Upper Missouri River Breaks National Monument
Interpretive Center

Teacher's Guide

5th & 6th Grade Activities

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Freshwater Habitats – A Water Ecology Activity

Objectives:
Students will understand the following:

1. The presence of specific organisms in a freshwater habitat determines the quality of that habitat.
2. An organism's behavior and adaptations relate to its habitat.
3. Freshwater habitats have different characteristics depending on whether water is still or moving.

Materials Needed:

- Various field guides of pond life or freshwater life
- Collecting nets such as small fish nets, long-handled dip nets, kick seine nets
- Collecting buckets, preferably white, so that it is easier to see collected organisms
- pH paper
- Thermometers, preferably those that do not contain mercury
- Meter sticks or tape measures
- Fish floats or any object that will float on water (even a leaf)
- Stop watches or watches with a second hand
- Magnifying glasses or bug boxes to help identification
- Old shoes or boots
- Copies of the Identification Sheet: Identifying Macroinvertebrates
- Copies of the Activity Sheet: Freshwater Habitat Data – Habitat Observations and Physical Factors; and the Activity Sheet: Freshwater Habitat Data – Stream Organisms ID Sheet

Instructions:
1. Discuss with students the characteristics of freshwater habitats. Explain that scientists consider water to be a freshwater source if it has a salinity (saltwater content) of less than .005%. Freshwater habitats can be ponds, lakes, bogs, rivers, streams, creeks, marshes, and swamps. Even a puddle or a drainage ditch can be a source of freshwater. A reservoir is an example of an artificial freshwater resource.

2. Remind students the Marias River is a freshwater habitat and ask them to describe the plant and animal life that they might find in the area. Is there anything around the river that could influence the life found there, such as farms, manicured lawns (which may contain chemicals), asphalt, trees or other bodies of freshwater? Ask students to hypothesize about the health of the river and its diversity of life. Would they consider it healthy or unhealthy? Why?

3. Explain to students that they can learn about the health of a freshwater habitat, such as the Marias, by studying the organisms living within it. Scientists have determined that certain organisms can tolerate a polluted freshwater environment, while others can only live in a healthy freshwater environment. In this activity, students will determine the health of the Marias River based on the presence of specific organisms.

4. Introduce the word *macroinvertebrate* to the class. Explain that a macroinvertebrate is an animal without a backbone living in one stage of its life cycle, usually the nymph or larval stage. Macro-invertebrates can spend a few years living in this stage in a freshwater habitat and can be seen without a microscope. Many macroinvertebrates are benthic organisms, or bottom dwellers.

5. Explain that scientists look at the number and type of organisms present in a freshwater habitat to determine its health. The water quality of a freshwater habitat is *good* when it is rich in oxygen and capable of supporting a variety of organisms. Water quality is *fair* when it contains less oxygen and low concentrations of pollutants, and *poor* water quality habitats suffer from high levels of pollutants. Some organisms can only be found in healthy freshwater habitats with good water quality, while others can tolerate fair water quality, but are unable to survive in a poor water quality habitat. And some organisms are able to live just about anywhere.

6. Clarify for students that a pollutant is something introduced to an environment that is not native to it. For example, warm water introduced to a stream is called a thermal pollutant and can harm the organisms adapted to live in the cool water; environmental pollutants taint freshwater habitats; and human and animal waste products contain bacteria such as fecal coliform that pollute freshwater.

7. Share with students the list below: organisms and the quality of water their presence indicates. The larvae of a stonefly, for example, is a macroinvertebrate that is very sensitive to chemical and physical changes in water, and its presence indicates good water quality. Clams and crayfish are able to survive in fair water quality areas but not in poor water quality areas. Blackfly larvae and leeches can be found in any type of water, and their presence alone suggests a poorer water quality.

Good Water Quality	**Fair Water Quality**	**Poor Water Quality**
Mayfly larvae	Crayfish	Aquatic worms
Stonefly larvae	Scud	Leech
Caddisfly larvae	Dragonfly nymph	Pouch snail
Dobsonfly larvae (Hellgrammite)	Cranefly larvae	Midge fly larvae
Water penny	Clam	Blackfly larvae
Riffle beetle	Damselfly larvae	Carp
Trout	Sow bug	
	Catfish	

8. Divide students into teams of three or four. Provide each student with a copy of the Identifying Macroinvertebrates Sheets and the Freshwater Habitat Data Sheets. Review these pages with the class. The identification sheets will be used to distinguish and classify organisms found during the field study. The activity sheets will be used to record students' findings.

9. Explain to students that they will study two specific parts of the freshwater habitat—shallow and deep areas. The shallow water should reach no higher than a student's ankle and the deep water should reach no higher than the knee.

10. Review these safety precautions to follow during fieldwork:

- Wear old boots that will keep feet dry.
- Remember wet surfaces, such as rocks with algae, are slippery.
- Be sure of the depth before stepping further into the water.
- Handle organisms gently and return them to the habitat alive.
- Be aware that some organisms can bite or pinch.
- Never drink the water.

11. Have each team gather collecting equipment and choose a place to work in the habitat. Have each student first quietly stand or sit and observe the habitat. What can they hear? What can they see? Have them record their observations. Then, ask students to observe the river's edge and water's surface. Have

them look through the water to the bottom of the river. Have the students record their initial observations on their data sheet.

12. Next, have students measure the water temperature with a thermometer. Then, using a yardstick, they will record the depth. Next, students should determine the velocity of the flowing water by measuring the distance a float travels downstream in a 10- second time period (see the Water Stick Race Activity). Students can measure the pH of the water with a pH kit, pH paper or pH probe. They can also test for phosphates and other chemicals if there are kits available, time and interest. Students should record all data on their data sheets.

13. Suggest students choose an area of the river that has riffles to collect macroinvertebrates. A riffle area is where water passes quickly over a barrier or structure in the stream, creating a slight disturbance in the water's surface. This disturbance increases the oxygen content in the water.

14. Students should use a kick seine net or a large net with a small mesh so the bottom rests on the bottom of the stream to prevent organisms from being washed downstream underneath the net. Encourage them to disturb the bottom of the stream by picking up rocks and rubbing the surface of the rocks to dislodge organisms to be captured in the net. After a few minutes, students will carefully raise the net without releasing any organisms. They will gently put them into a collecting bucket. Students should identify and count the organisms, record their information on the data sheet, and release them.

16. They can also collect in more quiet, still areas of the river. They should carefully sift through mud or sand in the net when looking for macroinvertebrates. Collect all organisms in buckets and identify and count those captured. Record the data on the data sheet.

