Water Hunt	Preassessment lesson in which student teams set off to find water in the garden habitat.	Communicating Relating	✔			✔	✔	✔	✔	Language Arts
Water Puzzle	At this free-exploration station, students are challenged to make a measured amount of water disappear and then reappear.	Relating Organizing		✔		✔	✔	✔		Math
Small Worlds	Students collect plants and animals from the garden to make small closed and open terrariums.	Relating Organizing		✔		✔	✔			
Invisible Water	Students create devices to monitor the air's humidity.	Measuring Relating		✔		✔	✔	✔	✔	Math
Leaf Water	Students collect and measure the amount of water transpired by leaves to calculate the amount of water transpired by garden plants and graph the results.	Measuring Relating		✔		✔	✔	✔		Math
Sticky Water	Students investigate properties of cohesion and adhesion through simple investigations of water drops.	Observing Relating		✔				✔		Art
Upward Bound	Students set up a simple demonstration to compare how water flows up different types of paper products.	Comparing Modeling		✔		✔	✔	✔		
Water-Go-Round	In this postassessment activity, student teams complete their water cycle chart and act out the life of a water drop as it cycles through a habitat.	Communicating Relating			✔	✔	✔	✔		Language Arts
Endangered Species Project	Students research how their adopted species uses water and how its water supply has been impacted.	Organizing Communicating			✔	✔	✔	✔	✔	Language Arts

Unit Planner

Unit Activity	Time	Special Arrangements	Literature Links
Water Hunt	45 mins.	• Schedule this activity for a day soon after a rain or watering • Try to arrange for an aide	Cole, *The Magic School Bus at the Waterworks*
Discovery Center: Water Puzzle	Part 1: 15 mins. Part 2: 45 mins. with 10 min. periods 2–3 times during the day	• Arrange assorted materials in Life Lab Center • Arrange for a cold place for ice cubes	Westburg, *Water's Way*
Small Worlds	50 mins. with four 5 min. monitoring periods over 2 weeks	• Find a diverse outdoor area to collect things for terrarium	Williams, *Between Cattails*
Invisible Water	Part 1: 45 mins. Part 2: 30 mins the next day.	• Cut out newspaper weather reports that include relative humidity for this day and the two previous days	Radin, *High in the Mountains*
Leaf Water	Part 1: 45 mins. Part 2: 30 mins.	• Choose a sunny day • Find easy-to-reach trees or shrubs • Plan to do Part 2 the next day	Cobb, *This Place is Wet*
Sticky Water	45 mins.	• Clear table space	
Upward Bound	30 mins.	• Prepare celery stalks	
Water-Go-Round	60 mins.	• Measure strips of paper – See illustration in unit	Bassett & Bartlett, *Raindrop Stories*
Endangered Species Project	variable	• Adopt an Endangered Species • Obtain a topographical map of your area and Endangered Species area	Smith, *Sea Otter Rescue*

Unit Planner

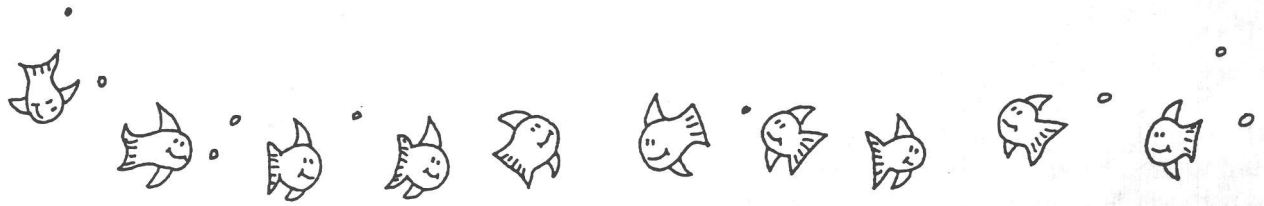
Life Lab Center

Rearrange the Life Lab Center to reflect this unit. Display pictures of habitats that include visible water and others where it is not immediately obvious. Place a prompt question above the pictures: "Can you find the water in these pictures?"

- Add other pictures: people from around the world using or gathering water, water in different forms or different places in the water cycle—glaciers, rain, evaporation, lakes, rivers, sunshine, and so on.
- Set up an aquarium or frog terrarium in your classroom. Consulting an expert on aquarium set–up at a local fish or pet shop can start you in the right direction. The store might also be willing to donate some of the items you will need.
- Put up a map of your town or area. Use it to trace where the water that is used for homes, industries, and agriculture in your community comes from. Trace also where your wastewater goes . A state map or regional map may be needed.
- Post pictures of how people use water in the home, for recreation, for business and industry, and in nature.
- Label a section of the bulletin board "Current Events" and encourage students to bring in newspaper articles that are water related.

Garden Activities

- Plant a cover crop such as vetch, fava beans, or rye to help hold the soil in place and add nutrients to it.
- Broccoli, cabbage, chard, and lettuce can all grow in cool weather, but they must be planted well before the first frost.
- Mulch your garden paths with dried leaves or wood chips to prevent compaction of the soil and to keep them from getting too muddy. Spread the mulch about two inches thick.
- Build a cold frame to extend your growing season. See *Gardening Know–How for the '90s*, (pp. 43–46), for simple instructions.



Recommended Literature

Story Books

Andrews, Jan. *Very Last First Time.* New York: Macmillan, 1985. An Inuit child goes below the ice at low tide to hunt for mussels for the first time.

Bassett & Bartlett. *Raindrop Stories.* New York, N.Y.: Four Winds Press, 1981. Originally oral stories, these imaginative tales take children on raindrop adventures.

Bellamy, David. *The River.* New York: Clarkson N. Potter, 1988. Wonderfully illustrated story of a polluting spill on a river. Life and death in the river is shown.

Bruchac, Joseph and Caduto, Michael. *Keepers of the Earth.* Golden, CO: Fulcrum, 1988. American Indian legends and environmental activities for children. Chapters 9–12 are water–related.

Cobb, Vicki. *This Place is Wet.* New York: Walker, 1989. This story focuses on the land, ecology, people, and animals of the Amazon rain forest in Brazil.

Cole, Joanna. *The Magic School Bus on the Ocean Floor.* New York: Scholastic, 1992. Ms. Frizzle's class goes on another field trip, this time to the ocean. The Magic Bus goes across the beach, into the ocean, and all the way to deep sea vents.

Cole, Joanna. *The Magic School Bus at the Waterworks.* New York: Scholastic, 1986. Ms. Frizzle's class takes a trip through the water works. This is a factually accurate, highly entertaining exploration of the water cycle and water treatment.

Cruz Martinez, Alejandro. *The Woman That Outshone the Sun.* San Francisco: Children's Book Press, 1991. This bilingual (Spanish/English) story is adapted from a poem about a woman with whom the river is in love. When she is treated badly by the people of her village, she leaves. The river leaves with her and the people realize their mistake.

Cummings, Pat. *C.L.O.U.D.S.* New York: Lothrop, Lee, & Shepard, 1986. Chaku is given the job of painting the skies of New York City, an assignment he learns to love.

Dorros, Arthur. *Follow the Water from Brook to Ocean.* New York: HarperCollins, 1991. Children follow raindrops dripping off their roof to a stream, a river, and then all the way to the ocean.

Holling, Clancy. *Paddle–to–the–Sea.* Boston: Houghton Mifflin, 1941, 1969. A small canoe carved by an Indian boy makes a journey from Lake Superior all the way to the Atlantic Ocean.

Humphrey, Margo. *The River that Gave Gifts.* San Francisco: Children's Book Press, 1987. A young girl brings a powerful gift from the river to honor an old woman in her Afro–American community.

