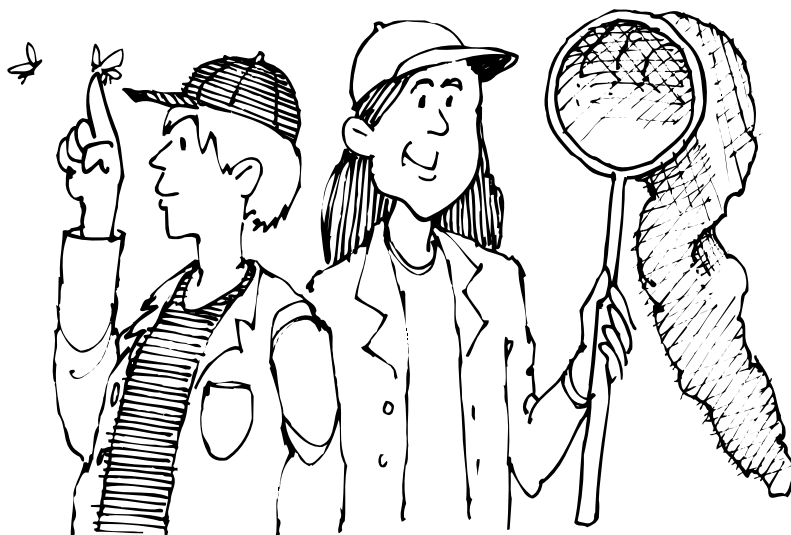


URBAN ECOLOGIST



ACTIVITY BOOK



Urban Ecologist Activity Book

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This book features five hands-on activities designed for 8- to 12-year-olds. Each activity includes one 30- to 45-minute project and extensions. Activities can be used in any order. Also included are objectives and learning outcomes, assessment questions, ideas for a presentation or exhibit and topics for further investigation. Wonderwise learning outcomes are based on national science education standards identified by McREL (Mid-continent Research for Education and Learning), the Nebraska Educational Standards, and the National Science Education Standards developed under the direction of the National Research Council. This book incorporates concepts of inquiry-based learning and the 4-H Youth Development experiential learning model.

Each youth participant should receive a copy of the activities. Copies of this book can be downloaded from the Urban Ecologist CD-ROM.

WONDERWISE **Women in Science Learning Series**

Wonderwise introduces you to women who have made science their career. Each kit is a comprehensive instructional package that includes a video, CD-ROM, and activity book. With these materials, leaders and youth explore the world of women scientists and discover together the fun of learning about science. For more information about Wonderwise, including free samples, Web activities, resources, science education standards and ordering information, visit our Web site:

wonderwise.unl.edu



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Funded by: Howard Hughes Medical Institute and the Informal Science Education Program of the National Science Foundation

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Watch a video about ecologist Carmen Cid and sharpen your observations of the natural world.

Learning outcome: Youth develop an understanding of the work of a scientist, learn to make systematic observations, and develop an understanding of the abilities needed to do scientific inquiry.

COOL TOOL / ACTIVITY TWO 10

Learn how to test whether or not you have a healthy environment.

Learning outcomes: Youth plan and conduct an investigation, learn to estimate, measure and interpret data, and develop an understanding of diversity and ecosystems.

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Predict and test the traveling strategies of seeds.

Learning outcomes: Youth learn to collect, analyze, interpret and display data and develop an understanding that plants have different structures serving different functions in growth, survival, and reproduction.

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Make a waterbug and explore the effects of water pollution.

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Build a watershed and learn about toxic runoff into lakes and streams.

Learning outcomes: Youth develop an understanding of evidence, models and explanation, and of the effects of environmental changes.

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Create a story about a scientist who studies wetlands.

Learning outcomes: Youth draw on what they have learned in the activities to construct their own understanding of what it means to be a scientist.

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Here are some ideas you might like to use for projects or exhibits.

Learning outcomes: Youth develop an understanding of science and technology in society and of resources and environments.

INFORMATION FOR LEADERS

What You Will Need for Each Activity

Listed below are the materials and preparations you will need for each activity. Most of the materials can be purchased locally. The more difficult-to-find items, such as magnifying lenses, can be purchased from Wonderwise. The symbol ☉ indicates that an item can be ordered from the Wonderwise Web site or GPN, the Wonderwise distributor. To purchase supplies, kits, videos, or CD-ROMs contact:

GPN (Great Plains National)
P.O. Box 80669 ■ Lincoln, NE ■ 68501-0669
Phone: 1-800-228-4630 ■ FAX: 1-800-306-2330
e-mail: gpn@unl.edu ■ Web site: gpn.unl.edu

Activity 1 Sound Sense	Activity 2 Cool Tool	Activity 3 Seedy Travelers	Activity 4 Walk On Water Bugs	Activity 5 Drain Game
<p>For the entire group:</p> <ul style="list-style-type: none"> ☉ 18-min. video <i>Carmen Cid, Urban Ecologist</i>; 8-min. video <i>Nebraska Wetlands</i> <p>For each team of 4:</p> <ul style="list-style-type: none"> ■ clock or watch for recording minutes 	<p>For each team of 4:</p> <ul style="list-style-type: none"> ☉ 2 magnifying lenses ■ 2 end markers (bricks or stones) ■ 2 frames (see instructions below) ■ 12-meter transect line (see instructions below) <p>To prepare the frames</p> <p>For each team of 4:</p> <ul style="list-style-type: none"> ■ 2 copies of data collection sheet, p. 15 ■ 8 cardboard strips 3 x 36 cm ■ stapler or tape <p><i>Directions: Make a 30-cm square space using four cardboard strips to frame the sides. When the sides are straight, tape or staple them securely into position. Now make a second frame.</i></p> <p>To prepare the transect line.</p> <ul style="list-style-type: none"> ■ 12-13 meters of string ■ 1 dark-colored felt marker ■ masking tape (1-inch wide) ■ 1 meter measuring stick <p><i>Directions: Using the felt marker and the meter measuring stick, mark 2-meter intervals along the transect line. Attach pieces of tape to each mark and number the pieces 1 to 6.</i></p>	<p>For each team of 4:</p> <ul style="list-style-type: none"> ☉ 2 magnifying lenses ■ 1 package seed mix plus any seeds you find outdoors. Seeds such as maple, dandelion, cattail, or milkweed are great for the fly test in Part 2. ■ 1 palm-sized piece of flannel or fuzzy cloth (a sweat shirt or an old sock) ■ 1 bending straw ■ 1 funnel ■ 1 marking pen ■ 1 paper punch ■ 1 small index card (3 x 5) ■ 30 cm ruler ■ clear tape ■ glue or glue stick ■ scissors ■ 2 sheets of 8 x 11 paper ■ 4 toothpicks ■ 4 sheets of different-colored, 8 x 11 paper <p><i>Make 4 copies each of p. 23 and assemble with tape to make target.</i></p>	<p>For each team of 2:</p> <ul style="list-style-type: none"> ■ tap water ■ 3 cups (short, wide-mouthed, clear plastic cups) ■ 6 small metal paper clips (#1 regular) ■ 1 plastic spoon ■ 1 tablespoon soil (not potting soil) ■ toothpicks ■ a drop of liquid detergent ■ 1 funnel ■ several paper towels ■ two #2 coffee filters ■ about 3 tablespoons each of gravel and sand 	<p>For each team of 2:</p> <ul style="list-style-type: none"> ■ 2 sheets of 8½ x 11 bond paper ■ water-soluble pens in green, yellow, red, brown, and blue ■ tape ■ spray bottle of water ■ pen or thin permanent marker ■ paper towels

SOUND SENSE

ACTIVITY
ONE

Watch the 18-minute video of Carmen Cid at work and use it to test your own skills of observation. Then, investigate whether or not you hear better with your eyes open. Good luck.