17. Ask students to study different sites in the river and compare their data for each site. Have them make detailed observations of the surrounding area to hypothesize what affects the health of the stream.

18. Explain to the students that to determine the quality of the river (good, fair, or poor), they must calculate how many macro-organisms they find in each category, using their Identifying Macroinvertebrates sheet. If students find an equal number of poor and fair water quality organisms, have them hypothesize how the habitat can be improved to sustain good water quality organisms.

19. Review the questions below with your students:

1. Compare and contrast the areas in the freshwater habitat. Which area had the greatest diversity of life? Which had the highest population? Why were some areas more diverse than others?

2. Discuss whether the river would be considered healthy or unhealthy. What organisms indicated this? Are there any threats to the water quality there? Are measures being taken to maintain the quality of the habitat? What could be done to improve the health of the habitat?

3. Discuss how the land around the habitat is used and the effects this might have on the river. Are lawns or fields adjacent to or nearby the river? Are these lands chemically treated? How might the Tiber Dam affect the river and its inhabitants and therefore its water quality?

4. Explain at least one predator-prey relationship in the river. Hypothesize what would happen if one of the organisms disappeared from the habitat.

5. Discuss how people use freshwater daily. Remind students that freshwater on Earth is limited, then have students suggest what things can be done by people to conserve freshwater effectively.

Activity from DiscoverySchool.com with modifications for the Marias River habitat:
http://school.discoveryeducation.com/lessonplans/programs/freshwater/

Name: _____

Freshwater Habitat Data Sheet

Use this data sheet to record the observations you make while studying a freshwater habitat. Record your data accurately.

1. Record initial habitat observations.

What do you see?

What do you hear?

2. Record physical factors of the freshwater habitat.

	Deep	**Shallow**	**Other**
Describe the bottom. (sand, mud, gravel, rocks)			
Water temperature			
Water depth (m or cm)			
Current velocity (meters/second)			
pH			

Name: _____

Freshwater Habitat Data Sheet

Use this data sheet to record the observations you make while studying a freshwater habitat. Record your data accurately.

3. Use the Identification Sheet to record stream organisms in the freshwater habitat.

Type (name)	How many?	Identifying Characteristic

Identification Sheet:
Determining the Health of Freshwater Habitats

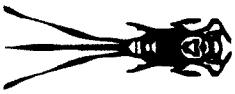
Name: _____

Identifying Macroinvertebrates

Good Water Quality	Fair Water Quality	Poor Water Quality
Mayfly larvae	Crayfish	Aquatic worms
Stonefly larvae	Scud	Leech
Caddisfly larvae	Dragonfly nymph	Pouch snail
Dobsonfly larvae (Hellgrammite)	Cranefly larvae	Midge fly larvae
Water penny	Clam	Blackfly larvae
Riffle beetle	Damselfly larvae	
	Sowbug	

Good Water Quality

These macroinvertebrates cannot survive in polluted freshwater habitats:



Mayfly larvae: I am _ inch to 1 inch long. I have brown leathery gills on both sides of my lower body. I have six legs with hooked tips, antennae, and two (sometimes three!) hairlike tails. Sometimes my tails are webbed together.

Stonefly larvae: I am _ inch to 1-_ inches long. I have six legs with hooked tips, antennae, and two hairlike tails. I do not have gills on the lower half of my body.

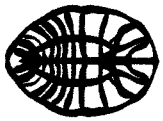
Caddisfly larvae: I am as long as 1 inch. I have six hooked legs on the upper portion of my body, and two hooks at the back end. I might be found in a stick, rock, or leaf case with my head poking out. I sometimes have fluffy gill tufts on the lower half of my body.

Identification Sheet:
Determining the Health of Freshwater Habitats

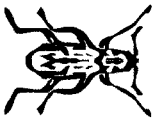
Name: _____

Identifying Macroinvertebrates

Dobsonfly larvae: I am _ inch to 4 inches long. I am dark colored. I have six legs and large, pinching jaws. I have eight "feelers" on the lower half of my body, with paired cottonlike gill tufts along my underside. I have short antennae, two tails, and two small hooks on my bottom!



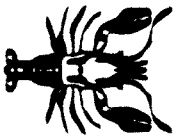
Water penny: I am _ inch long with a flat, saucer-shaped body. I have a raised bump on one side of my body, and six tiny legs on the other. Some people refer to me as an *immature* beetle.



Riffle beetle: I am _ inch long. I have an oval body covered with tiny hairs. I have six legs and antennae and I walk s-l-o-w-l-y underwater. I do not swim on the surface of the water.

Fair Water Quality

These macroinvertebrates can tolerate fair water quality:



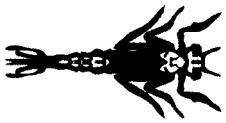
Crayfish: I can grow as long as 6 inches. I have two large claws, eight legs, and many say that I resemble a small lobster.

Scud: I am _ inch long. My body is higher than it is wide. I can be white or gray. I swim sideways and sometimes resemble a small shrimp.

Dragonfly nymph: I am _ inch to 2 inches long. I have large eyes, six hooked legs, and a wide oval or round abdomen.

Crane fly larvae: I am _ inch to 2 inches long. I am milky green colored or light brown. I am pleasantly plump, almost caterpillar-like, and have a segmented body. I have four fingerlike lobes at the back end of my body.

Clam: A clam I am. I am a bivalve mollusk. My body is tucked within two shells joined by a hinge.

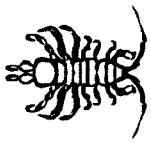


Damselfly larvae: I am _ inch to 1 inch long. I have no gills on the lower half of my body. I have three, broad, oar-shaped tails positioned like a tripod. I have six, thin, hooked legs and large, large eyes. I am the damselfly.

Identification Sheet:
Determining the Health of Freshwater Habitats

Name: _____

Identifying Macroinvertebrates

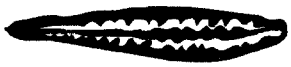


Sow bug: I am _ inch to _ inch long. My body is wider than it is high. I am gray with an oblong body. I have more than six legs and long antennae.

Poor Water Quality

These macroinvertebrates can survive in unhealthy freshwater environments.

Aquatic worms*:* I am _ inch to 2 inches long. I have a very tiny, thin, wormlike body.



Leech*:* I am _ inch to 2 inches long, brown, and terribly slimy. I have suction pads near my head. You might want to check and make sure that I am not attached to your leg when you leave the water.