Lewis, Richard, ed. *In a Spring Garden.* New York: Dial Books, 1989. A book of haiku poems, many of which have to do with water and pond life.

Locker, Thomas. *Where the River Begins.* New York: Dial Books, 1984. Grandfather takes grandson in search of the source of the river that flows by his house. Rain comes, adding to his understanding of water cycle.

Radin, Ruth Yaffe. *High in the Mountains.* New York: Macmillan, 1989. Poetic story of a child watching the daily changes in the mountain from early morning mist to nighttime.

Ryder, Joanne. *Inside Turtle's Shell.* New York: Macmillan, 1985. Beautiful poems about animals living in a pond and meadow ecosystem.

Schmid, Elenore. *The Water's Journey.* New York: North–South Books, 1989. A simple journey of the water cycle with nice illustrations. The story begins in the frozen snow and moves through a mountain brook to the ocean to be evaporated and begin again.

Westburg Peters, Lisa. *Water's Way.* Boston: Little, Brown, 1991. Tony witnesses the phase changes water makes both inside and outside his house while he waits for it to snow.

Williams, Terry Tempest. *Between Cattails.* NY: Charles Scribner's Sons, o.p. A poetic description of life in a marsh.

Reference Books

Jennings, Terry. *The Young Scientist Investigates Water.* Chicago: Children's Press, 1988. This introduction to the study of water and its properties, origins, and uses includes study questions, activities, and experiments.

Lewis, Barbara. *The Kids Guide to Social Action.* Minneapolis: Free Spirit Publishing, 1991. A how–to guide for teachers and children working for social justice. Contains many stories of successful campaigns by children.

Marsh Wolfe, Linnie. *Muir of the Mountains: The Unpublished Journals of John Muir.* Wisconson: University of Wisconson Press, 1979. Vivid Journal entries by naturalist and explorer, John Muir.

Parker, Steve. *Eyewitness Books: Pond and River.* New York: Knopf, 1988. A photo essay about the plants and animals found in ponds.

Radlauer, Ruth. *Everglades National Park.* Chicago: Elk Grove Books, 1989. Story and photos of plants and animals that live in a large swamp.

Reid, George K. *Pond Life: A Golden Guide.* New York: Golden Press, 1987. A well–illustrated guide to animals and plants of the pond.

Simon, Seymour. *Oceans.* New York: Morrow Junior Books, 1990. Text and photographs explore the physical characteristics, lifeforms, and fragility of the world's oceans.

Simon, Seymour. *Storms.* New York: Morrow Junior Books, 1989. This book describes the atmospheric conditions that create thunderstorms, hailstorms, lightning, tornadoes, and hurricanes and how violent weather affects the environment and people.

Silberstein, Mark, and Eileen Campbell. *Elkhorn Slough.* Monterey, CA.: Monterey Bay Aquarium, 1989. Discover one of California's few remaining wetlands. Beautiful photographs explore the waterway and marsh where plants and animals find a rich home.

Smith, Roland. *Sea Otter Rescue.* New York: Cobblehill Books, 1990. This book describes the rescue of the sea otters following the 1989 oil spill in Valdez, Alaska.

Stille, Darlene. *Water Pollution.* Chicago: Children's Press, 1990. The benefits of water, its pollution, and the harmful effects of and ways of avoiding water pollution are discussed.

Williams, Terry Tempest. *Between Cattails.* New York: Scribner 1985. This book gives a poetic description of life in a marsh.

Zambucka, Kristin. *Keepers of the Earth.* Honolulu, Hi.: Harrane Publishing Co, 1984. Native American legends and related activities to do with children. Chapters 9–12 are water–related.

Some of these books may be available in Spanish–language editions. Check with your local bookstore for Spanish titles currently in print and available by special order.

Date: _____

Dear Parent or Guardian:

We are beginning the Water unit of our Life Lab Science curriculum. In the next few weeks, students will be exploring how water changes from liquid to solid to gas and cycles through the environment. Many exciting lessons and activities to investigate water are planned.

At home, you can contribute to your child's learning by doing some simple investigations of water together.

- Go on a water hunt with your child. Look for the many ways you use water in your home—for washing, drinking, cleaning, watering plants and maybe even filling a bird bath. Look for water in different forms—as a solid in ice cubes, as a gas when it steams from a kettle or cooking pot, and as a liquid flowing out of a hose or faucet.
- Do a water conservation check with your child. Look for dripping faucets, running toilets, and sprinklers watering sidewalks or the street. If you get a water bill, show it to your child and see how many ways you can save water in the next month.
- Investigate with your child where our drinking water comes from. Find out where it goes after we use it.
- Look in the library for *That Sky, That Rain* by Carolyn Otto, a book that you and your child can share about the magic of a summer rainstorm.

We will be needing plastic containers for one of our experiments, the kind you find at fast food salad bars. In addition, we will need clear plastic cups and glass jars (like mayonnaise jars) throughout the unit. Please send any of these materials with your child if you can.

As always, we welcome you to join us in our lessons or activities at school. If you can join us for a lesson or in the garden, please fill out the form below and return it to me.

Sincerely,

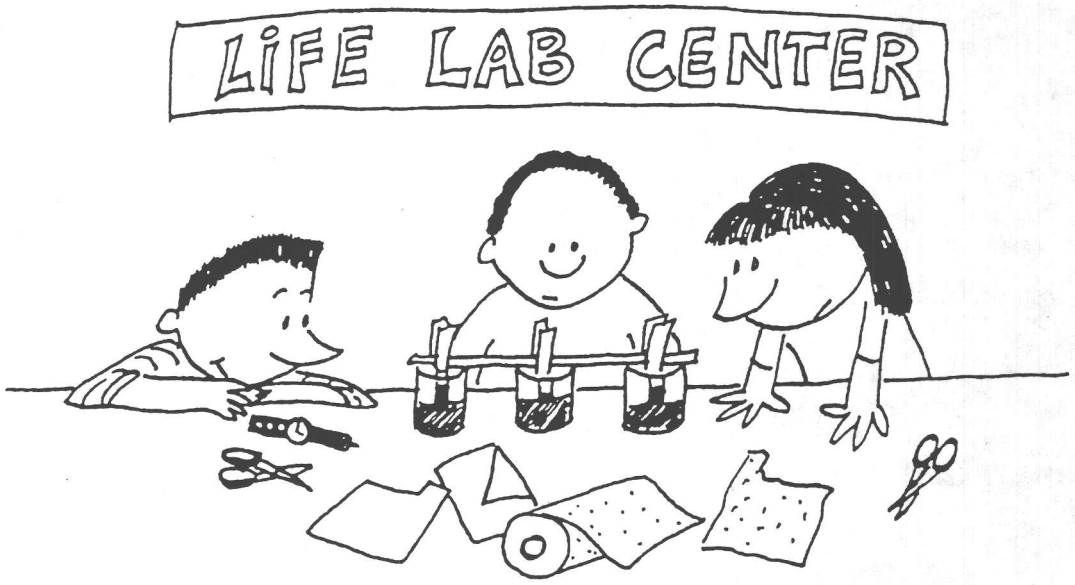
Name _____ **Date** _____

_____ **Yes. I can help. Please call me.**

_____ **No. I cannot help at this time, but please keep me informed.**

Upward Bound

Students set up a simple demonstration to compare how water flows up different types of paper products.