Before You Begin

Teams of 3 or 4

Length:

Part 1 - 45 mins.

including 18-min. video

Part 2 - 15 mins.

Part 3 - 30 mins.

What You Need

For the entire group:

© 18-min. video

Carmen Cid, Urban Ecologist; 8-min. video
Nebraska Wetlands

For each team of 4:

- clock or watch for recording minutes

What We Know. Good observation skills are very important to scientists. They look for clues in the environment and notice patterns to understand how the big picture of nature fits together. Meet Carmen Cid and tag along while she uses her observation skills in her job as an urban ecologist. An ecologist observes the ways all living things interact in their environment. As an urban ecologist, Carmen Cid observes the natural world close to her home in the town of Willimantic, Connecticut.

Ecologists study the diversity of living things.

Diversity is the number of different living things in an area. Carmen Cid is interested in finding out what happens to plant diversity in places where nature meets cities and towns. To do this, Carmen says, she needs to use all her powers of observation: "If we try to look for things by using just our eyes, it will be difficult." Along with scientific tools, Carmen Cid looks for clues by listening, smelling, and touching.

Good observation skills like sharp eyes and keen ears are great to have no matter what your interests are.

Part One: Look and Listen

1 Watch the video about Carmen Cid. Observe closely. When the segment about Carmen Cid is finished, stop the video and be ready to answer some questions about what you saw.

2 Carmen Cid makes many observations to see what is going on in the natural world. However, there is a big difference between looking and seeing. You just looked at the video, but how much did you see?

Try to remember some details from the video.

What was Carmen Cid wearing? List the items below

In what seasons was the video made? List them below

How many living things can you remember from Carmen Cid's pond?
List them below.

SOUND SENSE

ACTIVITY
ONE

Think It Over

What is an urban ecologist?

SOUND SENSE

ACTIVITY
ONE

Part Two: Sounds Around

Seeing is one kind of observation. Now try observing with your ears. Your team will track the small sounds that you usually tune out.

- 1 Form a team of three to four people. Pick one person to be the timekeeper. He or she will need a clock or watch to tell when one minute is up.
- 2 Everybody get really, really quiet. Take a few seconds to listen to the small sounds that you usually tune out.
- 3 Predict how many sounds will happen in a minute's time. _____
- 4 When the timekeeper says go, listen for one minute. As you listen, list every sound you hear. For every sound, name what might have made the sound. If you run out of space, write the sounds on the back of this sheet. For example: hum = air conditioner, computer.


SOUND (describe the sound)	SOUND MAKER (what you think made the sound)

- 5 Do you tend to describe the sound or what made the sound?
Take a minute to fill in both sides of the table above.

Part Two: Sounds Around (cont'd)

- 7 Take a team count. How many different sounds did your team hear? _____
- 8 Listen for another minute. Challenge yourself to add five new sounds to your list.

Think It Over



Sometimes simple sense information can tell a scientist a lot. What do you think it might mean if Carmen Cid visited her wetland and heard no sounds at all?

Part Three: Sound Tracks

Sounds are like animal tracks. They provide clues to living things and events when they can't be seen. Staying in your teams, test your wildlife observation skills by listening to the Nebraska Wetlands video two ways. (This video segment is found on the tape after Carmen Cid's video.)

SOUND ONLY

- 1 Be really quiet.
- 2 Play the first Nebraska Wetlands segment on the video.
This segment has a sound track but no picture.
- 3 While the tape plays, list every sound you hear in the table below.
- 4 For every sound, give at least two answers for what you think made the sound. For example: buzz = mosquito, wasp, electronic gadget.

SOUND (describe the sound)	SOUND MAKER (what you think made the sound)

SOUND SENSE

ACTIVITY
ONE

Part Three: Sound Tracks (cont'd)

SIGHT AND SOUND

- 1 Listen to the next segment of the videotape. This version includes the picture with the sound. Make a new list of all the sounds you hear on the table below. For every sound, name what might have made the sound.

SOUND (describe the sound)	SOUND MAKER (what you think made the sound)

Compare the Sound Only table (on p. 7) with the Sight and Sound table on this page. Describe any differences in the lists.

Good work! You have just finished your eyes and ears observations.

SOUND SENSE

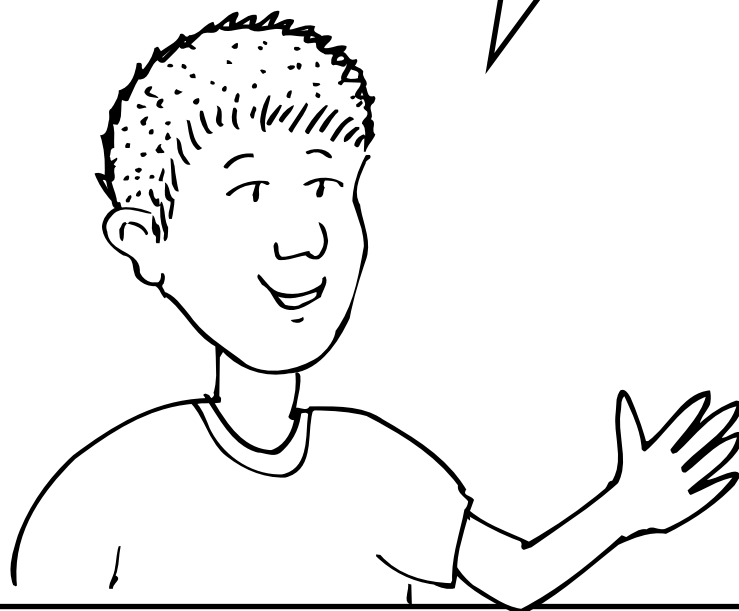
ACTIVITY
ONE

Think It Over

1. How does listening with your eyes and ears make you hear differently?

2. Today you made observations using your sight and hearing. What other senses might scientists use to investigate the environment?

Let's investigate our local biodiversity! First, form a team of four to place a transect line outside and use it to sample your local biodiversity. Then you can judge whether or not you have a healthy environment.



What We Know. When urban ecologist Carmen Cid studies a wetland, she doesn't have time to count every plant and seed.

