National Park Service
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Southeast Utah National Parks & Monuments

Canyon Country Outdoor Education
Fourth Grade Curriculum


Megan

Canyon Country Outdoor Education

Fourth Grade Curriculum

National Park Service
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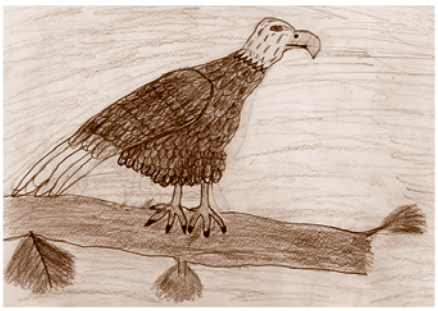
Learning about eagle adaptations at Big Bend



CORTNEY YAZZIE

FIELD TRIP

Animal Adaptations

Theme
High desert animals are adapted to their environment in many different ways.

Utah State Science Core Curriculum Topic
Standard Five: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.
- **Objective Two:** Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.
- **Objective Three:** Use a simple scheme to classify Utah plants and animals.

Field Trip Location
This field trip will work in any area where there is evidence of beavers. A wide open area for migration and a wooded area for deer's ears would be an asset. Areas along the Colorado River such as Big Bend Campground and Negro Bill Canyon are excellent.

Science Language Students Should Use
wetland, forest, desert, adaptation, deciduous, coniferous, invertebrate, vertebrate, bird, amphibian, reptile, fish, mammal, insect, hibernation, migration

Background

An adaptation is a characteristic that makes an organism more suited to its environment. This program introduces students to both behavioral adaptations (activities) and physical adaptations (parts) of several high desert dwellers.

Beavers, the largest North American rodents, are found along streams, ponds, and lakes throughout most of the United States and Canada. In southeastern Utah, beavers live in mountains and desert canyons. Their habitat ranges from small creeks to large rivers to wetlands. Beavers are herbivores. They eat the cambium layer of bark, especially of willows, cottonwoods, and aspens, as well as some green leafy vegetation. They are *crepuscular*, meaning that they forage most actively at dawn and dusk, when predation is less likely. They are rather clumsy on land, but they are excellent swimmers. When beavers dive, their heart and metabolic rates slow down, allowing them to stay underwater for up to 15 minutes.

In wetlands and along small streams, beavers build stick-and-mud dams and lodges, often significantly altering the environment in the process. On larger, swifter streams, such as the Colorado River, dam construction is impossible. Instead, they burrow out bank dens, holes several feet long and about 18 inches in diameter. The holes are underwater except when the river is low. The dens slant uphill to dry living ledges. Beavers have numerous physical adaptations to this unusual lifestyle; these are addressed in the "Amazing Beaver Adaptations" station description.

Mule deer have an array of adaptations that make them specifically suited to their environment. Their long necks and the location of their eyes (on the sides of their heads) allow them to see in every direction, except directly behind them. The camouflage coloring of their coats is another defensive adaptation. Speed and agility are good examples of adaptive strategies

Common raven

as well; mule deer can move up to twenty feet in one bound. In addition, their large ears, which are roughly two-thirds the length of their head, allow for a keen sense of hearing. In comparison, a white-tailed deer's ears are only one-half its head length. Hollow hair gives deer greater insulation from cold during winter months. Mule deer have behavioral adaptations, too. Because movement attracts prey, mule deer freeze if danger is nearby. If a predator is in pursuit, a mule deer's zigzag bound increases its likelihood of escape.

In Utah, an average of 80 percent of a mountain lion's diet consists of mule deer. The physical adaptations that make mountain lions successful predators include powerful jaws that can crush a prey's neck in one bite, sharp, pointed teeth, retractable claws for tearing meat, skin and fur between toe pads to muffle sound as the cats stalk, excellent day *and* night vision, and excellent depth perception so that they can attack with accuracy. Mountain lion behavioral adaptations include lying in wait and stalking, followed by bursts of speed for short chases.

An eagle's eyesight, like that of most raptors, is extraordinary. Most raptors can see ten times farther than humans. An object that humans can see at 33 feet is visible to an eagle at 330 feet. A raptor's eyes do not magnify as much as provide incredible distance perception. They are able to see movement and bright colors more easily than still, camouflaged prey.

Each fall groups of birds migrate to the south for the winter. This is a useful adaptation for these animals because their bodies do not generate enough heat to survive cooler temperatures and/or because there are not sufficient food supplies at one location through all four seasons. Canada geese normally migrate by flying in a V or a J-shaped flock. The largest goose normally flies in front, blocking out a large proportion of the wind. The V-shape is supposed to be more efficient aerodynamically than flying alone. The Canada goose mates for life. If hunters shoot down a goose's mate, the goose may fly in a circle above the mate, honking. Eventually, a replacement mate will be found. Geese migrate as a family, often with the father, or eldest offspring, leading the group.

Mule Deer

PRE-TRIP ACTIVITY

Adapt and Survive

(adapted from Caduto & Bruchac, 1991, 170-172)

Objectives

Students will be able to:
a. Define animal adaptations.
b. Name four animal adaptations.

Materials

Adapt and Survive: A Rabbit's Choice; an *A* card and a *B* card for each student.

PROCEDURE

1) Write *ADAPTS: Animals Depend on their Activities and Parts to Survive* on the board. Discuss what this means. Explain that animal activities, or behaviors, and body parts are called adaptations. Have students think of several examples of animal activities and parts, and discuss how each adaptation helps the animal to survive.

2) Hand out an *A* card and a *B* card to each student.

3) Read the first section of the story *Adapt and Survive: A Rabbit's Choice*. Have each student make the choice they think a rabbit might make. Tell students to hold up their choice (*A* card or *B* card), all at the same time, when you say, "Ready, set, go!" Read the correct survival choice.

4) Continue reading all the sections of the story in a similar manner. Have students keep track of whether they made the right choice or not for each section. Even if a student makes the wrong survival choice at a certain point in the story, have him or her continue making choices until you reach the end of the story.

5) Discuss the students' choices. How many were able to make the necessary choices to survive each time? Which choices made it most difficult to make the right survival decisions? Which choices were the easiest?

6) Review the items that students need to bring to school on the day of their field trip.

EXTENSION

Ask students to give at least two examples of animal adaptations and to tell how these adaptations enable the animals to survive.

Adapt or Survive: A Rabbit's Choice

(adapted from Caduto & Bruchac, 1991, 170-172)

1. You are a tiny baby rabbit living deep in your family den. One day your mother is out foraging and leaves you behind to sleep. You are awakened by a strange piece of thin wire on the end of a stick. It is being pushed toward you, down the hole from the surface. You see it coming and are afraid. You:

a. hop down another passage farther into the warren.
b. get closer to investigate the wire.

If you said (a), you survived. If you chose (b), you were snared and taken away by a hunter.

2. You think you should find your mom, but as you try to get out of the nest, you notice many of the holes have been filled in with dirt. Do you:

a. settle back into your nest and wait for your mom?
b. leave through a back door hidden under a bush?

If you said (a), a rancher filled in all the holes and you were trapped inside the nest. If you said (b), you escaped and survived.

3. It has not rained for a long time. You notice there are less and less green plants around your nest and no water to drink. You are feeling weak, yet you feel the need to explore for food and water. You start to hop away from your nest, but it is hard. Do you:

a. go ahead and search for food and water knowing you might die doing so?
b. return to the nest and wait for the rain to fall?

If you said (a), you hopped over two sandstone domes and found a pothole filled with water. If you said (b), you became too weak to leave your nest. You did not survive.

4. From your pothole, you see a green lawn dotted with many colored hills. There are many strange smells and two legged creatures walking around. It is evening, and the sun is beginning to set. You decide to:

a. sneak in and eat the green grass.
b. hop away and look somewhere else for food.

If you said (a), you snuck into the campground and ate the grass safely while the campers slept. If you said (b), you used all your energy searching for edible plants. You did not survive.