Indoor

Time
30 minutes

Science Key
Life, Earth, Physical Science

Related Subject
Language Arts

Process Skills
Comparing
Modeling

Materials

For the Class:

- 2–6 stalks of celery
- clear jar
- red food coloring
- water
- various types of paper: towels, brown bags, coffee filters, coated paper, writing pad, manila envelopes, magazine pages, newspaper, butcher paper, construction paper, posterboard, used greeting cards
- clock with a second hand
- Water Cycle chart or 3–foot sheet of butcher paper

For Each Group of 4–6:

- straw or chopstick
- 3 clothespins
- 3 clear cups with 1/4 cup of colored water in each
- scissors
- 1 or more hand lenses
- ruler

For Each Student:

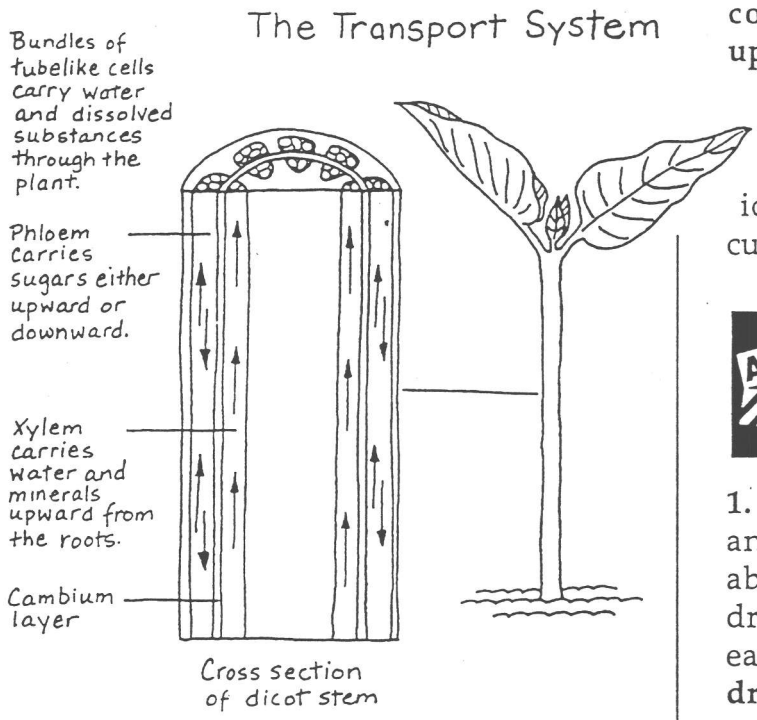
- Lab Sheets, pp. 71–73

Outcome

Students relate two properties of water—cohesion and adhesion—to the movement of water from the roots to the leaves of plants.

For the Teacher

In the previous lesson students investigated the stickiness of water—its cohesive property—which allows water drops to unify into a puddle. Now they will relate this property to the ability of water to move up through a plant. Water's *adhesive* force (the attraction between unlike substances) can be demonstrated by dipping one end of a paper towel, which is made from wood pulp, into water and watching the water move up the towel. In a plant, this *capillary action* moves water upward through the xylem cells, while water's surface tension pulls the water through in a steady stream. As water is transpired by the leaves, more water is pulled from the soil by the roots to replace it. To connect this lesson's demonstration to actual water flow in trees and other plants, be sure students connect paper products to their source: trees.



Preparation

1. Measure how long the strips of paper should be for your cups (see set–up illustration). The strips should dangle in the water.

2. Fill the cups that will hold the celery stalks one–third full with water colored with red food coloring.

3. Make a clean, fresh cut on the ends of the celery stalks so that the water will be able to enter easily.

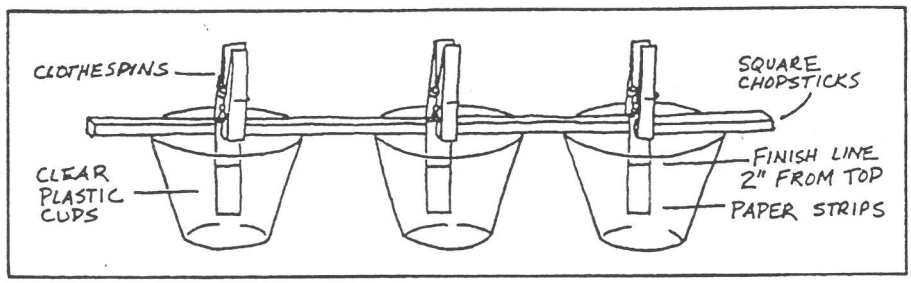
Getting Started

Ask students to speculate on how water can get from the soil to the top of the tallest trees.

What is the tallest tree you know? Do you think its leaves transpire water vapor? Where does the water come from? How does water get from the soil through the roots to the top of the tree? Have you ever seen water run uphill? If the water is coming from the roots, it must travel uphill to get to the treetop: How could it possibly do that? What do you think will happen when I place these celery stalks in this water? Record students' ideas on a butcher paper chart. Set the cups aside for a few hours.

Action

1. Show students the collection of paper and ask what paper is made from. Ask about students' experiences when they dropped water on the newspaper squares earlier. **What happened to the water you dropped on the newspaper? Did it bead up? What happens to water on paper towels? What are newspapers and paper towels made from?**



2. Show students the cups of colored water, the straw or chopstick, the clothespins, and how to set up the equipment and dangle a strip of paper in the cups (see illustration).

3. Tell students that they are going to find out if water will travel uphill on paper. Invite them to select three different kinds of paper to test. The object is to find the paper that gets the water to the top in the shortest amount of time.

4. Before the groups make their choices, suggest they spend some time feeling the various papers and looking at them through the hand lens. After choosing their papers, they should predict which the water will travel up fastest, next fastest,

and last. Have them report their observations on the Upward Bound Lab Sheet.

5. Post on the chalkboard the dimensions of the strips students should measure and cut. Tell them to draw a finish line 5 cm (2 in) from the top of each strip. Have each team appoint one person the Timer and another the Dipper; the Dipper will put the strips in the water when the Timer says "Go." Teams record their results on the Lab Sheets.

6. When all the groups have finished racing the water, ask them to report their fastest and slowest times and papers. Chart the results.

7. Check for any observable changes in the celery stalks. If the food dye has not reached the leaves yet, take one stalk and carefully pull the fibers apart so that students can examine the water moving up the plant. When the food coloring reaches the leaves, encourage teams carefully to pull the fibers apart from the remaining stalks and examine the fibers with a hand lens.

Assessment

Discuss the results of the race and have students infer how water might get to the top of a tree.

Which paper transported water the fastest? How does it feel? How does it look under the hand lens? Is it loosely or tightly held together? Which paper transported water the slowest? What does it feel and look like? Do you know of other materials that allow water to travel uphill? (glass tubes, soil, cotton and other natural fibers, sponges, and so on.) **How does what you have discovered about water's stickiness help explain how water moves up a tree? When a tree takes up and releases water, where is the water traveling from? Where is it being released? Do you think plants play a part in the water cycle?**

Digging Deeper

- Look at the pattern of xylem tissue in common vegetables, such as celery, carrots, and onions or leeks. Place the stalks of various vegetables in colored water for a couple of hours. Dry the pieces and use a razor blade to slice off thin sections so that students can observe them with a hand lens or microscope.

- Have students read about the effect the Amazon rain forest has on climate and how trees raise water to their crowns in *Life Lab Beat*, pp. 79–80.

Teacher Reflections

- Did students relate their demonstrations to how water flows upward in plants?

- Were students able to infer how cohesion and adhesion might apply to the natural world?

- Were students intrigued by the properties of water?