By taking a sample of life in an area, she can get a pretty good idea of what lives there. Sampling happens all the time. In fact, you have done it. You sample when you take a nibble out of a new food to find out if you like it, or when you flip the channels on TV to decide which show to watch.

Ecologists use many methods of sampling. Carmen Cid relies on a method called a linear transect to survey the plants in her wetland. A

transect is a line placed on the ground to measure the location and number of plants or animals in an area.

Transect lines can be used to measure many things in an environment. Carmen Cid uses a transect line to understand changes in plants growing along the ground between wet and dry places. Transects can also measure the overall biodiversity of an area. Biodiversity is the number of different living things in an environment. This also means the number of different species that are found there. Healthy environments have lots of biodiversity.

Before You Begin

Teams of 4

Length:
Part I - 60 mins.
Part II - 30 mins.

What You Need

For each team of 4

- 2 magnifying lenses
- 2 end markers (bricks or stones)
- 2 frames (see instructions below)
- 12-meter transect line (see instructions below)
- 2 copies of data collection sheet, p. 14

To prepare the frames

For each team of 4

- 8 cardboard strips 3 x 36 cm
- stapler or tape

Directions: Make a 30-cm square space using four cardboard strips to frame the sides. When the sides are straight, tape or staple them securely into position. Now make a second frame.

To prepare the transect line.

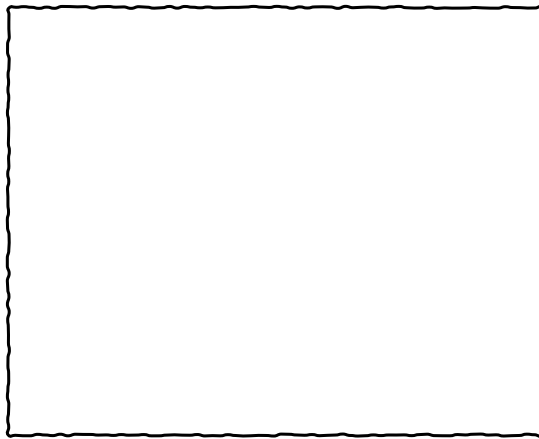
- 12-13 meters of string
- 1 dark-colored felt marker
- masking tape (2-3 cm wide)
- 1 meter measuring stick

Directions: Using the felt marker and the meter measuring stick, mark 2-meter intervals along the transect line. Attach pieces of tape to each mark and number the pieces 1 to 6.

Part One: Measuring Diversity

- 1 Form your team of four. Gather your equipment: 12-meter transect line, 2 magnifying lenses, 2 cardboard frames, and 2 data collection sheets. Find 2 rocks or bricks to anchor your line.
- 2 Before you get to work on your transect, take a minute to discuss some predictions with your team members.
- 3 How many different kinds of living things do you think you might find in one cardboard frame along your transect? *Hint: Consider the evidence for living things such as tracks, traces, scat or signs of partially chewed food.*

Place your estimate in the square below.



Part One: Measuring Diversity (cont'd)

- 4 Discuss how you will decide where to place your transect.
Find out from your leader what area you should use for placing your transect. Find out the out-of-bounds areas (streets, etc.).
- 5 Decide where you are going to lay your transect line. Find a location where you can lay your 12-meter line in one direction—no curves or turns. You will want to place your transect in an area where the environmental conditions change from the beginning to end of your line. For example, your line could go from the sun to shade, from a dry area to a moist one, from a flat site to a hilly one, or from open lawn to trees or bushes.

Choose a starting point that you will always be able to find again. It could be the corner of a building, a large tree, or a fence post. It should be something that will be around six months from now in case you decide to repeat the transect.



Good work!

Part One: Measuring Diversity (cont'd)

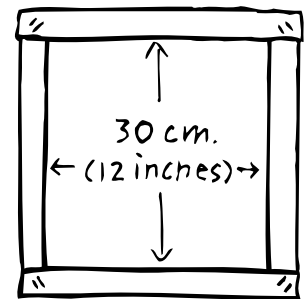
6 Lay out the transect line, securing the string ends with the stone or brick. Make sure that there are 6 tape markers showing along the line. Note your starting location at the top of each data sheet.

7 Now you are ready to collect your data.

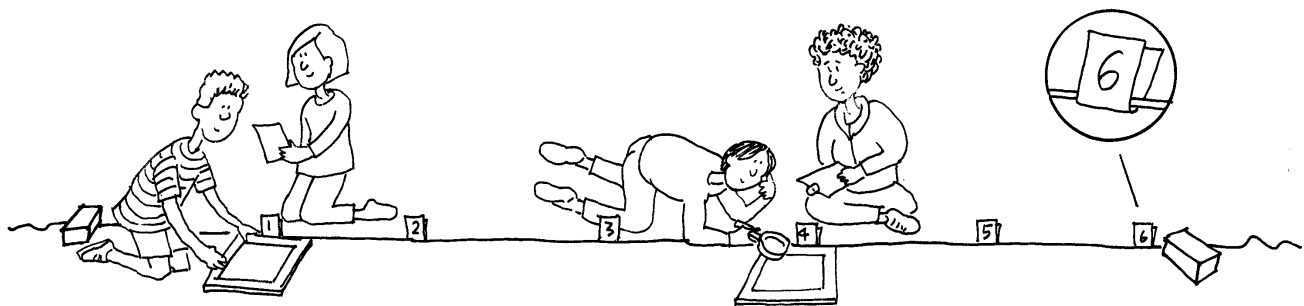
Divide your team into pairs. One pair starts at tape marker 1. The other pair starts at tape marker 4.

Each pair needs a Data Collection Sheet (p.14). Record the number of each tape marker (1 to 3 or 4 to 6) on your Data Collection Sheet.

Place your cardboard frame along one side of the string next to the tape marker.



8 Count the different kinds of living things in the cardboard frame. Name or draw each kind of organism in the box provided on the data sheet. Then write the total for that frame. Do this for each of the three tape markers.



Hurray! You've just recorded the diversity of living things along your transect.

COOL TOOL

ACTIVITY
TWO

Name _____ Date _____

Location of transect start _____

DATA COLLECTION SHEET

TRANSECT MARKER NUMBER: _____

Draw or list the different living things you can find in this plot:

Total # of different living things in this plot: _____

TRANSECT MARKER NUMBER: _____

Draw or list the different living things you can find in this plot:

Total # of different living things in this plot: _____

TRANSECT MARKER NUMBER: _____

Draw or list the different living things you can find in this plot:

Total # of different living things in this plot: _____

Think It Over

A lot of biodiversity can be the sign of a healthy environment. What can you say about the overall health of the environment where you placed your transect?

