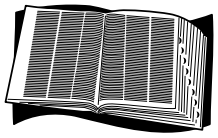
Things to Know Before You Go!



Zone Words

nutrients: substances that promote growth. In a stream or other body of water, fertilizers, animal waste, or decaying leaves and grasses can be considered nutrients.

pH: the measure of the acidity and alkalinity of a solution based on a scale from 1 (most acidic) to 14 (most alkaline).

riffle: shallow, fast-moving water where the flow is broken by a bed of gravel, cobbles, or boulders.

turbid: muddy or cloudy because of sediment, algae, or other small particles floating in the water.

Measurement Conversions

30.5 centimeters (cm) = 1 foot

° C x 9/5 + 32 = ° F

° F – 32 x 5/9 = ° C

What you will learn:

- whether the quality and quantity of the water support plant and animal life in the zone
- ways in which water helps to shape the GREEN Zone

Water Ecologist Checklists

1. Materials

Your team will use these items in the field. Your leader has collected all the materials and will give you a large plastic container. Check off each item as you put it into the container. Go through this checklist again before you leave the riparian site so you don't leave anything behind.

- ❑ Key to Macroinvertebrate Life in the River
- ❑ Macroinvertebrate Tally Sheet
- ❑ White bucket or tray
- ❑ White ice cube trays
- ❑ Magnifying glass
- ❑ Plastic cups
- ❑ Tweezers
- ❑ Spoons
- ❑ A fine-meshed net with a long handle
- ❑ Clipboard
- ❑ 2 pencils with erasers
- ❑ Tape measure (meters)
- ❑ 4 marker flags
- ❑ Timer (stopwatch or watch with a second hand)
- ❑ Meter stick
- ❑ Thermometer
- ❑ pH test kit
- ❑ 3 apples or 3 oranges
- ❑ Other

_____

_____

_____

_____

2. Safety

A safe trip will be a fun trip for everyone. Read the safety tips below and put a check next to each one so your teacher/leader knows you've read it.

- ❑ If you plan to work in the water, make sure you have a buddy and an adult supervisor present.
- ❑ Check with an adult before entering the water, and stay out of streams with fast-moving water.
- ❑ When you wade into water, stop when it reaches your knees.
- ❑ Work carefully on stream banks. They may crumble or be slippery.
- ❑ Know the poisonous plants in the area. (Ask your leader.)
- ❑ Watch out for broken glass, rusty cans, barbed wire, and other hazards that you may find at your test site.
- ❑ Wear goggles and gloves when you work with chemicals or with water you think might be polluted.
- ❑ Wash your hands before touching your face or food if you have been working in the water or soil or with chemicals.
- ❑ Stay in the testing area. Don't wander away from the group.

Water Quantity - Observations and Data

As you make some brief observations about the quantity and flow of water in your riparian zone, keep in mind some of the important functions of the zone:

- slowing the speed of high, fast-moving water, which helps to reduce erosion;
- storing floodwater and recharging groundwater; and
- creating deep, calm areas in the water that provide habitat for fish, waterfowl, and other aquatic animals.

Type of Stream in a Normal Year

Depending on where you live, the stream you are studying may not have water in it throughout the year. Scientists have several terms they use to describe streams, based on their observed flow. Circle the term in the data sheet below that best describes your stream. Ask your guest natural resource specialist or other adult if you're not sure of the correct answer.

Stream Type Data Sheet		
Perennial Usually flows through the entire year	**Intermittent** Usually does not flow during dry seasons	**Ephemeral** Only flows for a short time after a storm

Water Levels

Water levels in a stream can be affected by a variety of factors, including recent precipitation or drought. Do you see signs of variation, such as indications of high water or flooding, at your site? If yes, describe and/or sketch what you see below.

Stream Velocity

How fast is the water in your stream moving? Taken together, the speed or velocity and the amount of water in a stream make up the flow of the stream. Stream flow can affect the concentration of various substances in the water, including pollutants. It can also have a great impact on how much erosion and deposition can take place. In addition, flow helps to determine the kinds of plants and animals that can inhabit any particular stretch of the stream. By testing your stream's velocity, you can gain a better idea of the stream's flow and of how that flow affects the functions of your riparian zone.

Work with your leader to find a safe place where your team can test your stream's velocity. You will need an access point, such as a bridge or a point bar, and a second place 3 meters downstream where a timekeeper with a stopwatch has a clear view of the stream. Then follow the steps below:

1. The person at the "top" point (upstream) should gently toss an orange or apple at least 2 meters upstream of where he or she is standing. The "tosser" should try to throw it into the middle of the stream. As the object passes the point, a spotter should yell "start." This is the signal for the timekeeper to start timing.

2. When the object passes the location 3 meters downstream, a spotter there should yell "time." The timekeeper should stop timing and record the time in seconds.

3. Repeat the process 2 more times. Do not count any trials where the float gets stuck in debris, along the bank, or in an eddy.

4. Use the formulas provided in the data sheet to figure out the velocity of the stream.

Stream Velocity Data Sheet

Trial 1: _____sec

+

Trial 2: _____sec

+

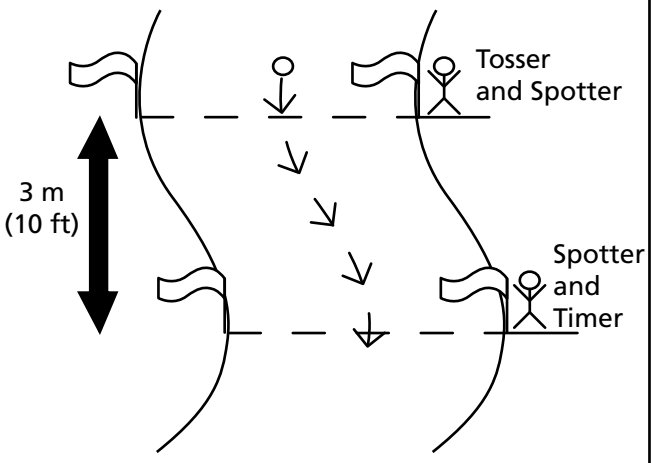
Trial 3: _____sec

=

Total of _____sec

divided by 3 = an average travel time of _____ sec.

The length of the test site divided by the average travel time equals the velocity.



3 m distance traveled divided by _____ avg. travel time = _____ velocity (m/sec).

Water Quality - Observations and Data

You already know that water has to be clean before you can drink it safely. It must also have certain chemical and physical characteristics to sustain healthy plants and animals. Human activities can cause undesirable changes in water that can harm living organisms. The things we add to water that cause these changes are called pollutants. Animal waste, excessive sediment, and hazardous chemicals, such as fertilizers and weed killers, are examples of pollutants that can affect water quality in the riparian zone.

Scientists rely on a variety of tests and observations to evaluate water quality. Here are a few that you and your team members can perform in your zone.

Water Appearance

Do you see any signs of water pollution? Check the term(s) in the data sheet that best describes the physical appearance of the water in the stream.

Water Appearance Data Sheet

- ❑ Clear: colorless, transparent.
- ❑ Turbid: cloudy-brown due to silt or plant material in the water.
- ❑ Milky: cloudy-white or gray; may be natural or due to pollution.
- ❑ Foamy: caused by excessive nutrients from either natural sources or from pollution.
- ❑ Dark Brown: may indicate that acids are being released into the stream by decaying plants.
- ❑ Oily Sheen: a multi-colored reflection; can occur naturally or it may indicate oil or other petro-chemicals in the stream.
- ❑ Reddish: may indicate acids draining into the water or iron bacteria.
- ❑ Green: caused by algae that may indicate excess nutrients being released into the stream.

Water Odor

What do you smell? Water odor may be an indication that water is polluted.
Check those indicators that apply.

Water Odor Data Sheet

- ❑ No odor
- ❑ Odor present. Rank the strength (circle one): weak strong overwhelming
  - ❑ Sewage: May indicate the presence of human waste or livestock manure. If you smell sewage/ manure or a rotten egg smell, please do not touch or enter the water. Check with your leader before proceeding.
  - ❑ Chlorine: May indicate that a sewage treatment plant is using too much chlorine and discharging it into the stream; also a component of milkhouse cleaning.
  - ❑ Fishy: May indicate the presence of dead fish or excessive algae.
  - ❑ Rotten Eggs: A sulfurous smell may indicate muck soils or sewage/manure pollution. Hydrogen sulfide gas is a product of organic decomposition.
  - ❑ Petroleum: May indicate an oil spill from boats and personal watercraft, land, or storm drains.

Litter Evaluation

Litter in or near the water is another form of pollution. Examine your site and note the types of litter you see. See the data sheet below for an example of how to describe the litter.[1]

Litter Data Sheet		
Type of Litter	**Description/Quantity**	**Location**
Paper		
Small trash		
Cans		
Bottles		
Tires		
Cars		
Other		

EXAMPLE

Litter Data Sheet		
Type of Litter	**Description/Quantity**	**Location**
Paper	newspaper	At the edge of the water, 8 meters upstream from transect site 0
Small trash	fast food wrappers	On the stream bank, across the stream from transect site 0
Cans	4 soda cans	On the stream bank, across the stream from transect site 0
Bottles		
Tires		
Cars		
Other	Hat	Floating in the water 3 meters downstream of transect site 0.

[1] From *Water Action Volunteers—Volunteer Monitoring Factsheet Series* (Univ. of Wisconsin—Extension and Wisconsin Dept. of Natural Resources, 2001)

pH

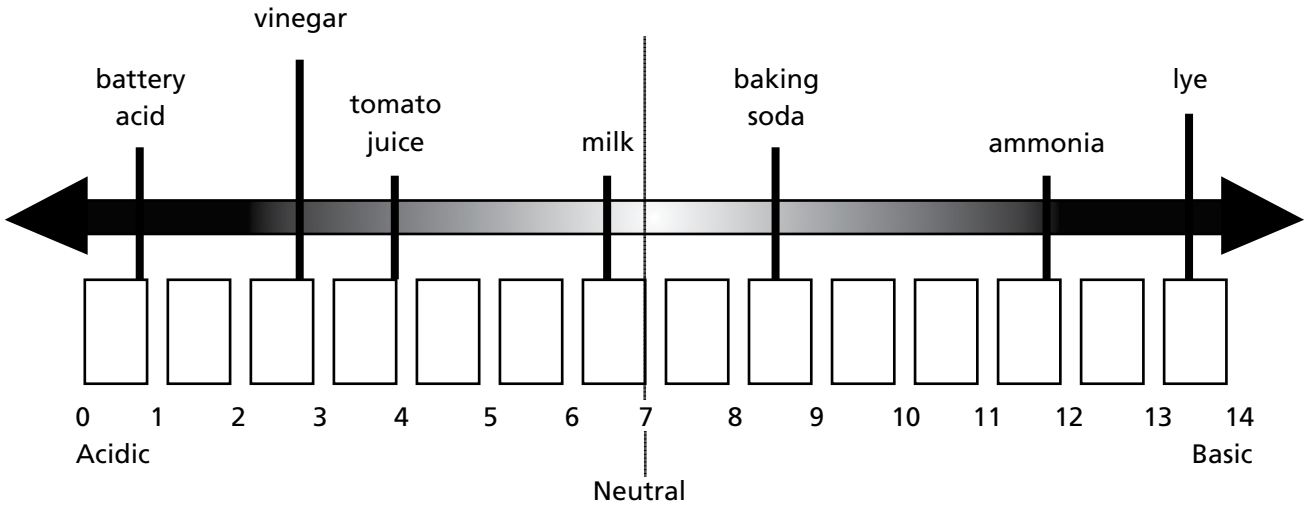
pH is a measurement of the alkalinity or acidity of a substance on a scale from 1 (most acidic) to 14 (most alkaline). Some streams are more acidic or more alkaline than others, and aquatic organisms in a particular stream are adapted to life in that stream's range of pH. Water with a pH range of 6.5-8.6 will have little effect on most organisms. If the pH of a stream falls unnaturally below 5 (becomes more acidic) or increases unnaturally above 9 (becomes more basic), the health of aquatic life will be in jeopardy.