Pouch snail*:* My shell opens to the left; it cannot seal tightly shut when a predator finds me. Since I breathe air, I like to crawl out of the water.

Midge fly larvae: I am up to _ inch in length. I have a dark head and a wormlike, segmented body. I have two tiny legs on each side.

Blackfly larvae: I am up to _ inch long, and one end of my body is wider than the other. My head is black with a suction pad on one side of it.

Estimate the Area of a Streambed

This activity can be used when you stop for camp.

Materials Needed:
Yardstick
Tape Measure
Pens/Pencils
Notebook

Instructions:

Divide students into groups of four and measure out three 30-foot sections of the river. Have each group of four be responsible for taking measurements in one of the 30-foot sections. Have each group estimate the area of the river in their section. First, have two students measure the width of the streambed in their location using a tape measure. Have someone from the group write down the measurement in feet in their notebook.

Next, two other students can measure the depth of the river in three equally-spaced locations in their section. Use the yardsticks to locate the bottom of the river and then read the measurement in inches. The person recording the data should write down these measurements. Have students make an average of these measurements. Then, have them multiply the width of the stream times the average depth to get an estimated area of their river location.

Reconvene as a large group and compare results. Why might the areas of each location be different? Are some parts of the river deeper or wider than others? Why or why not? Does the width of depth of a river area impact the geology (or vice-versa)? Does it affect the vegetation and wildlife? Why or why not?

Habitat Want Ads

Background:

Wildlife use a variety of habitats in our area, and various species are adapted for the habitat they use. This activity will help students understand what a habitat is and what animals need for survival.

Materials Needed:

Newspaper Want Ads
Pen/Pencil
Notebook for writing and drawing

Objectives:

1. Students will learn what "habitat" means, and therefore, the elements needed for an animal to survive in this region.
2. Students will conduct a science-based writing exercise.

Instructions:

Ask students what they think a wild animal needs to survive; create a list of their ideas. Ask students what the word habitat means and what elements they think comprise a habitat (a habitat consists of soil, water, air, shelter and sun).

Read a newspaper want ad for a house or apartment to the students and discuss how this habitat meets a person's requirements. For example: water runs through the facet taps; shelter would be a roof covering; heat from a furnace, etc.)

Talk about the different types of wild animals found in the Marias region, including mule deer, jack rabbits, pronghorn, bobcats, and merganser. How do the habitats needs differ and how might they be similar? Share ideas and list them.

Ask each student to choose an animal that lives in the area (wildlife, not domesticated) and have them write a habitat want ad for his or her animal. Ask the students to share their want-ad with the group without naming the animal they are writing about, and see if the group can guess which animal is "looking for a home" through the want-ad. Then, have them sketch their animal in its habitat.

Extension: Habitat Impacts

Discuss what activities impact wildlife habitat, either positively or negatively. Take a walk in the area where you've camped (or stopped for a lunch break) – ask the students if they notice any positive or negative impacts on the habitat area.

Then, have students write a short story about an impact, such as damming a river, hikers leaving trash and other litter in the environment, or a farmer leaving some of the crop harvest at the edge of the field. Ask students to consider the following questions in their essay: How does that impact affect the habitat, and therefore, the wildlife, is that impact positive or negative and why, and what might be some solutions to the negative impacts or how could others be encouraged to do more of the positive impacts?

Activity based on "Habitat Want Ads", National Park Service, Great Basin National Park.

Invent an Animal Adapted for the Marias

Background:

All organisms that live in varied habitats have physical, biological, and behavioral adaptations that help them survive in their environment. In this activity students will work collaboratively to create fictitious animals in order to understand adaptations that help wildlife survive.

Objectives:

1. Identify specific adaptations that aid animals in survival.
2. Understand the special environment of the Marias River area and its diverse habitats

Materials Needed:

A field guide to birds, mammals, and reptiles
Drawing paper
Colored pencils, Markers and/or Crayons
Pens/Pencils
Notebook

Instructions:

Remind students of some important biological and ecological words:

Habitat: the place where a plant or animal lives
Community: are the living components of an ecosystem. The plants and animals forming the community are dependent upon one another.
Niche: the role a particular organism plays within its community, its job.
Species: organisms with shared characteristics, capable of interbreeding.
Carnivore: an animal that eats meat.
Omnivore: an animal that eats both plants and animals.
Herbivore: an animal that eats plants.

Then, explain how physical, biological, and behavioral adaptations help plants and animals survive. Ask the students to list examples of physical, biological and behavioral adaptations among plants and animals that help them to survive.

Divide the class into small groups, and explain that each group will be designing or creating a new animal for the Marias River area. One student in each group should be designated as the sketch artist; another should keep a list of the special adaptations this creature will have to survive in this area.

Distribute field guides as reference material. Have student choose a habitat found in this area, such as riparian, river, or plains. Explain that the animal they invent must have adaptations that enable it to thrive in the habitat it has been assigned.

The following questions should be addressed:

- Does your creature lay eggs? If so, how many eggs?
- Does your creature give live birth? If so, when and how many are born each year.
- Is your creature camouflaged? In what way does in blend into its habitat?
- Is your creature a carnivore, omnivore, or herbivore? What does it eat?
- Does it have enemies? If so, how does it protect itself?
- Where does your animal live in its habitat? (example – a den, a nest, an open field)

Allow 15 – 20 minutes for the students to design their creature. Make sure they color their drawing with colored pencils, markers, or crayons. Have them present their creature to the class and answer the above questions. Make sure that the students name their creature. Have other students take notes and ask questions or make comments about the animals presented.

Activity based on “Invent an Animal”, Bighorn Canyon National Recreation Area, National Park Service.

Mad Libs – Our River Trip

With Mad Libs, you'll create a story about your river trip, but you don't know how the story goes until you come up with some great words! Let's get your brain going thinking of some words as described below, and then we'll see how the story comes together!

Words:

1. The name of your best friend.
2. Your favorite color.
3. An adjective.
4. An animal.
5. Another adjective.
6. Your favorite food.
7. A verb.
8. Another verb.
9. Your best friend's name again.
10. How a horse moves.
11. Your favorite sport.

Now, let's put the words together in a Mad-Lib story about a river adventure!

The Mad-Lib River Story

Yesterday _____ and I took a river trip. On our way to the _____ River, we saw a big _____ _____. We also saw a _____ bird eating _____. That bird _____ and _____. _____ and I decided it was time to head back home and so we _____ our canoe. We'll wait until _____ season is over before we get in our canoe again.