Part Two: Summarize Your Data

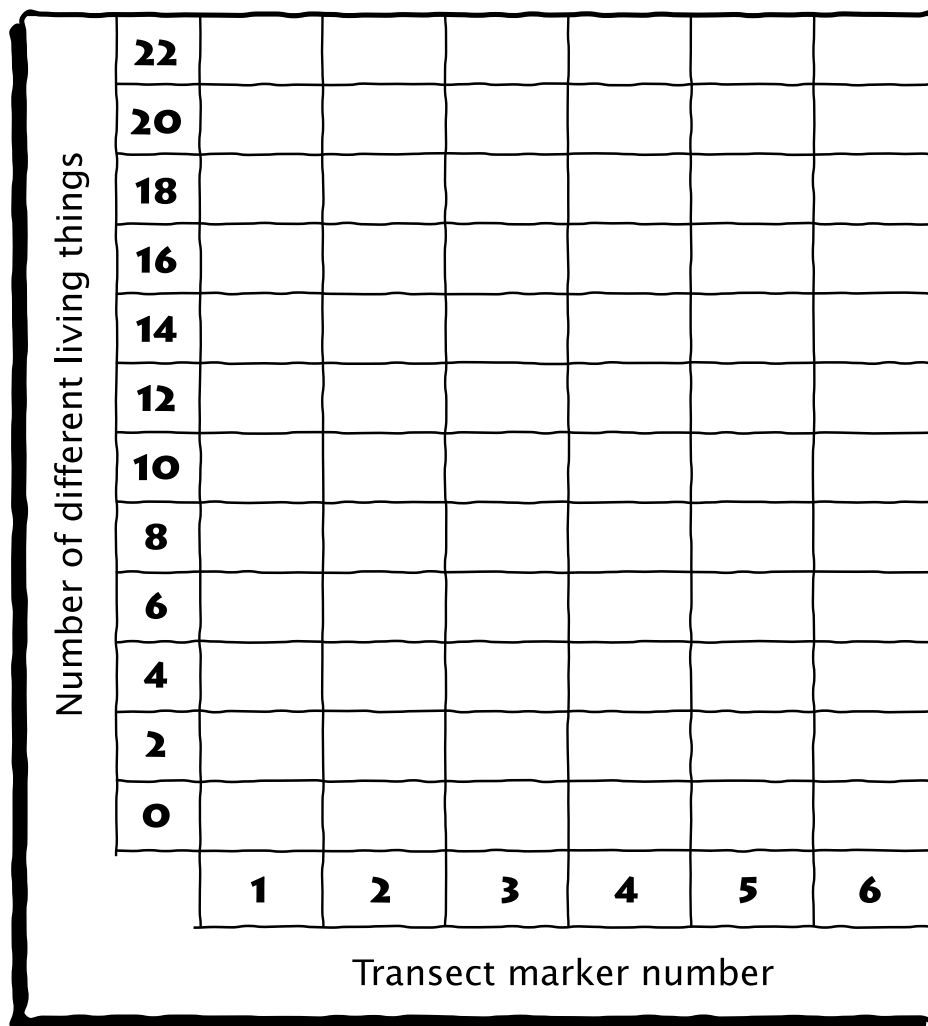
- 1 Fill in the table below to show the entire team's findings for each of the six markers.

SUMMARY OF DATA COLLECTION

Transect marker number	1	2	3	4	5	6
Number of different living things						

- 2 Use the data from the table above to complete the bar graph below.

TRANSECT BIODIVERSITY



Think It Over



1. What can you conclude about the diversity along your team's transect?

2. Imagine that in six months you do the same transect survey. How might the numbers of living things be different?

SEEDY TRAVELERS

ACTIVITY
THREE

Investigate a mix of seeds and use their shapes as clues to how they might move. Your team will build some testing devices to test the seeds' traveling ability and verify your predictions.



What We Know. A seed is a baby plant in a box with its lunch. The box or seed coat protects the baby while it travels. The lunch gets the baby started until the plant grows leaves so it can make its own food.

Seeds need to get away from their parents in order to get a start in life and grow up. They use a number of traveling strategies. Some seeds are round enough to roll away from their parents. Some seeds have hooks to hitch a ride

on passing animals. Others have wings to catch the wind. Seeds sometimes go to amazing lengths to get planted away from their parents. Seed heads of the Canary Island broom plant explode with a pop, flinging seeds far and wide. Coconuts float on the ocean hundreds, sometimes thousands, of miles from the parent plant. Seeds have even been found drifting at the same high altitudes as jet planes. Seeds may look dull and earthbound, but they are made to travel. See for yourself.

Before You Begin

Teams of 4

Length:

Part I - 30 mins.

Part II - 60 mins.

What You Need

For each team of 4:

- 2 magnifying lenses
- 1 package seed mix plus any seeds you find outdoors. Seeds such as maple, dandelion, cattail, or milkweed are great for the fly test in Part 2.
- 1 palm-sized piece of flannel or fuzzy cloth (a sweat shirt or an old sock)
- 1 bending straw
- 1 funnel
- 1 marking pen
- 1 paper punch
- 1 small index card (3 x 5)
- 30 cm ruler
- clear tape
- glue or glue stick
- scissors
- 2 sheets of 8 x 11 paper
- 4 toothpicks
- 4 sheets of different-colored, 8 x 11 paper

Make 4 copies each of p. 22 and assemble with tape to make target.

SEEDY TRAVELERS

ACTIVITY
THREE

Part One: Seed Sort

Nature has designed some wild and crazy seed shapes. Work with your team to sort a sample of seeds.

- 1 Divide into teams of four and gather your equipment.
- 2 Pour your seeds onto a sheet of white paper.
- 3 Use toothpicks to separate the seeds. Take turns using the magnifying glasses to sort through the mix.
- 4 How many different seed shapes can you find? _____

Now you have a chance to use your detective skills. Work with your team to make some predictions.

- 5 Seed shapes tell you something about how seeds travel. Some seeds are built to roll. Some have stickers or hooks to grab a ride. Others are designed to catch the wind.
- 6 Choose several seeds you think will roll well. Tape them to your Seedy Travelers Prediction Sheet below.
- 7 Choose several seeds you think might be hitchhikers. Tape them to your sheet.
- 8 Choose several seeds you predict are good fliers. Tape them to your sheet.

SEEDY TRAVELERS PREDICTION SHEET		
ROLLERS	HITCHHIKERS	FLIERS

Good Work!

SEEDY TRAVELERS

ACTIVITY
THREE

Think It Over

What do seed shapes tell you about how
seeds travel?

SEEDY TRAVELERS

ACTIVITY
THREE

Part Two: Building and Testing the Tools

You will need to make some tools for testing whether your seeds roll, hitchhike or fly. Two of your team members will set up the roll test, while the other pair gathers the ready-made hitchhike test and then makes the fly test tool.