In Nature

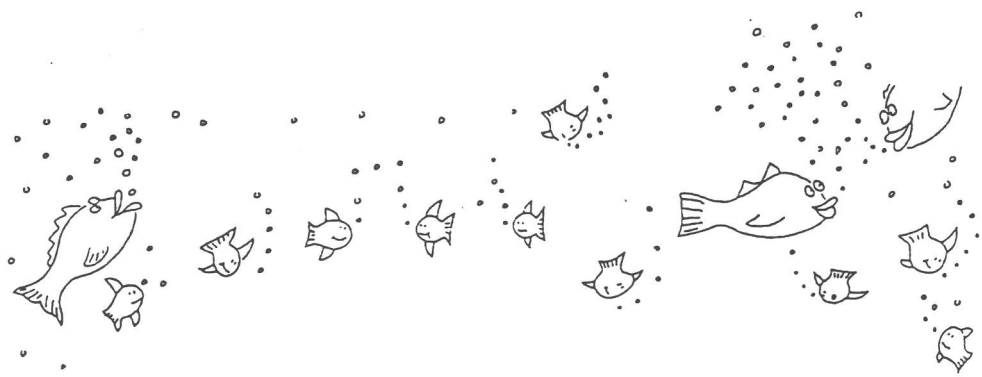
Visit your nature study area during or soon after a rain shower. Follow the water's path. Compare the soil, terrain, and vegetation where the water soaks into the soil and where it runs off. Explore low–lying places where water collects. What animals are making use of the standing water? Compare how long a leafy, deciduous tree drips to the drip time of a pine or other conifer. If your area has ponds, streams, marshes, or other wetlands, trace the source of their water. Try to obtain a light microscope so that students can observe the microscopic life in a drop of pond water.

Endangered Species

Water: Precious as Gold

Drip. Drop. Drip. Drop. Water is like the blood of the ecosystem. It interacts by moving under and around and through most elements of each habitat. People and animals greatly affect natural water systems through overpopulation (humans and livestock), pollution (manufacturing waste, pesticides, livestock excrement), water diversion (human dams, canals, beaver dams), and overuse (overgrazing, improper farming, overdevelopment).

To create a greater water supply for human use, water is often diverted from its natural course. Every diversion affects plant, animal, and human habitats. Dams flood stream valleys, destroying fertile land and migration corridors. Draining of wetlands for agriculture, housing developments, and other uses affects hundreds of species (seventy–five percent of birds in the U.S. depend on wetlands for breeding, nesting, and feeding). If water diversion isn't handled with great care, wildlife can be threatened.



Activities

• Read "Spotlight on Endangered Species" in *Life Lab Beat, pp. 81–82,* about Jackson Elementary School adopting Pigeon Creek and cleaning it up. Discuss adopting a stream, cleaning it up, and planting native plants along its banks.

• Obtain a U.S. Geological Survey topographic map of your area from a sporting goods store, park, or county or municipal office. Trace your local water source to the tiny streams and runoff that feed it. **What dams, canals, and other water diversions have been built to increase your water supply? If your community uses groundwater, how far down is it? What are the threats to its purity?**

• Take a field trip to your local water works. Arrange to see how water quality is tested.

• Ask students to write stories about what it would be like to be a polluted rain drop. **How many living things do you touch? Who do you affect? What happens to your pollution?**

Endangered Species Project

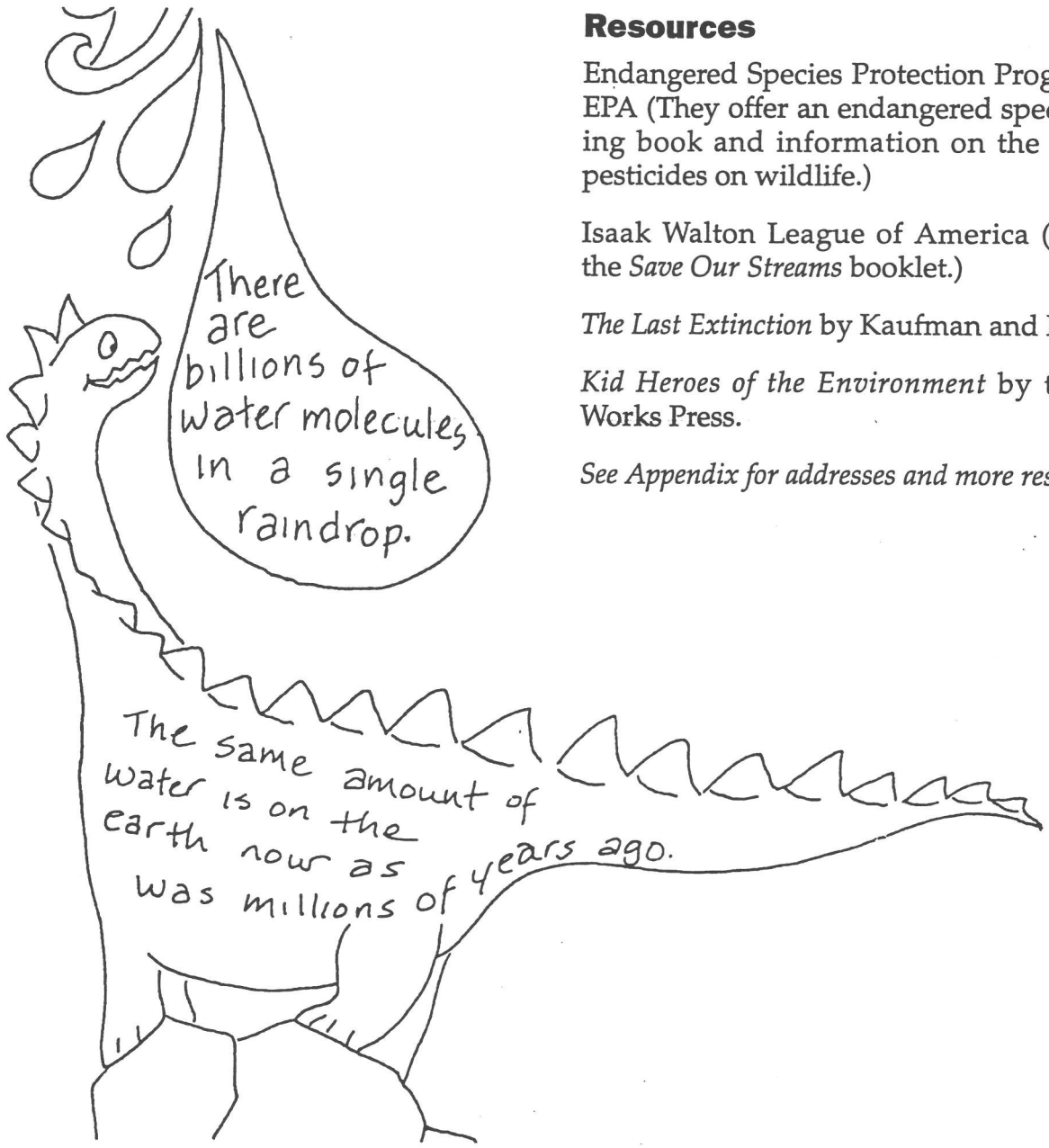
Now that you have selected your endangered species, continued research, writing, and discussion will help your class understand the challenges that your species and other species face.

Remind your students that the species they've chosen is just one of hundreds that are endangered. However, by helping to save one species, other species will benefit as well.

• **Mural project, scrapbook, and fact sheet** As in the previous activity, trace your endangered species' water sources. **Do you think it has changed in the last 10 or 20 years? How?** Add new information to your mural, scrapbook, and fact sheet.

• **Activity chart** Begin an activity chart that you will put up near your mural and use throughout the year. Row headings might be your species' different survival challenges, such as pollution, habitat depletion, lack of food, water diversion, and so on. The column headings might identify the people who can take action (your class, fellow students, teachers, family, community). Under each action group, for each problem, write what the person or group can do to help.

