

Habitat

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Shorebirds depend on at least three different places for habitat every year of their lives.
- Shorebirds face numerous threats.
- The most serious threat to shorebirds is loss of habitat.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Wetland and grassland ecosystems provide extremely important habitats for shorebirds.
- Your local environment may provide important habitat for shorebirds.
- Your local environment is part of a natural ecosystem that we all depend on.

Activities

Shorebird Food Webs

(lower elementary, upper elementary/middle school)

In this activity, students take on the roles of abiotic or biotic components of a wetland or grassland habitat. Using a ball of yarn, students create a web to demonstrate how shorebirds are connected to all parts of their habitat. They discover how changes in the food web can affect a shorebird's survival.

Can't We Share?

(lower elementary)

Students learn how natural and man-made events affect shorebird survival by playing a game of musical chairs in which the students are shorebirds and the chairs are different habitats.

Wetland Metaphors

(lower elementary, upper elementary/middle school)

Students make comparisons between unrelated objects through metaphors to learn the functions of a wetland.

Match the Habitat Cards

(upper elementary/middle school)

By playing a card-matching game, students learn that shorebirds use diverse habitats. Students will discover that shorebirds use these habitats to meet their own specific needs.

Types of Habitats

(upper elementary/middle school)

By building a three-dimensional model, students learn principles of geography and the components of aquatic and terrestrial shorebird habitats.

Map Your Habitats

(upper middle school/ high school)

By examining maps, students discover the variety of habitats that local shorebirds might use.

When the Grass Was Greener

(upper middle school / high school)

Through simulation, participants will see how the reduction of grassland habitat and the altering of agricultural practices such as corn production, grazing, and mowing can affect grassland nesting shorebirds.



Shorebird Food Webs

Adapted from “Salt Marsh Food Web.” San Francisco Bay National Wildlife Refuge. “Salt Marsh Manual.”

Grade Level: lower elementary, upper elementary/middle school

Duration: one 30-minute class period

Skills: critical thinking, problem solving, predicting, discussion, and vocabulary

Subject: science

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Wetland and grassland ecosystems provide extremely important habitats for shorebirds.

Vocabulary

- ecosystem
- endangered
- extinct
- food web
- producers
- consumers
- predators
- prey
- habitat

Overview

In this activity, students take on the roles of abiotic or biotic components of a wetland or grassland habitat. Using a ball of yarn, students create a web to demonstrate how shorebirds are connected to all parts of their habitat. They discover how changes in the food web can affect a shorebird’s survival.

Objectives

After this activity, students will be able to:

- Identify at least five different plants and animals from one of the seven habitats.
- Name at least two relationships between plants and animals.
- Name at least two shorebirds that live within the habitat studied.
- Explain what it means to be an endangered species.
- Define the word extinct.

Materials

- Ball of yarn to create a web
- Shorebird Food Web Cards for either: tundra, salt marsh, freshwater marsh, mudflat and sandy beaches, rocky-intertidal habitat, or grasslands.

Introduction

Habitat is the place where species find food, water, shelter, and space to survive. Habitat is found within an *ecosystem*. An ecosystem consists of all living parts (plants and animals) and the nonliving parts (air, water, soil, minerals) in an area of any size, interacting and linked together by nutrient flow and energy from the sun. There are many relationships and interactions between the *producers*, the green plants that use sunlight to produce their food, and the *consumers*, those animals that feed on plants and each other. These relationships and interactions in an ecosystem can be demonstrated as a “web,” with each plant, animal, or nonliving part connected to each other either directly or indirectly. When one part of the web is touched, every part is affected.

Plants and animals are considered *endangered* when there are so few of a particular species left that it runs the risk of becoming *extinct*. Many shorebird populations today are in trouble because the habitats they depend on for nesting, migration, stopover, and

nonbreeding have been lost to development.

For more information on shorebird habitats, read *Shorebirds Depend on a Chain of Healthy Habitats* in the *Shorebird Primer*.

Activity Preparation

1. Select the habitat food web that you want to explore with your students from the Shorebird Food Web Cards.
2. Photocopy the Food Web Cards onto cardstock and cut them out.
3. If you have more students in your class than you have cards, photocopy and cut extra producer cards. It is okay for more than one student to represent the producers in the food web. In reality, a healthy food web requires a greater number of producers to support the other organisms.

Procedure

1. Ask the students to form a circle. Hand out a food web card to each student. Save the sun card for yourself. Let the students know that it is okay for several people to have the same cards.
2. Ask the students if they know why several students are representing *producers* in the web? These are the producers at the base of the food web which usually do outnumber the *consumers* in nature. They have to support the animals at the top.
3. Have the students read their cards silently, then aloud to the rest of the class. Ask them to listen to each other carefully for clues to the order of the web. Explain that they will have to connect their organisms to other organisms they depend on.

4. You, the “sun,” start the web activity. Read your card, then wrap one end of the yarn around your hand and pass the ball of yarn to the student representing the organism you are connected to. For example, the “sun” would connect to a “plant” and say “I am the sun and I provide energy for the plant to grow.” NOTE: Connections can be indirect—that is animals also require air, water, and sunlight.
5. Now the student with the ball of yarn reads his or her card and passes the ball to the organism he or she is connected to. For example, a student with a plant card would then pass the ball of yarn to an animal that eats it and say “I am a plant and provide food for ____.”
6. Continue this until all the students are connected by the web of yarn.
7. Discuss with students what might happen if one species were lost from the web. Simulate removing one of the organisms from the web by tugging on one line in the web or have one “organism” drop its line. Instruct everyone who feels the tug to *gently* tug the line(s) she or he is holding. This ripple effect should pass through everyone in the web.
8. Have a class discussion of the following questions:
 - How does the loss of one species in the food web affect the other species?
 - What would happen to the food web if one of these species were to be permanently removed from the habitat?
 - What does it mean when a species is listed as *endangered*?
 - Are any animals in this food web endangered?
 - What do you think we can do to keep shorebirds from becoming endangered?

Additional Activities

Food Webs in Other Habitats

Make another set of food web cards for a habitat not found in your area. After creating this food web as a class, ask students to research this food web further. What other plants and animals live there? What are the environmental conditions in this habitat? Refer older students to the *Habitats Student Readings* in the *Types of Habitat* activity in this section for more information about important shorebird habitats.

Shorebirds of Your Habitat

Read the *Shorebird Profiles* found in the *Appendix* to find the shorebirds mentioned in your food web. Find and color the matching shorebird illustrations in the *Shorebird Coloring Pages* of the *Appendix*.

Make a Food Web Mobile

Divide your class into seven teams and assign each team one of the habitat types included in this activity. Instruct each team to color its food web cards and assemble them into a mobile. Ask them to highlight, in any way they choose, any species in the web that are endangered. Have each team present its food web mobile to the entire class before hanging it in the classroom.



List of Food Web Cards

Food Web Habitats

Tundra	166
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Salt Marsh	183



Tundra Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Most plants and animals find me pooled in small depressions on top of the soil. I cannot seep into the hard frozen permafrost of the tundra.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. *Fish*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow. Only the top six inches of me thaws in the summer. *Animals* get their nutrients from plants. When living things die, they decompose and form a spongy layer on top of me called peat.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton*, and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *crabs*, *worms* and *snails*. I can be found in the small pools of water scattered across the tundra.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, and *insect larvae*. You can find me floating in the small pools of water scattered across the tundra.

Lichen

I am lichen—part algae, part fungus. I use *sunlight* and nutrients in the *soil* to grow. I am one of the main diets of the *caribou* that nibble on me year round!

Detritus

I am detritus—dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *insect larvae*, *grasshoppers*, and *beetles* eat me.



Tundra Food Web Cards

Cloudberry

I am cloudberry. I use *sunlight* and the *nutrients* in the soil to grow. *Ptarmigan*, *Arctic foxes*, *Arctic hares*, and *lemmings* eat my ripe berries in the fall.

Cotton Grass

I am a cotton grass. I use *sunlight* and the nutrients in the *soil* to grow in clumps across the tundra. I provide shelter and nesting material to many small animals. *Lemmings*, *Arctic hares*, and *musk ox* nibble my delicate shoots and eat my seeds.

Mosquito/Insect Larva

I am an insect larva. I hatch from an egg my parent laid on the *cotton grass*, *cloudberry*, or in the *water* of the small wetlands pools scattered across the tundra. I eat *zooplankton*, *phytoplankton*, and *detritus*. Tundra shorebirds like the *Pacific-Golden Plover*, the *Buff-breasted Sandpiper*, and the *Dunlin* time their arrival at the yundra just when I am hatching because I give them lots of energy to raise their chicks.

Ptarmigan

I am a ptarmigan. I eat *cloudberry*, *cotton grass seed*, and *insect larva*. *Arctic fox*, *gray wolf*, and *snowy owl* all try to make a meal of me. Thank goodness for camouflage! There aren't many places to hide from predators on the flat, barren tundra landscape.

Lemming

I am a lemming. I eat tundra plants like *cloudberry* and *cotton grass* and *insect larvae*, *beetles*, and *grasshoppers*. I have to watch out for *Arctic foxes*, *gray wolves*, and *snowy owls*—tundra predators that eat me.

Arctic Fox

I am an Arctic fox. I eat almost anything smaller than myself. I chase tundra shorebirds like *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, and *Dunlin*. I will also eat *lemming*, *ptarmigan*, *Arctic hare*, and even *beetles*, *grasshoppers*, and the berries of the *cloudberry* plant!

Caribou

I am a caribou, the wild relative of the reindeer. Even though I am one of the largest animals on the tundra, I survive by nibbling the *lichen* growing on the rocks scattered across the landscape. While I graze, I keep a careful watch for *gray wolf* which tries to catch the young and weak members of my herd.

Pacific Golden-Plover

I am a Pacific Golden-Plover. Like other tundra shorebirds, I feast on *insect larvae*, *beetles* and *grasshoppers*. *Arctic fox*, *gray wolf*, and *snowy owl* prey on my chicks and me.



Tundra Food Web Cards

Buff-breasted Sandpiper

I am a Buff-breasted Sandpiper. I use *lichen* and *dead willow leaves* to line my nest. I eat *beetles*, *grasshoppers*, and *insect larvae*. Sometimes *caribou* trample my nest and eggs as they slowly graze across the tundra.

Dunlin

I am a Dunlin. I feed on the abundant supply of tundra insects—*beetles*, *grasshoppers*, and *insect larvae*. My camouflage helps hide me from the *Arctic fox*, *gray wolf*, and *snowy owl* which like to eat my chicks and me.

Beetle

I am a beetle. I eat whatever I can find including the bodies of dead animals! Mostly I feed on *insect eggs and larva*, *detritus*, *cotton grass*, *cloudberry*, and other tundra plants. In turn, I am food for *Arctic fox*, *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, and *Dunlin*.

Grasshopper

I am a grasshopper. I feed on tundra plants like *cloudberry*, *cotton grass*, and *dwarf willow*. *Arctic fox*, *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, and *Dunlin* eat me.

Dwarf Willow

I am a dwarf willow. I offer shelter and protection to many tundra birds and small animals. *Ptarmigan*, *grasshopper*, *caribou*, *lemming*, and *Arctic hare* eat my tender buds.