Use the pH test kit for your measurement. Follow the directions provided by your leader. Once you determine the pH of your stream, put an arrow on the chart in the data sheet below.

Keep in mind that you are testing the pH of your stream at one point in time. In order to assess the health of a riparian zone, scientists look for changes and trends over time.

pH Data Sheet

The pH of my stream is _____ .



pH scale

Water Temperature

Monitoring water quality involves more than just checking on pollution. The temperature of the water is also important to aquatic organisms. The temperature can affect organisms in several ways:

- Warm water holds less oxygen than cold water and triggers more plant growth.
- Most aquatic organisms have adapted to living within a range of water temperatures. Trout and salmon, for example, require very cool water, while bass and carp thrive in warm water.
- Extreme temperature fluctuations can make fish and macroinvertebrates more susceptible to disease, parasites, and the harmful effects of pollutants.

Check with your leader to make sure it is safe. Then follow the steps below to determine the temperature of the water and of the surrounding air. Start with the air temperature.

1. Place your thermometer in a location out of direct sunlight, and after a few minutes, note the temperature of the air.
2. Then lower the thermometer about 10 cm below the surface of the water, as close as possible to the middle of the stream.
3. Leave the thermometer underwater until the reading has stabilized. This usually takes about two minutes. Try to take the reading with the base of the thermometer still underwater. Remember to note whether you've measured the temperature in degrees Fahrenheit (F) or Celsius (C).

Temperature Data Sheet	
Air_____**˚C/F (circle one)**	**Water**_____**˚C/F (circle one)**
List three things besides air temperature that might affect water temperature.	

Macroinvertebrate Survey [2]

Scientists also rely on some small aquatic creatures to tell them whether water is polluted. Macroinvertebrates are organisms that have no backbone, spend at least part of their life cycles in water, and can be seen without a microscope. Some macroinvertebrates are more sensitive to pollution than others. By tallying the types of macroinvertebrates in your stream, you and your team members can gain more information about the quality of the water in the zone. Use the "Macroinvertebrate Tally Sheet" to conduct your survey.

The "Macroinvertebrate Tally Sheet" separates organisms into four groups based on their sensitivity to pollution:

Group 1 – These organisms are very sensitive; they can't live in polluted water. If pollution increases, the number of these organisms will decrease.	**Group 2 – These organisms are somewhat sensitive; they can be found in either very clean or mildly polluted water.**
Group 3 – These creatures are fairly tolerant of pollution. Organisms in this group can be found in either clean or somewhat polluted water.	**Group 4 – These organisms are found in poor water quality. Organisms in this group are very tolerant of polluted water, but they can still be found in clean water. As pollution worsens, tolerant organisms become more abundant.**

A healthy stream will have many different organisms—both pollution-tolerant and pollution-sensitive. Follow the steps below to complete the "Macroinvertebrate Tally Sheet" and give your stream a water quality score.

1. Choose a site for monitoring in an area near the 0 point of the transect line that has been set up for the other teams. You should choose a site with shallow water (8-30 cm) that is moving fast over a stony or gravelly bottom. Areas like this are called riffles. Remember, in the spring the water may be a bit deeper and faster than at other times of the year, so you should be especially careful working in the stream.

2. Before you begin, rinse the net and check that it doesn't contain any debris from the last time it was used. Fill your basins or buckets with about 3 cm of clean stream water. If you find you have too much water or if the water is too muddy, pour the excess/muddy water through your net into another bucket so you don't lose any organisms. If necessary, add some clean water to the original sample. Check the net and water in the second bucket for any organisms and return them to the first bucket.

3. At the riffle, place the net downstream from where you are standing so the water current passes you first and then flows into the net. Be sure that the bottom of the net fits tightly against the streambed so no water can flow underneath it.

[2] From *Water Action Volunteers—Volunteer Monitoring Factsheet Series* (Univ. of Wisconsin—Extension and Wisconsin Dept. of Natural Resources, 2001)

Water Ecologist Macroinvertebrate Tally Sheet

Group 1: These are sensitive to pollutants. Circle each animal found.

Relative Size Key:
(+) = larger than picture
(-) = smaller than picture


Stonefly Larva


Dobsonfly Larva


Alderfly Larva


Water Snipe Fly Larva

Number of group 1 animals circled: ☐

Group 2: These are semi-sensitive to pollutants. Circle each animal found.



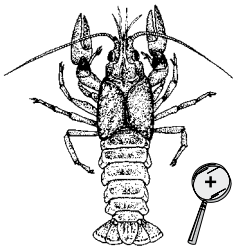


Caddisfly Larva*

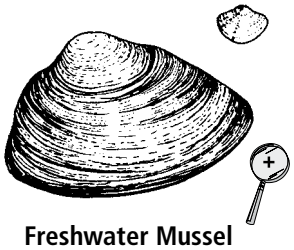
*All Caddisfly Larva = 1


Dragonfly Larva

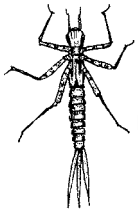

Water Penny


Crawfish


Crane Fly Larva


Freshwater Mussel or Fingernail clam


Mayfly Larva


Damselfly Larva


Damselfly tail (side view)


Riffle Beetle Larva*

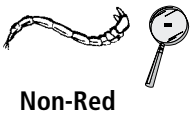

Riffle Beetle Adult*

*All Riffle Beetles = 1

Number of group 2 animals circled: ☐

Group 3: These are semi-tolerant of pollutants. Circle each animal found.


Black Fly Larva


Non-Red Midge Larva



Snails: Orb or Gilled (right side opening)


Amphipod or Scud

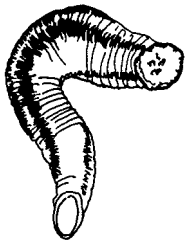
Number of group 3 animals circled: ☐

Group 4: These are tolerant of pollutants. Circle each animal found.


Pouch Snail (left side opening)


Isopod or Aquatic Sowbug


Bloodworm Midge Larva (red)


Leech


Tubiflex Worm

Number of group 4 animals circled: ☐

Macroinvertebrate Tally Sheet [2]

Name: _____ Date: _____

Stream Name: _____ Time: _____

Do not count individual animals. Instead, focus on the types of animals found in each group. The variety of animal types and their tolerance to pollution provide clues about the quality of the water you are testing.

Number of animals from Group 1: Sensitive _____ x 4 = _____

Number of animals from Group 2: Semi-sensitive _____ x 3 = _____

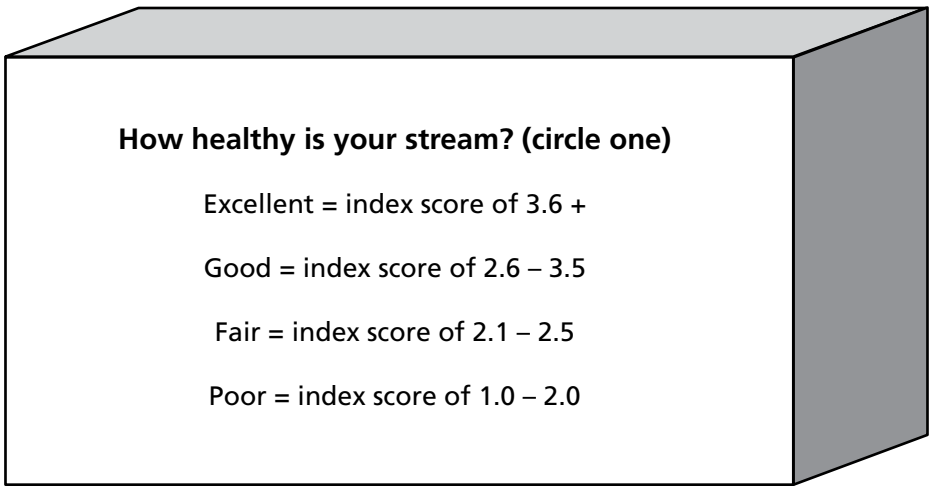
Number of animals from Group 3: Semi-tolerant _____ x 2 = _____

Number of animals from Group 4: Tolerant _____ x 1 = _____

TOTAL NUMBER OF ANIMALS (A) _____ TOTAL VALUE (B) _____

Index score (C) = The total value (B) divided by the total number of animals (A)
(C = B / A)

My stream had an index score of: _____



[2] Adapted from ***Water Action Volunteers***, Univ. of Wisconsin - Extension and Wisconsin Dept. of Natural Resources, 2001.

4. Kick the rocks and gravel on the bottom of the streambed. This will dislodge critters that live on or under rocks, allowing them to float downstream into your net. Use your hands to "scrub" some of the rocks, too. Scrubbing will help dislodge even more organisms.

5. After kicking, carefully remove the net from the stream. Use a scooping motion to bring it toward you without losing anything that's caught in the net.

6. Place about 3 cm of water in each white tray or basin and empty the contents of your net into them. Look for anything that moves. Sift through the debris (leaves, algae, sediment) to make sure you don't miss anything. Little animals are more abundant than big ones such as fish and crayfish.

7. Repeat Steps 3-6 until you have collected about 100 organisms in your basin or tray.

8. On the stream bank, fill the ice cube trays with stream water. Separate the organisms into look-alike groups in different sections of the trays. Use the spoons and tweezers to pick up the organisms. Then using the "Key to Macroinvertebrate Life in the River," do your best to carefully identify your catch.

9. Use the "Macroinvertebrate Tally Sheet" to record the kinds of animals that were collected from your site.

10. Calculate your stream's water quality score using the formulas on the tally sheet and enter this information on the data sheet below.

11. Return the organisms to the water after you've identified them.

Macroinvertebrate Survey Data Sheet

My stream's water quality score is _____.

My Macroinvertebrate Tally score indicates that the water quality of the stream is:

(circle one)

Over 3.5 **Excellent** 2.6 - 3.5 **Good** 2.1 - 2.5 **Fair** 1 - 2 **Poor**

Water Ecologist Zone Notes

Use your observations and data to answer the following questions in your Zone Notes:

1. Did erosion in the GREEN Zone have an effect on the water quality of the stream you tested? What evidence did you see that supports your opinion?

- Did the speed of your stream contribute to erosion in the zone? How can you tell?

2. Do you think the temperature of the stream or the quality of the water could have any effects on the plants and animals in the riparian zone? Cite some specific examples you observed.

- Will the pH level in your stream support aquatic life?

- Do you think the quality of the water affects human activities around your stream? How?