5. As daylight begins to break, you decide that you need to find a place to sleep. There is a strange above ground burrow ahead. It is large, and the morning sun reflects off the strange smooth skin into your eyes. You hop up into it and try walking through a place that looks like an entrance, but you bump into something you cannot see. You finally find an opening on the side and hop in. The area smells strange, but you are suddenly very tired. You decide to:

a. lay down and sleep here.
b. move on and look for a safer place.

If you chose (a), you slept in an old abandoned car that was parked near the campground. If you chose (b), you found a rock overhang under which to rest. You survived as well.

6. In the morning, you leave your temporary shelter to look around. You see some green trees far away down a dry wash. As you start to hop down the wash, a large black shadow envelops you and then goes away. Do you:

a. ignore it and keep hopping towards the far off green trees.
b. hunker down under the branches of a rabbit-brush and rest for awhile.

If you chose (a), you were caught by a golden eagle and eaten for lunch. If you chose (b), the eagle could not find you and ate a rock squirrel instead.

7. You hop down the wash for the rest of the day. You do not notice the wash getting deeper and narrower. All of a sudden the dry wash meets a very large, very long river. You notice green trees, like the ones you have been seeking, on the other side of the river. Do you:

a. jump in the river and try to swim to the other side.
b. turn around and return the way you came.

If you chose (a), you drowned in the Colorado River. If you chose (b), you hopped thirty feet up the wash before you spotted a side wash you had not noticed before. You hop up the side wash and it leads to a grassy bottomland filled with old cottonwood trees.

You explore the bottomland for a while until you spy some movement in the distance. You go to explore and find a whole family of rabbits who welcome you into their community. You meet a mate and raise a family of your own.

STATION #1

Amazing Beaver Adaptations

(adapted from unpublished Aspen Center for Environmental Studies activity and other sources)

Objectives

Students will be able to:

a. Describe three physical adaptations of beavers.

b. Describe the diet and one behavioral adaptation of beavers.

Materials

Beaver-cut stick if none in the area; pictures of beavers and beaver tracks; pair of small swim fins; 2 rattail combs; small can of WD-40; small can of musk deodorant; kickstand or canoe paddle blade attached to a belt; pair of "sticky-dot" work gloves; ear plugs or protectors; goggles; paper beaver teeth; beaver skull (optional)

Notes

Navajo students should not be asked to handle skulls or fur.

Explore the area beforehand for beaver sign.

PROCEDURE

1) Show a picture or two of beaver and find out what students know about them. Briefly discuss beaver diet and lifestyle, clarifying that beavers are herbivores and do not eat fish. Explain that beavers on large rivers don't build dams and live in holes in the banks rather than lodges. Discuss the beaver signs that students may be able to find along the river (i.e. fresh-cut trees with ridges left by beaver teeth, tracks and tail-drag marks, branch drag marks, slide marks where beaver entered the river, piles of cut branches and logs in shallow water, scat (usually in shallow water), and holes in the riverbank if the river is low).

2) Explore the riverbank for beaver sign. Examine beaver-cut branches, and have students feel the ridges. Show pictures of tracks if you don't see any.

3) Discuss a few activities (behavioral adaptations) of beavers. Then choose a student volunteer to model a beaver's special parts (physical adaptations). Dress the student from the feet up with objects representing its various adaptations, explaining the adaptations as you go:

- Feet: Swim fins represent webbed hind feet for swimming.
- Feet: Rattail combs represent split claw (second claw of each foot) for grooming.
- Tail: A canoe paddle (attached by belt) represents the use of the tail as a rudder in swimming. Alternatively, a kickstand can represent the tail function of holding the beaver upright while it is gnawing on a tree. Beavers do not use their tails for patting mud (except in cartoons), but they do slap them on the water surface to make a loud noise that serves as a warning device.
- Fur: Use a pelt tucked under the belt to represent the beaver's coat. A beaver's coat

Learning first-hand about a beaver's adaptations

consists of guard hair with a soft underfur. It provides insulation as well as a waterproof layer, thanks to the oil provided by an oil gland.

- Fat layer: Use a layer of foam tucked under the pelt to represent an insulating fat layer that keeps the beaver warm while swimming in cold water.
- Oil gland: Insert the WD-40 under the belt near the base of the tail. This represents the gland that produces oil for waterproofing the beaver's coat. Grooming with the split claw helps keep the coat oiled.
- Scent gland: Have students sniff the musk deodorant, and then insert it under the belt near the WD-40. The scent gland produces a smell for marking territory and attracting mates.
- Hands: Put on "sticky-dot" work gloves to represent the rough pads for gripping on a beaver's front feet. These feet also have long claws for digging.
- Eyes: Swim goggles represent a *nictitating membrane*, or clear inner eyelid, that allows beavers to protect their eyes, yet also see, while swimming. Beaver eyes are positioned near the top of their head, so they can see above water while most of their head is still underwater.
- Ears: Earplugs or protectors represent the special flaps inside beaver ears that close while they are swimming in order to keep water out.
- Mouth: Beavers have a flap at the back of their mouth that they can close to keep water out of their throat while swimming, even when they are carrying sticks in their mouth. If you have a beaver skull, show the gap between front incisors and back molars where sticks are carried. Finally, give the student model the paper front teeth, which represent the sharp front teeth beavers use for cutting trees and branches. These teeth grow continuously and are made up of hard brown enamel in front and softer dentin behind. Chewing on trees gives their teeth a chisel-like edge.

4) To review, ask students to briefly describe each adaptation as you remove the objects, or have each student choose one object and describe the beaver adaptation it represents. Review beaver diet and activities.

Looking for beaver tracks along the Colorado River

STATION #2

Canada Geese Migration Station

Objectives

The students will be able to:
a. Cite three reasons why Canada Geese migrate.
b. Describe two obstacles in geese migration.

Materials

Signs labeled North, South, East and West (pieces of poster board, cut in the center so they intersect); sets of clue cards for migration course (see note below).

Note

This station is set up as a 150-yard course with clue cards hidden along the way. The directional signpost should be set up in a prominent place that students can see.

PROCEDURE

1) Talk with students about migration as an animal adaptation. Discuss Canada Geese in particular and how they migrate. Talk about some of the dangers of migration.

2) Tell the students that before birds migrate, they build up fat reserves. These fat reserves provide the birds with energy during their long migration. Tell the students that they need to help you do the following calculations. Using a white board, have the students help you answer the following questions.

(adapted from Migration Math, Growing Wild, p. 10).

1. In order to calculate how much birds need to eat before migration, we need to figure out how much weight they need to gain. Have students divide their weight (estimated) by 3. This is the number of pounds they need to gain, in order to survive the trip.

2. If all goes well on their trip they will 60 flaps a minute for 10 hours a day. Have the students figure out how many flaps a day they would make on their journey [60*60 (flaps per hour) *10 (hours per day) = _____ number of flaps per day].

3. You can fly 40 miles an hour. If you are traveling 4,000 miles at how long would it take you to get there? How many total flaps would you make? [40*10 hours per day = miles per day. 4000/miles per day = how many days].

4. The average person burns 60 calories if they run for an hour. Pretend you are a bird. How many calories would you use in your migration? [10(hours per day) * 10(days) = total hours flying. 60(cal)* total number of hours = the total calories.]

Ask the students if they think they stored enough body fat to cove the number of calories needed? If not where might they get more fuel?

3) Tell students they will be migrating together as a gaggle of geese and following a set of clue cards. Discuss direction with students by pointing to north and south and then asking them to point east and west. Tell the students that they are going to be flying in a V formation. Explain that the oldest goose flies at the point since the oldest is most likely the strongest, and the goose at the point works the hardest. Have the students figure out who is the oldest. Tell them that this person will read the clues and lead the group. This person is also the only one to pick up the next clue. When the oldest finds the clue, he/she hands the clue to someone else to read. The reader then leads the group. Give the eldest goose the map and first clue to read. Have the entire group count the flaps as they move through the course.

4) At the end, review the migration of Canada Geese.

EXTENSION

Draw a picture of the Canada Geese migration. Show the events that a goose might encounter along the way.

Geese Migration Cards

1. **In order to fly south for the winter you must make a "V" formation. Daddy Honker you belong at the point of the "V." You will lead the group.**

When flying, who uses the most energy?
Why?