Campfire Stories: Read a Native American Legend then Create Your Own Legend about Nature

Have you ever wondered why some things in nature are as they are? For example, why does a pelican have the type of bill/beak that it does? Why do aspen leaves turn yellow in autumn? Native Americans have stories about some of these things, such as why bears hibernate in winter. Below is a Blackfoot legend about why a chipmunk has stripes on its back. Read the legend. Then think about something in nature you have a question about and write a story/legend that might answer that question. Share your story with your campmates around the campfire one night!

Why the Chipmunk's Back is Striped

A Blackfoot Legend

What a splendid lodge it was, and how grand War Eagle looked leaning against his back-rest in the firelight! From the tripod that supported the back-rest were suspended his weapons and his medicine-bundle, each showing the wonderful skill of the maker. The quiver that held the arrows was combined with a case for the bow, and colored quills of the porcupine had been deftly used to make it a thing of beauty. All about the lodge hung the strangely painted linings, and the firelight added richness to both color and design.

War Eagle's hair was white, for he had known many snows; but his eyes were keen and bright as a boy's, as he gazed in pride at his grandchildren across the lodge-fire. He was wise, and had been in many battles, for his was a warlike tribe. He knew all about the world and the people in it. He was deeply religious, and every Indian child loved him for his goodness and brave deeds.

About the fire were Little Buffalo Calf, a boy of eleven years; Eyes-in-the-Water, his sister, a girl of nine; Fine Bow, a cousin of these, aged ten, and Bluebird, his sister, who was but eight years old.

Not a sound did the children make while the old warrior filled his great pipe, and only the snapping of the lodge-fire broke the stillness. Solemnly War Eagle lit the tobacco that had been mixed with the dried inner bark of the red willow, and for several minutes smoked in silence, while the children's eyes grew large with expectancy.

Finally he spoke: "Napa, Old-Man, is very old indeed. He made this world, and all that is on it. He came out of the south, and traveled toward the north, making the birds and animals as he passed. He made the perfumes for the winds to carry about, and he even made the war-paint for the people to use. He was a busy worker, but a great liar and thief, as I shall show you after I have told you more about him. It was Old-Man who taught the beaver all his cunning. It was Old-Man who told the bear to go to sleep when the snow grew deep in winter, and it was he who made the curlew's bill so long and crooked, although it was not that way at first. Old-Man used to live on this world with the animals and birds. There was no other man or woman then, and he was chief over all the Animal-People and the Bird-People. He could speak the language of the robin, knew the words of the bear, and understood the sign-talk of the beaver, too. He lived with the wolves, for they are the great hunters. Even today we make the same sign for a smart man as we make for the wolf; so you see he taught them much while he lived with them.

"Old-Man made a great many mistakes in making things, as I shall show you after a while; yet he worked until he had everything good. But he often made great mischief and taught many wicked things. These I shall tell you about some day. Everybody was afraid of Old-Man and his tricks and lies -- even the Animal-People, before he made men and women.

He used to visit the lodges of our people and make trouble long ago, but he got so wicked that Manitou grew angry at him, and one day in the month of roses, he built a lodge for Old-Man and told him that he must stay in it forever. Of course he had to do that, and nobody knows where the lodge was built, nor in what country, but that is why we never see him as our grandfathers did, long, long ago.

"What I shall tell you now happened when the world was young. It was a fine summer day, and Old-Man was traveling in the forest. He was going north and straight as an arrow -- looking at nothing, hearing nothing. No one knows what he was after, to this day. The birds and Forest-People spoke politely to him as he passed but he answered none of them. The Pine-Squirrel, who is always trying to find out other people's business, asked him where he was going, but Old-Man wouldn't tell him. The woodpecker hammered on a dead tree to make him look that way, but he wouldn't. The Elk-People and the Deer-People saw him pass, and all said that he must be up to some mischief or he would stop and talk a while. The pine-trees murmured, and the bushes whispered their greeting, but he kept his eyes straight ahead and went on traveling.

"The sun was low when Old-Man heard a groan" (here War Eagle groaned to show the children how it sounded), "and turning about he saw a warrior lying bruised and bleeding near a spring of cold water. Old-Man knelt beside the man and asked: 'Is there war in this country? ' "'Yes,' answered the man. 'This whole day long we have fought to kill a Person, but we have all been killed, I am afraid.' "'That is strange,' said Old-Man; 'how can one Person kill so many men? Who is this Person, tell me his name!' but the man didn't answer -- he was dead. When Old-Man saw that life had left the wounded man, he drank from the spring, and went on toward the north, but before long he heard a noise as of men fighting, and he stopped to look and listen. Finally he saw the bushes bend and sway near a creek that flowed through the forest. He crawled toward the spot, and peering through the brush saw a great Person near a pile of dead men, with his back against a pine-tree. The Person was full of arrows, and he was pulling them from his ugly body. Calmly the Person broke the shafts of the arrows, tossed them aside, and stopped the blood flow with a brush of his hairy hand. His head was large and fierce-looking, and his eyes were small and wicked. His great body was larger than that of a buffalo-bull and covered with scars of many battles.

"Old-Man went to the creek, and with his buffalo-horn cup brought some water to the Person, asking as he approached: "Who are you, Person? Tell me, so I can make you a fine present, for you are great in war.' "'I am Bad Sickness,' replied the Person. 'Tribes I have met remember me and always will, for their bravest warriors are afraid when I make war upon them. I come in the night or I visit their camps in daylight. It is always the same; they are frightened and I kill them easily.'

" 'Ho!' said Old-Man, 'tell me how to make Bad Sickness, for I often go to war myself.' He lied; for he was never in a battle in his life. The Person shook his ugly head and then Old-Man said, 'If you will tell me how to make Bad Sickness I will make you small and handsome. When you are big, as you now are, it is very hard to make a living; but when you are small, little food will make you fat. Your living will be easy because I will make your food grow everywhere.'

"'Good,' said the Person, 'I will do it; you must kill the fawns of the deer and the calves of the elk when they first begin to live. When you have killed enough of them you must make a robe of their skins. Whenever you wear that robe and sing -- "now you sicken, now you sicken," the sickness will come -- that is all there is to it. '

"'Good,' said Old-Man, 'now lie down to sleep and I will do as I promised.' "The Person went to sleep and Old-Man breathed upon him until he grew so tiny that he laughed to see how small he had made him. Then he took out his paint sack and striped the Person's back with

black and yellow. It looked bright and handsome and he waked the Person, who was now a tiny animal with a bushy tail to make him pretty.