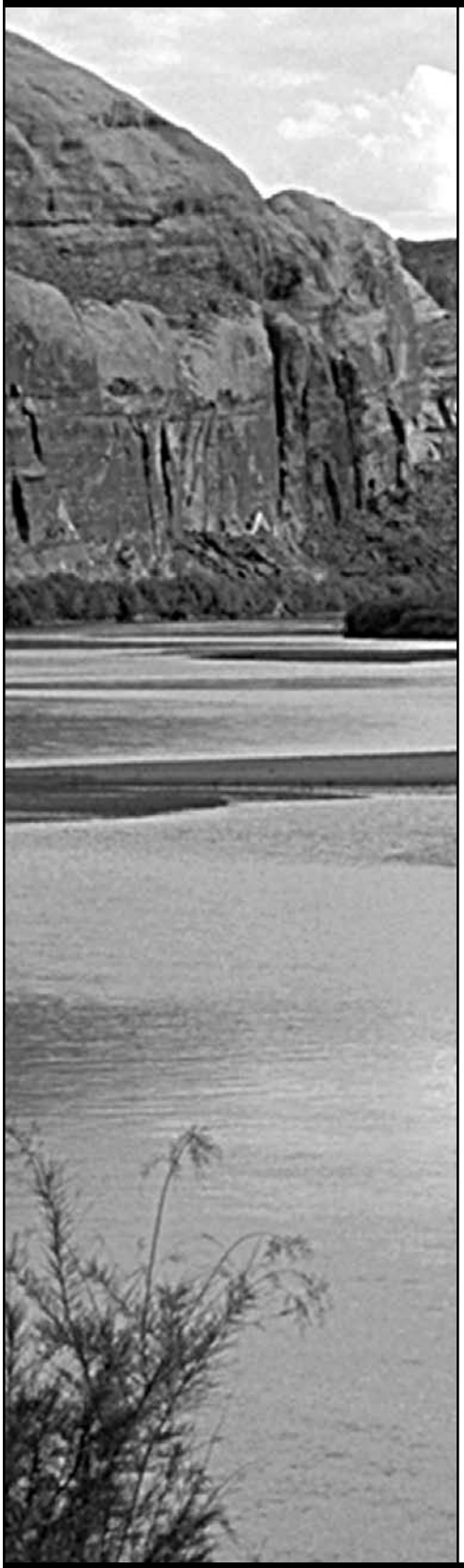
3. What effects do you think vegetation has on the temperature and the quality of the water in your riparian zone? Explain your answer.

- Did you observe any evidence of human or animal activity affecting the quality of water in the riparian zone? If so, cite some examples.

4. What natural features or events might increase or decrease the speed of the stream in your riparian zone? What about human actions? Make a list with your team.

5. How do you think the quantity of water in your stream affects the plants and animals that live in your riparian zone?

UNIT 3 - Soil Scientist



Preparing for Field Work

What you will do:

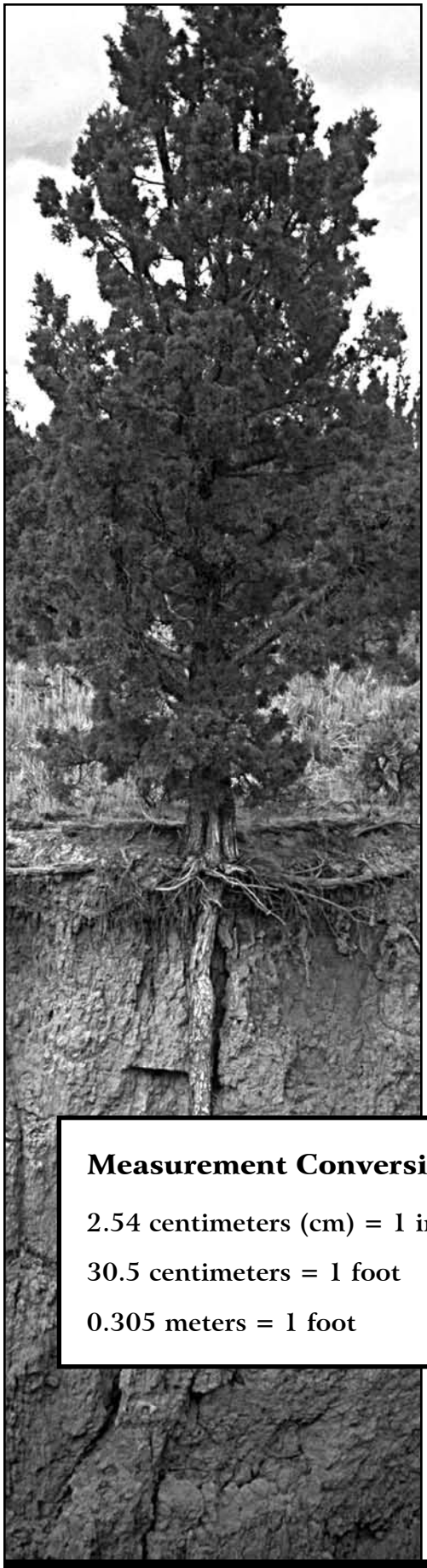
- **observe, record, and describe the soils that are found in your riparian zone**
- **describe the condition of the stream bank and look for evidence of erosion**
- **observe streambed deposits and the shape of the stream channel**

You will be conducting many of your investigations along a transect line that your teacher/leader will set up. All the information you need to do your job is in this guide.

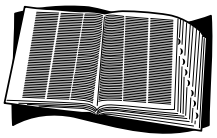
What can you determine by examining riparian soils and their characteristics? For one thing, the soils can help you to define the borders of your GREEN Zone. If you've already completed Unit 2 in the Action Guide, think back to the soil activities. In the Scoop on Soil activities (Texture Test and Percolation Test), you learned how to identify different soil characteristics. You will use the same sampling techniques to examine the soils in your riparian zone. If you haven't completed the indoor soil activities, you might want to do so before heading out on the field trip.

Once you've completed your field observations and data collection, you will answer some questions in your Zone Notebook. And after all four specialist teams finish collecting their data—the key pieces of the GREEN Zone puzzle—all the teams will combine their information to create a detailed picture of the area.

Stream bars are islands of sediment surrounded by the flowing water of a stream or river. Stream bars can form when stream flow goes down. They also occur when there is too much sediment for the stream to move. Stream bars sometimes occur where stream banks have soft soils and are easily eroded. When many stream bars are created, the stream is said to be braided.



Things to Know Before You Go!



Zone Words

braided stream: stream with many stream bars surrounded by flowing water. (See "stream bars" below.)

point bar: an area found on the inside of a river meander where sediment is deposited after falling out of slow-moving water.

riffle: shallow, fast-moving water where the flow is broken by a bed of gravel, cobbles, or boulders.

runoff: water from precipitation that flows over the land surface into rivers, streams, marshes, and other water bodies.

stream bars: islands of soil, gravel, cobbles, or boulders that form in the middle of a stream or river.

What you will learn:

- **if your GREEN Zone has the soil characteristics that will help it capture, store, and release water**
- **where the zone begins and ends**

Measurement Conversions

2.54 centimeters (cm) = 1 inch

30.5 centimeters = 1 foot

0.305 meters = 1 foot

Soil Scientist Checklists

1. Materials

Your team will use these items in the field. Your leader has collected all the materials and will give you a large plastic container. Check off each item as you put it into the container. Go through this checklist again before you leave the riparian site so you don't leave anything behind.

- ❑ Garden spade
- ❑ Meter stick
- ❑ Calculator
- ❑ Clipboard
- ❑ 2 pencils with erasers
- ❑ 10-meter-long string
- ❑ Other _____

2. Safety

A safe trip will be a fun trip for everyone. Read the safety tips below and put a check next to each one so your teacher/leader knows you've read it.

- ❑ If you plan to work in the water, make sure you have a buddy and an adult supervisor present.
- ❑ Stay out of streams with fast-moving water.
- ❑ When you wade into water, stop when it reaches your knees.
- ❑ Work carefully on stream banks. They may crumble or be slippery.
- ❑ Ask your leader to show you poisonous plants in the area.
- ❑ Watch out for broken glass, rusty cans, barbed wire, and other hazards that you may find at your test site.
- ❑ Wear goggles and gloves when you work with chemicals or with water you think might be polluted.
- ❑ Wash your hands before touching your face or food if you have been working in the water or soil or with chemicals.
- ❑ Stay in the testing area. Don't wander away from the group.

Soil Characteristics - Observations and Data

The types of soil in a riparian zone can provide you with clues about the zone and its boundaries, and about the way the zone functions. As you move along the transect line, you may observe surprising changes in the soil. You may notice variations in texture, for example, which can indicate that soils were deposited at different times or came from different sources. Differences in color can indicate whether water and organic material are plentiful in a particular area or not. Some soils are more typical of riparian zones, while others are more likely to be found in drier upland areas. Follow the steps below to investigate soil characteristics in your GREEN Zone.

1. Start this investigation at the transect line. Use a spade to dig a hole about 60 cm deep at three transect sites: 0 m, 20 m, and 50 m. Use the spade to make a clean cut in the side of the hole so you can clearly see the soil layers (called soil horizons).

2. Repeat the following procedure at each of the depths indicated on the data table (20, 40, and 60 cm):
   a. Take a handful of soil and form a soil ball about 4-5 cm in diameter.
   b. Examine the outside of the soil ball and then break it into pieces to examine the inside.
   c. Make observations of the soil characteristics using words like those in the descriptions below.
   d. Record your descriptions on the data sheet (next page).

3. After completing this activity, please remember to fill the holes.

Answer the questions below to help describe the soil characteristics. The words listed after each question are just suggestions; there are many other words that might be appropriate for describing your soil sample.

How does the soil feel?

Texture: Is it sticky, slippery, gritty, full of coarse pieces?

Water content: Is it dry, moist, wet, sloppy? Make a note if water appears in the hole. If so, at the end of your soil observations, record the distance from the top of the hole to the top of the water level. This would indicate where the water table is located.

What does the soil look like?

Color: black, brown, tan, orange

Tone: light, medium, dark

Pattern: blotchy, striped, spotty

Other observations

Are there living organisms in the soil (worms, “bugs”)?

Is there non-living matter in the soil (rocks, decayed plant matter)?

Does the soil have an odor?

Soil Characteristics Data Sheet

Transect site - 0 m

Soil depth	Describe how the soil feels	Describe what the soil looks like	Other observations
20 cm			
40 cm			
60 cm			

Transect site - 20 m

Soil depth	Describe how the soil feels	Describe what the soil looks like	Other observations
20 cm			
40 cm			
60 cm			

Transect site - 50 m

Soil depth	Describe how the soil feels	Describe what the soil looks like	Other observations
20 cm			
40 cm			
60 cm			

Example:

Soil depth	Describe how the soil feels	Describe what the soil looks like	Other observations
20 cm	sticky, moist	light brown, orange, blotchy	worms

Erosion - Observations and Data

Erosion is a natural process. Even though plant roots in a riparian zone hold the soil, it is natural for portions of a healthy stream bank to erode a small amount each year due to the force of water flow during flood events. When sediment drops out of the water—is deposited—it creates rich soils that are an important part of a healthy riparian zone. Erosion is considered harmful when it destroys the stream bank, lowering water quality and reducing the amount of land available for wildlife habitat, livestock foraging, and other uses.[1] Follow the steps below to investigate erosion in the zone.

1. Standing at the 0 transect mark, look upstream and downstream. Use the first part of the data sheet below to guide your observations.

2. Next, look for evidence of erosion on the banks, such as exposed soils and disturbed areas. Start at the 0 transect mark and walk along the transect line. Survey the area within 10 m on either side of the line. Use a 10-m-long string to determine these limits.

3. Use the information on the second part of the data sheet (next page) to guide your survey. Record your data in the appropriate boxes.