Take 10 flaps SOUTH and 3 flaps WEST

2. **You have run into a storm and must take shelter in a bunch of shrubs.**

Why can't you fly in bad weather?

Take 8 flaps WEST
Count to 15 to wait out the storm.

3. **The weather is much better today.**

Take 15 flaps SOUTH.

4. **Last year this was a corn field. A great place to rest. But now it is a housing development. You must keep flying.**

Where do you get the
energy to keep flying?

Take 15 flaps EAST and 3 flaps SOUTH.

5. You land next to a big sign that says "Wildlife Preserve." It is a large wooded area next to a wheat field. Wheat is left on the ground after the harvest. Eat well and rest here because you have a long way to go.

What can geese eat besides wheat?

Count to 10 to rest. When you have finished resting take 8 flaps SOUTH and look EAST.

6. This is a popular hunting area. Fly high so that hunters can not shoot you. Your next stop will be at another wildlife preserve. When landing, fly in tight circles so you remain in the preserve.

Why do people hunt geese?

Take 15 flaps WEST and 5 flaps SOUTH.

7. You are in luck. You have a tail wind. You can fly farther and use less energy.

How fast can geese fly with no wind?

Take 23 flaps SOUTH and 15 flaps EAST.

8. You have been flying for a long time now. You have been flying during the day and the night.

Why would it be helpful to fly at night?

Take 14 flaps SOUTH and 5 flaps WEST.

9. **You fly over a mountain range, cross a river and through a field and there is a beautiful marsh. The perfect place to rest and feed.**

How do you find your way?

Take 6 flaps SOUTH and 3 Flaps WEST.

10. **Last year this pond was smelly and filthy. A storm had spilled pig and chicken sewage from farms into the ponds. The farmers decided to clean the pond so their livestock could drink from it. You decide to rest here.**

How would sewage destroy a pond?

Take 10 flaps WEST and 5 flaps SOUTH.

11. **You feel the air getting warmer. You must be getting nearer to your winter home. You notice other flocks of geese flying in the same direction.**

Different flocks are made up of different _____?

Take 10 flaps SOUTH and 10 flaps WEST.

12. **You made it! Have a great winter. Eat lots of food so you will have plenty of fat to give you energy to fly back north in the spring.**

Why don't geese stay south all year long?

STATION #3

Deer's Ears

(Adapted from *Project Wild*, 1992, 112-3)

Objectives

Students will be able to:

a. State at least two physical and two behavioral adaptations of deer or their predators.
b. Relate the adaptations to function and/or survival.

Materials

Pictures of a deer and a mountain lion; blindfold.

PROCEDURE

1) Review the definitions of *adaptation, predator*, and *prey*. Show the pictures of a mule deer and a mountain lion, and discuss some of the adaptations of each.

2) Introduce the game (adapted from Henley, 1989, 158-159). Designate one student as a deer, blindfold her, and put a cloth "tail" in her back pocket. Ask the student to stand or kneel like a grazing deer and not to move except to turn in one place. Ask the other students to pretend to be mountain lions, predators of deer. Instruct the mountain lions to start at least 20 feet away from the deer and slowly stalk the deer. Cue them to begin stalking when you say "go," but instruct them to stop immediately if you say "freeze" (until they hear "go" again). Instruct the deer to listen for the approaching predators and to point in the predator's general direction (within two to three degrees) and shout "Starve!" if one is heard. If the deer is correct, that predator must quietly sit down until the round is over. (To make the event more realistic, limit the number of times the deer can say "Starve!" to the number of predators plus two. The instructor should stand near the deer and clarify if the deer caught anyone with their "Starve!") Tell the predators that if one of them gets close enough to the deer to snatch its cloth tail, then the deer is dead.

3) Let the predator that kills the deer be the next deer. Another option is to simply take turns being deer. Have the deer stand in different areas, and discuss how the deer uses its environment to protect itself. Review deer and mountain lion adaptations that helped the animals after each round.

EXTENSIONS

Have students create a dramatization of a mule deer, acting out the adaptations that help it survive in the wild.

Have students think up objects to represent deer or mountain lion parts, as in the beaver activity.

A blindfolded student tests her "deer's ears."

STATION #4

Eagle's Eyes

(adapted from Henley, 1989, 154-155)

Objectives

Students will be able to:

a. Name at least two bird of prey adaptations.

b. Describe how an eagle or other bird of prey's eyesight aids in survival.

Materials

laminated bird of prey pictures; small food items (Skittles)

Note

If location and weather permits, hide candy in advance for the second activity.

PROCEDURE

1) Build on prior student knowledge to talk about general raptor (bird of prey) characteristics and adaptations. Distribute pictures as students name species of raptors, giving each student a raptor identity. Have the students read the information about their bird on the back of the card and look at the picture. Ask them to find an activity and a part (adaptations) that help this bird survive. Have each student introduce their bird and share their adaptations. Show them the eagle skull replica and feathers. Discuss the adaptations. Pass them around for the students to touch and feel. (Note: Navajo students should not be asked to handle feathers or skulls.)

2) Activity #1: **Eagle's Eyes** - Ask each student to name one type of prey that her raptor might look for, and hand out one Skittle to represent that prey. Use a variety of Skittle colors. Have students place the Skittles on a line on the ground and then start backing away. When individual students can no longer see their Skittles, they have reached the limits of their eyes' resolving power and should stop. Next, gather the students where the first student stopped. Measure the distance from there to the Skittles. Multiply that distance by ten, and you have the calculated distance from which an eagle could see a Skittle. Discuss how high on the cliffs that distance is, which colors were easiest to see, and if a moving Skittle (or mouse) would be easier to see.

3) Activity #2: **I Spy with My Eagle Eyes** - Have students pretend to be eagles or their chosen raptor and look for hidden Skittles. When a Skittle is seen, the raptor should say, "I spy with my eagle (or other raptor) eyes something green (or other color)," without giving away the prey location. Ask them to count how many prey items they see, but not to pick them up. Give the students several minutes, and ask each student how many he/she found. Discuss why some birds found more food than others. Review the types of prey that raptors look for and raptors' adaptations for hunting.

EXTENSIONS

Have students create a story or skit based on a raptor. Have them include facts on eyesight adaptations. Ask students to choose a raptor, research more of its adaptations, and write a story about how it uses its keen eyesight and other adaptations to survive.

Have students research the effects of DDT on bald eagles or peregrine falcons as well as other animals in the food chain. In addition, they may research what other toxins affect wildlife.

Students test their "eagle eyes"

POST-TRIP ACTIVITY

Win, Lose or Adapt

(adapted from National Park Service and others, 1989, 8.12-8.18)

Objectives

Students will be able to:

a. Recognize that humans are animals with unique adaptations.
b. Identify two animal adaptations and describe how they help the animals to survive.

Materials

Draw the adaptation game cards; *animal adaptations* poster (labeled *Animal Adaptations*, with photographs of the animals from the game cards).

PROCEDURE

1) With the students, generate a list of human adaptations. Ask students to describe each adaptation and its usefulness to humans. Examples include: upright posture (seeing distances, holding and throwing objects, carrying things); eyes facing forward (judging distance); movable neck (seeing in many directions); ear lobes (gathering sound); big brains (intelligence); thumbs (precise and delicate hand movements); touch (sensitivity in hands and fingers); living in groups (cooperation, safety in numbers); speech (communication, cooperation).

2) Show the *Animal Adaptations* poster and, with student input, name the animals. Instruct students in playing a game based on the adaptations of these animals. Divide the class into two teams. Have one person from the first team pick a *Draw the Adaptation* game card. While the student is drawing the animal and its adaptation on the blackboard (one-minute limit), the rest of the first team guesses the animal and its adaptation. (Team Two watches quietly; their turn may be coming soon!) If a guess includes part of the correct answer, write that part on the board. If Team One does not guess the animal and its adaptation within a minute, give Team Two a minute to draw and guess from the same card. When correctly guessed, have a student read the back of the card, which tells how the adaptation helps the animal to survive. Continue the game, with the two teams alternating picking a card, drawing, and guessing.