• Demonstrate how pollution moves through water. Put a few drops of food coloring in a jar of water and watch it disperse. Ask students to imagine the food coloring as a pollutant in your endangered species' water source. Repeat the demonstration outside in a natural body of water, using popcorn, leaves, or twigs. Have students toss the objects into the water and observe the pollutants' movement.



Resources

Endangered Species Protection Program, U.S. EPA (They offer an endangered species coloring book and information on the effects of pesticides on wildlife.)

Isaak Walton League of America (They sell the *Save Our Streams* booklet.)

The Last Extinction by Kaufman and Mallory.

Kid Heroes of the Environment by the Earth Works Press.

See Appendix for addresses and more resources.

Assessment Checklist

Water Interactions

Use the following scale (or one of your own) in order to monitor your student's understanding and skill development as you teach this unit. Space is provided for you to record your own outcomes and/or anecdotal information.

1	2	3	4	5
Does not understand the concept or cannot use the skill.		Has partial understanding of the concept or partial ability to use the skill.		Has solid grasp of the concept or skill.

Expected Outcomes

A. Student relates investigations to natural phenomena in the world at large. (process skill)
All activities

B. Student demonstrates verbal and written understanding of the causes of the phase changes of water. (content)
Water Puzzle, Small Worlds, Invisible Water, Water–Go–Round

C. Student constructs independent description of how water cycles through a habitat. (content)
Water Hunt, Small Worlds, Leaf Water, Upward Bound, Water–Go–Round

D. Student communicates importance of water conservation and maintaining water quality. (content)
Endangered Species Project

E. Student participates in group work and encourages other team members to participate. (cooperative learning)
All activities

Add other outcomes you would like to monitor throughout the unit:

F. _____

_____

Activities: _____

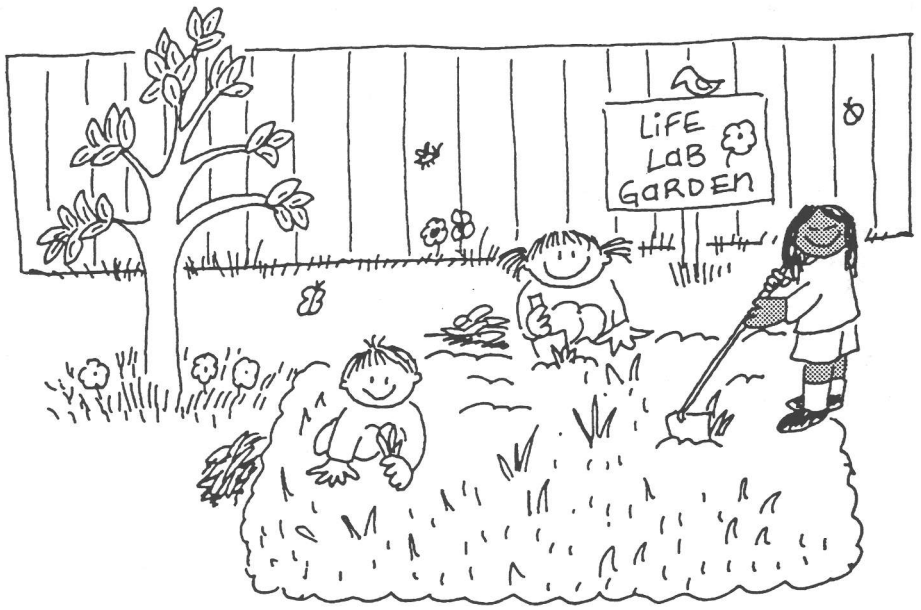
_____

Water Interactions

Student Name	Outcomes						Notes
	A	B	C	D	E	F	

Student Lab Book Section

Lab Sheets
Field Log
Life Lab Beat



Month _____ Name _____

Monday	Tuesday	Wednesday	Thursday	Friday

Upward Bound

Name(s):_____ Date: _____

After all of the tricks that you have seen water perform, would you be surprised to learn that water can travel uphill? Think about how a tree uses water. It takes in water through its roots from the soil. Where does it go from there?

Super Sleuth

How does water travel uphill?

_____

Water acts differently when dropped on different substances. What happens when you drop water on a piece of newspaper or paper towel?

_____

_____

What is paper made from? _____

_____

Which paper do you think water will travel up the fastest?

_____

Which will be next fastest? _____

Which will be slowest? _____

Why? _____

In the hand lenses below, draw pictures of what the different kinds of paper look like.

Evidence

Which paper won the race?

_____

Why do you think this happened? _____

_____

What did you observe about the celery stalk at the beginning of this lesson?

_____

_____

Solution

How is the way the water traveled in the celery similar to the way it traveled in the paper?

_____

_____

Based on your observations, which direction does water travel in a tree?