Roll Test Tool

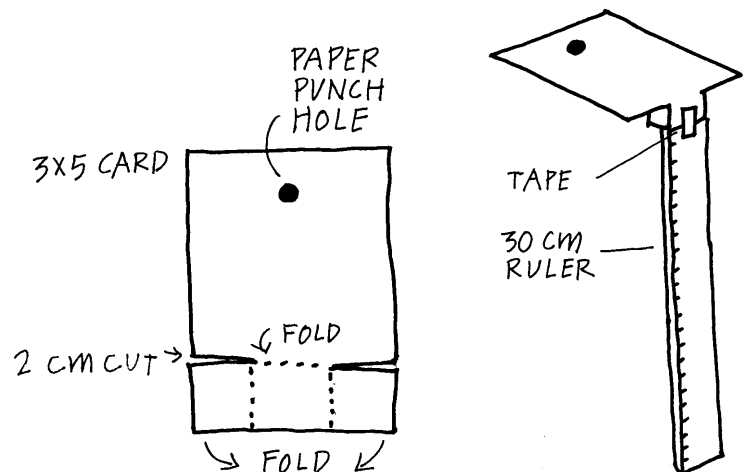
Gather the following materials: ruler, 4 sheets of p.22 to make the target, tape, paper punch, scissors, index card, and marker.

To make the target:

Lay out four target sheets so they make a circle. Tape the sheets together on the **back side**. Find a flat space on the table to lay out the target. Tape edges to the table if necessary to stabilize and flatten your target.

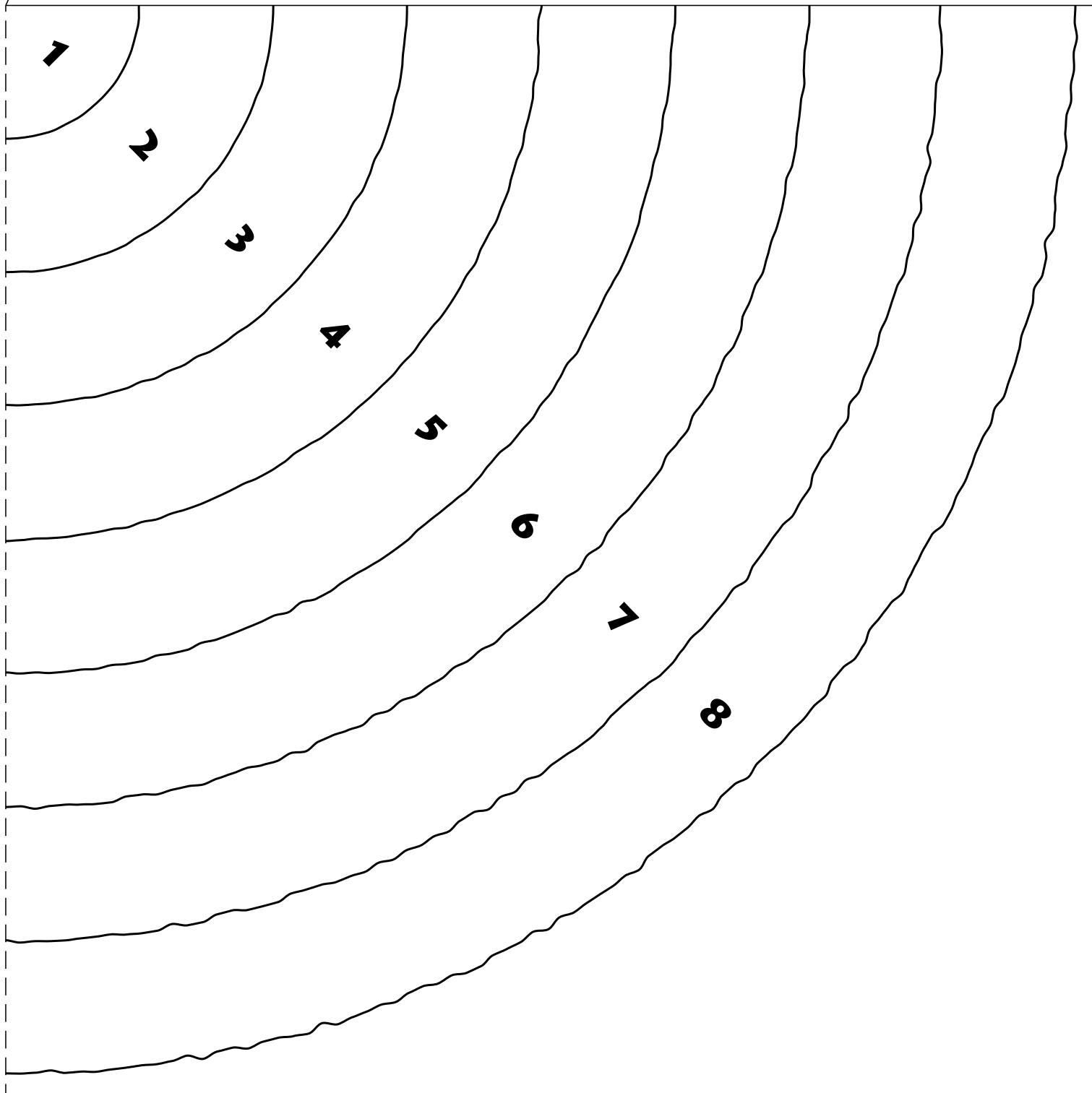
To make the launch pad:

- 1 Cut the index card 2-3 cm from the end, and fold the card along the dotted line.
- 2 Tape the card to the ruler. Fold the flaps under the launch pad to make it steady.
- 3 Punch a hole in the pad with a paper punch.



Now You're Ready to Roll!

Cut along dotted line. Glue tab to underside of next piece / Join 4 pieces total.



SEEDY TRAVELERS

ACTIVITY
THREE

Part Two: Building and Testing the Tools (cont'd)

Get ready to test your predictions. Trade off using the test sites with the other pair of people working at your table. Ready?...Set?...Test!

Roll Testing

Some seeds are designed to rock and roll away from the adult plant. Test which seeds make the best rollers. Good luck!

- 1 Choose three types of seeds you think will roll well and three types that won't.
- 2 Gather four seeds of each type. Tape one of each seed to the chart below.
- 3 Hold the launch pad up on the third zone. The hole should line up with the center circle of the target.
- 4 Slide each seed from a group (one at a time) through the hole so it drops on the center of the target.
- 5 On the chart below record where each seed stops by placing an **X** in that column. Record all of the seeds of each type on the same line of the chart.
- 6 Test each of the other groups of seeds.
- 7 When you are finished testing, circle the seeds on your chart that are the champion rollers. How correct were your predictions?



ROLL TEST CHART

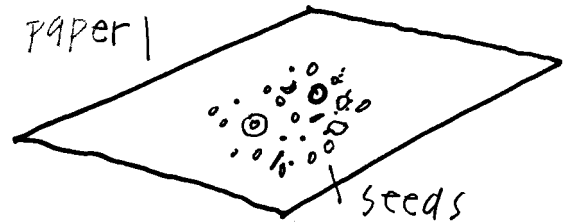
SEED (tape sample down)	PREDICTION (check good rollers)	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	ZONE 7	ZONE 8 or more

Excellent work. Now try a different test.