3) Integrate the activity with the field trip lessons by discussing the following types of questions:

- What are some adaptations we learned about on the field trip, and why are they important to these animals?
- What sort of adaptations might lead animals to extinction? (Specialized adaptations to small, isolated habitats, to a specific food, or to habitats in which humans like to build are risky.)
- How are some animals in our area adapted to survive the upcoming winter season?

EXTENSION

Have students describe three problems that an animal they learned about on the field trip would have if it were moved to the school grounds. Could these problems be solved? Why or why not?

Draw the Adaptation Game Cards

Photocopy and cut apart along dotted lines.

Adaptation:
Sharp-edged spade on each back foot

These help the animal burrow into the ground during dry times.

Spadefoot Toad

Adaptation:
Feet for grasping

Strong feet and large, curved claws, or talons, are used to kill and hold prey.

Hawk

Adaptation:
Paws with claws

Most meat-eaters use these to climb, dig for food, and hold their prey.

Fox

Adaptation:
Long, hollow beaks

These are used to reach nectar deep inside blossoms.

Hummingbird

Adaptation:
Short, cone-shaped beaks

These are strong enough to open seeds.

Sparrow

Adaptation:
Hooked beaks

These are used to tear up animal food.

Hawk

Adaptation:
Forked tongues

These are used to "smell."

Snake

Adaptation:
Webbed feet

These help with swimming and with walking on top of mud.

Duck

Draw the Adaptation Game Cards

Photocopy and cut apart along dotted lines.

Adaptation:
Whiskers

These act as feelers when going through brush or small places.

Bobcat

Adaptation:
Long, pointed canine teeth

These are used to catch and kill prey.

Coyote

Adaptation:
Large hind legs

These help the animal jump long distances to escape predators.

Kangaroo Rat

Adaptation:
Stingers

These are used for protection.

Bee

Adaptation:
Exoskeletons

These hard outer coverings provide protection from enemies, and keep the animal from drying out.

Insect

Adaptation:
Eyespots

These are used to scare away predators.

Butterfly

Adaptation:
Long tongues

These are used to zap food such as insects.

Lizard

Adaptation:
Horns

These are permanent and slow growing. They are used for defense and finding mates.

Desert Bighorn Sheep

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WESLEY WILLIAMS

FIELD TRIP

Cultural Contributions

Theme
In order to learn important lessons from ancient civilizations, we must preserve the artifacts they left behind.

Utah State Core Curriculum Topic
Social Studies Standard One: Students demonstrate the sequence of change in Utah over time.
- **Objective One:** Recognize the sequence of change in Utah over time.
- **Objective Two:** Trace the development of the state of Utah.

Social Studies Standard Four: Students participate in activities that promote cultural understanding and good citizenship.
- **Objective One:** Demonstrate cultural understanding.
- **Objective Two:** Demonstrate basic citizenship skills.

Field Trip Location
A southeastern Utah rock art site. Two ideal locations are the petroglyph panel behind Wolfe Ranch near the Delicate Arch trailhead, Arches National Park, and Newspaper Rock Recreation Site on Highway 211, east of the Needles District of Canyonlands National Park.

Time
All lessons are 30 minutes

Background

This program introduces students to the field of archeology and its role in preserving our human past. Students experiment with making cordage, rock art, and pottery. Students learn how to enjoy archeological sites without damaging them and are introduced to some of the threats to preserving past cultures, such as vandalism of archeological living sites and rock art.

Even though ancient peoples in this area grew corn, beans, and squash, and the cultures hunted animals to varying degrees, they also used wild plants for food and other needs.

Cordage, one example of a household item made from the area's wild plants, consists of several strands of fiber twisted together into a string or rope. Prehistorically, cordage was made from a variety of materials including the long plant stalk fibers of milkweed and dogbane, yucca leaf fibers, and juniper and sagebrush bark. Ancient people also used human hair and animal sinew. The different sizes of cordage that were made probably depended on both the plant fiber source and the intended purpose of the finished object. Some archeologists make replicas of cordage artifacts in order to learn more about how they were made and how much time was required for their production. A ranger at Arches National Park spent two months making a pair of cordage sandals similar to those found in the area. Most cordage artifacts have been found in dry cave sites in the western United States. Although many are only small pieces of larger items, a net measuring 140 feet by 4 feet was found at Hogup Cave

Working on compass skills at Arches National Park

in northwestern Utah (Smith, Moe, Letts, & Peterson 1992, 133).

Archeologists Winston Hurst and Joe Pachak (1989, 1) state that "in modern America, the most common kind of 'rock' art is that which is painted on the concrete and brick walls of the artificial canyons of our cities and on bridge abutments and rock faces along our highways. In modern American culture, as in all cultures, it expresses the values, attitudes, beliefs, and desires of the society." Others believe art in modern society often reflects the fringe or cutting edge of society, whereas ancient rock art usually represents more central societal values and beliefs. Because of this, some archeologists now prefer the term *rock images* to *rock art*.

Rock images can be found around the world, yet there are few places where it is as widespread or varied as in southern Utah. Although it is possible to identify some of the images, such as bighorn sheep and sandal prints, the context or symbolic nature is more difficult to determine. While modern tribal members can shed light on this discussion, their insights also confirm that one image may have different meanings in different contexts and cultures.

Because of the durability of fired clay pottery, potsherds are one of the most common types of artifacts. Pottery styles are distinctive to particular cultures and changed through time, so pottery is helpful in determining both the age of a site and which group of people lived there. Pottery artifacts also give insights into how ancient people cooked and stored food and seeds.

The 1979 Archeological Resources Protection Act prohibits disturbance of any archeological sites more than 100 years old on any federal lands. The act sets penalties for those convicted of violations. A first offender may be fined up to $250,000 and could spend up to two years in jail. A second offender may be fined $250,000 and could spend five years in jail. A similar 1990 state law protects state lands. The state law allows digging on private land with permission of a landowner. Digging on private land without permission may bring penalties similar to those on federal land. Disturbing a human burial is a felony offense.

Coyote gourd grows next to a ruin in the Needles District of Canyonlands National Park

PRE-TRIP ACTIVITY

Pieces of the Past

Objectives

Students will be able to:

a. Name at least one reason why it is important to leave artifacts where they are found.
b. Describe ways of enjoying archeological sites without disturbing them.

Materials

shoestring; poster labeled petroglyph with drawings or photographs of local petroglyphs; poster labeled pictograph with drawings or photographs of local pictographs; pottery sherd; poster labeled pottery with drawings or photographs of ancient pottery; *Sherdy: The Storyteller* video (Southern Utah University, 1993).

PROCEDURE

1) Write *archeology* on the board, and discuss its meaning. A simple definition of *archeology* is the study of people from the past. Ask students to close their eyes and think of an object, important to them, that reminds them of their past (Smith, Moe, Letts, & Peterson, 1992, 9-10). Name some examples, such as a baby blanket or a toy. Have volunteers describe their special object to the rest of the class. Ask if students think a stranger might be able to learn something about their lives by examining their objects. Would the stranger learn more by examining several objects from each student's past? Relate the students' objects to archeological artifacts, and introduce the importance of saving these artifacts or "pieces of the past." Explain that on the upcoming field trip students will be exploring pieces of the past from the ancient people who lived in this area.

2) Describe the three field trip stations in the following manner. For the cordage station, hide a shoestring in one hand, stand in front of the class, and tell one thing about the mystery object. Instruct the students to take turns, each asking one yes-no question about the object and taking one guess at its identity, until someone correctly names the object. Explain that on the field trip, students will be learning how the ancient people of this area made cordage (twine or string) and how they used it. Students will have a chance to make some cordage themselves. For the rock art station, follow a similar procedure with a petroglyph replica. Show the students the *Petroglyph* and *Pictograph* posters, and discuss. For the pottery station, ask the students to guess what is in your hand (a potsherd). Present the *Pottery* poster. Discuss the poster, and use it as a lead-in to the video *Sherdy*.

3) Show the *Sherdy* video. After the video presentation, have the students list ways that we can enjoy archeological sites without damaging or disturbing them.

4) Review the items that students need to bring to school on the day of their field trip.

STATION #1

Making Cordage

(Smith, Moe, Letts, & Peterson, 1992, 132-135)

Objectives

Students will be able to:

a. State one way prehistoric people used cordage in everyday life.

b. Perform the skill of making cordage.