<table>
<tr><th colspan="4">Signs of Erosion in the Stream Data Sheet</th></tr>
<tr><td>Is the stream clear or muddy?</td><td>Circle one
Clear Muddy</td><td colspan="2">If muddy, list possible causes.</td></tr>
<tr><td rowspan="3">Are stream bars present?</td><td>Circle one</td><td>If yes, indicate location (how many meters from transect site 0?)</td><td>Source of excessive sedimentation (if evident)</td></tr>
<tr><td>Yes</td><td></td><td></td></tr>
<tr><td>No</td><td></td><td></td></tr>
</table>

[1] Adapted from *Montana Stream Management Guide for Landowners, Managers and Stream Users* (Montana Department of Environmental Quality, 1998)

Signs of Erosion on the Banks Data Sheet			
Look for:	**Where along transect? (Identify site in meters)**	**Description or sketch of erosion site**	**What do you think caused the erosion?**
Exposed soil **Examples:** • Mud along stream bank • From construction or flood event			
Disturbed areas **Examples:** • Trampling • Road construction • Agricultural activities			
Other evidence of erosion **Examples:** • Runoff carrying sediment • Gullies cut in soil • Collapsing stream bank			

Stream Characteristics - Observations and Data

Streambed Deposits[2]

The kind of materials you find on the streambed can give you clues about the flow of water in your stream. Streambed deposits also affect the habitat available for aquatic creatures. Check with your leader to make sure it is safe to proceed; then follow the steps below to identify streambed deposits and estimate the percentage of each.

1. If possible, enter the stream from the 0 transect site.
2. Use the descriptions on the data sheet to help you identify the types of bed material in your stream.
3. Estimate the percentage of streambed materials that you find at the 0 transect site. Choose from 0, 25, 50, 75, or 100 percent. The total percentages of all the types should add up to 100 %.

Streambed Deposits Data Sheet	
Types of Bed Materials	**Percent (circle)**
silt, clay These substances have a sticky feeling. The particles are fine. The spaces between the particles hold a lot of water, making the sediments feel like ooze.	0% 25% 50% 75% 100%
sand (<0.2 cm in diameter) A sandy bottom is made up of tiny, gritty particles of rock that are smaller than gravel but coarser than silt (gritty, smaller than a grain of rice).	0% 25% 50% 75% 100%
gravel (0.2-7.5 cm in diameter) A gravel bottom is made up of stones ranging from tiny 2-mm pebbles to rocks of about 7.5 cm (fine gravel – rice size to marble size; coarse gravel – marble to ping pong ball size).	0% 25% 50% 75% 100%
cobbles (7.5-25 cm in diameter)	0% 25% 50% 75% 100%
stones (25-60 cm in diameter)	0% 25% 50% 75% 100%
boulders (>60 cm in diameter)	0% 25% 50% 75% 100%
bedrock (solid)	0% 25% 50% 75% 100%
TOTAL (should add up to 100%)	

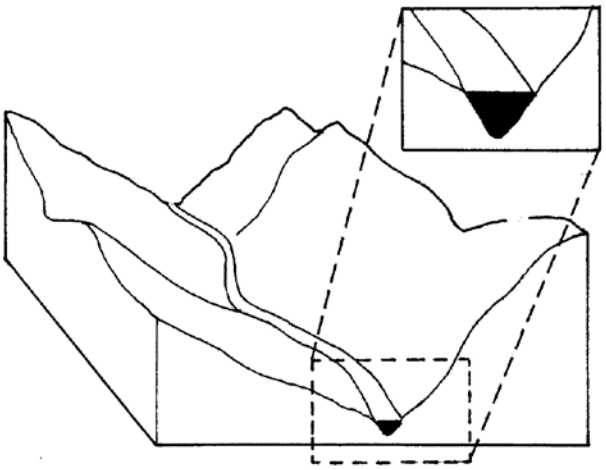
[2] Adapted from "Habitat Assessments: The Parts Equal the Whole," *Water Action Volunteers—Volunteer Monitoring Factsheet Series* (Univ. of Wisconsin-Extension and Wisconsin Dept. of Natural Resources, 1999)

Stream Channel

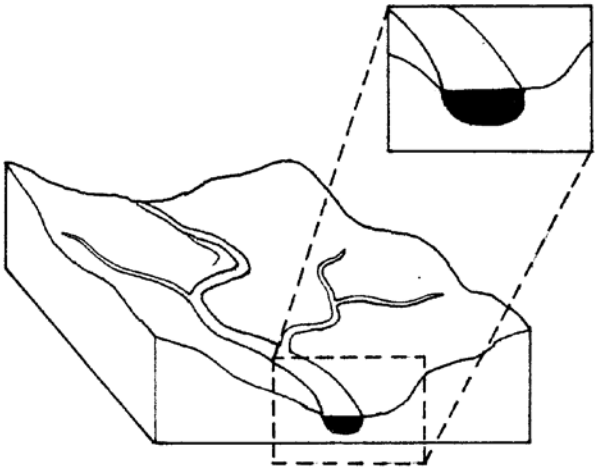
The channel is the part of the stream that holds the main flow of water. The shape of the channel can tell you a lot about how much water and sediment the stream carries. Circle the diagram in the data sheet below that best illustrates your stream channel shape.

Stream Channel Data Sheet

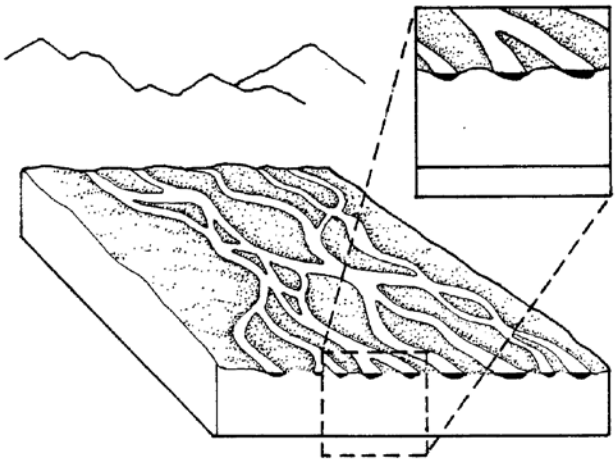
V-shape



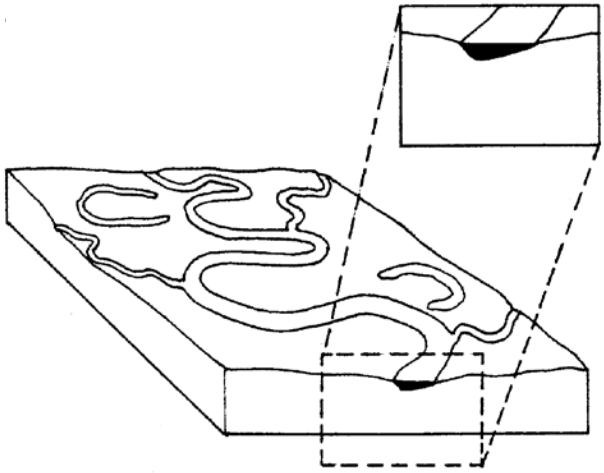
U-shape



Braided



Wide and Shallow



Stream Bank

The shape and appearance of the stream bank in your riparian zone can supply you with more clues about the forces of erosion that are at work in the zone. You will also be able to get some ideas about whether your zone is providing habitat for fish and other aquatic animals. Stand at the 0 transect point and look upstream and downstream. First, observe how much vegetation covers the banks of the stream; then note other characteristics of the stream bank. Check the appropriate boxes in each section of the data sheet.

Stream Bank Data Sheet	
Which description best fits the bank of your stream? (check one)	❑ Most of the stream bank surfaces are covered by vegetation. ❑ About half of the stream bank surfaces are covered by vegetation. ❑ Very little of the stream bank surfaces are covered by vegetation. ❑ None of the stream bank surfaces are covered by vegetation.
Whether or not the stream bank is vegetated, what other characteristics apply to it? (check all that apply)	❑ Eroded ❑ Rocky ❑ Trampled (vegetation broken or crushed) ❑ Compacted (hardened from being pressed together) ❑ Undercut

Soil Scientist Zone Notes

Use your observations and data to answer the following questions in your Zone Notes:

1. What soil types did you find in the riparian zone? Were they mostly clay, sand, silt, or a combination?

- Would these soil types help slow water during flooding? Why or why not?

- Predict how these soil types might affect groundwater recharge.

2. One of the purposes of the field trip is to define the boundaries of your riparian zone.

- Did the types of soil you sampled change as you moved away from the stream? If so, make a list of the changes you observed.

- Were you able to determine where the riparian zone ends and the upland begins? How? Discuss the clues you used with your team.

3. Does your stream show evidence of upland or streamside erosion creating too much sediment for the water to carry? How can you tell?

- What factors did you observe that might contribute to erosion in your stream?

4. Did you see evidence that vegetation in your riparian zone affects the movement of soil? Cite specific examples of what you observed.

5. Did you see evidence that erosion is affecting the plant life in your riparian zone? If so, describe the evidence you saw.

6. If you saw evidence of excessive erosion in your riparian zone, list animal and/or human activities that might be contributing to this erosion. If you saw little or no evidence of erosion, can you explain why?

7. What effects do you think erosion in the zone might have on animal and/or human activities there?

UNIT 3 - Biologist

Preparing for Field Work

What you will do:

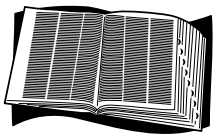
- **observe, record, and describe the plant and animal life of your riparian zone, including changes in vegetation**
- **describe ways in which the plants in your zone provide habitat for birds, fish, and other wildlife**
- **look for ways in which plants and animals have an impact on your zone—either positive or negative**

You will do most of your work along a transect line set up by your teacher or leader. All the information you need to do your job is in this guide.

From stabilizing stream banks and reducing erosion to providing food and shelter for wildlife and livestock, native riparian vegetation performs many important functions in the GREEN Zone. As you saw in Unit 2, plants can help to improve water quality and contribute in other ways to the overall health of the zone. Animals, too—both wildlife and livestock—can have an effect on the way the riparian zone functions. The observations your team makes about the plants and animals in the riparian zone will help your team to suggest where the boundaries of the zone are and to assess the ability of the zone to do its job.

Once you've completed your field observations and data collection, you will answer some questions in your Zone Notebook. And after all four specialist teams finish collecting their data—the key pieces of the GREEN Zone puzzle—all the teams will combine their information to create a detailed picture of the area.

Things to Know Before You Go!



Zone Words

canopy: the parachute-shaped cover provided by shrubs and trees.

habitat: the place where an organism finds the food, water, shelter, and space it needs to survive.

nutrients: substances that promote growth. In a stream or other body of water, fertilizers, animal waste, or decaying leaves and grasses can be considered nutrients.

What you will learn:

- **how to determine where the riparian zone begins and ends**
- **whether the zone is providing habitat for plants and animals**

Measurement Conversions

30.5 centimeters (cm) = 1 foot

0.305 meters = 1 foot

° C x 9/5 + 32 = ° F

° F – 32 x 5/9 = ° C

Biologist Checklists

1. Materials

Your team will use these items in the field. Your leader has collected all the materials and will give you a large plastic container. Check off each item as you put it into the container. Go through this checklist again before you leave the riparian site so you don't leave anything behind.