Snowy Owl

I am a snowy owl. I hunt from above, soaring in search of *lemming*, *arctic hare*, *Arctic fox kits*, *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, *Dunlin* adults and chicks, and *ptarmigan*. Few tundra predators can catch me, but *gray wolf* will eat me if he can.



Freshwater Marsh Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Rain and snowmelt bring me into the marsh.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. *Fish*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow. *Animals* get their nutrients from plants. When living things die, they decompose and return their nutrients to me.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *aquatic worms*, *snails*, *tadpoles*, and *mosquito larvae* as I swim through the water.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, *insect larvae*, and *tadpoles* as I float in the water.

Detritus

I am detritus—dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *insect larvae*, *tadpoles*, and *fish fry* eat me.

Cattail

I am a cattail. I use the *sun*, *water*, and *soil* to grow in the shallows of the freshwater marsh. *Muskrat* eat my tender shoots and collect my stalks to make their huts. *Red-winged Blackbirds* nest within my tall growth.



Freshwater Marsh Food Web Cards

Rush

I am a rush. I use the *sun*, *water*, and *soil* to grow along the edges of the freshwater marsh. Many wetland creatures including *Mallard ducks* eat the seeds I drop.

Snail

I am a snail. I eat *phytoplankton* and *zooplankton*. Lots of different birds prey on me, such as *Spotted Sandpiper*, *Hudsonian Godwit*, and *Great Blue Heron*. I live in the mudflats of the wetland.

Duckweed

I am duckweed. I float on top of the *water* like little green dots, using the sun to make food for myself. *Mallard ducks* use their strainer-like bills to collect me off the water's surface.

Dragonfly

I am a dragonfly. As a winged adult I am a fierce *mosquito* predator. I have to watch out for birds that like to eat me, like the *Red-winged Blackbird* and *sunfish* that grab me as I drink from the surface of the water. *Humans* who sometimes like to collect me are a danger too!

Insect Larva

I am a dragonfly larva. I begin life in the water eating *detritus*, *small fish*, *tadpoles*, and other *insect larvae*. However, *fish*, *frogs*, and *turtles* like to eat me when they can.

Mosquito

I am a female mosquito. When I am hungry I look for any warm-blooded animal to feed on. At the wetland, I feed on *muskrat*, *Mallard duck*, *Red-winged Blackbird*, *Spotted Sandpiper*, and *Hudsonian Godwit*, but I like *humans* the best!

Mallard Duck

I am a Mallard duck. I spend my time straining *duckweed* from the water's surface. I often get an *invertebrate* along with my plant meal. Unleashed *dogs* and *humans* are my biggest threats.

Great Blue Heron

I am a Great Blue Heron. I use my sharp, pointed bill to spear *fish* and *frogs*. Like Mallard duck, unleashed *dogs* are a threat to my chicks and me.

Freshwater Marsh Food Web Cards

Sunfish

I am a sunfish. I take shelter as a young fry among the *cattails* and *rushes*, eating *detritus*, *zooplankton*, *phytoplankton*, and small *insect larva*. As I grow, I venture out into the open water area of the pond in search of a bigger meal—dragonflies as they try to take a drink, *tadpoles*, and small *frogs*.

Muskrat

I am a muskrat. I eat *cattails* and use them to build my home. If I am not careful I may be trapped by a *human being* or caught by an unleashed *dog*. *Red fox* likes to eat my young—and me too!

Leopard Frog/Tadpoles

I am a leopard frog. As a tadpole I feast on the *detritus* near the edges and on the bottom of the wetland. I am food to *fish* and *dragonfly larvae* when I am young. Once I am a frog, even more wetland creatures consider me food, including *Great Blue Heron*.

Red-winged Blackbird

I am a Red-winged Blackbird. I make my nest among the tall *cattails* at the edge of the wetland pond. I eat wetland insects like *dragonflies* and *mosquitoes*. A stray *dog* or a *red fox* will make a meal of me when they catch me.

Spotted Sandpiper

I am a Spotted Sandpiper. I probe the wetland mud for *tiny snails* and *insect larvae*. I move quickly and am well camouflaged to help me hide from *red fox* and *dog*.

Hudsonian Godwit

I am a Hudsonian Godwit. My long, slightly upcurved bill is perfect for finding *snails* and *insect larvae* in the mud. If I am not careful, I can become food for *red fox* or *dog*.

Red Fox

I am a red fox. I am the great hunter of the wetland. I eat *Mallard ducks*, *muskrats*, *Red-winged Blackbirds*, *Spotted Sandpipers*, and *Hudsonian Godwits* when I can catch them. I am happy, however, to eat *leopard frogs* too. I watch out for *dogs*, a relative of mine that is often quite bigger than I am. I also stay clear of *human beings* who sometimes trap me for my beautiful red fur coat.

Dog

I am a dog. I love to chase anything that runs. I can catch *Mallard ducks*, *muskrats*, *Red-winged Blackbirds*, *Spotted Sandpipers*, *Hudsonian Godwits*, *Great Blue Herons*, and even *leopard frogs* when I am loose in the wetland!



Freshwater Marsh Food Web Cards

Human Being

I am a human being. As you know, I eat a huge variety of foods including *ducks* and *fish*. I am at the top of the food chain, so no animals prey on me except that pesky *mosquito*! Sometimes I drain wetlands to build homes and businesses or to make way for roads and shopping centers. *Dog* often accompanies me on my walks, and I let him run off-leash for exercise.



Rocky-Intertidal Habitat Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Saltwater from ocean tides and freshwater from the rain collect in small pools among the rocks.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. *Fish*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Rocky Substrate

I am rock. I take the place of soil in the rocky intertidal habitat. *Seaweed* anchors its roots to me. *Mussels*, *limpets*, *barnacles*, *starfish*, and *sea urchins* cling to my surface as waves crash to shore.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *aquatic worms*, *shrimp*, *clams*, and *barnacles* as I swim through the water.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *small fish*, *aquatic worms*, *zooplankton*, *shrimp*, *clams*, and *barnacles* as I float in the water.

Detritus

I am detritus—dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *phytoplankton*, *tidepool shrimp*, *aquatic worms*, *clams*, and *barnacles* eat me.

Seaweed

I am seaweed. I use *sunshine* to make food for myself. *Sea urchins* and *small fish* nibble at me as I cling to the rocks. I also provide places for fish and other wildlife to hide. When I die and become *detritus*, I am eaten by many other organisms.



Rocky-Intertidal Habitat Food Web Cards

Tidepool Shrimp

I am a tidepool shrimp. I feed on *seaweed* and *detritus* floating through the water. *Ruddy Turnstones*, *starfish*, and *gulls* make a meal of me.

Limpet

I am a mussel called a limpet. I cling to the rocks like a suction cup. I eat *phytoplankton* and *zooplankton* that floats in with the tide. *American Oystercatchers* use their strong, flattened beak to pry me off the rocks to eat my soft body that is hidden under my shell.

Razor Clam

I am a razor clam. I burrow deep into the sand and wait for the tide to bring me a fresh supply of *phytoplankton* and *zooplankton* with each pulse of the surf. Birds like *gulls*, *Ruddy Turnstones*, and *oystercatchers* are always looking to make a meal of me. *Starfish* and *Gulls* eat me too when rough surf brings me to the surface.

Starfish

I am a starfish. I cling to the *rocks* as the surf rolls in out of the tidepool. I eat anything that I can get my strong arms around, mostly *clams*, *limpets*, *barnacles*, *oysters*, and *sea urchins*. *Gulls* like to eat me if they can tear me loose from the rocks.

Sea Urchin

I am a sea urchin. I cling to the *rocks* as the surf rolls in and out of the tidepool. I eat *seaweed* that grows on the rocks or is brought in with the surf. *Gulls*, *sea otters*, and *starfish* like to eat me.

Gull

I am a gull. I eat almost anything I can find on the beach—*starfish*, *sea urchins*, *clams*, and even the chicks and eggs of shorebirds like *oystercatcher* and *Ruddy Turnstone*!

Oystercatcher

I am an oystercatcher. I use my chisel-like beak to pry open the shells of *razor clams* and *oysters* and to pull *limpets* from the rocks. *Gulls* prey on my eggs and chicks.

Ruddy Turnstone

I am a Ruddy Turnstone. I get my name from the way I flick over *seaweed* or turn over small stones in search of small marine invertebrates like *snails*, *aquatic worms*, *razor clams*, and *tidepool shrimp* to eat. *Gulls* prey on my eggs and chicks.



Rocky-Intertidal Habitat Food Web Cards

Small Fish

I am a small marine fish. The tide brings me into the rocky tidepool where I spend my time nibbling on the *seaweed* I find there. If I am not careful, a *starfish* or a *Gull* may make a meal of me.

Barnacle

I am a barnacle. I filter *zooplankton*, *phytoplankton*, and *detritus* from the water for food. *Starfish* eat me.

Oyster

I am an oyster. I filter *zooplankton* and *phytoplankton* by sucking ocean water into my shell through my siphon. *Crabs*, *starfish*, *oystercatchers* and *human beings* eat me.

Aquatic Worm

I am an aquatic worm. I eat mostly *detritus*, *phytoplankton*, and *zooplankton*. Lots of animals eat me, including *gulls* and *Ruddy Turnstones*. I live in the wet sand along the shoreline.

Human Being

I am a human being. I harvest *oysters* from the sea for food. I sometimes bring my pets to the ocean for a swim and accidentally disturb *Ruddy Turnstones* and *oystercatchers* when they are feeding.



Mud Flats and Sandy Beaches Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Saltwater from ocean tides and freshwater from the rain bring me to mudflats and sandy beaches.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Grasses* use the nutrients in me to grow. When living things die, they decompose and return their nutrients to me.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *aquatic worms*, *snails*, *invertebrate larvae*, and *sand fleas* as lake tides and river floods carry me in.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, *invertebrate larvae*, and *sand fleas* as lake tides and river floods carry me in.

Detritus

I am detritus--dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *phytoplankton*, *shrimp*, *sand fleas*, *aquatic worms*, *fiddler crabs*, and *clams* depend on me for food.

Invertebrate Eggs and Larvae

I am an invertebrate egg that will hatch into a larva. Snails, worms, sand fleas, clams, shrimps, and crabs all lay eggs. Sooner or later many of me end up becoming food for Sanderlings, Dowitchers, Black-bellied Plovers, and fiddler crabs.



Mud Flats and Sandy Beaches Food Web Cards

Snail

I am a snail. I eat *phytoplankton* and *zooplankton*. Lots of different birds prey on me—such as *Dowitchers*, *Laughing Gulls*, *Sanderlings*, and *Black-bellied Plovers*. I live in the grasses of the mudflats and the *seaweed* that washes up along the sandy beach.

Aquatic Worm

I am an aquatic worm. I eat mostly *detritus*, *phytoplankton*, and *zooplankton*. Lots of animals eat me, including *Laughing Gulls*, *Sanderlings*, *Dowitchers*, and *Black-bellied Plovers*. I live in the wet sand and mud along the shoreline.