Materials

Twine, cut into 12 to 15 inch lengths; cordage replica, such as yucca sandals and/or picture of cordage artifacts; picture of a yucca plant; 12 to 15 inch lengths of natural materials for making cordage, including milkweed or dogbane stalks; yucca leaves, sagebrush bark and/or juniper bark (natural fibers are easiest to use when wet); *Treading in the past: Sandals of the Anasazi* (Kankainen, 1995).

PROCEDURE

1) Ask students where they purchased their sneakers and how long they think it took to make them. Show students the cordage replica sandals and pictures of ancient sandals. Discuss how long it took to make the replicas. Discuss with students how making their own shoes in this way would change their lives.

2) Distribute a piece of twine to each student. Have students examine the twine, and see if they can determine how it was made. Define *fiber* as a slender, threadlike strand or string. Describe *cordage*, on the other hand, as consisting of several strands of fiber twisted together into a string or rope. Students may use twine for their first attempts at making cordage and advance to natural plant fibers when they are ready. Explain and demonstrate the steps to make cordage. If using natural fibers, remove debris by rubbing the plant fiber between the palms of your hands. Next, whether using twine or plants, separate two long strands. Hold one end of Strand A and one end of Strand B together, side-by-side, in your left hand between your forefinger and thumb (vice-versa if left-handed). Pick up Strand A between your right forefinger and thumb, and twirl the strand away from your body (clockwise). Take the twisted Strand A, and bring it toward your body, over and then under Strand B. Hold Strands A and B between your left forefinger and thumb where you crossed A over B. Repeat the twirling and crossing sequence. Pick up Strand B, twirl it away from your body, and cross it over and under Strand A. Continue these steps.

3) Explain that the Ancestral Puebloans used the fibers of the yucca plant to make cordage, sandals, and baskets. Show a picture of the yucca plant, and pass around one of the leaves. Discuss how the yucca leaf is prepared to make into cordage. Let the students try to make cordage with yucca fiber.

4) After all the students have been successful in making cordage, discuss their impressions of daily life of prehistoric people. In what ways might the daily life of the Ancient Puebloans be similar to the students' daily lives? In what ways was it different?

Making cordage

STATION #2

Symbols on Rock

(adapted from Smith, Moe, Letts, & Peterson, 1992, 151-153)

Objectives

Students will be able to:

a. Describe the difference between petroglyphs and pictographs.
b. Name one reason for preserving rock art panels.

Materials

Copies of *rock art symbols* sheet; *Petroglyphs* and *Pictographs* posters (See Pre-Trip Activity); scratchboards (available from Salix Corporation 801-531-8600), or paper, pencils and clipboards.

PROCEDURE

1) Gather students around the rock art panel. Give students guidelines for observing the rock art without touching. Give the students time to observe the panel and talk with each other about the symbols. Discuss some possible meanings of the symbols.

2) Have students imagine that they lived in this area one thousand years ago. Ask students if they would live here permanently. Is there enough water nearby to survive? What would they use for shelter? How would they hunt? What would they hunt? Ask students to think about why they might create rock art if they lived here.

3) Using the *rock art symbols* sheet, posters, and your own drawings, show students examples of international symbols and rock art symbols. Explain that although we don't know what the prehistoric symbols mean, a few seem obvious and we can get some pretty good ideas about some of the others by speaking with modern tribes or studying archeology. Explain to the students that they will be using symbols to create some of their own "rock art." With the students, brainstorm examples of symbols they would recognize. Give students time to think of symbols that mean something to them in their own lives. Give each student a scratchboard or paper, pencil, and clipboard, so they may sketch or draw their own symbols. If using scratchboards, instruct students in their use. Remind the students that they cannot put letters on their artwork. Instruct them not to tell others what they are drawing.

4) As students finish their rock art creations, have them present to the group. Ask the other students to try and guess the message in each rock art display. Ask the kids to think about our guesses of the actual rock art. They could be just as wrong as our guesses of our friend's rock art. Deciphering real rock art, however, is even more difficult because no one is still around to clear up our misconceptions.

5) Discuss how students would feel if someone came along and threw rocks at their rock art, wrote their name on it, or defaced it in any other way. Relate their feelings to how archeologists, Native Americans, and others feel when they see a site that has been vandalized. Explain that it is against the law to deface ancient rock art.

Part of the Newspaper Rock panel

STATION #3
Pottery

Objectives
Students will be able to:
a. Identify at least one reason that artifacts are important.
b. Perform the skill of making a coil pot or figure.

Materials
Potsherds borrowed from a museum collection; *Pottery* poster (See Pre-Trip Activity); clay; tarp.

PROCEDURE

1) Hand out an ancient potsherd to each of the students. Have the students pass them around so that everyone has a chance to see and touch all the potsherds. Then place the potsherds in the middle of the circle. Discuss how most of the potsherds in the pile were collected by uneducated visitors and, therefore, tell us nothing new about the past. Have a student point to the potsherd with numbers on it. Discuss how the number corresponds to archeological data and can tell us many things about it and other potsherds. Give students information about potsherds, and explain to them that studying pottery has taught us about the Ancestral Puebloan peoples. Have students point out the appropriate potsherds as you talk. Use the *Pottery* poster in coordination to the potsherds to describe relevant designs, shapes, and uses.

2) Demonstrate how to make coil pottery and how to brandish the coils using fingers or smooth stones. Instruct students to make miniature pots and figures, as Ancient Puebloan and Fremont children commonly did. Distribute clay. Have students sit on the tarp to work, and help the students in making their pottery.

3) While students are working, discuss the process for making pottery. Include all of the main steps: finding and collecting the clay, forming the pottery, and firing the pottery.

4) Have students show their pots and describe different ways they might use them if they lived in this area one thousand years ago.

Pottery found in Canyonlands National Park

POST-TRIP ACTIVITY

All Mixed Up

(adapted from Smith, Moe, Letts, & Peterson 1992, 22-23.)

Objectives

Students will be able to:

a. Define *chronology* or describe what a time line represents.
b. State at least two reasons that artifacts shouldn't be removed from archeological sites.

Materials

Index cards or paper squares (four per student plus a few extras).

PROCEDURE

1) Review the definition of *archeology* and the role of an *archaeologist*. Introduce the concept of a *timeline* or *chronology*. Draw on the board, and discuss, a cross-section of two or three soil layers containing artifacts (including modern "artifacts" in the top layer). Draw a historical linear timeline and/or a timeline of your own or someone else's life as another way to illustrate chronology. Show the importance of sequence by switching two events, or removing an event, and seeing the resulting confusion. Explain that chronological data is important in understanding how past peoples lived and that digging up archeological sites destroys this chronology.

2) Pass out four index cards to each student, and instruct students to write an important event in their lives on each card (e.g., "My sister was born," "My family moved," "I learned to ski," "I got my dog, Max"). Have students arrange their cards in chronological order, most recent on top, in the same arrangement as artifacts in layers at archeological sites.

3) Have each student mix up her set of cards and exchange sets with a partner. Instruct students to make a best guess at the order of their partners' tags. Partners should check the cards and explain any mistakes in the chronology. Then, have each student randomly remove one card from his own set and exchange cards with a different partner. After ordering and checking, ask if partners had a more difficult time guessing the chronology with one event missing. Explain that digging through an archeological site is like mixing up the cards and taking artifacts is like removing events. Briefly describe the careful digging and recording of an archeological dig.

4) Have students imagine that they cannot remember significant events in their lives, and discuss the following questions: How would the history of the student's life be changed? How does digging in an archeological site cause the loss of information about the past? In what ways is a hole dug by vandals in the archeological site similar to a loss of significant events in the student's life? What might the students say to an artifact collector about the importance of leaving sites undisturbed?

EXTENSIONS

Ask students to complete a timeline of significant events in their lives and describe its importance to them. Then, have them relate the importance to an archeological site.

Have students create informative posters on why people should not alter archeological sites.