- ❑ Clipboard
- ❑ 2 pencils with erasers
- ❑ 50 cm of rope
- ❑ Tape measure (meter)
- ❑ Ruler (meter)
- ❑ Ocular tube or toilet paper roll
- ❑ Field guide to local plants
- ❑ Field guide to local animals
- ❑ Other

_____

_____

_____

_____

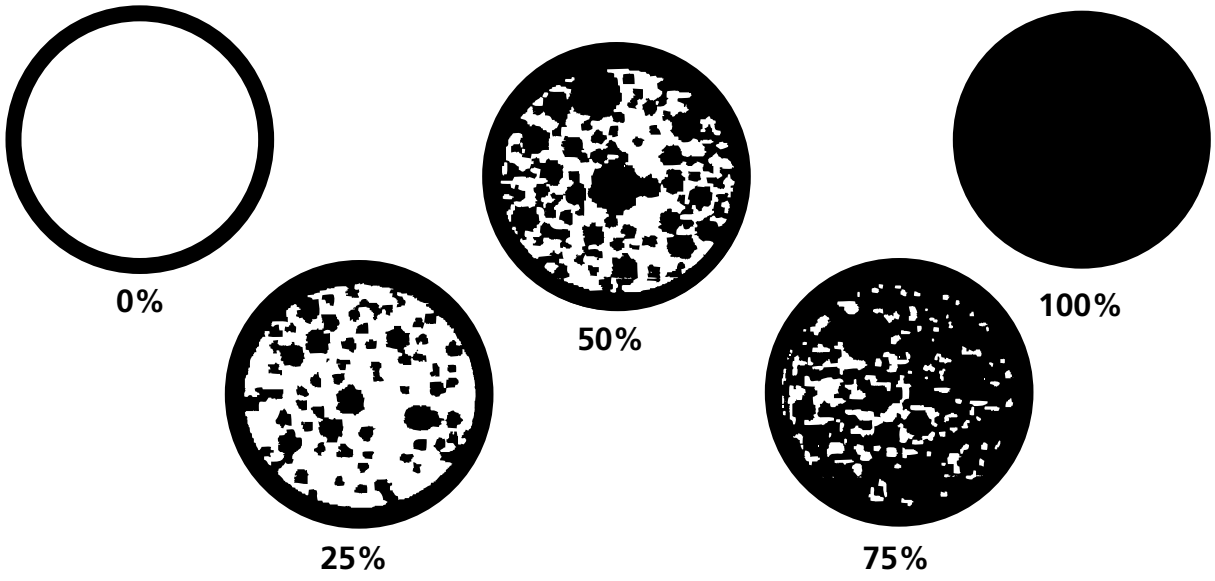
_____

2. Safety

A safe trip will be a fun trip for everyone. Read the safety tips below and put a check next to each one so your teacher/leader knows you've read it.

- ❑ If you plan to work in the water, make sure you have a buddy and an adult supervisor present.
- ❑ Stay out of streams with fast-moving water.
- ❑ When you wade into water, stop when it reaches your knees.
- ❑ Work carefully on stream banks. They may crumble or be slippery.
- ❑ Ask your leader to show you poisonous plants in the area.
- ❑ Watch out for broken glass, rusty cans, barbed wire, and other hazards that you may find at your test site.
- ❑ Wear goggles and gloves when you work with chemicals or with water you think might be polluted.
- ❑ Wash your hands before touching your face or food if you have been working in the water or soil or with chemicals.
- ❑ Stay in the testing area. Don't wander away from the group.

Vegetation - Observations and Data



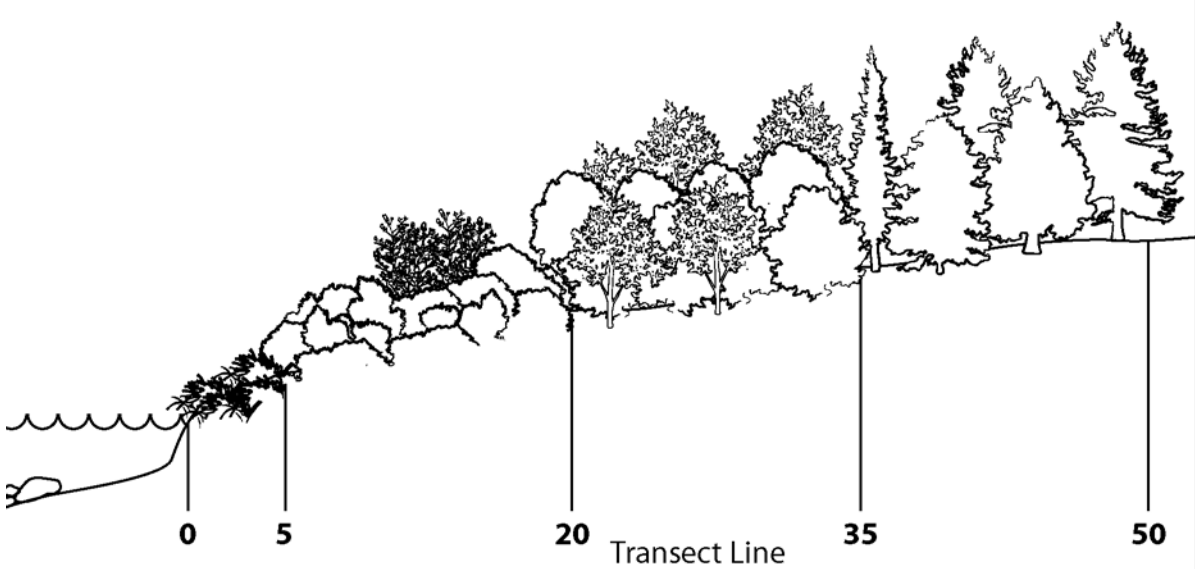
Canopy Cover

Whether a riparian zone has trees, shrubs, herbaceous (non-woody) plants, or a mix of all three, the vegetation provides cover to the soil, protecting against the energy of raindrop impact. The branches and leaves of riparian plants create an umbrella- or parachute-shaped cover over the ground. By reducing the impact of raindrops, this vegetation canopy can reduce erosion in the GREEN Zone. Less erosion means less sediment in the water, which benefits the spawning and growth of fish. In addition, shade from the canopy of trees helps to moderate water temperatures, which also improves habitat for aquatic creatures.

How much of your riparian zone is covered by vegetation? Stand at each of the transect sites listed below. Using one eye, look up at the sky through the ocular tube (or toilet paper roll). As you look, have a partner make sure the tube is straight up and down, not tilted. Estimate the percentage of canopy cover at that site by deciding how much of the area visible through the tube is covered by vegetation. See the diagram above for examples. Mark your estimate for each transect site on the canopy cover data sheet below.

Canopy Cover Data Sheet					
Transect Site	**Canopy Cover**	**Canopy Cover**	**Canopy Cover**	**Canopy Cover**	**Canopy Cover**
0 m	0%	25%	50%	75%	100%
5 m	0%	25%	50%	75%	100%
20 m	0%	25%	50%	75%	100%
35 m	0%	25%	50%	75%	100%
50 m	0%	25%	50%	75%	100%

Plant Diversity



A healthy GREEN Zone supports a wide variety of riparian vegetation that performs many important functions. In Unit 1, you discovered that the riparian zone is an **ecotone** – a place where ecosystems blend together. Ecotones are characterized by a rich diversity of life, so you would expect to find a variety of both upland plants and aquatic plants in your riparian zone. By surveying the diversity of plants in your zone, your team should find evidence of the transition between aquatic and upland species. Follow the steps below to conduct your survey and enter your observations on the data sheet on the next page.

1. At each transect site use a 50-cm piece of rope to help you estimate a circle 1 m in diameter.

2. In the second column of the data sheet, estimate the percentage of the ground in each 1-m circle that is covered by vegetation. Use the diagrams on page 84 as a guide.

3. If the ground at a site does have vegetation, note how many different kinds of trees, shrubs, and herbaceous (non-woody) plants you see within the circle. Mark your answers in the third column.
   - Trees are plants with trunks bigger than 8 cm in diameter.
   - Shrubs are plants with many woody stems smaller than 8 cm in diameter.
   - Herbaceous plants include sedges, grasses, and other non-woody plants.

4. What plant type is dominant at this site? Use a field guide or ask an adult to help you identify the plant. Write your answers in the fourth column.

5. As you walk along the transect line, take note of places where the vegetation changes. Describe these transitions in column five, along with the location on the transect line where they occur. See the example at the bottom of the data sheet.

Plant Diversity Data Sheet					
Transect site	**Percentage of ground covered by vegetation**	**Number of trees, shrubs, non-woody plants**		**Most abundant plant type at this site**	**Transitions observed and location**
0 m		Trees			
		Shrubs			
		Non-woody plants			
5 m		Trees			
		Shrubs			
		Non-woody plants			
20 m		Trees			
		Shrubs			
		Non-woody plants			
35 m		Trees			
		Shrubs			
		Non-woody plants			
50 m		Trees			
		Shrubs			
		Non-woody plants			
Example 5 m	75%	Trees	1	Sedges	Sedges thinning out, more willows ~7 m
		Shrubs	3		
		Non-woody plants	4		

The Water's Edge - Observations and Data

As you know, many factors contribute to the condition of the stream banks. This data sheet will help you focus on the area closest to the water. What does it look like? Are there rocks or eroded banks close to the stream? Do the plants there have deep and binding roots that hold onto the soil and reduce erosion? Keep in mind that not all plants provide the same benefits to the zone. Think back to Unit 2 and the characteristics to look for in riparian vegetation. Follow the steps below to survey the water's edge.

1. Stand at the water's edge at the 0 transect point and look upstream. How would you describe the stream bank? On the data sheet, check any of the descriptions that apply for as far as you can see.

2. Next, observe the area on each side of the stream up to about 5 meters from the water's edge. Review your plant diversity data sheet to note the plants that are most abundant at transect points 0 and 5 m. Use your field guide or check with your natural resource professional to determine if any of those plants are invasive species.

Water's Edge Data Sheet	
	Banks breaking off or eroding
	Banks with rock
	Banks of sand and silt
	Undercut banks
	Banks with overhanging shrubs and trees (like willows, dogwood, alders)
	Banks with desirable native grasses and sedges (Ask your guest natural resource professional for help.)
	Banks with other non-woody plants (knapweed, leafy spurge, dandelion, Canada thistle)
	Banks with signs of disturbance (trampling, beaver activity). Describe what you see.
In the space below, make a sketch of the water's edge.	

Animal Life - Observations and Data

Both in the water and along the water's edge, healthy and diverse riparian vegetation helps to sustain bird and fish populations as well as populations of game species such as elk and deer. Riparian plants provide food and cover from predators. Even in the water, fallen trees and branches shelter aquatic animals. Is your riparian zone doing its job of providing food and shelter for a large variety of animals? Try the following techniques to find out. Keep in mind that one visit to a riparian zone will not give you a complete view of animal life in the zone. And don't forget to keep quiet as you work to avoid scaring animals away.

Animal Sounds

As you walk your transect line, stop and listen at each site listed on the data sheet. Do you hear any animal sounds? If so, list them in the data sheet.

Animal Sounds Data Sheet

Transect Site	Type of animal sound (vocal, tapping, movement)	Describe the sound.	How often did you hear it?	Was it up high or down low?	Can you see the animal making the sound? If so, try to identify it.
0 m					
5 m					
20 m					
35 m					
50 m					

Animal Sightings

Walk along the transect line. Stop at each transect site and look around. Pick up rocks or branches, if you can, and look under them. Just don't forget to put them back. Do you see any animals from that spot? Try to identify the animals with the help of your field guide or your natural resource professional. Use the data sheet to describe what you see.

Animal Sightings Data Sheet				
Transect Site	**Animal seen**	**Describe or draw the animal.**	**Where was it seen? (Above ground, under a shrub, etc.)**	**Abundance (How many did you see?)**
0 m				
5 m				
20 m				
35 m				
50 m				

Animal Signs

Do you see any signs of animals at each of the transect sites? Look for tracks; scat (animal droppings); webs or nests; fur or hair on branches; feathers; plants that have been dug up, bitten off, or chewed on; holes in the ground; piles of sticks, grasses, or branches.

Animal Signs Data Sheet				
Transect Site	**What sign did you find? Describe it.**	**What animal do you think left the sign?**	**Where did you see it?**	**How many signs did you see?**
0 m				
5 m				
20 m				
35 m				
50 m				

Biologist Zone Notes

Use your observations and data to answer the following questions in your Zone Notes:

1. Does the soil in your zone support a wide variety of plant types? How can you tell?

2. Do you think the vegetation in your GREEN Zone helps to provide erosion control?

- Cite specific evidence you observed to support your answer.
- How could erosion affect aquatic life?
- Why is erosion control important for the stream's aquatic life?