Sand Flea

I am a sand flea, but you may know me as a “sand hopper.” I am not really a flea at all but a marine crustacean. I feed mostly on decaying seaweed called *detritus*. Shorebirds like *Sanderlings*, *Dowitchers*, and *Black-bellied Plovers* pick through washed up *seaweed* and *grasses* along the edges of the mudflat in search of me.

Fiddler Crab

I am a fiddler crab. I get my name from my one oversized claw that looks like a violin (fiddle) and the smaller one that looks like a bow. I eat any small plants or animals I can pick up with my claws—*sand fleas*, *aquatic worms*, *snails*, *invertebrate eggs* and *larvae*, *clams*, and *shrimp*. *Laughing Gulls* and *raccoons* catch and eat me when I venture too far away from the safety of my underground burrow.

Clam

I am a clam. I burrow deep into the sand and wait for the tide to bring me a fresh supply of *phytoplankton* and *zooplankton* with each pulse of the surf. Birds like *Laughing Gulls*, *Dowitchers*, and *Black-bellied Plovers* probe the sand for me.

Shrimp

I am a shrimp. I feed on *seaweed* and *detritus* floating through the water. *Laughing Gulls*, *Dowitchers*, and *Black-bellied Plovers* make a meal of me.

Dowitcher

I am a Dowitcher. I use my bill like a sewing machine needle, probing the sand and mud for *invertebrate eggs and larva*, *snails*, *aquatic worms*, *sand fleas*, and *clams*. I am afraid of *raccoons*, *Laughing Gulls*, and *human beings*.

Black-bellied Plover

I am a Black-bellied Plover. You will find me running back and forth from the water's edge, picking food off the surface of the sand or mud. I eat *snails*, *aquatic worms*, *sand fleas*, *clams*, and *invertebrate eggs and larvae* like the other shorebirds here.

Mud Flats and Sandy Beaches Food Web Cards

Sanderling

I am a Sanderling, sometimes called a “wave chaser.” What I am really doing is trying not to get wet while I peck for small bits of food like *invertebrate eggs and larvae, aquatic worms, sand fleas, clams, and snails*.

Laughing Gull

I am a Laughing Gull. I am a bold and persistent predator. I will attack unsuspecting *Sanderlings, Black-bellied Plovers, and Dowitchers*. I also eat *shrimp, snails, crabs, and even mice* when I can catch them!

Grass

I am grass. I grow in the *soil* along the edges of the mudflats and on areas of the sand dunes. I use *sunlight, water, and air* to grow and produce my own food. *Mice* nibble on me; *shorebirds* use my dead stalks to line their nests; some *invertebrate eggs and larva* cling to me where I am wet and grow near the water’s edge. *Crabs* and *snails* hide within me.

Mouse

I am a mouse. I eat grasses growing along the edges of the mudflat. *Laughing Gulls* and *raccoons* sometimes eat my young and me.

Raccoon

I am a raccoon. I eat just about anything I can find. *Human beings* help me by leaving their food scraps and trash behind. When they get too close to a shorebird nest, they unknowingly leave a scent trail that I can follow right to my prey!

Human Being

I am a human being. I accidentally disturb *Sanderlings, Black-bellied Plovers, and Dowitchers* when I walk too close to where they are feeding. I unknowingly trample nests and lead predators like the *raccoon* right to the nests of shorebirds when I get close enough to see the eggs and chicks.



Mud Flats and Sandy Beaches Food Web Cards

Flyway-Specific Additional Cards

Horseshoe Crab

(Atlantic Flyway)

I am a horseshoe crab, a coastal scavenger. I will eat just about any small animal the surf brings me, including clams and aquatic worms. I am a favorite food of coastal birds including gulls. When I am just an egg, Ruddy Turnstones feast on me too. In fact, thousands of shorebirds time their spring migration along the Atlantic flyway to arrive when I am laying eggs. My eggs provide important energy that shorebirds need to continue their journey to the Canadian tundra. It is okay that they eat my eggs because the eggs are on top of the sand and would not hatch anyway.

Red Knot

(Atlantic Flyway)

I am a Red Knot. I migrate from Tierra Del Fuego, Argentina to the Delaware Bay to feast on horseshoe crab eggs. This gives me the energy to continue my flight to the Canadian tundra to nest.

Snowy Plover

(Pacific Flyway)

I am a Snowy Plover. I nest in the flat, open sandy beach habitat. Laughing Gulls and raccoons eat my eggs and even sometimes my chicks. Human beings get too close to me and scare me off my nest or disturb me while I am feeding on snails, aquatic worms, sand fleas, and clams. They also unknowingly walk or drive on my nests.

Piping Plover

(Atlantic Flyway)

I am a Piping Plover. I nest in the flat, open sandy beach habitat. Laughing Gulls and raccoons eat my eggs and even sometimes my chicks. Human beings get too close to me and scare me off my nest or disturb me while I am feeding on snails, aquatic worms, sand fleas, and clams. They also unknowingly walk or drive on my nests.



Grassland Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Rainwater brings me to the potholes hidden within the grassy landscape.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow and provide food to many other kinds of animals. When living things die, they decompose and return their nutrients to me.

Big Bluestem

I am big bluestem. I use the *soil* and the *sun* to grow. I am eaten by lots of different animals, including *grasshoppers*, *beetles*, *prairie dogs*, *ground squirrels*, *cottontail rabbits*, and even the noble *bison*.

Purple Coneflower

I am purple coneflower. I use the *soil* and the *sun* to grow. *Bees* and butterflies drink nectar and take pollen from my flowers.

Bumblebee

I am a bumblebee. I visit *purple coneflower* and collect nectar and pollen from the flower of this prairie plant. Birds like the *Bobolink* and the *Upland Sandpiper* eat me.

Beetle

I am a beetle. I feed on prairie grasses, including *purple coneflower* and *big bluestem*. *Killdeers*, *Upland Sandpipers*, and *Long-billed Curlews* eat my larvae and me.



Grassland Food Web Cards

Grasshopper

I am a grasshopper. You can find me eating prairie plants like *purple coneflower* and *big bluestem*. I also hide in the prairie grasses to keep from being eaten by *Bobolink*, *Upland Sandpiper*, *Marbled Godwit*, *Long-billed Curlew*, and *Killdeer*.

Earthworm

I am an earthworm. I live deep in the prairie soil, chewing on plant material like *big bluestem*, helping to decompose it into nutrients for other plants. *Long-billed Curlew* and *Marbled Godwit* both have bills designed to probe for me under the soil.

Bison

I am a bison. I roam across the grassland grazing on the plants growing there, including *purple coneflower* and *big bluestem*. *Human beings* hunt me in some parts of the grasslands for meat and for my coat. Sometimes *coyote* catches one of my sick or injured calves.

Coyote

I am a coyote. I like to eat *prairie dog*, *ground squirrel*, *cottontail rabbit* and *red fox*. *Human beings* do not like me around and will shoot or trap me if I venture into their territory.

Prairie Dog

I am a prairie dog. I live together with many other prairie dogs. We take turns watching out for *coyotes*, *red foxes*, and *Red-tailed Hawks* that would eat us if they caught us. *Human beings* trap or poison us if we try to start a "town" on their property. I guess they do not like our system of underground tunnels.

Bobolink

I am a Bobolink. I eat insects like *bumblebees* and *grasshoppers*. *Coyotes*, *red foxes*, and *Red-tailed Hawks* try to eat me.

Ground Squirrel

I am a ground squirrel. I eat plants like *big bluestem* and *purple coneflower*. *Coyote* and *red fox* eat me. If I am not careful and venture into the territory of a *human being*, I might get trapped or poisoned.

Red Fox

I am a red fox. I eat *ground squirrels*, *cottontail rabbits*, *Bobolinks*, and *prairie dogs* when I can catch them. *Grasshoppers* are often an easier meal for me. I have to watch out for *coyote* because he would like to eat my kits and me. *Human beings* love my fur coat and try to shoot or trap me in some areas.



Grassland Food Web Cards

Cottontail Rabbit

I am a cottontail rabbit. I eat grassland plants like *purple coneflower* and *big bluestem*. I hide from the animals that want to eat me—*red fox*, *coyote*, and *Red-tailed Hawk*.

Long-billed Curlew

I am a Long-billed Curlew. I eat *grasshoppers*, *beetles*, and *earthworms*. *Red-tailed Hawk*, *red fox*, and *coyote* will eat my chicks and me. *Human beings* have drained the prairie potholes where I breed.

Upland Sandpiper

I am an Upland Sandpiper. I eat *grasshoppers*, *beetles*, and *earthworms* just like the Long-billed Curlew. *Red-tailed Hawks*, *red foxes*, and *coyotes* are the predators that hunt me. When *human beings* graze their cattle in areas where I nest, my eggs and chicks are often trampled.

Killdeer

I am a Killdeer. I eat *grasshoppers*, *beetles*, and *earthworms* like other grassland shorebirds. *Red-tailed Hawks*, *red foxes*, and *coyotes* eat me. I have adapted to living around *human beings* but am sometimes killed by their loose dogs and cats.

Red-tailed Hawk

I am a Red-tailed Hawk. I soar over the grasslands in search of shorebirds and their chicks like the *Killdeer*, *Upland Sandpiper*, and the *Long-billed Curlew*. I also eat *ground squirrel*, *cottontail rabbit*, *prairie dog*, and *Bobolink*.

Human Being

I am a human being. I hunt the *buffalo* for meat and fur and because they compete with my cattle for tender prairie grasses. I graze my cattle, farm crops, and build homes on the grasslands. I do not like *prairie dogs* and *ground squirrels* because their underground tunnels make a mess of my pastures, yard and gardens. Birds like the *Killdeer* that have adapted to living in my territory sometimes fall victim to my free-roaming cats and dogs.



Salt Marsh Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Most plants and animals in the salt marsh are adapted to salt water. Twice a day, the high tide fills the slough and marsh with salty bay water. This area is sometimes called an estuary because salt and fresh water mix here.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. Fish like the *goby*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow. *Animals* get their nutrients from plants. When living things die, they decompose and return their nutrients to me.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including small *fish*, *crabs*, *worms*, and *snails*. I can be found in the slough.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, *snails*, *crabs*, and fish such as the *goby*. You can find me in the slough.

Northern Harrier

I am a northern harrier. I eat different animals, including the *salt marsh harvest mouse*, *rail*, *Mallard duck*, and *stilts*, *avocets*, and *phalaropes*. I am at the top of the food chain so other animals do not prey upon me.

Rail

I am a rail. I eat lots of different things such as *crabs*, *small fish*, *snails*, and even *salt marsh harvest mice*. I am sometimes eaten by *northern harriers*. I live in the salt marsh, hiding and nesting in the *pickleweed* and *cordgrass*.



Salt Marsh Food Web Cards

Mallard Duck

I am a Mallard duck. Some of the foods I like to eat are *detritus*, *worms*, *phytoplankton*, and *zooplankton*. Sometimes *people* eat me. I live in the *waters* of lakes, ponds, sloughs, and rivers.