References and Resources

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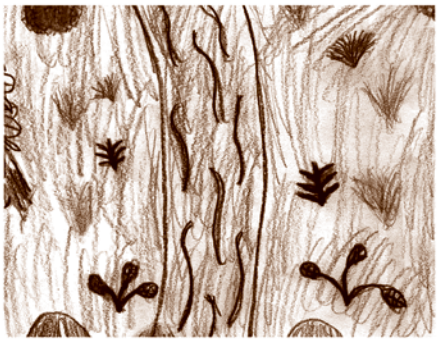


CARIE GARLETT

FIELD TRIP

Water Cycle

Theme
Water is essential for all life.

Utah State Core Curriculum Topic
Standard One: Students will understand that water changes state as it moves through the water cycle.

Objective One: Describe the relationship between heat energy, evaporation, and condensation of water on Earth.

Objective Two: Describe the water cycle.

Suggested Field Trip Location
The Nature Conservancy Scott M. Matheson Wetlands Preserve, Moab. Other locations are suitable for many of the activities. Any season except winter; students may get a little wet.

Times
All lessons are 30 minutes

Science Language Students Should Use
vapor, precipitation, evaporation, clouds, dew, condensation, temperature, water cycle

Background

Key words in the discussion of the water cycle are *evaporation, transpiration, condensation, precipitation, surface runoff (transportation)*, and *percolation*. Of these, *transpiration, condensation* and *percolation* are the words least familiar to fourth graders. *Transpiration* is the escape of moisture from plant leaves, similar to *perspiration* in humans and other animals. A helpful metaphor for explaining cloud *condensation* is a glass of ice water. Because air cools near the glass and cool air can't hold as much moisture as warm air, moisture condenses on the side of the glass. *Percolation* refers to the concept of water filtering down into the ground.

Most wetlands are transitional lands that lie between terrestrial systems (such as the Moab Valley) and aquatic systems (such as the Colorado River). The key ingredient in a wetland is water. Some wetlands always have standing water; others appear to be dry much of the year. All wetlands are at least seasonally flooded with shallow water, or the soils are at least seasonally saturated. All wetlands have specialized aquatic plants at least part of the year, specialized undrained soils, and the presence of water. The particular types and arrangements of these three characteristics are what make one kind of wetland distinct from another. *Marshes, swamps, potholes, bogs, fens, floodplain wetlands,* and *sloughs* are all names that reflect the diversity of wetlands. Some of these are informal names, including *slough*, the name historically used for the Matheson Wetlands.

Water comes into wetlands from two main sources: surface water and ground water. Surface water is runoff over the land. In the case of the Matheson Wetlands, Mill Creek, irrigation runoff, and the Colorado River are the main sources of surface water. Surface water follows gravity to the wetlands. That is, water from Mill Creek and its tributaries runs

downhill from the La Sal Mountains, across the Moab Valley, and then slows down in the relatively flat wetlands before continuing on the slight downhill grade to the Colorado River. The river contributes surface water to the wetlands only during springs when the river is high enough (near 40,000 cfs) to overflow its usual banks into the wetlands. The Colorado River flooded the Matheson Wetlands three out of every ten years prior to 1959; since then, the average has dropped to once every ten years (due to dams, irrigation, etc.). Much of the water in the Matheson Wetlands comes from ground water. Some springs and seeps where underground water comes to the surface emerge at the base of the slopes across highway 191 from the north end of the wetlands. Ground water also seeps to the surface within the wetlands themselves, from saturated underground rock layers and sediments near the surface.

Wetlands contribute to the quantity and quality of our water supply. Dry lands soak up some rain and briefly recharge or replenish ground water after a rainfall. Because wetlands collect runoff and store standing water over longer periods of time, they slowly release water to the ground-water supply. Wetlands and wetland plants are traps for both sediments and pollutants that are washed off the land. Because water traveling at high velocities has the ability to pick up and carry much sediment, water coming off of steep slopes is usually sediment-rich. When that water slows down, such as it does in the relatively flat lands found at the base of slopes where wetlands are commonly located, it drops its sediments. Plants contribute to slowing down the waters and act as sediment traps; they also filter nutrients from water and use them in their own metabolism. Wetlands keep pollutants (including excess nutrients), which are attached to sediment particles and in

School group at the Matheson Wetlands

PRET-TRIP ACTIVITY

Water on My Mind

the water, from degrading the quality of surface and ground water.

Objectives

Students will be able to:

a. Name the components of the water cycle.

b. Explain in their own words the processes of evaporation, condensation, and precipitation.

Materials

Aerial photo of Matheson Wetlands Preserve; *A Drop Around the World* (McKinney, 1998); Banana Slug String Band video (water cycle twist).

PROCEDURE

1) Show the students the aerial photo of the Matheson Wetlands, and orient them to it. Ask if it looks wet. Find out how many students have been to the wetlands. Let them know that the field trip stations will focus on different parts of the water cycle in the wetlands.

2) Explain to the students that you will be reviewing the water cycle by reading them a story. Tell the students that in the story, the water droplet travels not only around the water cycle, but also through out the world. For each page, select a volunteer to come up and point out the tiny water drop in the picture. As you read, discuss some of the concepts mentioned in the book.

3) Tell the students that you have a music video that is all about the water cycle. Direct them to stand up and sing and dance with the guys in the video. After the song, discuss some of the concepts talked about in the lyrics.

4) Review the items that students need to bring to school on the day of their field trip.

EXTENSION

Let students work on a water cycle themed crossword puzzle.

Beaver lodge at the Matheson Wetlands

STATION #1

Erosion Motion

Objectives

Students will be able to:

a. Compare rates at which water flows through different areas.
b. Name two benefits of water slowing down in the wetlands.

Materials

The Hero Twins and the Swallower of Clouds (Caduto & Bruchac, 1988, 78-81); 2 buckets; 20 beanbags; 4 name tags, each labeled *PLANT*; stopwatch.

PROCEDURE

1) Read the story *The Hero Twins and the Swallower of Clouds*. Briefly discuss why clouds, rain, and water are important to this region.

2) Have students look around and imagine what it would be like in a thunderstorm. Remind them that water always flows downhill, quickly on steep ground, and more slowly on less steep ground. Around Moab, it flows to the Colorado River and then downstream to the ocean. Point out the bare, steep slickrock, where the rain runs quickly downhill and is not stopped by anything. Next, point out or have them visualize washes, which are often less steep than the slickrock slopes. The less steep slopes slow the water, as do the plants at the edges of the wash. Finally, point out the wetlands, where there are so many plants and there is such a low slope, that the water almost stops. Tell the students that as water runs, it picks up soil and nutrients and carries them with it. Water carries the most sediments and nutrients when it is moving fast; as it slows down, the sediments and nutrients drop out of the water. Discuss the benefits of having water slow down in the wetlands. Slow-moving water a) keeps the wetlands soils from washing away, b) adds sediments to the area, c) adds nutrients, which combine with the sediments to form rich wetlands soils that nourish the plants, and d) collects in pools for wildlife to drink.

3) For the first round of the erosion activity, ask students to act out water from a rainstorm, which takes soil and nutrients from the top of the cliff to the river. Place two buckets 100 feet apart on the walkway, with the closest one full of beanbags. Have students line up at the beanbag bucket. As water, have each student carry soil and nutrients (a beanbag) down the slickrock slope (path) to the river (far bucket). Once they deposit their soil and nutrients in the river, have students run back to the beginning to get another load of nutrients. Instruct students to stay on the designated path. To avoid collisions, have those running to the river bucket stay on one side of the path and those returning to the beanbags stay on the other, as they will all be running simultaneously. Time how long it takes for the group to move all the soil/nutrients to the river.

4) In the second round, water runs down a wash instead of traveling across slickrock. Give one or two students plant nametags to wear, and place them along the edges of the path between the buckets to represent plants along the edge of the wash. Instruct the plant-students that they are rooted and cannot move their feet, but should try to capture nutrients from the water running by using their branches (arms). Any water-student that gets tagged must run around the plant twice (simulating soaking into the soil) and drop a nutrient bag at the plant's feet. Then, the tagged student can run back to the start and get another beanbag. Time how long it takes for the group to empty the soil/nutrient bucket. Compare the times of round one and round two, relating it to the slower movement of water down a plant-edged wash compared to movement down steep slickrock. Discuss how many sediments and nutrients the plants captured.