3. Do you think the plant canopy cover at your site is helping to moderate water temperatures? Why or why not?

4. Did you see any evidence that humans have affected the plant life in your riparian zone? If so, list some examples.

5. Did you observe any impacts from wildlife or livestock on your riparian zone? Cite examples you saw.

- Do you think these impacts are helping or harming the zone? Explain your answer.
- Did you notice more animals (wildlife or livestock) in one part of your site than another? Where? Why?

6. Do you think this site provides good nesting and food choices for birds? Why or why not?

7. Did you observe changes in the vegetation as you moved along the transect line in your zone? If so, describe those changes.

8. Were you able to suggest where the riparian zone ends and the upland begins? How? Discuss clues you used with your team.

UNIT 3 - Physical Geographer

Preparing for Field Work

What you will do:

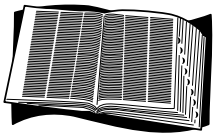
- **measure, test, record, and describe different characteristics of the land and water in your riparian zone**
- **observe the impacts of animal and human activities on your zone**
- **make a base map for use by the other specialist teams**

You will do some of your work near the stream, but you will also take a brief walking tour of the surrounding area. All the information you need to do your job is in this guide.

A physical geographer is a scientist who studies the surface features of the land and the processes that shape these features. Physical geographers also examine ways in which human activities affect the land. In Unit 2, you learned how "water shapes the GREEN Zone," and saw photos illustrating floodplains and terraces. You might want to review this section (Unit 2, Station 1) before you go on your field trip, because once you're "in the zone" you will be looking for similar features. You and your team are also responsible for collecting base information that will be used to create a site map—one that all the teams will use to help summarize their findings.

Once you've completed your observations, data collection, and mapping, you will answer some questions in your Zone Notebook. And after all four specialist teams finish collecting their data—the key pieces of the GREEN Zone puzzle—all the teams will combine their information to create a detailed picture of the area.

Things to Know Before You Go!



Zone Words

bankfull flow: the width of a stream when the channel is full and about to spill over onto the floodplain.

floodplain: a flat area on either or both sides of a stream or river that is created by periodic flooding.

gradient: the degree to which something slopes upward or downward.

point bar: an area found on the inside of a river meander where sediment is deposited after falling out of slow-moving water.

riffle: shallow, fast-moving water where the flow is broken by a bed of gravel, cobbles, or boulders.

topography: the shape of the land.

wetted edge: the point at the edge of a stream where the water touches the stream bank.

Measurement Conversions

1 foot = 0.305 meters

1 acre = 4,047 square meters (m^2)

1 hectare = 10,000 square meters (m^2)

1 kilometer = .62 miles = 1,094 yards

What you will learn:

- **where the zone begins and ends**
- **how the shape of the land affects other key parts of the riparian zone**
- **how human activities have affected the ability of the zone to do its job**

Physical Geographer Checklists

1. Materials

Your team will use these items in the field. Your leader has collected all the materials and will give you a large plastic container. Check off each item as you put it into the container. Go through this checklist again before you leave the riparian site so you don't leave anything behind.

- ❑ Spade
- ❑ Clipboard
- ❑ 2 pencils with erasers
- ❑ Tape measure (meters) or length of clothesline (10 m length)
- ❑ 2 stakes (approx. 30 cm long)
- ❑ Mallet
- ❑ 2 meter sticks
- ❑ Level
- ❑ Compass
- ❑ Colored pencils or markers for site map
- ❑ Poster paper for site map drawing
- ❑ Optional: Digital or 35 mm camera and film or video camera and videotape
- ❑ **Other**

_____

_____

_____

2. Safety

A safe trip will be a fun trip for everyone. Read the safety tips below and put a check next to each one so your teacher/leader knows you've read it.

- ❑ If you plan to work in the water, make sure you have a buddy and an adult supervisor present.
- ❑ Stay out of streams with fast-moving water.
- ❑ When you wade into water, stop when it reaches your knees.
- ❑ Work carefully on stream banks. They may crumble or be slippery.
- ❑ Ask your leader to show you poisonous plants in the area.
- ❑ Watch out for broken glass, rusty cans, barbed wire, and other hazards that you may find at your test site.
- ❑ Wear goggles and gloves when you work with chemicals or with water you think might be polluted.
- ❑ Wash your hands before touching your face or food if you have been working in the water or soil or with chemicals.
- ❑ Stay in the testing area. Don't wander away from the group.

Lay of the Land - Observations and Data

Slope of the Stream

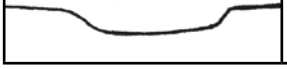
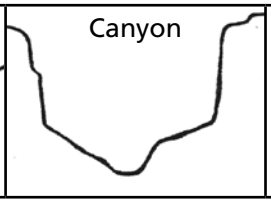
How steep is your stream? Steepness or gradient measurements indicate a change in elevation over a certain distance. The gradient or slope of the stream affects how fast the water flows and how much soil the stream can move downstream.

Scientists usually measure stream gradient in terms of feet per mile, or they use specialized equipment to measure the slope. But you can estimate the gradient of your stream by listening. Use your ears and the sound of the water to estimate slope as you stand on the bank at 0 on the transect line. Circle the percent slope that applies.

Stream Slope Estimate Data Sheet		
Gentle Slope < 2% I can't hear water flowing.	Moderate Slope = 2-4% I can hear water flowing.	Steep Slope > 4% The stream seems very loud - I can hardly talk over it!

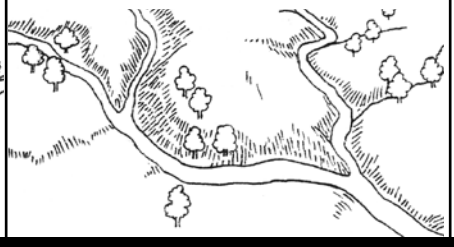
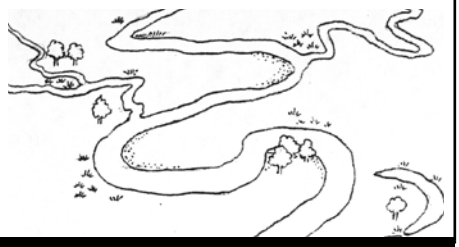
Topography

Stand on the bank at transect site 0 facing upstream. Look as far to the left and right as you can. What is the shape or topography of the riparian zone? Circle the drawing in the data sheet below that best illustrates the topography of your study area. If none applies, draw the shape of your zone in the "other" box.

Topography Data Sheet				
Flat	Terraces	Rolling hills	Canyon	Other
				

Meanders

Stream slope and topography influence the creation of meanders—or curves—in a stream channel. Can you observe any meanders when you stand at the 0 transect point? Look upstream and downstream. Pretend you are looking at your stream from a bird's-eye view. Circle the view that looks most like your stream in the data sheet below.

Meanders Data Sheet		
Straight	Slightly meandering	Very curvy (meandering)
		

Width of the Stream

How wide is the stream channel in your riparian zone? You will actually take this measurement at two points, the bankfull flow and the wetted edge. **Bankfull flow** describes the width of the stream when the channel is full and about to spill over onto the floodplain. The **wetted edge** is the place where the stream bank and water line meet. Depending on the topography and conditions at your stream, it may be difficult to recognize the distinction between bankfull flow and wetted edge. Check with your natural resource professional for help.

Measurements will be taken across the stream and perpendicular to the flow of water. Your ability to determine the width will depend on the size of the stream and your ability to access both banks. Talk to your leader about the best and safest way to take this measurement. Follow the steps below to determine your stream's width.

1. Start at transect site 0. To measure the bankfull flow width, find the point at the top of the stream bank where the water would leave the stream channel and spill onto the floodplain. Drive a stake in the ground at that point.

2. Cross the stream (only with the permission of your leader) and drive a stake in the ground at bankfull flow on the other side of the stream.

3. Using a tape measure or length of clothesline, measure the distance between the two stakes. Try to have the line taut and level (parallel) to the ground when you measure. Write your findings on your data sheet.

4. Next measure the width of the stream at the wetted edge. One team member should hold a meter stick at the point where the water touches the stream bank near transect site 0. This person should hold one end of the tape measure or clothesline.

5. A second team member should cross the stream (with your leader's permission), taking along a meter stick and the other end of the tape measure or clothesline.

6. Measure the distance between the two meter sticks. Try to have the tape or clothesline taut and as level as possible when you take the measurement. Mark your findings on your data sheet.

Stream Width Data Sheet

At transect site 0 the stream in my riparian zone is _____ meters wide at bankfull flow.

At transect site 0 the stream in my riparian zone is _____ meters wide at the wetted edge.

Use of the Land - Observations and Data

Land uses near the stream and throughout a watershed can have dramatic effects on a riparian zone. By surveying your site and the surrounding area, you can look for evidence of land uses and their impacts on your GREEN Zone.

Channel Alteration

Human activities can affect riparian zones in many ways. The data sheet below includes a list of some of the ways in which humans can change a stream channel. As you stand at the 0 transect site, look upstream and downstream. Do you see any signs of these activities? Use the data sheet to note your observations. Check all that apply.

Channel Alteration Data Sheet

Yes, this section of the stream has been:

- ❑ Straightened
- ❑ Dredged (deepened)
- ❑ Dammed
- ❑ Altered by bridge abutments (the base of the bridge)
- ❑ Diverted into a concrete channel
- ❑ Reconstructed with materials such as cobble, boulders, fencing, logs, etc.
- ❑ Reinforced with plant materials
- ❑ Other _____

❑ No, I see no change to the stream channel caused by people.

Signs of Disturbance

Start at the 0 transect site and take a walk with your team—and an adult leader—into the surrounding area. Go upstream for about 400 m (.4 km)—about the length of 4 football fields. Then proceed away from the stream for about the same distance. Look for any "Signs of Disturbance" listed on the data sheet on the next page, and check any that are present. Can you determine if these disturbances are having a clear impact on the riparian zone? Make a note in the "Clear Impact" box about what you think the impact is. (An example of a clear impact would be "increased erosion from housing construction.")