Snail

I am a snail. I eat *phytoplankton* and *zooplankton*. Lots of different birds such as *egrets*, *rails*, *Killdeer*, *American Avocets*, *Black-necked Stilts*, and *Wilson's Phalaropes* prey on me. I live in the mudflats of the slough.

Salt Marsh Harvest Mouse

I am a salt marsh harvest mouse, an endangered species. I eat *pickleweed*. *Northern harriers*, *rails*, and *egrets* like to eat me. You can only find me living in the salt marshes of San Francisco Bay, but you will not see me during the day because I am nocturnal.

Snowy Egret

I am a snowy egret. I eat lots of different things, including *small fish*, *mice*, *snails*, and *crabs*. *Northern harriers* try to eat my young. In the past, *human beings* killed me to decorate their hats with my feathers. I live in the salt marshes and tidal sloughs.

Pickleweed

I am pickleweed. I use the *sun* to produce my own food. The *salt marsh harvest mouse* eats me. The *rails* build their nests on me. I live in the salt marsh and get wet when tidal *water* comes in from the bay.

Cordgrass (Detritus)

I am cordgrass. I use *sunlight* to produce my own food. When I die, I decompose into a material called *detritus*. Lots of animals feed on *detritus*, such as *zooplankton*, *ducks*, *fish*, *worms*, and *crabs*. I grow close to the slough and the *rail* hides under me.

Black-necked Stilt

I am a Black-necked Stilt. I use my long, needle-like bill to pick *aquatic snails*, *worms*, *insects*, *small fish*, and *crabs* from the shallow water. Sometimes *northern harriers* will eat my chicks and me. *Human beings* sometimes scare me away from my feeding grounds. You can find me in the salt pond, salt marsh, and mudflats.

American Avocet

I am an American Avocet. I sweep my slim, upcurved bill from side to side, straining *aquatic snails*, *worms*, *insects*, *small fish*, and *crabs* from the water. Sometimes *northern harriers* will eat me and my chicks. *Human beings* sometimes scare me away from my feeding grounds. You can find me in the salt pond, salt marsh, and mudflats.



Salt Marsh Food Web Cards

Wilson's Phalarope

I am a Wilson's Phalarope. I am known for spinning like a top to create a temporary whirlpool in the water in order to stun the *aquatic snails, worms, insects, small fish*, and *crabs* I eat. Sometimes *northern harriers* will eat my chicks and me. *Human beings* sometimes scare me away from my feeding grounds. You can find me in the salt pond, salt marsh, and mudflats.

Aquatic Worm

I am an aquatic worm. I eat mostly detritus, phytoplankton, and zooplankton. Lots of birds, including Killdeer, Black-necked Stilts, American Avocets and Wilson's Phalaropes, like to eat me. Goby like to eat me as well. I live in the mudflats of the slough.

Crab

I am a crab. I eat different foods, including detritus, phytoplankton, zooplankton, and dead gobys. Lots of animals feed on me, including birds such as egrets, rails, Killdeer, avocets, phalaropes, and stilts. I burrow in the mudflats of the slough.

Aquatic Insect

I am an aquatic insect. Salt marsh birds like *avocets, stilts, phalaropes, Killdeer, egrets*, and *rails* are constantly probing and stirring the water looking for me. Small *fish* and *crabs* eat me too.

Bay Goby

I am a bay goby. I feed on the bottom of the slough, eating *phytoplankton, zooplankton, detritus*, and tiny mud creatures such as *aquatic worms*. Many different birds, including egrets, rails, stilts, avocets, and phalaropes, eat me. I live in the slough *water*.

Killdeer

I am a Killdeer. You will often find me probing the mud for food such as *aquatic worms, snails*, and small *crabs*. Many animals try to eat me, including the *northern harrier*. I can usually be found on the mudflats during low tide.

Human Being

I am a human being. As you know, I eat a huge variety of different foods, including *Mallard ducks* and fish. I am at the top of the food chain so no animals prey on me. Sometimes I build my home on top of salt marshes. I may get too close to feeding shorebirds like *Black-necked Stilts, American Avocets*, or *Wilson's Phalaropes* and scare them away from their feeding grounds.



Can't We Share?

Adapted with permission from "Bridges to the Natural World" from the New Jersey Audubon Society

Grade Level: lower elementary

Duration: 30-minute class period

Skills: communication, observation, interpretation of data, formulation of hypotheses, discussion, and vocabulary

Subject: science

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Shorebirds face numerous threats.
- The most serious threat to shorebirds is loss of habitat.

Vocabulary

- ecosystem
- habitat
- species
- breeding habitat
- nonbreeding habitat
- migration stopover site
- environmental stewardship

Overview

Students learn how natural and man-made events affect shorebird survival by playing a game of musical chairs in which the students are shorebirds and the chairs are different habitats.

Objectives

After this activity, students will be able to:

- List the four components of an animal's habitat.
- Explain how animal populations respond to habitat loss.
- Give at least one example of environmental stewardship.

Materials

- 1 chair per student
- Tape recorder/cd player
- Tape or cd
- Index cards
- Felt marker
- Sticking tape
- 2 copies of the Environmental Events sheet (included here)

Introduction

A healthy functioning *ecosystem* has adequate *habitat* (food, water, space, and shelter) for individual *species*, as well as population controls such as herbivores to maintain plant growth and carnivores to maintain animal population.

Often human actions, such as development pollution, fragmentation of habitats, and/or management for a single species upset a healthy functioning ecosystem. *Environmental stewardship* can help ensure that people and wildlife can coexist.

Natural conditions such as erosion, climate change, disease, flooding, and fire affect the functioning of an ecosystem. As a result of natural and human-related conditions, many animals will die, relocate, or increase their populations by adapting to the new circumstances. For example, species like the Pacific-Golden Plover now feed on lawns in their nonbreeding

grounds and roost on rooftops.

Buff-breasted Sandpipers now use agricultural fields instead of grasslands. Shorebirds rely on a variety of habitats for *breeding*, *nonbreeding*, and *migration stopover sites* where they rest and feed.

Important Shorebird Habitats

Tundra: A vast, flat, treeless wetland of the Arctic regions of northern and western Alaska and Canada. (Shorebird species found here are Red Knot, Ruddy Turnstone, Sanderling, Hudsonian Godwit, Black-bellied Plover.)

Stream and River Corridors: Low wetland areas along the banks of rivers and streams. These areas flood in the spring as snow and ice melt in the mountains and then dry up in late summer and fall. (Shorebird species found here are Killdeer, American Avocet, Spotted Sandpiper, Buff-breasted Sandpiper.)

Marshes: An open wetland of grassy areas that get freshwater from creeks, streams, rain, and snow or saltwater from coastal tides. (Shorebird species found here are Hudsonian Godwit, Killdeer, American Avocet, Black-necked Stilt, Spotted Sandpiper, Wilson's Phalarope)

Rocky Intertidal Habitat: A wetland area of the ocean shoreline made up of boulders, cliffs, gravel, shale, or rocks that are covered by saltwater during high tide and exposed to air during low tide. (Shorebird species found here are Black Oystercatcher and Ruddy Turnstone)



Mudflats and Sandy Beaches: Open sandy or muddy wetland habitats found in the area of the ocean shoreline, exposed to air during low tide, and covered by saltwater during high tide. (Shorebird species found here are Sanderling, Ruddy Turnstone, Dowitcher, Black-bellied Plover, Snowy Plover, Long-billed Curlew, Marbled Godwit, and Spotted Sandpiper.)

Grasslands: The prairie habitats of the central United States and Canada are comprised of three grass types. Some shorebirds will use human-made habitats that are similar to grasslands such as cemeteries, golf courses, school yards, and agricultural fields. (Shorebird species found here are Pacific Golden-Plovers, Killdeer, Mountain Plover, Upland Plover, and Buff-breasted Sandpiper.)

Prairie Potholes and Playa Lakes: Interspersed within grasslands of the United States are shallow, temporary wetlands called prairie potholes or playa lakes. (Shorebird species found here are Black-bellied Plover, Killdeer, American Avocet, Long-billed Curlew, and Marbled Godwit.)

For more information on shorebird habitats, refer to *Shorebirds Depend on a Healthy Chain of Habitats* in the *Shorebird Primer* and the *Habitat Readings*.

Activity Preparation

1. Select the music and arrange the chairs in two rows back to back, as in musical chairs.
2. Photocopy and cut the *Habitat Cards* included in this activity. If possible, select from the cards representing the habitats most common to your area.
3. Attach a habitat name to each chair, alternating the cards for equal distribution.
4. Photocopy and cut the *Shorebird Species Cards*, also included in this activity, so that each student has one. Be sure your selections match the number and types of habitat samples marked on the chairs.
5. Photocopy and cut two copies of the *Environmental Stewardship Cards*. Add your own local events to the blank cards provided. Place them in a box for random selection.

Procedure

1. Explain that each chair represents a specific shorebird habitat, such as marsh, mudflat, grassland, or stream corridor. Give a description of each habitat. Explain that each habitat supplies the shorebirds that live there with their basic life needs.
2. Hand out the species cards. Have the students read the cards and tell what kind of shorebirds they are and which habitat they live in.

3. Tell the students to stand in front of a chair representing their habitat and face the same direction, as if they were going to play musical chairs.

Note: Students may question why some shorebird species are represented in more than one habitat type. Explain that most shorebirds breed in one habitat type (often Arctic tundra) but use another during migration and the nonbreeding season. For example, the Red Knot breeds in the Arctic tundra but uses coastal wetlands during migration and the nonbreeding season.

4. Start the music and tell the students to walk around the chairs slowly. When the music stops, each student should sit down in one of the chairs representing his or her habitat.
5. The teacher or a student chooses an “event” from the box, reads it aloud, and removes a chair that represents the affected habitat.
6. Continue the game, removing one or more chairs at each stop in the music and as “events” are selected and read. As students are eliminated from the game, they keep the environmental events that affected their habitats.
7. Play until there is one student left.



8. Now discuss the following questions with the class:

- Ask students to tell how events affected them in their habitats. What basic needs were shorebirds deprived of in these situations? What will they do now?
- When more than one person was trying to take the same chair, what happened? How is the same behavior reflected in nature?
- Which events were natural phenomena and which were the result of human behaviors? Which of these events can people do something about and which cannot be controlled?
- What can people do to correct natural disasters? What alternatives exist for the human “events” that hurt shorebirds and their habitat?

9. Now tell students that they are going to do the activity again, but in reverse. Explain that humans have an important responsibility to be good land *stewards*. Explain that land stewardship is taking care of the land so it is available for all species and future generations of people.

10. Using the *Environmental Stewardship Cards*, play the activity backwards.

11. Discuss how students can be good stewards of the land in their community--for example, putting trash in its proper place, recycling, helping with conservation projects, etc.

Additional Activities

Research Your Shorebird

Use the **Shorebird Profiles** located in the *Appendix* of this education guide, the Web site, and the local library to learn more about the shorebirds in the activity. Ask student to research what the birds eat, where they live, and what unique adaptations and behaviors they have.

Hold a Mock Town Hearing.