Part Two: Building and Testing the Tools (cont'd)

Hitchhiker Test Tool

Gather your materials: a blank sheet of paper to put the seeds on and a piece of fuzzy cloth. That's it! You've made your tool.



Hitchhiker Testing

Some seeds are expert hitchhikers. They come equipped with hooks, stickers, and stabbers designed to cling to passing animals. Which of your seeds do you think are hitchhikers?

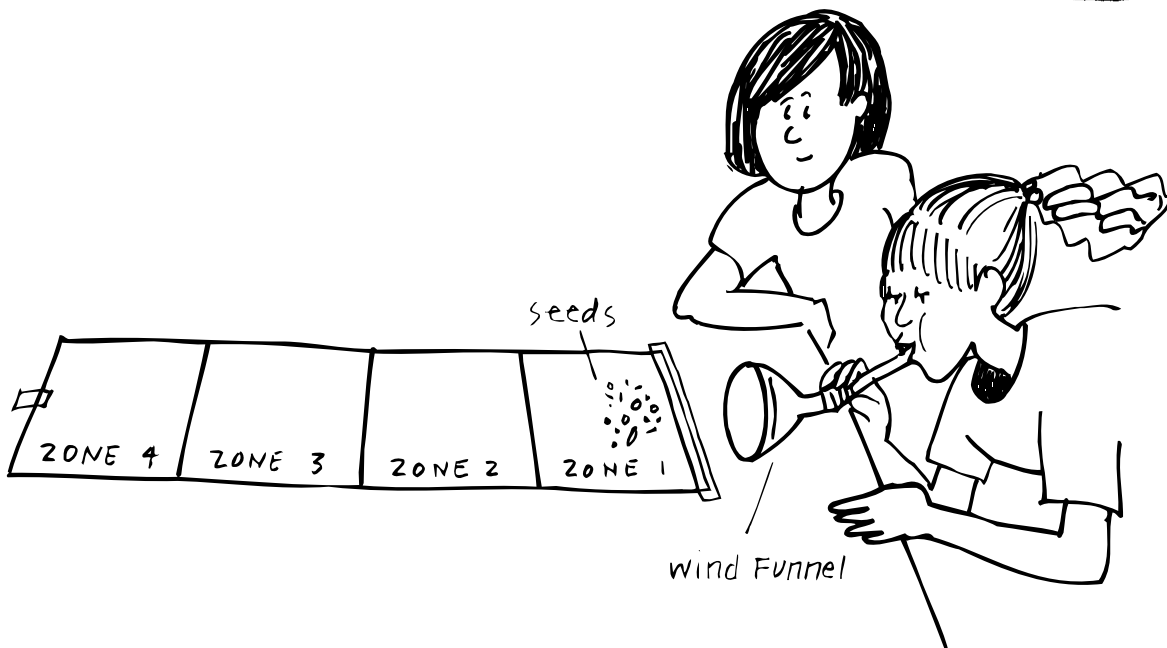
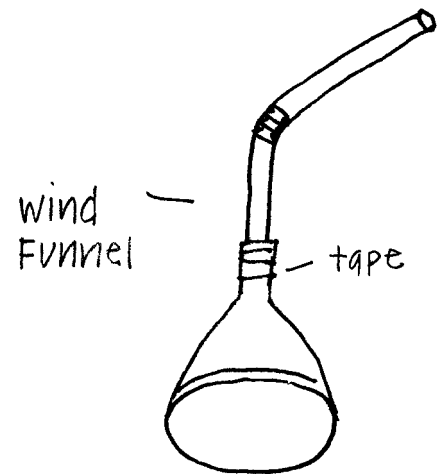
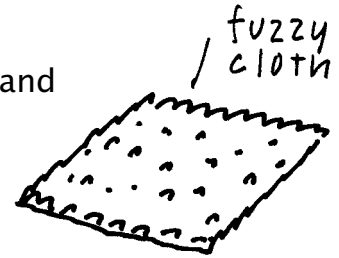
- 1 Choose three types of seeds that you think will hitchhike and three that won't.
- 2 Gather four of each type of seed. Tape one of each type to the chart below. Mark an **X** in the prediction box if you think it will be a good hitchhiker.
- 3 Test one group of three seeds by dragging the fuzzy cloth across the pile of seeds.
- 4 Record the test results by marking an **X** on the chart for each seed in either the "sticks" or "doesn't stick" box.
- 5 Test each of the other groups of seeds.
- 6 Circle the seeds on the chart that are good hitchhikers. How correct were your predictions?

HITCHHIKER TEST CHART			
SEED (tape sample down)	PREDICTION (check good hitchhikers)	TEST RESULTS	
		Sticks	Doesn't stick

Part Two: Building and Testing the Tools (cont'd)

Fly Test Tool

- 1 Gather your materials: tape, 1 straw, funnel, marking pen, and 4 sheets of different-colored paper.
- 2 To make the landing strip, lay each of the 4 colored papers in a row so the long sides touch each other.
- 3 Tape the sheets together on the **back side**.
- 4 Turn the strip over. Label the first sheet zone 1, the second zone 2, and so on.
- 5 Find a flat space on the table and lay out the landing strip. Tape the entire front edge down. Then tape the rest of the landing strip down.
- 6 To make the wind funnel, tape the straw securely to the funnel. Bend the straw for easy blowing.



Nice job! You are ready to test your seeds.

Part Two: Building and Testing the Tools (cont'd)

Fly Testing

Seeds that are good fliers are lightweight and look like wings or parachutes. Which of your seeds do you think are good fliers? Choose one person to be the blower. Then test fly some seeds and record the results.

- 1 Choose three types of seeds that you think will fly and three that won't.
- 2 Gather four of each type of seed. Tape one of each type to the chart below and check the prediction box.
- 3 Make one pile of all the seeds.
- 4 Place the funnel 5 cm from the front edge of the landing strip. Puff a blast of air through the straw so it scatters the seeds down the landing strip.
- 5 Record where each seed landed by marking an **X** in the appropriate column on the chart below. Circle the sample seeds on the chart that are the good fliers.

FLY TEST CHART					
SEED (tape sample down)	PREDICTION (check good fliers)	ZONE 1	ZONE 2	ZONE 3	ZONE 4

Excellent work!

SEEDY TRAVELERS

ACTIVITY
THREE

Think It Over

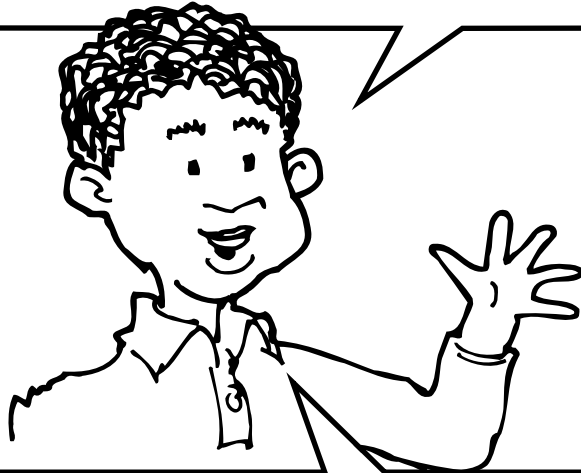


Carmen Cid says that wetlands are packed with plants competing for space. If you were a wetland plant, what characteristics would you want for your seed to help it compete?