Signs of Disturbance Data Sheet		
Present	Clear Impact	Residential buildings
		Single-family housing
		Multi-family housing
		Lawns
		Commercial/institutional buildings
Present	Clear Impact	Roads and related structures
		Paved roads
		Unpaved roads
		Bridges
		Culverts
		Other stream-crossing mechanisms
Present	Clear Impact	Construction under way on:
		Housing development
		Commercial development
		Culvert repair or upgrade
		Bridge construction/repair
		Road construction/repair
Present	Clear Impact	Agricultural activity
		Grazing land
		Feed lots or animal holding areas
		Cropland
		Inactive agricultural land/fields
		Hoof damage from livestock
Present	Clear Impact	Recreation
		Camping
		Golfing
		Power boating
		Swimming/fishing/canoeing
		Hiking/paths
		Horseback riding
		Park/picnic area/playground
Present	Clear Impact	Wildlife
		Beaver dam
		Heavily browsed vegetation
		Hoof damage (elk or deer)
Present	Clear Impact	Other
		Mining or gravel pits
		Logging
		Industry
		Oil and gas drilling
		Trash dump
		Landfill
		Other _____

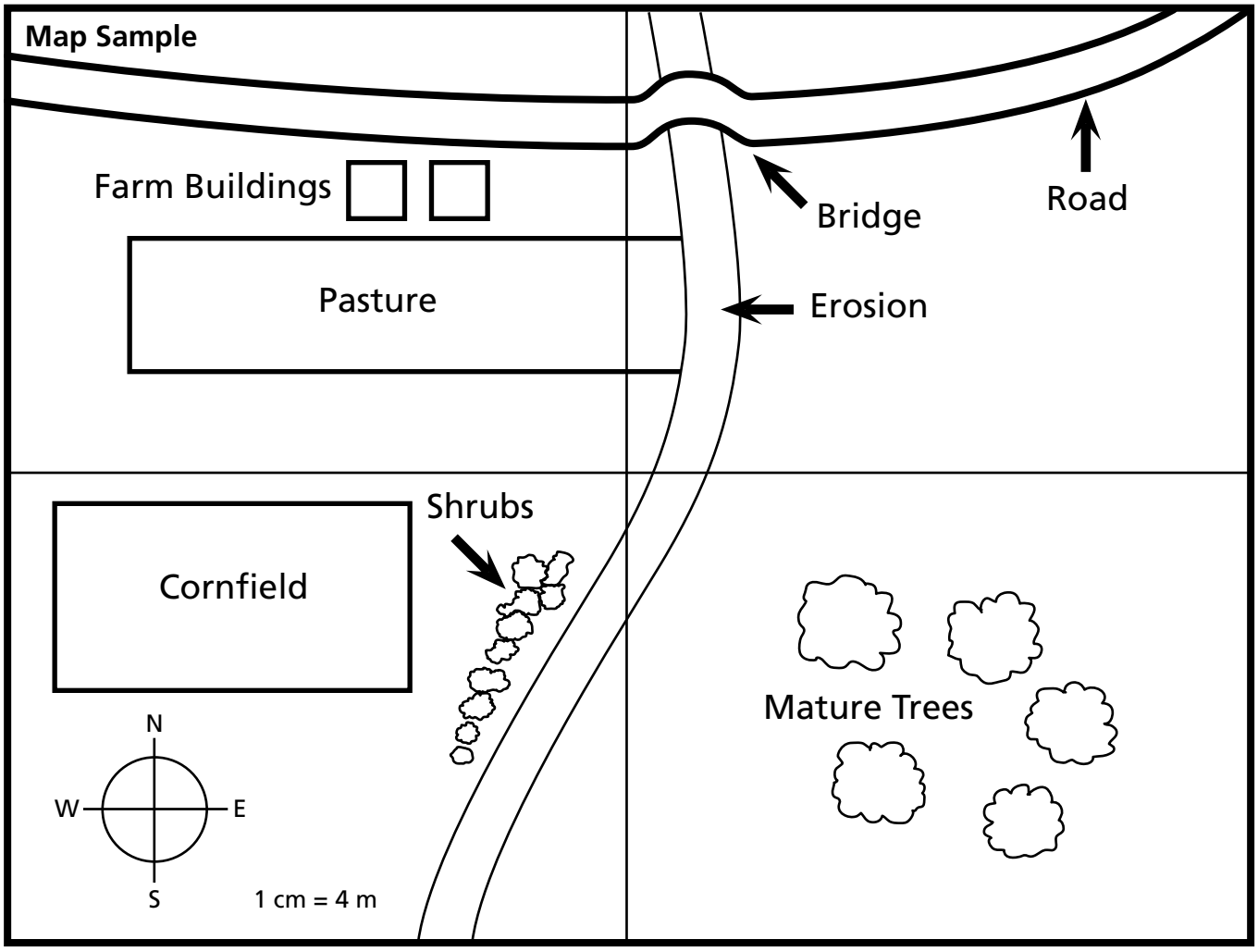
Map of the Land

Make a Site Map

Your team is responsible for making the site map of your riparian zone. You may need to do this activity indoors, but while you're in the field make a rough sketch of the area to transfer to your site map later. Start at the 0 transect site and measure 30 m in each direction. Use the compass to determine the orientation of your map. And don't forget to include a scale on your rough drawing. See the example illustrated below.

Mark on your map the following things:

- Vegetation types (grasses, shrubs, trees)
- Areas where vegetation has been removed because of land uses such as logging, housing developments, or livestock grazing
- Physical features in the stream and on land – meanders, riffles, point bars, boulders, terracing, and eroded banks
- Structures made by humans – roads, bridges, culverts, buildings, fences
- Effects of animals such as beaver activity, livestock use



Physical Geographer Zone Notes

Use your observations and data to answer the following questions in your Zone Notes:

1. How do the slope of the stream and the topography of your study area affect the shape of the stream? Cite specific examples you observed.

2. How does the movement of water in your stream affect the topography of your riparian zone?

- Did you see evidence of erosion, terracing, etc.?

3. Was there a difference between bankfull flow and wetted edge?

- What do your observations tell you about the quantity of water in the stream?

- Have storm events or fast-moving water eroded the stream bank? Cite specific examples you observed.

4. What evidence did you see of human activities that are affecting your riparian zone? Make a list of ongoing activities and those that occurred in the past.

5. How does the topography of your study area affect the living components of your riparian zone?

- How do livestock and wildlife make use of the zone?

6. What effects do these living components have on your riparian zone? Cite specific examples you observed.

7. Were you able to determine where the riparian zone ends and the upland begins? How? Discuss the clues you used with your team.

UNIT 4 - Putting the Pieces Together

What is a Healthy Riparian Zone?

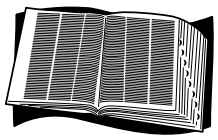
You've heard of bus service or phone service or electrical service, but did you know that earth's ecosystems also perform services? When a riparian zone is healthy and doing its job, it performs many services. It stores and purifies water; reduces damage from floodwaters; and provides a home and food for plants, animals, and people—to name just a few. Natural resource specialists say that the zone is healthy if it is in proper functioning condition; in other words, it's healthy if it can do its job.

To determine whether the riparian zone is healthy and can do its job, natural resource specialists investigate these factors:

- Water quality and quantity
- Soil qualities
- Plant characteristics
- Stream shape, slope, and speed
- Erosion and deposition
- Land uses – human, livestock, and wildlife

You've learned about the important features of a riparian zone and you've gathered GREEN Zone data in the field. On your field trip, your specialist teams focused on water, soil, vegetation and wildlife, and physical geography. In this unit, your team will present its findings to your entire class or group. After you hear what the other three teams discovered, you will be able to form a more complete picture of your riparian zone.

What does this picture look like? Does it show a riparian zone that benefits your community? Do plants and animals also benefit from the riparian zone? By following the steps below, you and your team will be able to organize your observations and put the pieces of the riparian puzzle together.



Zone Word

biodiversity: a variety or richness of life on Earth. A key part of healthy ecosystems, biodiversity refers to the number of plants or animals within a single species, the variety of the species themselves, and the variety of ecosystems. Diversity strengthens the potential of populations and species to respond or adapt to changing environmental conditions.

Activity - Specialist Team Presentations

Your specialist team will need:

- Completed specialist checklists
- Zone Notes from each team member
- Your natural resource partner, if available
- Copy of the map produced by the physical geographer team
- Copies of the "Key Pieces of the Puzzle" chart (one for each team member—your leader will provide)

Part 1—Planning the Presentation

1. Finish all the calculations on your team's data sheets and review your specialist Zone Notes. Try to answer all the questions. Your natural resource partners and field trip volunteers should be able to help you.

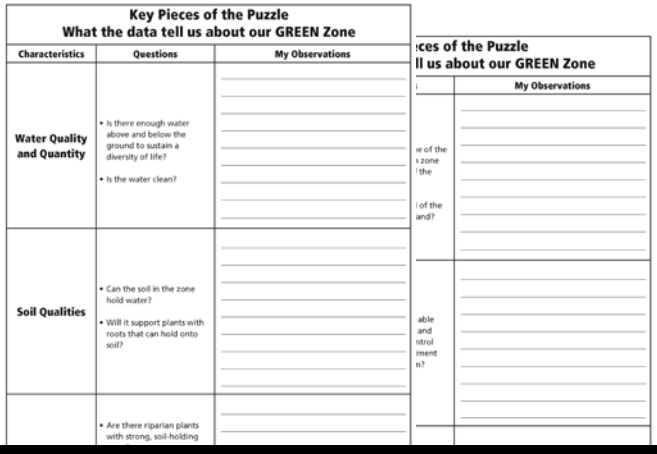
2. Use the copy of the map produced by the geographers' team to help summarize your team's data and explain your results. Make sure your notes and drawings are clear.

3. With your team members, decide how your specialty team will present its results to the class/group. Besides the map, will you need any additional visual aids? Which team member(s) will produce them? Which team member(s) will serve as spokespersons?

4. Refer to the questions on the "Key Pieces of the Puzzle" chart. Decide which questions apply to your team's area of study. Make sure your team addresses these questions in your presentation.

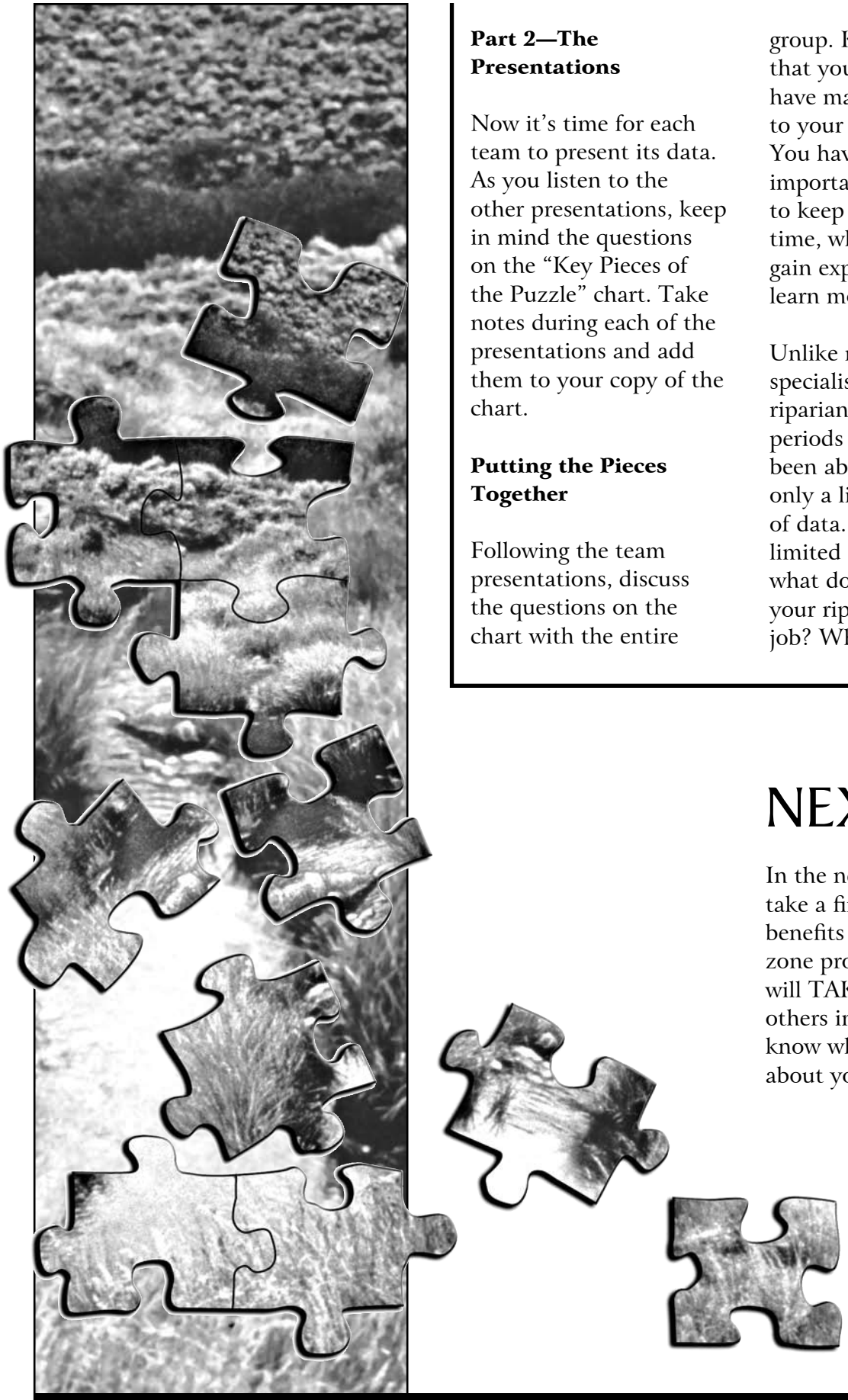
5. In addition, each team should try to answer the following questions. Be sure you're able to explain how your team information supports your answers.