Choose one of the environmental events named in the game as the issue to be discussed. The mayor and council (four or five students) listen to personal interest groups regarding a solution to the problem. Personal interest groups should represent many different points of view. This can also be expanded to include representatives from the different cultures along the shorebird's migration flyway.



Cultural Connection

In the ‘mock town meeting’ under *Additional Activities* at the end of this activity, have students represent different cultures along the shorebirds flyway expressing their view on the environmental issue.



Can't We Share? Habitat Cards

(Copy one card per chair. If possible,
use only habitats found in your
area.)

Habitat Type	Habitat Type
Tundra	Tundra
Habitat Type	Habitat Type
Tundra	Tundra
Habitat Type	Habitat Type
Marsh	Marsh
Habitat Type	Habitat Type
Marsh	Marsh



Can't We Share? Habitat Cards

(Copy one card per chair. If possible,
use only habitats found in your area.)

Habitat Type	Habitat Type
Stream and River Corridor	Stream and River Corridor
Habitat Type	Habitat Type
Stream and River Corridor	Stream and River Corridor
Habitat Type	Habitat Type
Rocky-Intertidal	Rocky-Intertidal
Habitat Type	Habitat Type
Rocky-Intertidal	Rocky-Intertidal



Can't We Share? Habitat Cards

(Copy one card per chair. If possible,
use only habitats found in your area.)

Habitat Type	Habitat Type
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Habitat Type	Habitat Type
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Habitat Type	Habitat Type
Prairie Potholes or Playa Lakes	Prairie Potholes or Playa Lakes
Habitat Type	Habitat Type
Prairie Potholes or Playa Lakes	Prairie Potholes or Playa Lakes

Can't We Share?

Shorebird Species Cards

(Photocopy so each child has one card.)

Tundra	Tundra
Red Knot	Ruddy Turnstone
Tundra	Tundra
Sanderling	Hudsonian Godwit
Tundra	Tundra
Black-bellied Plover	Western Sandpiper
Marsh	Marsh
Killdeer	American Avocet



Can't We Share? Shorebird Species Cards

(Photocopy so each child has one card.)

Marsh	Marsh
Black-necked Stilt	Spotted Sandpiper
Marsh	Marsh
Greater Yellowlegs* <small>* No Shorebird Profile in Educator's Guide.</small>	Wilson's Phalarope
Stream and River Corridor	Stream and River Corridor
American Avocet	Spotted Sandpiper
Stream and River Corridor	Stream and River Corridor
Lesser Yellowlegs* <small>* No Shorebird Profile in Educator's Guide.</small>	Killdeer



Can't We Share?

Shorebird Species Cards

(Photocopy so each child has one card.)

Rocky-Intertidal	Rocky-Intertidal
Black Oystercatcher	Ruddy Turnstone
Rocky-Intertidal	Mudflats and Sandy Beaches
American Oystercatcher	Snowy Plover
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Ruddy Turnstone	Sanderling
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Marbled Godwit	Long-billed Curlew

Can't We Share? Shorebird Species Cards

(Photocopy so each child has one card.)

Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Black-bellied Plover	Dowitcher
Grasslands	Grasslands
Buff-breasted Sandpiper	Upland Sandpiper
Grasslands	Grasslands
Pacific Golden-Plover	Mountain Plover* * No Shorebird Profile in Educator's Guide.
Grasslands	Grasslands
Long-billed Curlew	Marbled Godwit



Can't We Share? Shorebird Species Cards

(Photocopy so each child has one card.)

Playa Lakes	Playa Lakes
American Avocet	Long-billed Curlew
Playa Lakes	Playa Lakes
Mountain Plover* <small>* No Shorebird Profile in Educator's Guide.</small>	Snowy Plover
Prairie Potholes	Prairie Potholes
Dowitcher	Spotted Sandpiper
Prairie Potholes	Prairie Potholes
Marbled Godwit	Long-billed Curlew



Can't We Share? Environmental Events Cards

(Make 2 copies)

Environmental Event	Environmental Event
A town has 300 acres of undeveloped grassland. It is replaced by a shopping mall and office complex.	Tanks of toxic chemicals buried in a field eventually leak into the soil of a nearby wetland.
Environmental Event	Environmental Event
A coastal community sells 50 miles of beachfront property to a local developer who builds homes, a strip mall, and a hotel complex.	Silt barrier fences are not installed at a new construction project. Rain carries loose soil into a nearby wetland.
Environmental Event	Environmental Event
An oil spill off the Atlantic Coast near Delaware Bay threatens migrating shorebirds that feed there.	A drought threatens to dry out local freshwater wetlands.
Environmental Event	Environmental Event
An unusually heavy rainy season causes streams to flood lowland fields.	A hurricane blows away sand dunes where Snowy Plovers are nesting.



Can't We Share? Environmental Events Cards

(Make 2 copies)

Environmental Event	Environmental Event
A once restricted area of beach is opened up to public recreation. Personal watercraft vehicles (For example Jet Skis.) now scare away nesting and feeding shorebirds.	A farmer cuts hay in a field where shorebirds are nesting.
Environmental Event	Environmental Event
Agricultural chemicals are carried by runoff into a nearby wetland.	Because of habitat loss from disturbance, pollution, and development, migrating shorebirds have not been able to stop at their traditional stopover sites. They do not have enough energy to continue their migration to the Arctic to breed.
Environmental Event	Environmental Event
(Write your own local event here.)	(Write your own local event here.)
Environmental Event	Environmental Event
(Write your own local event here.)	(Write your own local event here.)



Can't We Share?

Environmental Events Cards

(Make 2 copies)

Environmental Stewardship	Environmental Stewardship
A town has 300 acres of undeveloped grassland. Of that, 200 acres will be used for a mall. The remaining 100 acres will be set aside as a preserve for local wildlife that includes an outdoor learning and research area.	Tanks of toxic chemicals buried in a field are removed by the Environmental Protection Agency. The company that buried the chemicals is paying to restore the land and the wetland.
Environmental Stewardship	Environmental Event
A coastal community sells 50 miles of beachfront property to a local developer for building homes, a mall, and a hotel. The developer also plans to work with biologists to protect important beach habitat by landscaping with native plants.	Silt barrier fences are installed at a new construction project. The silt barrier stops rain from carrying loose soil into a nearby wetland.
Environmental Stewardship	Environmental Stewardship
A federal law is passed that requires all oil tankers to be double-hulled to help prevent hull punctures that result in oil spills.	Through water management projects, the local National Wildlife Refuge is able to provide water for the wetland so that shorebirds can use the habitat.
Environmental Stewardship	Environmental Event
An unusually heavy rainy season causes streams to flood lowland fields. Shorebirds are able to find other nearby habitat to feed and rest.	Biologists plant native grasses to stabilize beach dunes, preventing them from blowing away. Though some natural damage still occurs from a hurricane, Snowy Plovers and the dunes survive.



Can't We Share? Environmental Events Cards

(Make 2 copies)

Environmental Stewardship	Environmental Stewardship
A once restricted area of beach is opened up to public recreation. However, boats and skiers stay 200 feet away from the beach and use provided ramps for access.	A farmer cuts hay in a field after the shorebirds finish nesting in mid-July.
Environmental Stewardship	Environmental Event
When applying agricultural chemicals, a landowner follows the directions on the label to keep chemicals 100 feet away from wetlands. He also applies only during the recommended weather conditions. As a result, there are not pollutants in the wetland.	Important stopover habitat is protected by national and state wildlife refuges and parks. Shorebirds have enough energy to complete their journey to the Arctic and breed successfully.
Environmental Stewardship	Environmental Stewardship
(Write your own local action here.)	(Write your own local action here.)
Environmental Stewardship	Environmental Event
(Write your own local action here.)	(Write your own local action here.)



Wetland Metaphors

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Grade level: lower elementary and upper elementary/middle school

Duration: one hour gathering objects and a 30-minute class period

Skills: application, visualization, team work, vocabulary, discussion, and communication/presentation

Subjects: science and language arts, fine arts (with additional activity)

Concepts

- Shorebirds are one part of a healthy functioning ecosystem.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Wetland ecosystems provide extremely important habitats for shorebirds.

Vocabulary

- Metaphors
- Microorganisms
- Decomposition
- Phytoplankton
- Zooplankton
- Algae
- Nutrients
- Runoff

Overview

Students make comparisons between unrelated objects through metaphors to learn the functions of a wetland.

Objectives

After this activity, students will be able to:

- Use metaphors to describe the basic functions of a wetland.
- Describe the value of wetlands.

Materials

- Large, concealing container (pillowcase, bag, or box)
- Sponge
- Small pillow
- Egg beater
- Toy doll's cradle or baby doll
- Sieve or strainer
- Can of soup or whole-grain cereal
- One copy of *Wetlands Metaphors* activity page per student (included here)

Optional

- Pictures illustrating other comparisons (e.g., gardens = food production for animals; airports/landing and takeoff = places for migrating birds)

Introduction

Coastal and freshwater wetlands provide unique habitats for a great diversity of plants and animals. They are nurseries for countless life forms.

Wetlands often act as buffers in times of both flood and drought. Absorbing overflow from flooding, wetlands often swell with *runoff* water and reduce potential flooding downstream. In drier periods, wetlands hold precious moisture after other ponds and lakes have disappeared.

Wetlands have a unique ability to trap silt and other solids, promoting the *decomposition* of many toxic substances, extra *nutrients*, and the neutralization of sewage wastes by *microorganisms* that live there. Yet it must be remembered that as remarkable as they are, the actions and capacities of wetlands have limits. Too much pollution can destroy a wetland.

Many of the functions of wetlands can be explored through *metaphors*. A metaphor is a direct comparison between two things. It gives a vivid image through direct (that is without using the terms "like" or "such as") comparison. "A tree is a home," "books are windows of thought,"

and "she is a tower of strength" are examples of metaphors. In this activity, a variety of objects represent the characteristics of wetlands in order to help students visualize (that is "paint a picture") and remember the valuable functions of wetlands.

For more information about wetlands and shorebird habitat, read *Shorebirds Depend on a Chain of Healthy Habitats* in the *Shorebird Primer*.

Activity Preparation

1. *Prepare a Mystery Metaphor Container* by collecting the metaphor objects listed above and placing them in a concealing box or paper sack.