"'Now,' said Old-Man, 'you are the Chipmunk, and must always wear those striped clothes. All of your children and their children, must wear them, too.' "After the Chipmunk had looked at himself, and thanked Old-Man for his new clothes, he wanted to know how he could make his living, and Old-Man told him what to eat, and said he must cache the pine-nuts when the leaves turned yellow, so he would not have to work in the winter time.

'You are a cousin to the Pine-squirrel,' said Old-Man, 'and you will hunt and hide as he does. You will be spry and your living will be easy to make if you do as I have told you.' "He taught the Chipmunk his language and his signs, showed him where to live, and then left him, going on toward the north again. He kept looking for the cow-elk and doe-deer, and it was not long before he had killed enough of their young to make the robe as the Person told him, for they were plentiful before the white man came to live on the world. He found a shady place near a creek, and there made the robe that would make Bad Sickness whenever he sang the queer song, but the robe was plain, and brown in color. He didn't like the looks of it. Suddenly he thought how nice the back of the Chipmunk looked after he had striped it with his paints. He got out his old paint sack and with the same colors made the robe look very much like the clothes of the Chipmunk. He was proud of the work, and liked the new robe better; but being lazy, he wanted to save himself work, so he sent the South-wind to tell all the doe-deer and the cow-elk to come to him. They came as soon as they received the message, for they were afraid of Old-Man and always tried to please him. When they had all reached the place where Old-Man was, he said to them: "'Do you see this robe?'

"'Yes, we see it,' they replied.

'Well, I have made it from the skins of your children, and then painted it to look like the Chipmunk's back, for I like the looks of that Person's clothes. I shall need many more of these robes during my life; and every time I make one, I don't want to have to spend my time painting it; so from now on and forever your children shall be born in spotted clothes. I want it to be that way to save me work. On all the fawns there must be spots of white like this (here he pointed to the spots on Bad Sickness's robe) and on all of the elk-calves the spots shall not be so white and shall be in rows and look rather yellow.' Again he showed them his robe, that they might see just what he wanted.

'Remember,' he said, 'after this I don't want to see any of your children running about wearing plain clothing, because that would mean more painting for me. Now go away, and remember what I have said, lest I make you sick. ' "The cow-elk and the doe-deer were glad to know that their children's clothes would be beautiful, and they went away to their little ones who were hidden in the tall grass, where the wolves and mountain-lions would have a hard time finding them; for you know that in the tracks of the fawn there is no scent, and the wolf cannot trail him when he is alone. That is the way Manitou takes care of the weak, and all of the Forest-People know about it, too.

"Now you know why the Chipmunk's back is striped, and why the fawn and elk-calf wear their pretty clothes. "I hear the owls, and it is time for all young men who will some day be great warriors to go to bed, and for all young women to seek rest, lest beauty go away forever. Ho!"

Story source: First People's Website:
http://www.firstpeople.us/FP-Html-Legends/Why_The_Chipmunks_Back_Is_Striped-Blackfoot.html

Prairie Beasts and Beauties

Background:

Insects, though small organisms, are important to a prairie habitat. For example, butterflies nurture prairie wildflowers, and beetles provide food for some songbirds. Insects are numerous, yet often go unnoticed and unappreciated.

One of the most important jobs of being a scientist is to sort and classify. The science of classification is called systematics. Systematics gives scientists the tools to communication clearly about the natural world. Living organisms are grouped according to how closely-related they are. These groups start out very large and become increasingly specific until finally scientists name individual species. Each species has a scientific name that is recognized anywhere in the world no matter what language is spoken.

Most people think that mammals are the most important numerous group of animals on the earth. If asked to name a list of animals, most people will name mammals long before they name any other group. In reality, mammals are a relatively small group of animals; insects are a much, much larger group. There are about 4,500 species of mammals and more than one million known species of insects. Eighty percent of the world's animals are insects.

Objective:

Students will observe insects in the field and learn that scientists classify living things according to similarities and differences. They will be able to list the characteristics of insects and arthropods and give examples of these animals.

Materials Needed:

Notebook
Pen/Pencil
Magnifying Glasses/Hand Lens
Insect and Plant ID books

Instructions:

Ask students to fill one notebook-sized sheet of paper (both sides) with the names of as many animals as they can think of in 10 minutes. Ask them to be as specific as possible. For example, instead of "bird", have them write "bald eagle" or "meadowlark". At the end of 10 minutes, ask them to stop writing and count how many animal names they listed.

Ask students how many mammals were on the list. Have them write that number on paper and circle it. Ask them how many birds they listed and write that number on paper and circle it. Then ask how many insects they listed, write that number on paper and circle it as well.

Then, explain to the students that most people think that mammals are the most important and numerous group of animals on Earth. Then, continue to explain the background information above.

Ask the students if their lists reflect what most people think – in other words, did they list more mammals or even birds than insects? Then ask them "why do you think that most people do not think of insects when they are asked to make a list as you've done?"

Ask students if they know what characteristics scientists use to classify an animal as an insect?" Have them brainstorm then explain the following characteristics of insects and have them write these in their notebook/journal:

- An exoskeleton
- Three body parts: head, thorax, abdomen
- Six legs attached to the thorax
- Two or four wings attached to the thorax (adult insects)
- Two antennae attached to the head (adult insects)

Divide students into groups of 3 or 4 and provide each group with a copy of the Invertebrate Photographs; ask them to sort these into piles of insects and non-insects based upon what they know about the characteristics of insects. Discuss the process – was it easy or hard? Ask how each group made the decisions they did, then ask how all of the animals in the piles are related to each other.

Explain to the students that all insects have skeletons on the outside of their bodies – this is called an exoskeleton. Other animals have exoskeletons as well. If an animal has an exoskeleton, segmented body and jointed legs, and is symmetrical on both sides of its body, then it fits into the group that scientists call arthropods. There are five major groups of arthropods. Insects are the largest group of arthropods. Scientists call each of these groups a "class".

1. Millipedes
2. Centipedes
3. Crustaceans: crabs, lobsters, and shrimp
4. Arachnids: spiders, mites, ticks, scorpions
5. Insects

Tell students that one of the most important jobs of being a scientists is to sort and classify. The science of classification is called systematics. Systematics gives scientists the tools to communication clearly about the natural world. Living organisms are grouped according to how closely-related they are. These groups start out very large and become increasingly specific until finally scientists name individual species. Each species has a scientific name that is recognized anywhere in the world no matter what language is spoken.