WALK ON WATER BUGS

ACTIVITY
FOUR

Work with a partner to build some model water bugs. Use the bugs to find out how small amounts of pollutants can affect water quality. Then create a filter to clean pollution (detergent and sediment) from water.



Before You Begin

Teams of 2

Length:

Part I - 30 mins.

Part II - 30 mins.

What You Need

For each team of 2:

- tap water
- 3 cups (short, wide-mouthed, clear plastic cups)
- 6 small metal paper clips (#1 regular)
- 1 plastic spoon
- 1 tablespoon soil (not potting soil)
- toothpicks
- a drop of liquid detergent
- 1 funnel
- several paper towels
- two #2 coffee filters
- about 3 tablespoons each of gravel and sand

What We Know. We owe our lives to water. Without fresh, clean water to drink we can live for only a few days. You might think we are lucky, then, that 80 percent of the earth's surface is water. There should be plenty to keep us alive. But clean, drinkable water actually is a rare and precious thing. Consider: 97 percent of the water floating around the earth is the salt water of the oceans, leaving only 3 percent fresh, drinkable water. Of this fresh water, 2 percent is frozen in the ice caps. Only 1 percent is available for drinking.

Unfortunately, our fresh water supply is getting even smaller because of pollution. Urban ecologist Carmen Cid says, "People need to remember that what you throw into a stream you will drink later." As the world gets more populated, more and more people are throwing more and more things into our limited supply of fresh water.

Water forms a tight "skin" across its surface. This property is called surface tension. You

can see surface tension when you pour a water glass really full and it bulges up over the rim without spilling over. The surface of clean water is so tight it can support lightweight things like water striders. You may have seen these inch-long bugs zipping across the surface of a fresh pond or stream. Water bugs such as water striders have a design that helps them walk on water. They have a hairy tail and their claws are located on the back of their legs. Their bodies don't break the water's surface.

When water gets polluted with detergents and other chemicals, it loses its surface tension. Even a tiny amount changes water quality, so bugs like water striders are no longer supported. They step right through the surface and drown.

One reason wetlands are so important is that they have the ability to filter and clean many kinds of pollution from water. Scientists are studying wetlands to learn about the ways they can help clean up pollution.

WALK ON WATER BUGS

ACTIVITY
FOUR

Part One: Create a Water Bug

Your team will create a “pond” in a glass of water and then make several “water bugs” to float on the surface of your pond.

1 Before you begin wash your hands. If your hands are oily, the activity won't work. Make sure your cup is clean.

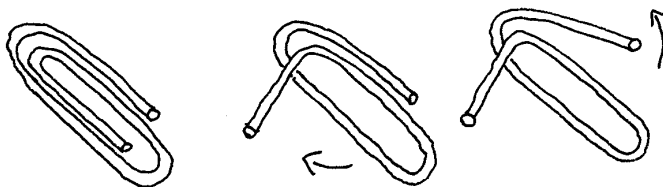
2 To make a pond, fill the cup with tap water to 1 cm below the brim.

3 To make a water bug, follow these steps:

Take the paper clip and locate the inside end.

Bend up the inside tip of the paper clip to a 45 degree angle to make a tail. Make sure you bend only the tip, keeping the rest of the paper clip flat. Bend the tip only slightly.

Open the outside end of the clip slightly (no more than 45 degrees) for a more stable water bug.



4 Float your bug. To do this, hold the bug by the tail, then gently lower the bug onto the pond's surface. Keep it flat and let it go. Take care not to break the water's surface as you place the bug. The surface tension of the water should hold up the bug. It may take a little practice to get your bug to walk on water. If it doesn't work the first time, use the toothpicks to retrieve your bug and try again.

5 Make several bugs. Test them to make sure they all float. Remove the bugs from the pond to use later.



WALK ON WATER BUGS

ACTIVITY
FOUR

Part One: Create a Water Bug (cont'd)

Water bugs thrive in an environment of clean water, but what might happen to the bugs when several kinds of pollution are introduced into the pond? Experiment to find out.

DIRT TEST

1 Uh oh! It's the weekend and campers have arrived at the pond. The campers decide to go for a swim. They waded in and stir up the muddy bottom.

Predict: What will happen to the water and to your bugs when soil is added to the clean pond? Write your prediction: _____

Experiment: Stir half a spoon of soil into your pond. Float your bugs.

Test: Can the bugs still float? _____

Describe: What happened to the water and to the bugs? Remove bugs to a dry paper towel.



DETERGENT TEST

2 The campers have finished dinner and have decided to wash their dishes in the pond.

Predict: What will happen to the water and to your bugs when detergent is added to the clean pond? Write your prediction: _____

Experiment: Float your bugs. Dip the tip of your toothpick into a drop of liquid detergent. Introduce a tiny amount of soap into the pond.

Test: Can the bugs still float? _____

Describe: What happened to the water and to the bugs?

Great job! Save the water for the next section.

WALK ON WATER BUGS

ACTIVITY
FOUR

Think It Over

How do you think dirt in the water might
affect insects and fish in a real pond?

Part Two: Make a Clean Machine

Use different filtering materials to discover if you can remove the pollutants from the water. Consider the water clean if it is clear and the bugs can float.

1 Gather together the following materials: 1 cup of polluted water and your paper clip bugs (from Part one), 2 extra cups, a small funnel, 2 pieces of filter paper, a paper towel, and about 3 tablespoons of gravel or sand.

2 Rinse and dry the water bugs and equipment with clean water so they are free of any pollution.

3 Place the filter paper in the funnel.

4 Predict what will happen to the water after it is filtered. Use the **Find a Filter Test** on p.34 to record your prediction.

5 Pour about half of your polluted water through the funnel with the filter. Be sure you have a clean cup below the funnel to catch the water. Save the rest of your polluted water for later.

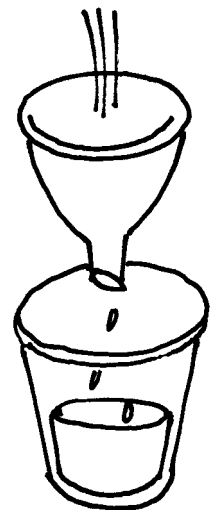
6 Check the results: Hold the filtered water up to the light to check for clarity. Float-test the bugs to find out if the detergent has been removed.

7 Record the results on the **Find a Filter Test**.

8 Rinse and dry the water bugs and equipment with clean water so they are free of any pollution.

9 Use the rest of your polluted water and your other filter to test whether sand and gravel will also clean the water of detergent.