Procedure

1. Discuss wetland functions and the meaning of *metaphor* with the class. Metaphors offer a dramatic way of drawing a comparison. For example: "Robin is a chip off the old block" or "Wes is a barrel of laughs."
2. Tell students that objects can be used to represent wetland functions.
3. Now bring out the *Mystery Metaphor Container*. Tell the students that everything in the container can be a metaphor that relates to the functions of wetlands.
4. Divide the class into six different groups. Announce that when it is his or her turn, you want a representative of each group to draw an object from the container.
5. Have the designated student reach into the container and withdraw one object.
6. When each group has an object, ask it to describe and demonstrate the relationships between their



Wetland Mystery Metaphors Chart

Object *Metaphorical Wetland Function: Wetlands...*

Sponge	...absorb excess water which helps to prevent flooding; and absorb excess, harmful nutrients from fertilizers and other sources that may cause contamination downstream (related also to filtering--see "Sieve" below).
Pillow or bed	...provide a resting place for migratory birds; and provide a home for resident microorganisms, fish, birds, and wildlife.
Egg beater or whisk	...mix nutrients and oxygen into water.
Cradle or baby doll	...provide shelter and protection (like a nursery) for young fish, insects, mammals, and birds. Have you seen mosquito larvae, dragonfly nymphs, frog eggs, duck nests, or moose calves in wetlands?
Sieve (strainer)	...can strain or filter debris and suspended material such as soil from erosion out of the water..
Can of soup (or whole-grain cereal)	...provide food for many animals in the form of <i>phytoplankton</i> , <i>algae</i> , tiny <i>zooplankton</i> , insects, and fish.
Soap	...clean polluted water that enters. Of course, even wetlands can be overpowered by too much pollution.
Flower	...are beautiful places.
	Add your own objects and ideas.

object and wetlands. Encourage the students to build on each other's ideas. You can also assist by strengthening their connections. Refer to the *Wetland Mystery Metaphors Chart* for guidelines. Be sure to allow each group time to discuss its ideas before presenting them to the class.

- Ask students to summarize the way wetlands contribute to a health habitat for wildlife. Ask them if their own attitudes about wetlands are different as a result of doing this activity. If so, how?
- Pass out a copy of the *Wetland Metaphors* activity page (included here) to each student to complete.

This page may be used as an evaluation tool.

Additional Activities

Poetry Writing

Have each student write a poem or essay about wetlands using a metaphor. This lesson is especially appropriate after a field trip.

Transforming a Metaphor into a Picture

Have your students use drawing or painting materials to create an actual image of a metaphor (for example, a tree as a home, a person as a chip off the old block, or a wetland as a sponge).

Shorebird Metaphors

Have students brainstorm other

wetland metaphors that demonstrate the value or function of wetlands specifically for shorebirds. Some other metaphors are: airport; bus transfer ticket for migration; restaurant; "singles" meeting place; even a place or ticket that represents the freedom which shorebirds would lose if they were endangered and confined to zoos.

When Nutrients Are Bad

Some minerals that are normally vital to a healthy wetland can sometimes become detrimental. Ask students to research this dilemma. Which nutrients pose a risk when found in excess? Where do these excesses come from? What is the effect when a wetland gets "too much of a good thing"?

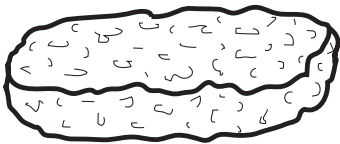


Wetland Metaphors

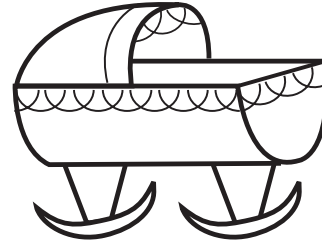
What is a home, a sponge, and a strainer all at the same time?

Metaphors are a way to compare unrelated things, such as "Wes is a barrel of laughs." Below are pictures of items seemingly unrelated to wetlands. Can you figure out how these items compare to a wetland? In other words, think about what each item does. Then compare that item's function to how a wetland might function in that same way. Good luck!

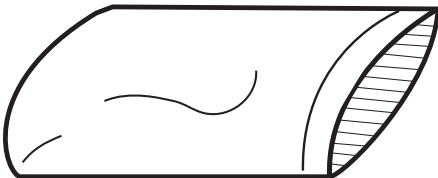
Sponge



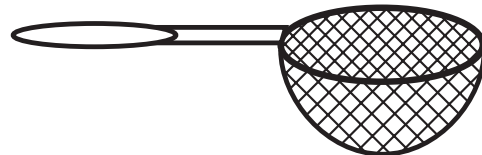
Cradle



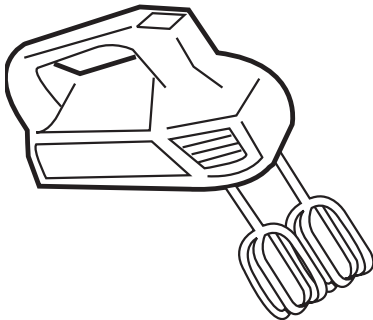
Pillow



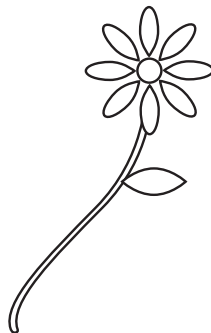
Strainer



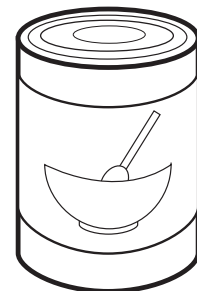
Egg beater



Flower



Can of soup

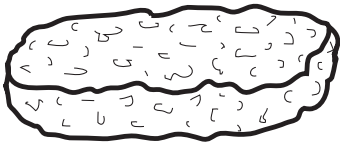


Wetland Metaphors Answer Sheet

What is a home, a sponge, and a strainer all at the same time?

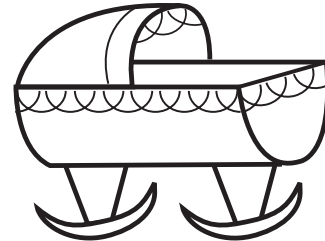
WETLAND

Sponge



help prevent floods,
absorbs water, holds moisture

Cradle



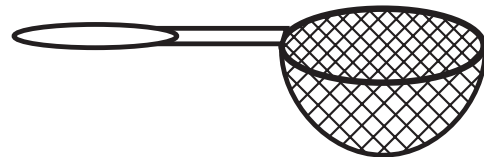
raise young, provide shelter

Pillow



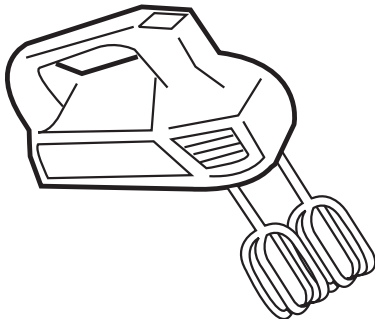
a resting place for migratory birds,
home for resident wildlife

Strainer



strain out debris and pollution

Egg beater



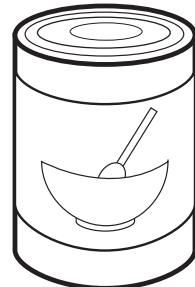
mix and cycle nutrients

Flower



beautiful places

Can of soup



food, nutrients



Match the Habitat Cards

Grade Level: upper elementary/middle school

Duration: one 40-minute class period.

Skills: vocabulary, critical thinking, and team building

Subjects: science and language arts, fine arts (with additional activity)

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Habitat is located within ecosystems.
- Shorebirds are one part of a healthy functioning ecosystem.
- Wetland and grassland ecosystems provide extremely important habitats for shorebirds.
- Your local environment may provide important habitat for shorebirds.

Vocabulary

See the *Match the Habitat Terms and Definitions Cards* for 35 words.

Overview

By playing a card-matching game, students learn that shorebirds use diverse habitats to find food and a place to breed or to rest. Students will discover that shorebirds use these habitats to meet their own specific needs.

Objectives

After this activity, students will be able to:

- Name seven different habitat types used by shorebirds.
- Describe the three reasons many shorebirds use more than one habitat type throughout the year.
- Correctly match habitat terms with their definitions.

Materials

- Set of 30–60 game cards (included here)
- A completed *Match the Habitat Clues Sheet*

- A copy of the *Habitat Readings* for each student or student team found in the *Types of Habitats* activity

Introduction

Bog, mudflat, tundra, swamp, marsh, prairie pothole, playa lake, and beach are some of the many areas that people recognize as wetlands. Although these wetlands may have very different climates, plant communities, and food webs, they all have one thing in common—they are wet at least part of the year.

Most shorebirds depend on many different wetlands to nest, migrate, and rest during the winter season. In fact, shorebirds are especially adapted for life in the wetlands they inhabit. Shorebirds with long legs easily keep their bodies dry as they wade into water in search of invertebrates. The long toes of mudflat shorebirds help them balance on the slippery, wet mud or sand. Those with long, sensitive, pointed bills can easily probe the mud for small crustaceans. Shorebirds of rocky-intertidal wetlands have strong, chisel-like beaks designed for cracking open the mussels they find clinging to the rocky shores.

Some shorebird species live in dry upland grasslands. Their bills are adapted for gleaning insects from the surface instead of probing in the mud.

For more information about the unique adaptations of shorebirds, read *Shorebirds Have Special Adaptations* in the *Shorebird Primer*. For more information about shorebird habitats read *Shorebirds Depend on a Chain of Healthy Habitats*, also found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy and cut out the *Match the Habitat Terms and Definitions Cards* included at the end of this activity. Add your own terms and definitions to the blank cards provided. Vary the definitions according to the reading level of your students. Focus on the habitats and definitions most appropriate for your area, and combine this activity with information your class studied in other shorebird activities.

Note: Twenty to 40 possible matches (40 to 80 cards) are a good level for seventh and eighth grade students. For younger students, use 15 matches (30 cards). You may choose to increase the number slightly for small classes (five to ten students).

2. Read through the *Habitat Readings* and complete the column “Source Clue” for each term on your master *Match the Habitat Cards Clue Sheet* by indicating what page and habitat reading the term came from.
3. Write your students’ names in alphabetical order on the chalkboard or flipchart.

Procedure

1. Have students take out one or two blank sheets of notebook paper to write their sentences on (explained below.) A set of *Habitat Readings* should be available as resource material.
2. Mix the term and definition cards together. Deal the cards to the students. It is not necessary that all students initially receive the same number of cards.



3. Explain the rules of this card game:

- The object of the game is to make as many matches as possible in the given amount of time (30 minutes is suggested). Tell the students the number of matches possible (example: 60 cards, 30 matches).
- Point out that more than one definition may match a term, but they should be looking for the best match.
- To make matches they will have to move around the room, find the students with their matching cards, and write down on their paper exactly what is written on the cards. This is a critical part of the game because this way you can tell that they actually found the match and did not just make up a definition or copy one from a book glossary. Once a student finds the person with a matching card, both write down the sentence. Do not actually exchange cards.

Note: Alternatively, students must form sentences using the pair of cards and the word “shorebird(s)” or you may choose to have them write the terms and definitions as a complete sentence (“A wetland is land that is covered or saturated with water at least part of the time.”). Another option is to have students write the terms and definitions separated by a period or “equals” sign. Write an example of what you want them to do on the chalkboard.

- The original owner of the term card then passes his or her card to the classmate whose name comes alphabetically after his or hers. The owner of the matching definition card does the same. If the holder of one of the matches happens to be the person who is next alphabetically, pass the card anyway after both students have written down the sentence. The match-holder should immediately pass the card to the next person in order.

Example: Wesley has the card “wetland” and recognizes that Franny’s card that reads “Land that is covered or saturated with water at least part of the time” is the match. Wesley and Franny each write “A wetland is land that is covered or saturated with water at least part of the time” on their own papers. Then Wesley passes the “wetland” term card to William (or Archie, if Wesley is the last student, alphabetically, in the class), and Franny passes the definition card to Grace (because “Grace” is the first name in the class, alphabetically, after “Franny”).