Have students take a 10 minute prairie hike to look for insects. Remind students bugs can be difficult to find. They should not only look for butterflies and beetles, but also grasshoppers, flies and ants. Have them write down the types they observe and what those insects are doing. Are there butterflies on the flowers? Perhaps a bee? Do they see millipedes, centipedes or beetles on the grasses or in the dirt? Have each student select a bug they observed and draw a picture of the insect in its habitat.

Lastly, brainstorm and discuss the jobs insects have within the prairie habitat. Ask students if they think humankind benefit from insects on the prairie, and if so, how? What other animals benefit from insects? (hint: some songbirds eat insects as do some larger animals, such as black bears).

Extensions:

1. Using plant identification books, have students again go into the field and identify some of the prairie plants (wildflowers and shrubs) which may benefit from insects such as butterflies and bees. Do they see any insects on these plants? Have them record their observations in their notebook/journal.
2. Have students complete the Bug Safari Maze during quiet time in camp.

Activities based on "Are You One of Us?" from the Smithsonian Institute, and the "Safari Maze Game", both available online from Orkin Learning Center: http://www.orkin.com/learningcenter/kids_and_teachers.aspx

Report on the Riparian Zone

Background:

Riparian zones are valuable ecosystems. They often contain vegetation important to many wildlife species, including small insects, birds, and larger mammals. You and your campmates are going to learn about these important ecosystems during your river journey by conducting actual field research and drawing conclusions from your data.

Objectives:

Students will:

1. Learn about ecosystems and the elements that make up the riparian ecosystem
2. Learn how to conduct habitat surveys and collect field data
3. Conduct research on a riparian zone found along the Marias River.

Materials Needed:

- Butcher paper
- Marking pens
- Notebook paper for recording observations
- Pens or Pencils
- Trowel or stick
- Thermometer
- Compass

Instructions:

1. Find three study sites along the river that are somewhat different from each other in terms of sunlight, air temperature, soil moisture, wind, and number and types of plants and animals living there. If possible, select one site that is open, like the prairie, one that has trees, and one that contains water or is near the water's edge.
2. Divide large group into three teams with each assigned to one of the areas noted in #1.
3. Using butcher paper and marking pens, prepare a large chart for compiling each team's data.
4. Before having teams go into the field, discuss with students a favorite place they like to visit and ask them to think about the following questions:

    - What did you particularly enjoy about the place: Was it the people? The physical space?
    - What did you do?
    - What living things made your place enjoyable?
    - Name any nonliving things that made your place enjoyable.

5. Help students see that any place has both living and nonliving parts that work together to make an ecosystem. Explain to students that they will investigate ecosystems at three different study sites to find out how living and nonliving elements affect each other.
6. Divide the group into three teams with 3 to 6 on each team. Each group will investigate and record observations of a different component (soil, sunlight, wind, temperature, and plant and animal life) of three different study sites. Give students instructions, a copy of the team chart, and materials described below. Later, teams will transfer their observations to the class data chart. After teams

have had sufficient time to investigate each location, have them all come together to present their findings and share what they have learned.

Soil: Ask students to determine the soil moisture at the study sites. They can use a trowel or stick to scrape the surface of the ground and to obtain a small sample of soil from underneath the surface. By feeling the soil, they should be able to tell whether it is wet, moist, or dry. They should examine the soil for other characteristics such as texture, color, and smell. They should also note plant material or organisms in the soil.

Sunlight: Ask students to determine how much sunlight penetrates the ground at each study site. Students may determine light intensity at each site by using a photographic light meter or photosensitive paper. If these items are not available, they can use relative terms such as shady, dark, medium light, or bright.

Wind: Ask students to use the small strip of paper to determine the wind movement at each site. One student can hold the paper away from the body, while the others observe whether it hangs straight down or blows at an angle. Ask students to use the compass to determine from which direction the wind seems to be blowing.

Temperature: Ask students to measure each site's temperature at aground level, 1" deep in the soil, and at 1 yard above ground. If one site contains water, have the team measure the temperature at just above the water, at 1" deep, and at 1 yard above.

Plant Life: Ask students to observe the various kinds of plants at each site (large trees, small trees, shrubs, small plants, grasses, grasses). Suggest that they record the most common types of plants found in each location and that they note especially where each grows relative to the others.

Animal Life: Ask students to note the various kinds of animals at each site (insects, birds, reptiles, fish, etc.). They should note evidence of animals such as scat, tracks, burrows, or leaves that have been chewed.

Lastly, ask teams to enter their data on the large class chart you prepared. Use this chart as a basis for discussing the differences between the locations and any interactions students observed among the elements. Use the following questions to guide your large group discussion:

- Which ecosystems had the greatest number of plants? Animals? Which has the least of each? How do you explain this difference?
- How are plants and animals the same at different sites? How are they different?
- Which has the wettest soil? The driest?
- Do plants seem to affect the light intensity, air temperature, and soil temperature in an area?
- How does water seem to influence the soil temperature, air temperature, and soil moisture?
- What relationship does light seem to have with air temperature? With soil moisture? With plants?
- Which of the six elements we studied seems most important for determining the character of the environment at each site? What makes you say so?
- Why might a riparian zone have a larger selection of plant and animal life?
- Did you notice any evidence of human actions that may have affected the areas? Discuss the potential negative or non-negative impacts of this on the ecosystems.
- Have students write an assessment about today's ecosystem observation – what did they learn today?

Activity Based on Activity from Scholastic:
http://www2.scholastic.com/browse/lessonplan.jsp?id=495

The Importance of Plants to People

Plants are important to the survival of people and other animals (did you know that people are animals? Humans are in the class *Mammalia*, the same classification as deer, donkeys, dogs and cats – just fyi!) Our basic needs as human beings and other animals for food, shelter, clothing and oxygen are provided, either directly or indirectly, by plants.

On the next page, you'll find various ways that plants are important to people. Choose seven different colors to help you learn more about the ways plants are important to people and follow the instructions below.

First, color the leaf and diagram labeled "Construction" (A). Plants provide strong yet lightweight materials used in construction. Many cultures rely upon plants to provide all or part of the materials used in shelter construction. In some types of shelters, such as yurts and teepees, poles obtained from plants are used as a basic framework. In other types of shelters, such as wood frame houses, wood is the major construction material.

Next, color the leaf and diagram labeled "Energy" (B). Light from the sun is the major source of energy for the earth. Through photosynthesis, plants capture light energy and store it as organic chemical energy. We utilize this storied energy internally through the consumption of food as a cellular energy source and externally through the combustion of organic materials, such as wood, as a heat or light energy source.