10 Don't forget to record your predictions and your results on the **Find a Filter Test**.



Part Two: Make a Clean Machine (cont'd)

FIND A FILTER TEST		
FILTER MATERIAL	PREDICTION	TEST RESULTS
<div></div>	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Floats <input type="checkbox"/> Doesn't Float	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Floats <input type="checkbox"/> Doesn't Float
<div></div>	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Floats <input type="checkbox"/> Doesn't Float	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Floats <input type="checkbox"/> Doesn't Float

Summarize your findings

Under what conditions did your paper clip water bug float?


Under what conditions did it sink?

How did you get the water bug to float again?

WALK ON WATER BUGS

ACTIVITY
FOUR

Think It Over



An advertising company chooses a wetland to film a car commercial. To get the perfect shot they drive across the creek many times. They wash the car with soap between shots. What might this do to the downstream animals and plants?

DRAIN GAME

ACTIVITY
FIVE

Build a mountain with a partner and make some rain. In the process you will learn why it's important to keep a watershed healthy.



Before You Begin

Teams of 2

Length:
Part I - 30 mins.

What You Need

For each team of 2:

- 2 sheets of 8½ x 11 bond paper
- water-soluble pens in green, yellow, red, brown, and blue
- tape
- spray bottle of water
- pen or thin permanent marker
- paper towels

What We Know. Most people can tell you what town they live in. But hardly anybody can tell you what watershed they live in. In fact, few people can explain what a watershed is. Yet, if a watershed disappeared tomorrow, everyone would notice.

There are many ways to describe a watershed. A watershed is the crucial dividing point or backbone for rivers and streams. All the water flowing down from the mountains into your area is considered your watershed. According to the U.S. Environmental Protection Agency,

watersheds are nature's boundaries. They are the areas that drain into water bodies such as lakes, rivers, estuaries, wetlands, streams, and the surrounding landscape. A watershed can also be described as a geographical area in which water, solids, sediments and dissolved materials flow to a common outlet.

If the watershed changed, you might literally be up a creek. Life can't survive without water, and life doesn't thrive without a healthy watershed. Take some time to meet a watershed up close.

DRAIN GAME

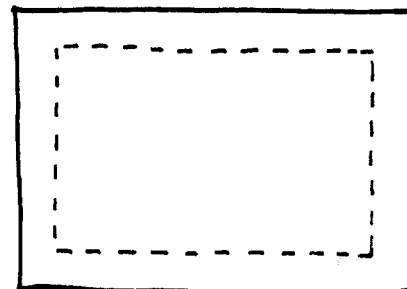
ACTIVITY
FIVE

Part One: Make a Watershed

1 Pick a partner and gather your materials.

2 Draw a 5 centimeter border on one sheet of paper to make the base.

3 Now make mountains. To do this, loosely crumple a second piece of paper so it's about the size of a grapefruit.



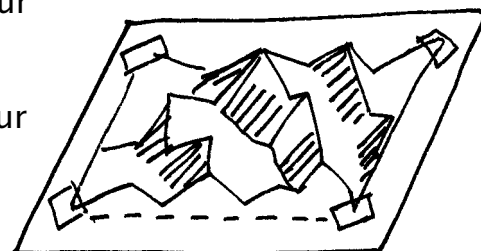
4 Open up the crumpled paper. Tape it down to the flat base sheet with its edges inside the border. Encourage the paper to form peaks and valleys.

5 Good work! You have just moved mountains. Now think about rivers. Starting at the highest peak, predict how water will flow down the slopes.



6 With a blue water-soluble pen draw where you think the river will flow. Count how many rivers you have on your model and write down the number. _____

7 Place your watershed on a paper towel. To test your river predictions, make it rain on the peaks. Spray the model so ink just begins to flow into pools. Describe how the water moves.



8 Step back and admire your work. You have created mountains, rivers, and watersheds. How many watersheds can you count on your model? (Hint: a watershed is the total land area that contributes water to a river or lake.) Write down the number of watersheds. _____

9 With your pen, trace the outline of one watershed on the model. Call it home.

Good work! Save your model.

Part One: Make a Watershed (cont'd)

When you want to clean something, you naturally use water. Water picks up, dissolves, and carries away dirt, chemicals, and debris of all sorts. But what happens to all the dirt, chemicals, and debris that have been washed away? Where exactly is “away”?

- 1 Find the outline of your home watershed on your model.
- 2 A lot of activity is happening in your home watershed. Get your pens handy and read on about the A B C s of runoff.

Agricultural runoff may contain fertilizers and animal manure. When these substances are added to water, they can cause plants and algae to grow like crazy. Under warm conditions, the rapid breakdown of dead algae uses up oxygen in the water, eventually killing fish. Color some areas of your watershed green to represent farms.

Bulldozers loosen soil, which runs into streams. Muddy water prevents light from reaching plants and algae. With less light, the plants and algae produce less oxygen. This lack of oxygen can choke and kill fish. Pick a site in your watershed for some new houses. Color that area yellow.

Companies in the United States legally dump more than 500 million pounds of toxic chemicals into our water systems every year. That’s not counting the illegal dumping. Draw a red factory on one of your rivers.


Debris from streets and highways, animal waste, lawn fertilizers, garden pesticides, and detergents are a few of the things that run off in urban and suburban areas. Choose brown to indicate an area with a town.

- 3 What do you predict will happen in your watershed when it rains?
- 4 Make it rain on your watershed. Observe what happens. Describe what you see.

DRAIN GAME

ACTIVITY
FIVE

Think It Over



Make a list of the kinds of things you washed
down the drain at home yesterday
(it might help to think back on what
you did yesterday).

PULLING IT ALL TOGETHER

**Create a story about
a scientist who
studies wetlands.**



NEW WONDERS

Here are some ideas you might like to explore for projects or exhibits.



1. Practice observing with your ears. Find something at home that makes an interesting or surprising sound. Hide it in a paper bag, and share it with your group. Have each person present a sound to the group from behind a screen. As you listen to a sound, number the sound on a piece of paper and write your guess next to the number. Later in the day, have each person play the sounds in the same order as before. Display the sound maker and check it against your guess. Be prepared to be surprised.

2. Repeat the transect in Activity two (Cool Tool) but at a different time of the year. Be sure to place the transect in exactly the same location. Compare your findings.

3. Discover your school's dirty secret. Find out where the water ends up after it washes down the school drain. Water goes into the sewer pipes, but where do the pipes go? Make a map of the route the water travels to reach its destination. You may need to call an expert from your Municipal Water Department to help answer your questions. Better yet, invite her to a youth meeting.

4. Investigate the following question: How do wetlands clean polluted water?

5. Become familiar with your community's watershed and predict what pollutants might be in it. Follow these steps: Find a map of your area and locate your community. Find the closest creek or river and trace the waterway upstream to determine the watershed your local creek is part of. Now predict what kinds of pollutants might exist in your watershed. Base your predictions on the map information and on what you know about your area. For example, are there farms? New buildings? Industries?