- Describe the upland ecosystem at your site: What does it look like? What lives there? How is it used?
- Describe the aquatic ecosystem: Is it a river, stream, lake, or pond? What living organisms did you see in or near the water? How is the water used?
- Where are the borders of your riparian zone? How did you decide?
- How would you describe the diversity of life in your GREEN Zone? What relationships between living and non-living things in the zone support a diversity of life there? For instance, plant roots hold onto soil, which helps stabilize stream banks, which in turn helps to control erosion, keeping the water cleaner for aquatic organisms. Look at your "Key Pieces of the Puzzle" chart for additional ideas.



Key Pieces of the Puzzle
What the data tell us about our GREEN Zone

Characteristics	Questions	My Observations
Water Quality and Quantity	• Is there enough water above and below the ground to sustain a diversity of life? • Is the water clean?	
Soil Qualities	• Can the soil in the zone hold water? • Will it support plants with roots that can hold onto soil?	
	• Are there riparian plants with strong, soil-holding	



Part 2—The Presentations

Now it's time for each team to present its data. As you listen to the other presentations, keep in mind the questions on the "Key Pieces of the Puzzle" chart. Take notes during each of the presentations and add them to your copy of the chart.

Putting the Pieces Together

Following the team presentations, discuss the questions on the chart with the entire group. Keep in mind that you and your group have made just one visit to your riparian zone. You have learned some important characteristics to keep observing over time, which is how you gain experience and learn more.

Unlike natural resource specialists who study riparian zones over long periods of time, you've been able to collect only a limited amount of data. Based on your limited observations, what do you think: Can your riparian area do its job? Why or why not?

NEXT TIME

In the next unit, you will take a final look at the benefits a healthy riparian zone provides, and then you will TAKE ACTION to let others in your community know what you've learned about your GREEN Zone.

UNIT 5 - Tell the News

Professional natural resource specialists, like water ecologists, soil scientists, biologists, and geographers, often work together on a team to determine if a riparian zone is healthy. They collect data about a particular site to determine if the riparian zone is healthy and functioning properly. The information is collected from many transect lines, at different times of the year, and over a period of time. Then, the specialists combine their information to recommend future action. This team, sometimes called a land management team:

- analyzes data collected by all the specialists studying the area;
- outlines a management plan to either maintain a healthy zone or restore an unhealthy zone to a healthier condition; and
- enlists the help of local land users (ranchers, farmers, business/ industry leaders, cities, towns) to put the management plan into action.

You have combined data gathered by your specialist teams and have described your GREEN Zone according to your observations. Now your specialist teams will come together as a larger group, the GREEN Zone Land Management Team.

A riparian land management team is a group of natural resource specialists who combine their expertise and efforts to find ways to hold onto the GREEN Zone.

Unit 5, Activity 1 - Tales of our GREEN Zone Adventure

Who would you like to tell about your GREEN Zone adventure? Your family, school, church group, community leaders? What would you like to tell them?

What did you do and what did you learn? Use your site map, pictures, posters, and demonstrations to tell people about your adventure.

Directions

1. Choose a presentation method:
- A talk in front of a group
- An exhibit for use in a school, library, or community-room display case
- Video, slide show, or PowerPoint presentation
- Other _____

2. Reserve a room or display space for the event.

3. Decide how to let people know about your presentation—letter, flyers, posters, announcements.

4. Arrange to have the equipment you need (VCR, TV monitor, slide projector, computer projector, projection screen, microphone, special lighting, etc.).

Planning a GREEN Zone Presentation

You worked hard and gathered important information as you studied your local GREEN Zone. In this unit your class or group will develop a presentation about what it learned. You will then share information with members of your community about the benefits healthy riparian zones provide. Discuss with your class or group your ideas for telling others about your work. The following activities present just a few options.

Zone Notes

Check what you've learned:

- If you had to describe a riparian zone to someone, what would you say?
- Why are riparian zones important places for plants, wildlife, and people?
- What else would you like to learn about riparian zones? What additional research could you do to learn more about your riparian zone?
- Look at the cover of your GREEN Zone Action Guide. Explain why you think the title of the guide is "Holding onto the GREEN Zone." What are some actions people can take to preserve riparian areas?

Unit 5, Activity 2 – Meet with the Pros

Present your results to a group of professional natural resource specialists. You can learn a lot by talking with people from the community whose work includes managing the GREEN Zone.

Directions

1. Plan a meeting to describe the activities of your GREEN Zone Land Management Team and the results of your investigations.

2. Decide who should be invited. Ask your teacher or leader for help. Give them an agenda for the meeting that includes the date, time, and location, as well as a list of questions you have about your riparian zone.

3. At the meeting, begin by introducing yourselves to your guests. Explain that you have been exploring a riparian zone and would like more information about what your findings mean.

4. Present what you have found. Show your site maps and the other materials you have created. Tell them about the most interesting things you learned.

5. Ask for information and feedback. See if the conclusions you gave are accurate. You might ask other questions like:

- How do people affect the quality of our riparian zone?
- How do you work to manage riparian zones?
- If part of your job is working with riparian zones, what projects are you working on in the riparian zone?
- Are there land use decisions being made that may impact my riparian zone in the future?

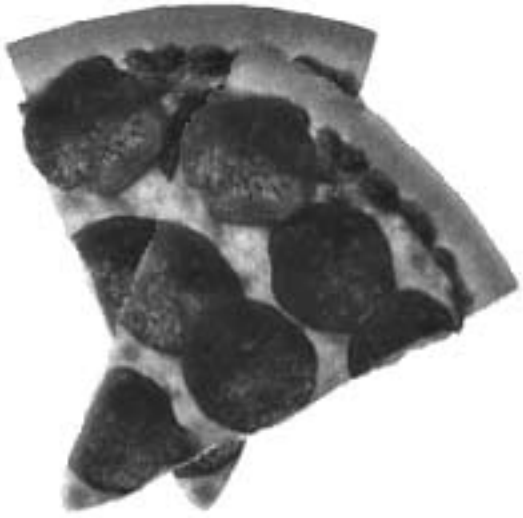
6. Thank your guests for sharing their time and expertise.

Then, CELEBRATE!

After all of your hard work collecting data and discovering riparian zones, it's nice to celebrate. Not only is celebration fun, but it's also a good way to say thank you to people who helped out.

You may want to have your celebration at your meeting with the experts. Here are some ideas for your celebration:

- Hold a pizza party or picnic.
- Make t-shirts for group members with the name of your group or riparian zone.
- Hold a fair, with displays showing what you have learned about riparian zones.
- Invite friends, family, classmates, and neighbors on a tour of your riparian zone.
- Use your imagination. It's your celebration!



Glossary

aquatic: of or in water.

aquifer: an underground layer of sand, gravel, or permeable rock where water collects.

bankfull flow: the width of a stream when the channel is full and about to spill over onto the floodplain.

bedrock: solid rock that is underneath soil.

biodiversity: a variety or richness of life on Earth. A key part of healthy ecosystems, biodiversity refers to the number of plants or animals within a single species, the variety of the species themselves, and the variety of ecosystems. Diversity strengthens the potential of populations and species to respond or adapt to changing environmental conditions.

braided stream: stream with many stream bars (see below) surrounded by flowing water.

canopy: the parachute-shaped cover provided by shrubs and trees.

colonizers: plants that are the first to grow in bare areas where streambeds and banks have been disturbed.

community: a group of people or other living things that live in a common location. You may be a part of many communities: school, neighborhood, church.

crown: the part of a plant where the stems and roots come together.

deposition: the process that occurs when sediment (sand, clay, gravel, cobble) falls out of the water, wind, or ice that carries it. A process that builds (or deposits) soil, deposition is the opposite of erosion, a process that carries soils away.

discharge: to flow from or past. Scientists use the term to describe the flow of water from groundwater into streams, and also the volume of water that passes through a channel during a specific time period.

ecosystem: a system or area defined by a community of living organisms (animals, plants, bacteria) and their environment working together. A meadow, forest, and wetland are all different types of ecosystems.

ecotone: a natural area where two ecosystems overlap. In an ecotone there is a gradual transition from the plants and animals found in one ecosystem to the plants and animals found in the other.

erosion: the wearing away or separation of soil and rock from the land by water, wind, ice, or gravity.

floodplain: a flat area on either or both sides of a stream or river that is created by periodic flooding.

gradient: the degree to which something slopes upward or downward.

groundwater: water that collects underground in the spaces between particles of sand and gravel or in cracks in bedrock.

habitat: the place where an organism finds the food, water, shelter, and space it needs to survive.

macroinvertebrates: organisms without a backbone that can be seen with the naked eye.

meander: the "S" shape of many streams and rivers.

nonpoint source pollution: contamination that cannot be traced to a single source. Oil, gasoline, brake fluid, trash, fertilizers, pesticides, and animal waste that wash into waterways and degrade water quality are considered nonpoint source pollution.

nutrients: substances that promote growth. In a stream or other body of water, fertilizers, animal waste, or decaying leaves and grasses can be considered nutrients. When present in excess amounts, nutrients can become pollutants.

percolate: to pass through or drain through a substance, as water percolates through sandy soils.

permeable: having openings that allow liquids to pass through.

pH: the measure of the acidity and alkalinity of a solution based on a scale from 1 (most acidic) to 14 (most alkaline).

point bar: an area found on the inside of a river meander where sediment is deposited after falling out of slow-moving water.

pollutant: any substance that degrades the quality of soil, water, or air.

proper functioning condition: a term used to describe a healthy riparian zone and the way in which its component parts—especially the water, plants, soil, and landforms—work together to provide a variety of services and benefits.

recharge: to refill or replenish. Melting snow in the spring helps recharge groundwater supplies.

riffle: shallow, fast-moving water where the flow is broken by a bed of gravel, cobbles, or boulders.

runoff: water from precipitation that flows over the land surface into rivers, streams, marshes, and other water bodies.

sediment: soil, rock fragments, and other material transported and deposited by water, wind, or other forces.

stabilizers: plants with strong crowns and roots that anchor the soil along stream banks.

stream bars: islands of soil, gravel, cobbles, or boulders that form in the middle of a stream or river.

stream channel: the bed where a natural stream of water runs or may run.

surface water: water found on the surface of the Earth in lakes, streams, and rivers.

terrace: a stair-like landform that is a former floodplain of a stream.

topography: the shape of the land.

transect line: a line across an area that marks where to take samples for recording, mapping, or studying.

turbid: muddy or cloudy because of sediment, algae, or other small particles floating in the water.

upland: the higher ground in a watershed, away from the stream, river, or lake. Uplands are usually drier than riparian zones.

water table: the top of the underground area that is filled with groundwater.

watershed: the land area that drains into a stream, river, or other body of water.

wetted edge: the point at the edge of a stream where the water touches the stream bank.