Now, color the leaf and diagram labeled "Food" (C). All animals, including people, are heterotrophic, which means they cannot manufacture their own food from inorganic materials. Instead, they must rely upon organic materials as their food, or internal energy, source. Most plants are autotrophic – they utilize an inorganic energy source, such as the sun, to manufacture energy-rich organic compounds from inorganic substances. People grow and harvest plants for direct food consumption; these plants include cereals, fruits and vegetables, or indirectly, as in the fodder and grains fed to livestock which are consumed as food.

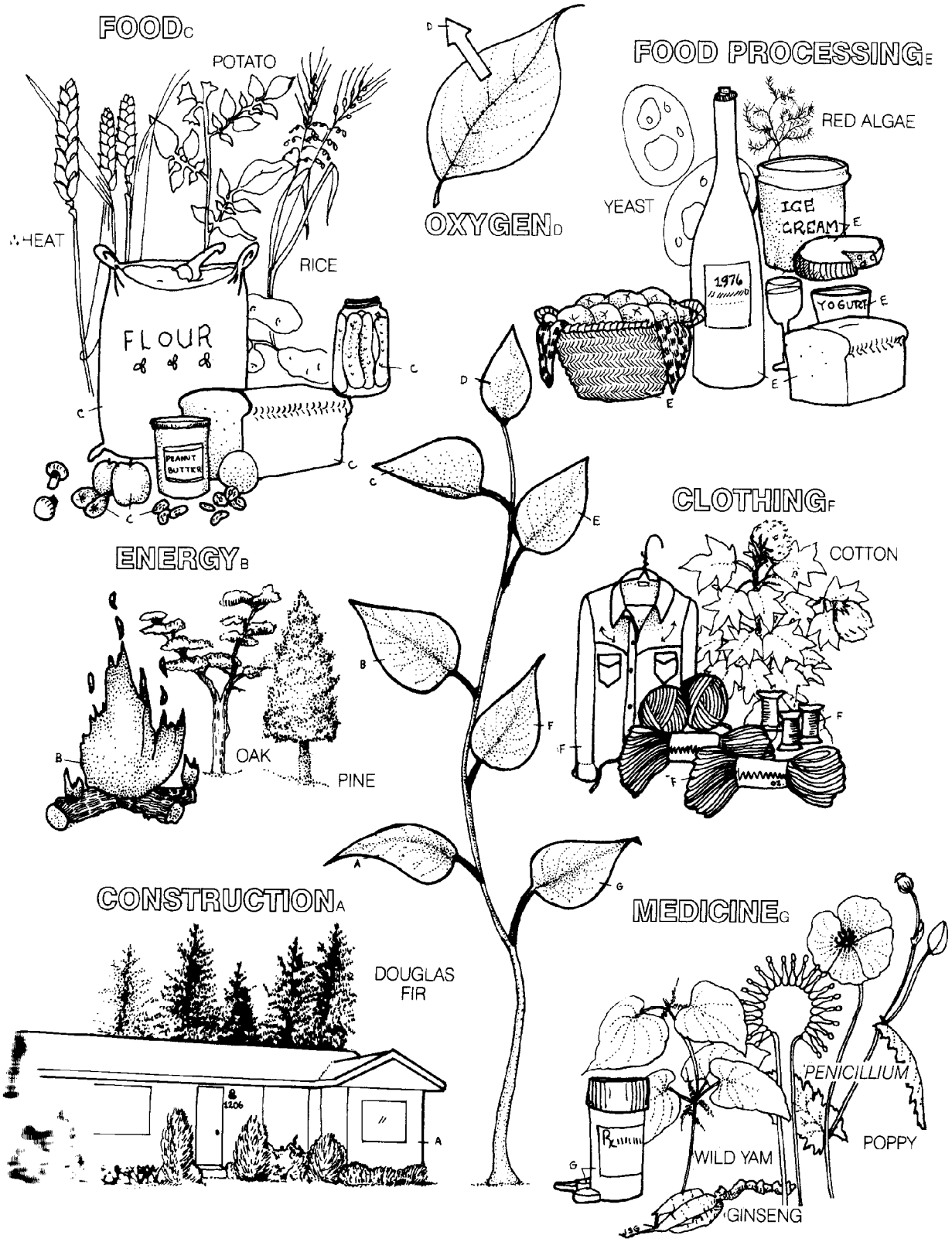
Next, color the leaf and diagram labeled "Oxygen" (D). During the energy-capturing, food producing process of photosynthesis, green plants split water and release free oxygen into the atmosphere. This is the source of the atmospheric oxygen we breathe. Without the continual release of large quantities of oxygen by green plants through photosynthesis, the free oxygen in the atmosphere would be depleted by the energy-releasing processes, called respiration, of living organisms and by combining with inorganic and dead organic materials through chemical oxidation (as in the rusting of iron and burning of wood).

Color the leaf and diagram labeled "Food Processing" (E). Some plants are very important in certain types of food processing. Yeast, a microscopic fungus, is important to us for baking. The CO_2 released by the yeast during fermentation of sugar in the bread dough creates a dough filled with minute gas bubbles that expand during baking to produce a light, airy product. Some bacteria are also important in food processing. The manufacture of many diary products, such as cheeses, yogurt and sour cream, for example, is based upon the activities of bacteria that utilize milk as their food source. Enzymes secreted by the bacteria alter the milk, and by-products toxic to the bacteria eventually kill them and produce a storable, preserved food.

Color the leaf and diagram labeled "Clothing" (F"). Some plants produce abundant amounts of long, thin cells called fibers that, because of their length and strength are used for weaving. In much of the world, the cotton plant, *Gossypium*, is the major source of plant fibers used to manufacture clothing. Other plants, such as flax (*Linum*) and hemp (*Cannabis*) provide course fibers.

Lastly, color the leaf and diagram labeled "Medicine" (G). Many medicines come from plants. For example, penicillin, an antibiotic obtained from a fungus (mold), was "discovered" in the mid-1940s. Quinine, used to decrease malaria symptoms, comes from the bark of the *Cincona* tree, and morphine, a drug used in hospitals to help a person in great pain, is derived from opium produced by the opium poppy, *Papaver somniferum*. Plants can help us get well and stay well.

The Importance of Plants to People



from The Botany Coloring Book by Paul Young, 1982, Coloring Concepts

The Stick Race: Measuring the Speed of Water

Background:

Natural water flow of rivers varied throughout the seasons of the year before dams were constructed. Learning how fast the water flows can not only keep people safer near the water, but can also help students understand how seasonality and humans can impact a river's flow.