- Keep your private “clue” sheet of sources you prepared earlier. If you notice that a student is really stumped on a card, use your “clue” sheet to refer him or her to “page so-and-so in such-and-such reading” for help with a definition. Knowing a basic definition should help them recognize the matching card.
- The game ends when the time limit has run out. Students turn in their papers. The student(s) with the most correct matches are the winners.
- Follow up the game with a discussion to ensure that the students know all the terms. Go around the room, asking each student to read one sentence from his or her paper and see if the rest of the class agrees that he or she has made the best match. What other matches might work?

Keep in Mind....

- Let students discover their own efficient ways to find matches (like spreading out their cards on the desk in front of them).

Term Cards

Surfbird

Pampas

Mudflats

Definition Cards

Nests in alpine tundra

Wintering habitat of American Golden-Plover

Habitat type where migrating Dunlin and Western Sandpipers are found



- Some students will accumulate a large pile of cards. Others will quickly go through their own cards. Either way, you may have to facilitate reluctant students to get up, move around the room, and communicate with each other to find matches.
- You may choose to accept some matches that work even if they are not “the best.”
- To make the game more difficult, alter the definitions so they reflect the habits of specific shorebirds of your area. See the example alternatives below.

Additional Activities

Match More Habitats

Hand out four index cards to each student (more for smaller classes), and instruct the students to choose two of their own shorebird habitat terms and compose definitions for them. Gather all of the cards, shuffle, and play the game with the student-made cards.

Habitat Card Rummy

Create a batch of cards with the habitat terms on them. Write down the list of corresponding definitions on a sheet of paper for yourself. Deal out the cards, at least three each, to the students (duplicates are okay). Read the first definition out loud to the class. Ask the students who think they have the matching term card to raise their hands. If they have the correct match they turn in their cards to the teacher. The first student to give up all of his or her cards is the winner.

Habitat Card Bingo

Create a batch of bingo cards with habitat terms in place of numbers. Remember to vary the order of the terms. Print the title “Habitat Bingo” across the top of each card and a small shorebird illustration in the center as the free space. Pass out one card and bingo markers (pinto beans, marshmallows, etc.) to each student. Read the definition of the term. Students who can match the definition with the correct term on their cards cover the spaces with a marker. The first student who completes a row horizontally, vertically, or diagonally wins.

Say It with a Picture

Have each student draw a picture that represents one of the matches. Hang up or presented the pictures to the class. Ask students to try to guess what each picture represents. If you prefer, create a larger wetland mural as a class. Start by brainstorming a list of wetland habitat elements so students have specific ideas about what to draw. Unroll a long sheet of paper on the floor and provide colored pencils, crayons, markers, or paints.



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Habitat	A place where organisms are adapted to live and find food and shelter
Term Card	Definition Card
Wetlands	Land that is covered or saturated (soaked) with water at least part of the time
Term Card	Definition Card
Marsh	Open, wet, grassy areas that can be inland or coastal
Term Card	Definition Card
Ocean Beach	Sandy habitat affected by the tides; home of oystercatchers and migrating Sanderlings



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Mudflat	Mud habitat that is exposed at low tide and is home to many invertebrate animals
Term Card	Definition Card
Freshwater Marsh	Inland habitat where the roots of grasses, sedges, and rushes are always under water
Term Card	Definition Card
Saltwater Marsh	Coastal or inland habitat made of ocean water and plants adapted to salt water
Term Card	Definition Card
Tundra	Northern Arctic wetland habitat with permafrost and no trees



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Intertidal Zone	Nutrient-rich, rocky beach habitat between the high and low tide mark
Term Card	Definition Card
Estuaries	Nutrient-rich places where freshwater and saltwater meet
Term Card	Definition Card
Roost	Flock of resting shorebirds or the place where they rest together on migration or in winter
Term Card	Definition Card
Tide	Daily movement of ocean water as it is affected by the moon's gravity

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Prairie Potholes	Shallow, temporary wetlands found within grasslands
Term Card	Definition Card
Permafrost	Permanently frozen subsoil of the tundra
Term Card	Definition Card
Playa Lakes	Shallow temporary wetlands in grasslands that are lined with a water-tight layer of bedrock
Term Card	Definition Card
Migration	The regular movement of shorebirds every spring and fall

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Stopover Sites	Important habitats where shorebirds stop every year on migration
Term Card	Definition Card
Nonbreeding Season	The portion of the year when shorebirds are not breeding
Term Card	Definition Card
Breeding Season	The portion of the year when shorebirds are nesting
Term Card	Definition Card
Shelter	A place in the habitat where an animal can escape from wind, weather, and predators

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Food	tiny clams and worms in the winter, and insects in the summer eaten by shorebirds
Term Card	Definition Card
Invertebrates	Small animals without a spine or backbone that shorebirds eat
Term Card	Definition Card
Crustaceans	Group of animals that includes small shrimp and crabs which shorebirds, especially phalaropes, feed on
Term Card	Definition Card
Grasslands	Upland dry habitat that some shorebirds are adapted to use instead of wetlands



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Mudflats, Estuaries, and Sandy Beaches	Places where organisms adapted to changes in wetness and salinity live
Term Card	Definition Card
Black Oystercatchers	A group of shorebirds specially adapted to nest and feed in rocky coastal habitat
Term Card	Definition Card
Stream and River Corridors	Low areas along the banks of rivers and streams that flood in the spring as snow and ice melt in the mountains
Term Card	Definition Card
Grasslands	Prairie habitats found in the Central United States and Canada that are breeding grounds for six species of shorebirds

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Halophytes	Plants adapted to high levels of salt
Term Card	Definition Card
Runoff	Water that carries nutrients from land into freshwater wetlands and streams
Term Card	Definition Card
Upland Sandpipers	Shorebirds that live in tallgrass prairies
Term Card	Definition Card
Riparian Habitat	Vital habitat for many migrating birds, such as Spotted and Solitary Sandpipers, found along the banks of rivers and streams

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Tundra	A habitat made up of mounds of grasses and sedges with low areas in between that are filled with water
Term Card	Definition Card
Ecosystems	A collection of habitats that include all the living and nonliving parts interacting and linked by nutrient and energy flow
Term Card	Definition Card
Common Snipe	A shorebird adapted to live in freshwater marshes
Term Card	Definition Card
Shorebird Habitats	Streams and river corridors, freshwater and saltwater marshes, grasslands, tundra, mudflats and sandy beaches, rocky intertidal areas, playa lakes and prairie potholes



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Spotted Sandpiper	A shorebird that uses riparian habitat
Term Card	Definition Card
Sanderlings	Small shorebirds adapted to running along the shoreline and probing for food
Term Card	Definition Card
Greater Yellowlegs	A group of shorebirds adapted to live in freshwater marsh habitat
Term Card	Definition Card
Black-necked Stilts	A group of shorebirds adapted to live in saltwater marsh habitat

Match the Habitat Terms and Definitions Cards

(Make as many copies as necessary
for your own terms and matching
definitions.)

Term Card	Definition Card
Term Card	Definition Card
Term Card	Definition Card
Term Card	Definition Card



Match the Habitat Clues Chart

Term Card

Definition Card

Source Clue

Habitat	A place where organisms are adapted to live and find food and shelter	
Wetlands	land that is covered or saturated (soaked) with water at least part of the time	
Marsh	Open, wet, grassy areas that can be inland or coastal	
Ocean beach	Sandy habitat affected by the tides; home of Oystercatchers and migrating Sanderlings	
Mudflat	mud habitat that is exposed at low tide and is a home to many invertebrate animals	
Freshwater Marsh	Inland habitat where the roots of grasses, sedges, and rushes are always under water	
Saltwater Marsh	Coastal or inland habitat made of ocean water and plants adapted to salt water	
Tundra	Northern Arctic wetland habitat with permafrost and no trees	
Intertidal Zone	Nutrient-rich, rocky beach habitat between the high and low tide mark	
Estuaries	Nutrient rich places where freshwater and saltwater meet	
Roost	Flock of resting shorebirds, or the place where they rest together on migration or in winter	
Tide	Daily movement of ocean water as it is affected by the moon's gravity	
Prairie Potholes	Shallow, temporary wetlands found within grasslands	
Permafrost	Permanently frozen subsoil of the tundra	
Playa Lakes	Temporary wetlands in grassland or desert areas that are lined with a water-tight layer of bedrock	
Migration	Regular movement of shorebirds every spring and fall	
Nonbreeding season	The portion of the year when shorebirds are not nesting	
Stopover sites	Important habitats where shorebirds stop every year on migration	



Match the Habitat Clues Chart

<i>Term Card</i>	<i>Definition Card</i>	<i>Source Clue</i>
Breeding Season	The portion of the year when shorebirds are nesting.	
Shelter	a place in the habitat where an animal can escape from wind, weather, and predators	
Food	tiny clams and worms in the winter and insects in the summer eaten by shorebirds	
Invertebrates	Small animals without a spine or backbone that shorebirds eat	
Crustacean	The group of animals that includes small shrimp and crabs which shorebirds, especially phalaropes, feed on	
Grasslands	Upland dry habitat that some shorebirds are adapted to use instead of wetlands	
Mudflats, Estuaries, and Sandy Beaches	Places where organisms adapted to changes in wetness and salinity live	
Black Oystercatcher	A group of shorebirds specially adapted to nest and feed in rocky coastal habitat	
Stream and River Corridors	Low areas along the banks of rivers and streams that flood in the spring as snow and ice melt in the mountains	
Grasslands	Prairie habitats found in the Central United States and Canada that are breeding grounds for six species of shorebirds	
Halophytes	Plants adapted to high levels of salt	
Runoff	Water that carries nutrients from land into freshwater wetlands and streams	
Upland Sandpipers	A group of shorebirds that live in tallgrass prairie	
Riparian Habitat	Vital habitat for many migrating birds, such as spotted and solitary sandpipers, found along the banks of rivers and streams	
Common Snipe	A shorebird adapted to live in freshwater marshes	
Shorebird Habitats	Stream/river corridors, freshwater/saltwater marshes, grasslands, tundra, mudflats/sandy beaches, rocky-intertidal areas, playa lakes, or prairie pothole	



Match the Habitat Clues Chart

<i>Term Card</i>	<i>Definition Card</i>	<i>Source Clue</i>
tundra	A habitat made up of mounds of grasses and sedges with low areas in between that are filled with water	
ecosystem	A collection of habitat that include all the living and nonliving parts interacting and linked by nutrient and energy flow	
Spotted Sandpiper	A shorebird that uses riparian habitat	
Sanderlings	Small shorebirds adapted to running along the shoreline probing for food	
Greater Yellowlegs	A group of shorebirds adapted to live in freshwater marsh habitat	
Black-necked Stilts	A group of shorebirds adapted to live in saltwater marsh habitat	

Add Your Own Terms and Definitions

<i>Term Card</i>	<i>Definition Card</i>	<i>Source Clue</i>



Types of Habitats Frequently Used by Shorebirds

Grade Level: upper elementary/middle school

Duration: one class period for reading and presentations, *plus* two 40 to 60-minute class periods for a short field trip to collect natural items and to build the model

Skills: vocabulary, comparison of similarities and differences, team building, critical thinking, and presentation.