5) For the third and final round, water runs through a wetland. Designate two or three students as plants, and line them up in the middle of the path. Play and time as before. Discuss with the students how long it took the water to flow through the wetlands versus down washes or slickrock. Discuss how many sediments and nutrients the plants captured.

6) Review the results of the activity. Which places did water flow fastest and slowest? Where did it soak in the most and deposit the most sediments and nutrients? Why?

EXTENSION

Have students think of other areas in which rain falls. Ask them to write a story describing the movement of water through one of these areas.

STATION #2

Do the Water-Cycle Twist

(adapted from Caduto & Bruchac 1988, 90-91)

Objectives

Students will be able to:

a. Identify the four main parts of the water cycle.

b. Describe the processes of evaporation and condensation.

Materials

Water cycle poster; two full buckets of water and two empty buckets; two sturdy cups; lake and cloud signs; extra supply of water if not available in the wetlands.

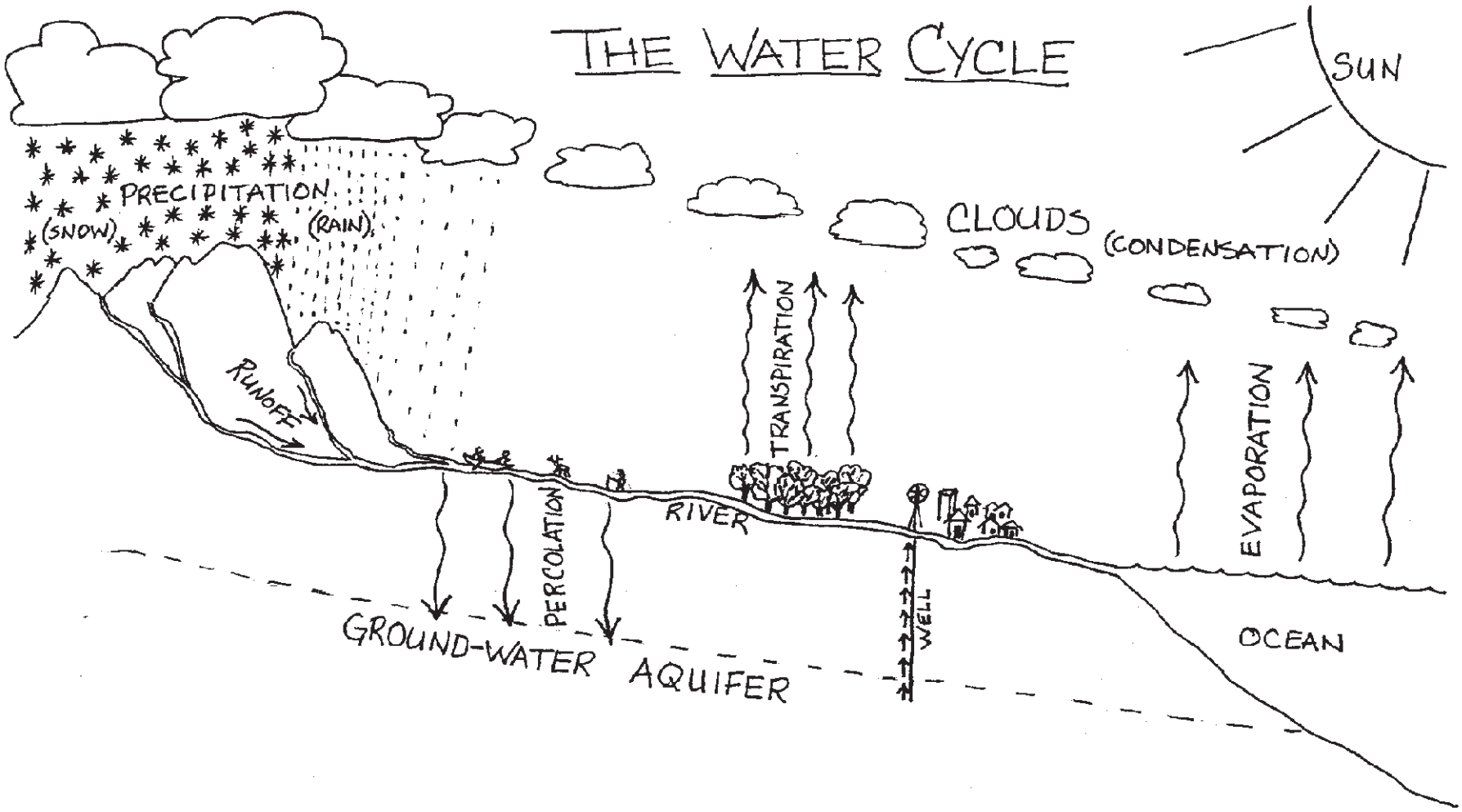
PROCEDURE

1) Using the water cycle poster, discuss and review the water cycle and its components (the six "tion" words, i.e. *evaporation, condensation, precipitation, transpiration*). Tell students to prepare to act out the water cycle in a relay. Place buckets in pairs, 35 to 40 feet apart, with the lake sign by the closer pair and the cloud sign by the other. Form two teams, and have them line up in two parallel lines behind the lake buckets. If you wish, have them name their teams for two wetland animals, and use that as a lead-in to talk briefly about a few of the wetland animals in the area.

2) Use guided imagery: "Imagine these (closer) buckets of water are big, blue lakes and you like to __in them." (Students fill in the blanks.) "As the sun heats up the lake, some water evaporates and rises up, cools off, and condenses to form white fluffy ____. Imagine that you are now evaporators with the power of the sun. When it is your turn, use the cup, scoop up water from the lake bucket, and run up to the clouds." Explain that it is important to conserve water; the object is to pour as much water into the cloud bucket as possible, while traveling as quickly as possible. After pouring, each student should run back and hand the cup to the next person in line. Start the relay. As students run, comment on what a hot day it must be with all this evaporation occurring, or describe the clouds getting heavier and darker. When both "lake" buckets are empty, walk to the other side and see which team evaporated the most water. The winning team is the one with the fuller end bucket (not always the team who emptied their bucket first). Commend students on the conservation strategies they came up with (hand over cup, cooperatively tipping bucket for easier scooping when water got low, etc.).

3) Have students stand with you in a circle, and tell them that they are going to work together to create a thunderstorm. They are to mimic whatever the person to the right is doing and make no other sounds. Start the storm off by rubbing your hands together (wait until everyone is doing this around the circle one by one), then click your fingers, then clap your hands on your knees, and finally stomp your feet. Reverse the order of the movements as the storm recedes. Ask the students if they recognized the sounds of a thunderstorm. Discuss runoff and percolation.

4) Have students line up in teams at the cloud buckets for another relay. Adjust the water volume in the buckets according to how much time you have left, and equalize them. Inform students that they are now precipitators and will take water from the cloud to the lake. Have them each choose a type of precipitation to be. Start relay, and interject comments as in the first relay.


THE WATER CYCLE
SUN
PRECIPITATION
(SNOW)
(RAIN)
CLOUDS
(CONDENSATION)
RUNOFF
TRANSPIRATION
EVAPORATION
RIVER
PERCOLATION
WELL
OCEAN
GROUND-WATER AQUIFER

STATION #3

Imagine!

Objectives

Students will be able to:

a. Describe the water cycle.

b. Identify changes in states of water that enable water to move through the water cycle.

Materials

Water cycle journey story (Project *WET* 1995, 159-160); water cycle puzzle cards; small poster describing lines of a diamante; quarter sheets of paper; pencils; clipboards

PROCEDURE

1) Review the water cycle. Distribute a water cycle puzzle card to each student. Ask them not to show the cards to each other. Tell the group that their goal is to make a circle in the correct order of the water cycle, without talking, by acting out what is on their cards. When they've reached the goal, have them all act out their parts in the cycle.

2) Tell the students that you are going to take them on an imaginary journey through the water cycle. Have them find comfortable spots, lie back, and look at the sky or close their eyes. Ask students to try to imagine what you are describing as you read *Water Cycle Journey*. Tell the students that they will be writing a unique kind of poem about some of their imaginings after listening to the story. Read the story.