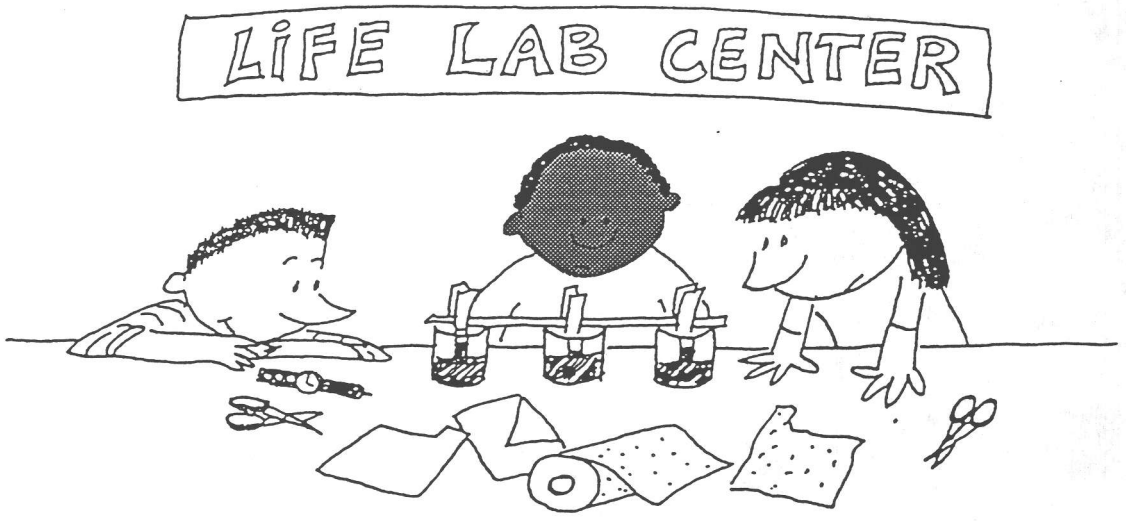
_____

_____

How do you think this is possible? _____

_____

_____



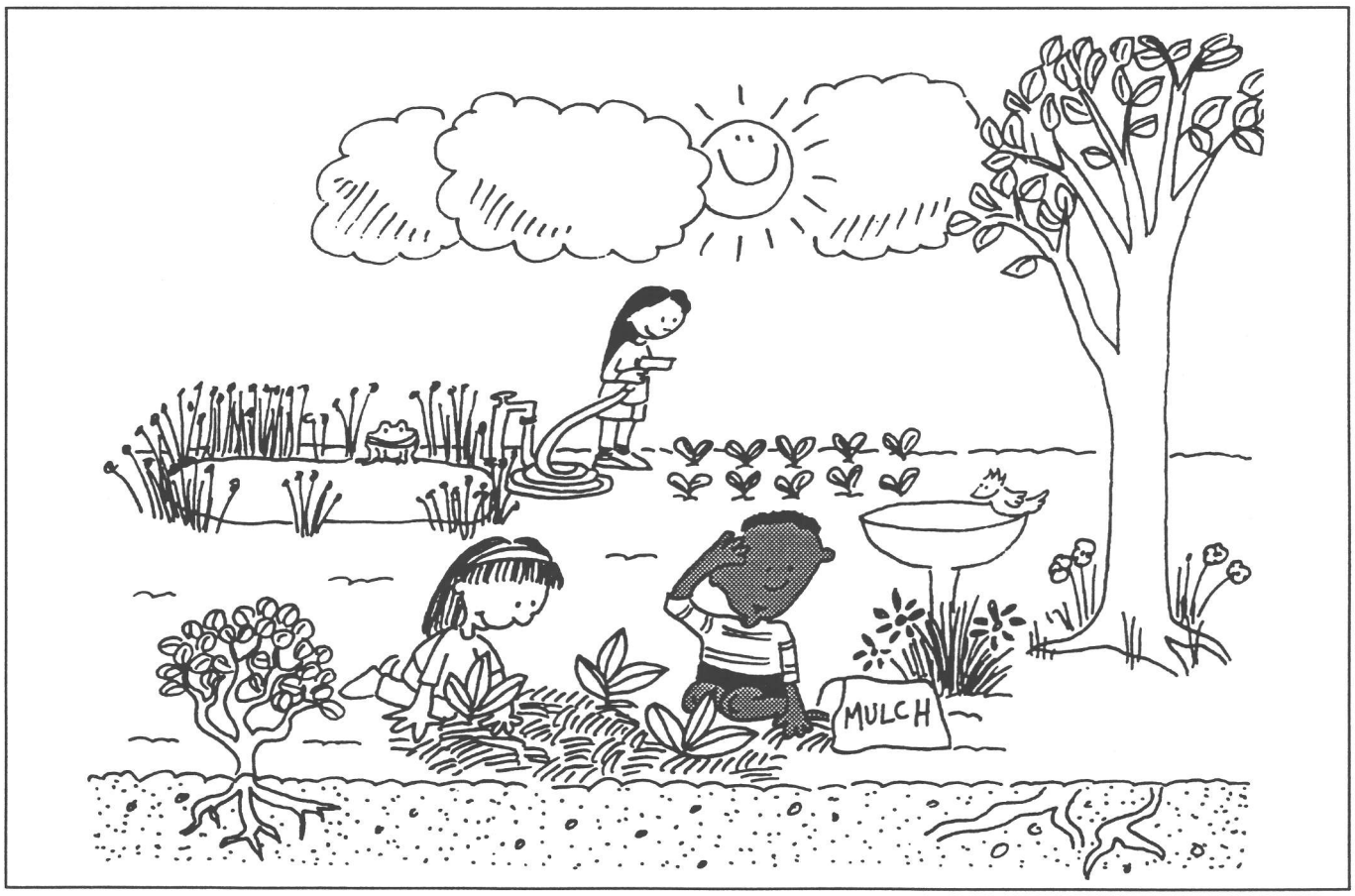
Water Go Round

Making the Connections

Name: _____ Date: _____

For this game, you get your own personal raindrop. Draw a picture of it here.

Put your raindrop anywhere in the picture below and take it on a journey. Now that you know so much about the mysterious properties of water, think about some of the things your raindrop might do. Draw a line through the picture to show where it goes.



TAKE ACTION
How much water do you use?

WATER WISE

Toilet flushing*
13 –27 liters (3.5 –7 gallons)

Bath
95 –114 liters (25–30 gallons)

1 ten minute shower
190 – 266 liters (50–70 gallons)

1 washing machine load
95 –152 liters (25–40 gallons)

1 dishwasher load
36 –46 liters (9.5 –12 gallons)

Washing car with hose
570 liters (150 gallons)

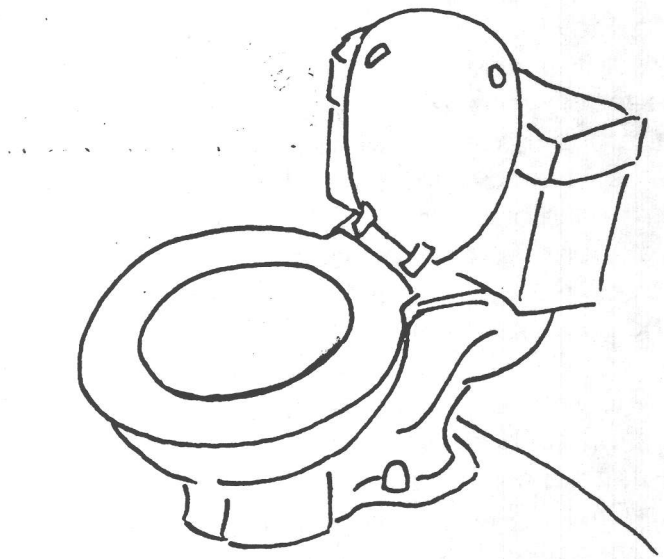
Try to figure out how much water you use in your house per day or in a week.

**In most homes, one third of the household water is flushed down the toilet!*

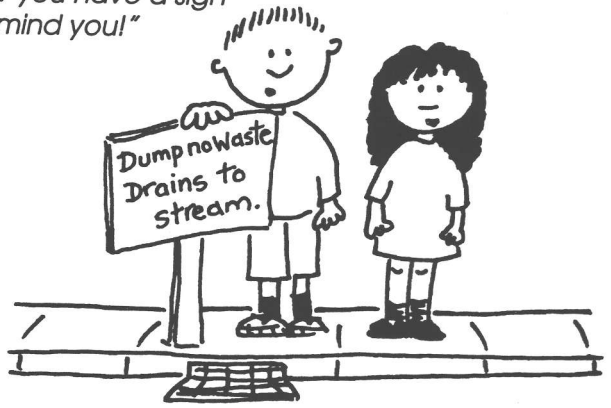
Take the Toilet Test

A dripping faucet is an obvious water waster. But what about a leaky toilet? The water leaks from the back of the toilet into the toilet bowl and disappears with every flush. A leaky toilet can waste more than 76,000 liters (20,000 gallons) of water a year. (That's enough to fill a small swimming pool). One expert estimated that about one in every five toilets in the U.S. is leaking at this very moment. Here's how to find out if your toilet is leaking.

First, ask your parents' permission to do the following toilet test. Remove the top of the toilet tank. Add a few drops of food coloring to the tank and put a "please don't use" sign on the toilet. After 20 minutes, look for colored water in the toilet bowl. Colored water in the toilet bowl means that your toilet is leaking! Your local hardware store should have a low-cost kit for repairing toilets. The repair may be simple enough for you and your parents to do yourselves.



"I never used to think about the soap suds running into the stream when I washed my parent's car."
"Now you have a sign to remind you!"

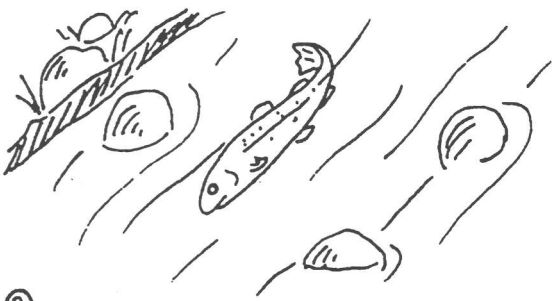


Armed with signs and leaflets, Mr. King's fifth graders spread the word around town about the adopt-a-stream program. Wherever they found a drain in a street they posted a special sign: "Dump No Waste — Drains to Stream."