Materials Needed:

Stopwatches (at least two, four is better)
6 Sticks
Pens/Pencils
Notebook

Instructions:

Divide students into two groups of six, each with two teams of three. One team in each group will launch sticks into the water while the other team will monitor the stopwatch and write down results. Have one group at the upper end of waterway and the second group at the lower end. Try to find places where the water is shallow and also where the water is deep for comparisons later on. Each group will monitor its own set of sticks.

Provide the Stick Team in each group with three sticks. Throw one stick into the river and have the person with a stopwatch start the watch and end the timing when the stick reaches him/her. Have another person on the Watch/Observe Team write down how long it took the stick to reach them. Have the second person on the Stick Team throw his/her stick into the water; again, the Watch/Observe Team member starts and stops the watch. The third member of the Stick Team also throws his/her stick into the water, and that timing is measured, for a total of three sticks thrown into the water and three timings taken.

Ask the students to average the three speeds written down. Have other members of the two teams measure the distance between each team. Have each team guess the speed of the water flow in their area, then have them actually measure the speed of the water flow by taking the average of the three speeds of the three sticks and dividing by the distance.

Reconvene as a large group and compare time findings. Which section of river was flowing the fastest or was there a difference? Did measurements differ in places where the creek is deeper or shallower? Why or why not? If there was a difference, describe it. How might the speed of the water flow change during different seasons of the year?

Weathering and Erosion

Background:
Two forces, weathering and erosion, are constantly at work wearing away the rocks that make up Earth's crust. Weathering causes rocks to fragment, crack, crumble, or break down chemically. Erosion loosens and carries away the rock debris caused by weathering. Over time these two forces, working together, can change the shape of the land.

Objective:
Students will complete a variety of activities that demonstrate how weathering and erosion change the Earth's surface.

Materials Needed:

- 15 rough, sandstone, limestone, or shale (sedimentary) rocks.
- 3 same size containers with lids (such as 32-ounce Gatorade bottles, wide mouth).
- 3 clear cups or jars.
- A pen, paper, and masking tape, to label both the cans and the clear jars with A, B and C. (Expand this activity by using an acid such as vinegar or lemon juice to show chemical erosion)

Instructions:
Brainstorm all the ways the surface of Earth can change. Take the list and put into three categories: weathering, erosions, and other. Discuss these findings and how long they take in each category. Using pictures, discuss that Earth's surface has gone through weathering and erosion.

All kinds of rocks weather, but not in the same way or at the same rate. It all depends on the mineral composition of the rock, as well as where the rock is located. Here is a closer look at the way rock weathers through the water erosion process.

- Separate the stones into three piles of five and put each pile onto a sheet of paper.
- Label each can and jar "A," "B," and "C," and put five rocks in each.
- Fill can "A " half way with water and put in the stones from pile "A." Do the same with pile "B," and with pile "C." Let the stones stand in the water overnight.
- Pass the jar around to the students. Instruct them to hold can "A" in both hands and shake it hard about 10 times each, about 1,000 shakes.
- Remove the stones from can "A" and pour the water into jar "A". Observe the stones and the water.
- Using the same process, give can "B " about 300 shakes (you may rest between shakes). Remove the stones and pour water into can "B." Once again, observe the stones and the water.
- Do not shake can "C." Remove the stones and pour the water into jar "C." Observe the stones and the water.
- Compare the three piles of stones and the three jars of water. Ask the students: "How do the piles of stones differ?" " Can you explain why?" "Which pile acted as a control group? Why?" "How do the jars of water differ?" "How does this show what happens to rocks and stones through the water erosion process?"

- Let the three jars of water sit overnight. Have the class observe any differences or changes.
- Explain that they have just learned the process of weathering. Erosion continues the work that weathering starts. It helps loosen particles and transport-weathered material. Erosion by way of waves, wind, glaciers, gravity, running water, etc., causes change in geological features. Valleys, canyons, buttes, and drakes are all examples. The main agent of erosion is running water. It probably does more to wear away the land than all the other geologic agents combined. Ice, wind, plants and animals also affect landscape.

Extension:

Take a hike in the area where you are camped and obverse and record the signs of erosion, weathering and deposition that you see. Look for signs of erosion on hillsides. Look for loose rocks and soil at the bases of slopes. Observe any plant growth that slowed down erosion. Write down as many weathering and erosion observations as you can.

Activity from Utah Education Network: http://www.uen.org/Lessonplan/preview.cgi?LPid=2692

Writing on the River: Haiku River Poetry

Background:
Haiku is an old, traditional form of Japanese poetry. Haiku poems consist of three lines. The first and last lines have five syllables and the middle line has seven syllables. The lines don't usually rhyme. Here's an example of a Haiku poem to show you the structure:

"I am first with five
Then seven in the middle --
Five again to end."

Materials Needed:
Pen/Pencil
Notebook

Instructions:

Write a haiku poem about the river or the river journey you're experiencing. Think about the different aspects of a river, the different experiences you've had on your journey, the plant and animal life which depend on or use the river, the history of the area. What inspires you about this waterway?

After writing your poem or poems, share your writings with your campmates. Help each other make your poems stronger by providing positive feedback and suggestions on how to improve each other's poems, then take some time to incorporate some of those ideas and write another poem based on your classmates' suggestions. Share these new versions.

Read some of the river haikus below for additional information and inspiration.

Haiku - River
River unchanging
Taking and giving as it goes
Water turns to sky

- Copyright 2003, by Joseph Rohrbach
http://www.mindspring.com/~jarzap/poem0101.htm

Dream River Haiku

running down rivers
life's endless dreams drifting by
free, but in limbo.

by Gloria Buono © 2006
http://www.authorsden.com/visit/viewPoetry.asp?id=161150

Haiku of Leaf and River

Leaf
i
the river carries
the leaf to destinations
yet undecided
ii
surface floating leaf
unnoticed by the river
inconsequential
iii
the leaf cannot go
where it would choose to travel
it can only ride
iv
powerless leaf
a victim of circumstance
resigns to river's will
v
in the end the leaf
will succumb to the current
and find it's ocean grave

River
i
the river carries
the leaf to destinations
only it will choose
ii
no power deters
the strong and steadfast river
it goes where it will
iii
placid river flows
singularly beautiful
firm in it's resolve
iv
beneath the surface
the thriving river carries
the wellspring of life
v
the river and the leaf
powerful and powerless
destinies contrast

by Carlton Lloyd Smith
http://poetry.unclesol.net/haiku-of-leaf-and-river