3) Tell the students that they are going to write a poem called a diamante about the journey they just took or something they saw along the way. Hand out clipboards, paper, and pencils. Show the diamante poster as you describe each line, and leave it where students can refer to it.

Diamante

Line one: Write one word (noun) that is the favorite thing you saw as a raindrop.

Line two: Write two adjectives describing it.

Line three: Write three things it was doing (verbs or actions).

Line four: Write two feelings about it.

Line five: Write one word it reminds you of.

4) Encourage volunteers to read their poems.

EXTENSION

Have students create a puppet show, play, or story about a drop of water that travels through the entire water cycle. Have them include where the drop of water goes and conversations that it has with plants, animals, rocks, and other parts of the environment it meets along the way.

Writing diamantes at the Matheson Wetlands

STATION #4

Pollution Solution

(adapted from Slattery, 1991, 122; and Anderson et al, 1998, 9)

Objectives

Students will be able to:

a. Name three characteristics of wetland soil.
b. Describe two effects of wetland soil on water and pollution.

Materials

Trowel; observation tray; nine pie pans; nine milk jugs with tops cut off and holes in the bottoms; sand; gravel; wetland soil; water; cups; food coloring; clipboards; paper; pencils

Note

Before the activity, set up three sets of three milk jugs sitting in pie pans. One jug in each set will contain gravel, one sand, and the other wetlands soil. Also, put some wetland soil in an observation tray, and collect a jug of muddy water from the creek. Stir up the creek if necessary; the water must be *muddy* for this experiment to work persuasively.

PROCEDURE

1) Show students the tray of wetland soil. Ask students to explore the soil using all their senses. Note the dampness, color, scent, texture, smell, and different grain sizes. Ask students to compare the soil to soil they have seen in their backyards or in Arches National Park. Discuss the formation of soil in the wetlands and the plants (and thus animals) that benefit from this rich, organic soil.

2) Divide students into two or three groups. Each group will experiment with a set of three milk jugs/pie pans and will need a cup for pouring and a sheet of paper. Ask students to fold the paper lengthwise, for predictions on one side and results on the other. Have them divide the paper into thirds in the other direction, for the three substrates in the different milk jugs. Label the three: *gravel*, *sand*, and *wetland soil*. Ask the students to write down two predictions for each substrate: how fast the water will travel through the substrate and whether the water will be clear, slightly muddy, or very muddy when it exits. After they have written predictions for all three, they may begin pouring an equal amount of water through each, observing, and writing down the results for each on their sheet. When they are finished, discuss the results, including which soils acted as better filters and the beneficial effects of this filtering.

3) Ask students what might happen if the water we poured through the jugs was polluted. With their input, list a few pollutants that might be in the water entering the wetlands. Ask where they think the pollution would go if the wetlands were not here. If there's time, simulate the filtering of invisible pollutants by pouring colored water through a jug of wetlands soil. Discuss. Have students clean off their pie tins.

EXTENSION

In small groups, have students create soil that they think would both filter and hold water as well as wetlands soil does. Have each student in a group bring an element (i.e. dead plants, sand, and mud) to mix together. Compare a jug test on the mixture to the wetlands soil jug test. Discuss results and what they could add or take out to make the soil more like wetlands soil.

Learning about water pollution

POST-TRIP ACTIVITY

The Water Cycle Journey

Objectives

Students will be able to:

a. Reproduce a map-view drawing of their local area and label local features.

b. Integrate major components of the water cycle into their drawing.

Materials

Moab wetlands water cycle poster (or draw on board); unlined paper.

PROCEDURE

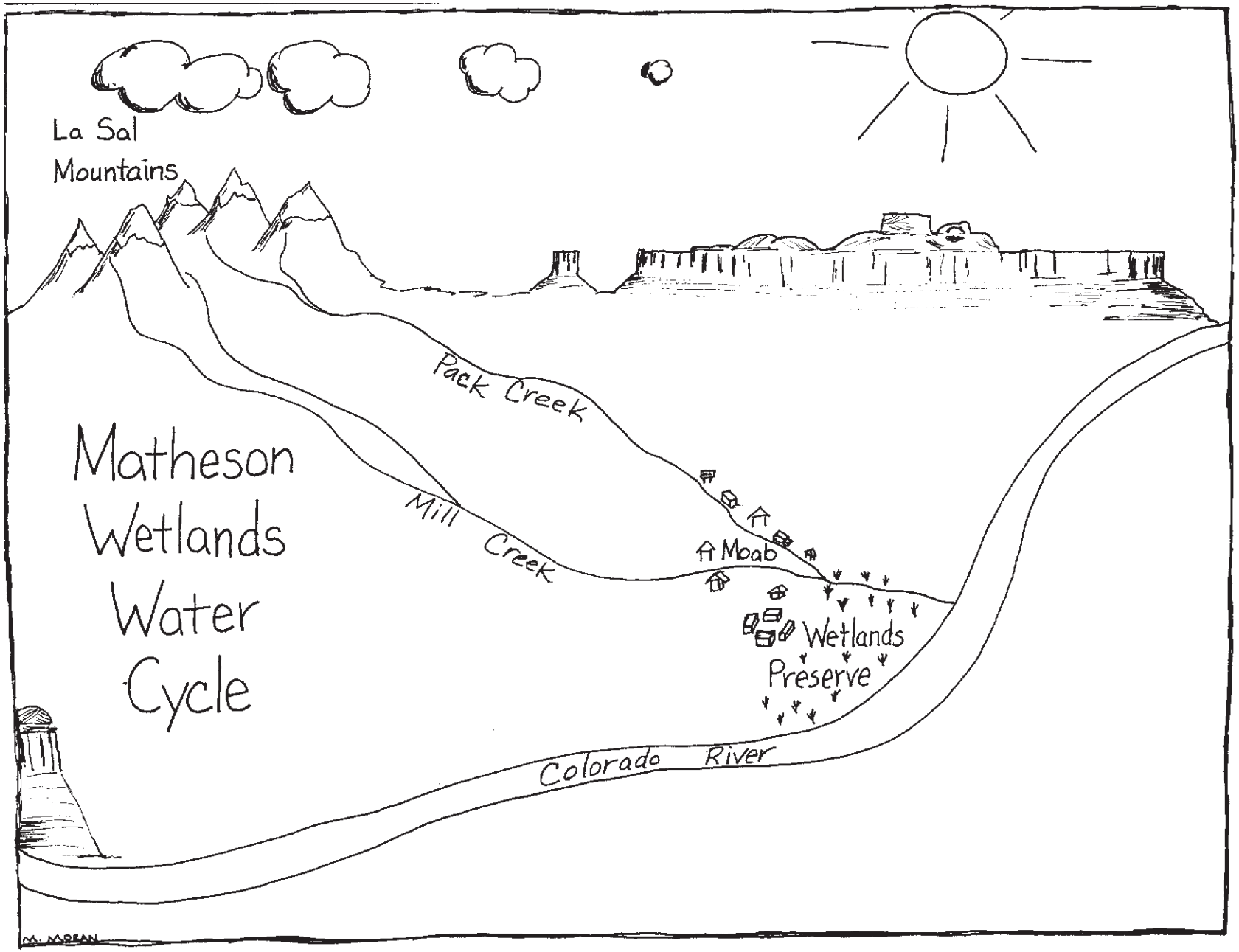
1) Review with students the four field trip stations. Write the water cycle components on the board as they are mentioned.

2) Show the poster, or draw its equivalent on the board, as you introduce it. Discuss the named features and their roles in the local water cycle. Instruct students to make a map (similar to the poster) on their own and to add the parts of the water cycle to it. On the blackboard, model how to integrate one of the water cycle components. The students should draw and label both the local physical features and the parts of the water cycle. Add to the blackboard list until it includes all features and components that they are to label.

3) Circulate among the students as they work on their drawings. Some of them might need help getting started or completing their drawing. If there is time, have a few volunteer students share their drawings with the class. Collect drawings, and give them to the classroom teacher.

EVALUATION

Have students create another water cycle drawing, this time of an imaginary land. Have them make up names for landforms and label the landforms, as well as, the water cycle components.



Matheson Wetlands Water Cycle

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