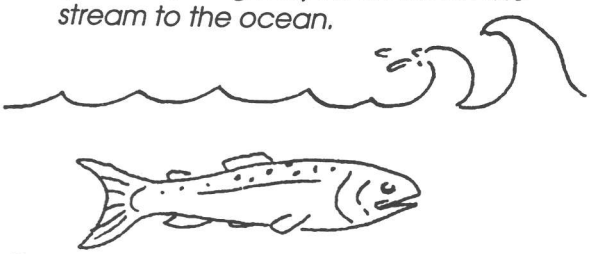
Now that Mr. King's fifth graders had done the dirty work, they got started on the really exciting part of the project: raising the salmon. In the middle of the main hall in their school stood a giant glass fish tank filled with tiny salmon eggs. In the first month, they watched the eggs hatch into baby salmon, called salmon fry. They took turns feeding the salmon fry and making sure that the fish tank was clean. Finally it was time to release the salmon. They took the salmon in buckets down to the stream. Each student put one salmon fry into the now clear water of Pigeon Creek and watched it swim away.

Two years later, after they released the salmon, all the hard work of Mr. King's students paid off. The salmon returned to Pigeon Creek in 1987 for the first time in twenty years! Every year since then, Mr. King's students have continued to raise salmon and to protect the stream with the help of a neighborhood group. Now the Pigeon Creek project has inspired other schools and neighborhoods to adopt streams in their areas.

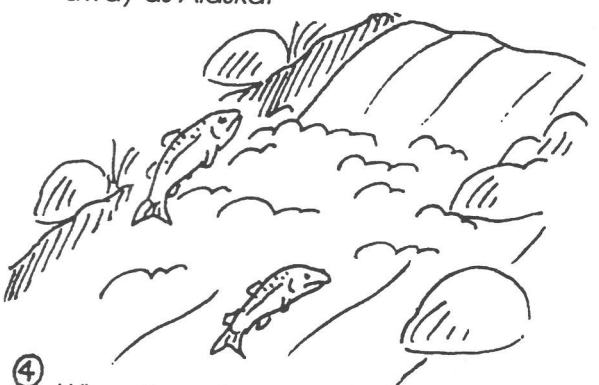
① *Salmon fry live and grow in the stream for several months to a year.*



② *When they are about 12 centimeters (5 inches) long they head down the stream to the ocean.*



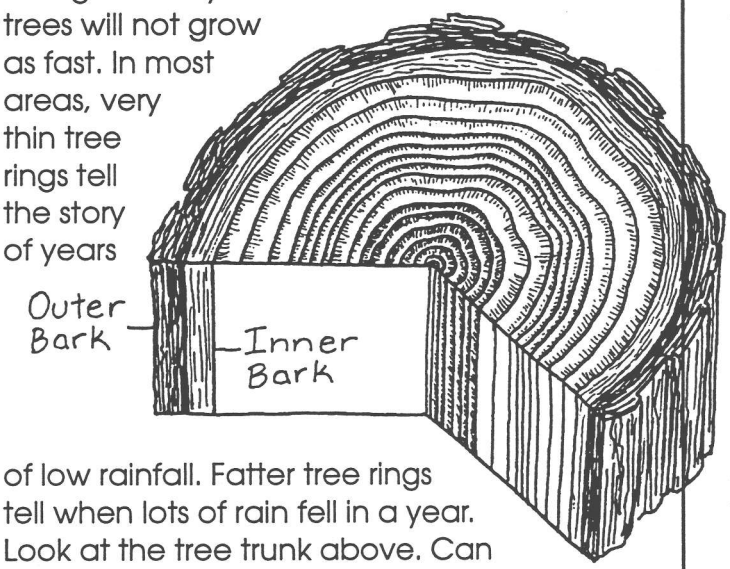
③ *In the ocean they swim and feed and grow. They may swim as far away as Alaska.*



④ *When the salmon are full grown, they return to their own stream. They recognize their stream by smell. They swim up stream against the current, often jumping through fast rapids and small waterfalls.*

Look at the two shades of wood in a tree ring. Each year one tree ring is formed with both a wide, pale-colored section and a thin, dark section. Normally, a tree grows very fast in the springtime and the light-colored layer forms. When summer comes, growth slows, and the darker section forms. To find out the age of this tree, count only the dark rings from the outside to the center of the trunk.

In times when there is little water, such as droughts or dry seasons, trees will not grow as fast. In most areas, very thin tree rings tell the story of years



of low rainfall. Fatter tree rings tell when lots of rain fell in a year. Look at the tree trunk above. Can you tell which rings represent high rainfall and which represent low? Next time you see a freshly cut tree stump or a cut log, check out it's rings!

SPOTLIGHT ON ENDANGERED SPECIES

Jammin' Salmon

How about helping out a species *before* it becomes endangered? That's what kids at Jackson Elementary School in Everett, Washington, have been doing for almost ten years now. Here's the story of how they helped bring salmon back into a stream in their neighborhood.

It started in 1985 when Jackson Elementary School adopted a stream called Pigeon

"I can't believe that any fish ever lived in this junk-filled stream."

Creek that ran right past the school. At that time Pigeon Creek was a mess! The creek's muddy water was littered with bottles, cans, tires, and other garbage, including an old bedspring and a rusty refrigerator.

A fifth grade teacher, Mr. King, told his students how Pigeon Creek had not always been a mess. He had grown up along the creek and remembered when salmon used to fill its clear waters. Over the years he saw changes: the small town of Everett grew into a city. It had more houses and shopping centers and fewer trees and wild areas. When the trees were cleared for buildings, dirt washed down into the stream, turning its water muddy. People dumped garbage into the stream, and other things polluted it, too. With every rain, oil from cars, soap suds from car washing, and fertilizers from lawns washed into the creek through storm drains. Soon the salmon disappeared from Pigeon Creek.

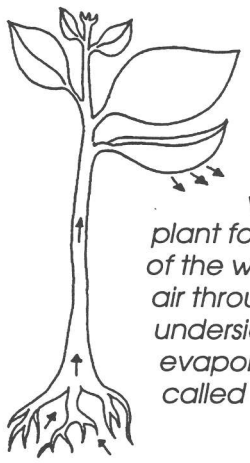
The fifth graders in Mr. King's class wanted to bring Pigeon Creek back to life. More than anything, they wanted to see salmon fill that stream again. So they formed a stream clean-up team. With help from some parents and neighbors, they hauled truckloads of junk—from candy bar wrappers to old chairs—out of the stream. But guess what?! Some people kept on dumping garbage in the stream! One day, students found a new pile of 600 tires. It was time to hit the street with an education campaign.

Life Lab Beat

FOCUS ON WATER INTERACTIONS

PLANT FOUNTAINS AND RAINFOREST SPONGES

How are plants like fountains? How are rainforests like sponges? What do these fountains and sponges have to do with the water cycle? Read on to find the answers to these moist mysteries.



Plumbing for Plant Fountains

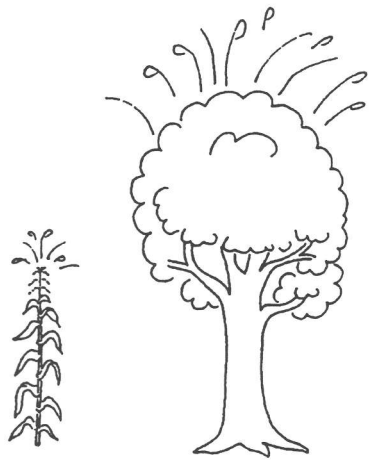
Water travels from the roots up through stems to the leaves. Some of the water is used to make plant food. On warm days, most of the water evaporates into the air through special holes on the underside of the leaves. This evaporation from leaves is called transpiration.

Maybe you've already caught transpiration in action. What happened when you put the plastic bag over a leaf in the lesson "Leaf Water?" Where did the water in the bag come from? Where will it go?

Think of how you sweat on a hot day. Then imagine a plant's leaves "sweating." Think of a plant as a fountain and imagine a fine mist coming off the underside of plant's leaves.

How Plant Plumbing Works

Imagine the tallest tree you've ever seen. Now think about how the water gets from the roots deep in the soil to the most tip-top leaf? How is all that water transported into the air? Do plants have pumps or elevators that carry water up? Guess again!



One corn plant may transpire 3.8 liters (one gallon) of water a day.

Large trees may transpire 190 -1140 liters (50-300 gallons) of water a day. In one year, a large tree can release as much as 152,000 liters (40,000 gallons) of water — enough to fill a huge swimming pool!

The secret is transpiration. When water transpires out the tiny holes in a plant's leaf, there is an empty space in the leaf. More water moves into the empty space. Imagine the water inside a plant as a long thin water rope that stretches from roots to leaves. Remember how water loves to stick together? When water moves to fill the

The Life Lab Scope and Sequence—A Full Program of Life, Earth, and Physical Sciences

The **Life Lab Science** Scope and Sequence demonstrates that Life, Earth, and Physical science concepts are integrated in a systems approach to science. As the garden grows and changes throughout the seasons, it provides a natural laboratory for studying how the science disciplines are interrelated. You will also discover numerous opportunities for integratng science with math, language arts, and social studies.

Life Lab Science	Grade 4	Connections			Scope and Sequence
	Theme/Interactions	**Life Science**	**Earth Science**	**Physical Science**	**Process Skills**
Overview	Interactions. A system is a web of interactions. An ecosystem is a web of interactions between the living and non living parts of a habitat or an environment. A garden is a managed ecosystem.	Living things depend on non living things and on other living things in their habitats to meet their survival needs. The garden ecosystem is a web of dependent and interdependent interactions.	The resources of the Earth provide the materials needed for the survival of living things. The sun is the primary source of energy for all living things. Water, minerals, and nutrients are resources that cycle through ecosystems.	In each interaction in a system, there is an exchange of materials and/or energy. Inputs to and outputs from a system can be observed and measured. Light energy is the original source of food energy for all living things.	Relating Organizing Measuring Communicating
Interactions	An interaction is a give and take relationship between two things. Interactions can be one-way or two-way	All living things interact with each other and with their environment to obtain the resources they need to survive. We interact with each other through communication and other actions. We use our senses to receive communications.	Soil, water, air and light are resources that most living things depend on for survival.	Matter has properties that can be observed. The physical organization of matter can be changed by interactions with living and nonliving agents and forces.	Observe objects in relationship to each other. Organize objects/events in naturally occurring order. Communicate by sharing ideas and listening to others' ideas.

Life Lab Science	Grade 4	Connections			Scope and Sequence
	Theme/Interactions	**Life Science**	**Earth Science**	**Physical Science**	**Process Skills**
Habitats	Plants and animals in a habitat interact with each other and respond to the conditions of their habitat.	Plants and animals need energy, air, water, and shelter to survive. Living things use their habitats' resources in different ways and amounts.	Soil is a habitat. The organisms that live in soil and the nutrient cycles that occur in soil can change the habitat.	The amount of light, moisture, and heat helps to determine what lives in a habitat.	Apply classification skills to organize information. Practice using measurement skills.
Water Interactions	Water allows things to flow between nonliving and living parts of the garden as it cycles through habitats.	All living things need water. Water moves through all living things, carrying nutrients and/or wastes. Plants transpire water into the air.	Water on Earth travels in cycles from below the surface to the surface to the atmosphere and back. The Earth is the "water planet": Water is present in oceans, rivers, glaciers, soil, clouds, and in all living things.	Water's chemical structure determines its unique properties. Water can exist as a solid, liquid, and gas at the temperatures that support life.	Describe the interactions in the water cycle. Use measurement tools to gather information and solve a problem.
Nutrient Interactions	Living things are dependent upon nutrients. Living things obtain nutrients from the soil through direct interactions and through chains of interactions.	Living things need nutrients to grow and survive. Plants take up nutrients as part of the nutrient cycle.	Minerals and organic matter are broken down by weathering and decomposition cycles into substances plants can use as nutrients.	Matter is conserved through natural cycles. As organic matter breaks down by decomposition, heat energy is given off.	Collect and organize data over time. Relate decomposition to plant and human nutrition.

Life Lab Science	Grade 4	Connections			Scope and Sequence
	Theme/Interactions	**Life Science**	**Earth Science**	**Physical Science**	**Process Skills**
Light Interactions	Earth is a solar powered planet dependent on the sun for light and heat energy.All living things need food energy.	Plants capture light energy form the sun and convert it to food energy and release oxygen. Animals' eyes respond to reflected or emitted light, enabling them to see.	The sun is a star. It is the source of energy for Earth and for other planets in the solar system. Without the sun's energy, there would be no life as we know it on Earth.	Light transfers energy from the source that emits it to the object that absorbs it. Most surfaces reflect, transmit, and absorb some of the light that hits them.	Manipulate a variable to look for relationships. Practice gathering information with measuring tools. Relate properties of light to investigations into how plants and animals use light.
Food Webs	The animals in a habitat relate to each other through competitive, cooperative, and predation relationships. All of these are interdependent relationships, forming food webs that link organisms.	All animals ultimately depend on plants for their food energy. Some animals eat plants; some eat animals; some eat both; and some are decomposers. Animals that share a common point in the food web may compete with each other for food. Animals at higher levels prey on animals at lower levels.	Decomposition returns nutrients to the soil. It is the key link in nutrient cycling in the soil. Food webs rely on decomposers to recycle nutrients in the soil.	Energy is transferred from the sun to plants, and then animals, through food webs. It takes energy to maintain each level in the food web, therefore only part of the initial energy is passed from one level to another.	Describe the organization of a system and the relationships that make up the system. Use tools and gather data over time.

Life Lab Science	Grade 4	Connections			Scope and Sequence
	Theme/Interactions	**Life Science**	**Earth Science**	**Physical Science**	**Process Skills**
Ecosystems	An ecosystem is a web of interactions. When material or energy inputs change, everything in the web is affected. The living and non living things of the garden, combined, make up the garden ecosystem.	Plants and animals interact in the garden ecosystem. When plants or animals are added to or removed from the garden, other things in the garden will be affected.	In an ecosystem, organisms interact with the physical environment. Water, minerals, and organic matter cycle through ecosystems.	Change in the amount of solar energy that a garden gets affects the garden ecosystem. Energy and matter are transferred among organisms within an ecosystem.	Use tools to gather data over time and organize information into a report. Communicate information to classmates and develop questioning skills.
Sustainable Systems	Humans interact with the garden. Garden plants and animals are affected by human efforts to produce food and flowers. A sustainable system conserves and recycles inputs and maintains the structures and organization of the system.	Plants and animals grow well when the resources they need are easily available in their habitats. Through gardening activities, we change the availability of nutrients, water, sunlight, and other plant needs in the garden.	Garden resources need to be recycled to maintain a healthy ecosystem. More solar energy enters the garden during the summer; so, more food energy can be produced at this time. Nutrients and water cycle through a sustainable system.	Changes in inputs and outputs of a system can be measured. A sustainable system is one in which energy and other losses from the system are reduced and/or returned to the system from renewable resources.	Organize data and observations into projects to create a sustainable garden system.

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