Subjects: science, language arts, fine arts, and social studies (geography)

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Wetland and grassland ecosystems provide extremely important habitat for shorebirds.
- Your local environment might provide important habitat for shorebirds.

Vocabulary

- habitat
- grassland
- wetlands
- nutrients
- estuary
- riparian
- tundra
- permafrost
- peat
- algae
- stream/river corridor
- sandy beach
- prairie pothole/playa lake
- niche
- tidepool
- rocky intertidal habitat
- mudflat
- habitat components
- abiotic factor
- biotic factor
- freshwater marsh
- saltwater marsh

Overview

By building a three-dimensional model, students learn principles of geography and the components of aquatic and terrestrial shorebird habitats.

Objectives

After this activity, students will be able to:

- List types of habitats used by shorebirds.
- Describe at least four components of each habitat.
- Categorize the components of each habitat into a list of abiotic and biotic elements.
- Build a visual representation of one of the habitats.

Materials

- Copies of the *Habitat Students Readings* and drawings
- Plywood, wood scraps, or small boxes for the base of the habitat models
- Scissors
- Glue
- Tempera paints
- Paint brushes
- Decoupage or other clear varnish
- Assorted pipe cleaners, tissue paper, toothpicks
- Collection of twigs, pebbles, grasses, mosses, and bags for collection
- Small plastic animals or handmade wildlife models

Introduction

There are many kinds of wetlands and grassland habitats that provide habitat for shorebirds. You may learn that you have these habitats near your community. Comparing and contrasting these shorebird habitats helps us learn about components common to all. We also need to understand the similarities and differences among habitats to understand some of the reasons why shorebirds can use more than one and why they migrate between them.

In this activity, there are descriptions of habitats frequently used by shorebirds: stream/river corridors, tundra, marshes, sandy beaches and mudflats, rocky intertidal zone, and prairie potholes, playa lakes, and grasslands. Below is one activity suggested for use with these habitat readings. Other suggestions for using these habitat readings are included under *Additional Activities*.

Additional Activities

For more information on shorebird habitats, read *Shorebirds Depend on a Chain of Healthy Habitats* found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy and cut out the Salt Clay Recipe Cards provided in this unit so that each student has one to take home.
2. Ask each student to mix up one batch of the salt clay the night before the activity and bring it to school.
3. Photocopy the Student Habitat Readings you choose to use in this activity. You may choose to study all the habitats or just a few depending on which Procedure #1 option you choose.

Procedure

1. Introduce shorebird habitats you selected in one of the following ways:
 - Divide your class into teams. Give each team a set of the student readings. Ask each student on the team to read about one of the habitat types and then tell the rest of his or her team what he or she learned.
 - Divide your class into enough teams so that each team is assigned one habitat type. Give each team one of the student

readings to study. Have each of the groups study and then present a different habitat type to the class. Assign tasks—drawing plants, animals, and abiotic parts of the habitat; preparing and coordinating the oral presentation; doing additional research in one other source; etc.

- Together, prepare a chart listing the components for each habitat type. List them under “*biotic* (living)” or “*abiotic* (nonliving)” headings on the chalkboard. This chart will give the students a reminder about how different these habitats are from each other. Your chart may look something like the one below with a column for each habitat you choose to study with the class.
- Take your class on a short field trip outside to collect small amounts of twigs, pebbles, leaves, grass, moss, even dead insects or snail shells that represent their habitat types. Stress collecting only *small* amounts and only organisms that are *already dead*. You may wish to take scissors and small bags for collection.
- Explain to your students that they will create a model habitat. Each model should contain or display at least three biotic (such as shorebird, snails, grasses)

and three abiotic (such as snow, gravel, water) components from the list on the chalkboard.

- Begin by forming the clay over a base such as a piece of cardboard or plywood. Insert paper cutouts or bits of the natural material collected to simulate the different components of the habitat before the clay dries. Once the clay is hard, paint areas that represent sand, mud, or water. Encourage the students to glue plastic figures or handmade “wildlife” to the habitat model. Remind them to label their habitat and include the names of their team members.

Alternative – A Large Class Model: Instead of making individual models, have the class work on one large model that incorporates several habitat types into the landscape. Divide up the work by assigning individual tasks (such as collection and care of materials, landscape planning) or forming teams responsible for just one section of the whole model.

- Display the models somewhere within the school or invite other classes for a habitat “art show.” Give each team a chance to tell other students about the habitat it studied and how it is important to shorebirds.

Grassland		Tundra	
<i>Abiotic</i>	<i>Biotic</i>	<i>Abiotic</i>	<i>Biotic</i>
Heat Fire Lightning Potholes	Grasses Insects Wildflowers Prairie dogs Bison Upland Sandpipers	Cold Wind Water Permafrost Snow	Lichens Sedges Grasses Fairy shrimp Copepods Insect larvae Caribou Ruddy Turnstones

Additional Activities



Cultural Connection

Students can make a collage of pictures depicting one of the interesting groups of people that live near the shorebirds’ habitat.

Compare and Contrast the Different Habitat Types Presented

- Have students practice critical thinking skills by comparing and contrasting the habitat types. Have them record their observations in a table, a list, or a written paragraph. What do all these habitats have in common? What characteristics are unique? Which habitats are found within your community?
- Students can research a wetland and/or grassland habitat on other continents and compare them to North American habitats.

Habitat Illustrations

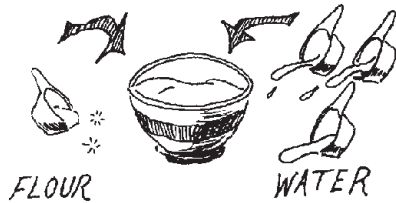
Ask students to draw a picture of a wetland or grassland based on the student readings. Remember to include plants and invertebrates into the scene.

Relating Adaptations to Habitat

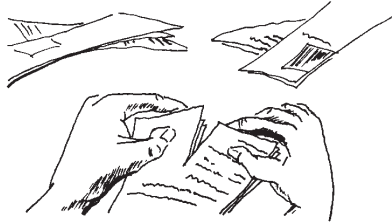
Ask students to come up with adaptations they would need to survive in the shorebird habitat they built (or studied). Give them ten minutes to brainstorm (alone or in pairs or groups) what modifications (snorkeling gear, wet suit, shovels for clam digging, etc.) would be needed to enable them to survive (eat, drink, rest) in these habitats :

- An open ocean beach where the water comes in over their heads twice a day
- A dry, open prairie where they would be exposed to strong wind, intense summer sun, bitter winter cold, drenching rains and wildfires

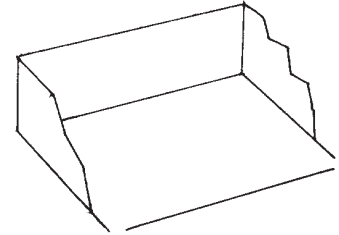
Steps To Make Salt Clay



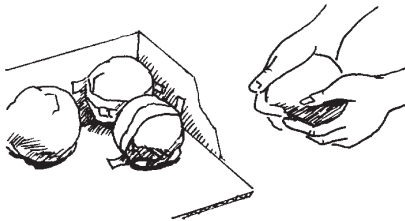
a.) Mix wallpaper paste or flour with water until it is like thin cream without any lumps.



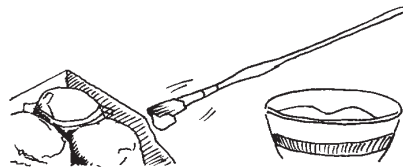
b.) Tear sheets of newspapers into long strips, about 1 inch wide and 6 inches long.



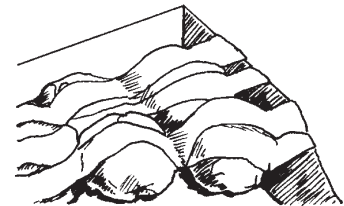
c.) If necessary, cut box into desired shape. This will form the base on which to build.



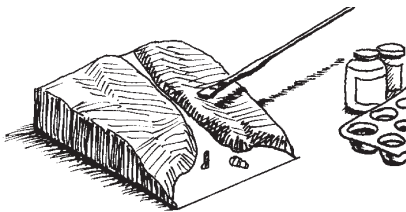
d.) Scrunch up newspaper into tight balls and tape into place as hills or tussocks.



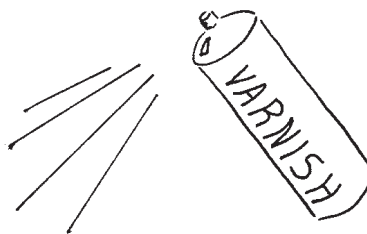
e.) Brush paste mixture over newspaper.



f.) Smooth and shape the form by layering strips of newspaper over it, brushing paste between layers.



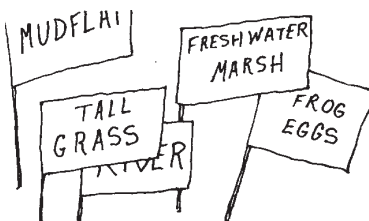
g.) Let the form dry for at least one day. Then paint the wetland model all over with a thick layer of paint.



h.) To help seal and prolong the life of the model, brush with decoupage or spray with varnish.



i.) Attach paper plants and animals, or the ones you collected, to complete a stream/river corridor, tundra, marsh, beach, or mudflat.



j.) Make labels for the wetland components out of paper and toothpicks.

Salt Clay Map Recipe Cards

(Photocopy and cut one recipe card
for each student.)

Recipe for Salt Clay

2 cups flour

1 cup salt

1 Tablespoon alum (You must include this.)

1 cup water

Stir ingredients and then knead until smooth and blended. Store in a ziplock bag or in a tight plastic container until ready to use.

Recipe for Salt Clay

2 cups flour

1 cup salt

1 Tablespoon alum (You must include this.)

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Habitat Readings

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Habitat Illustration Note: The habitat illustrations are general and do not represent all the plant and animal species found in each habitat.

As students learn more about these habitats, they can draw in new species and habitat differences. Students could also explore a local wetland or grassland and add the plants and animals they find.



What Is a Wetland?

What do you think of when you hear the word *wetland*? Do you picture mud squishing between your toes, mosquitoes buzzing in your ear, or a good place to catch a frog? What kind of plants do you think of--trees, grass, or something in between?

To understand a wetland, break the word in two. A wetland is both wet and land! Wetlands are places where water and land meet. Here, plants are adapted to wet, soggy conditions. Wetlands are usually found in the area between deep water (a lake, pond, river, or ocean) and dry land. Wetlands are low spots within a *watershed* where water collects. If the water is too deep for plants to grow (more than six feet deep), then wetland scientists call these areas deep-water habitats. If the land is too dry for wetland plants to grow, then it is called upland.

What Makes a Wetland

Wetlands are all about water. *Hydro* is the Latin word for water, and it can be found in the scientific words that describe wetlands. Can you find the water (hydro) in the following description? (Hint: Look at the words in the parentheses). All wetlands have: 1) water (*hydrology*), 2) wet (*hydric*) soils, and 3) water-loving plants (*hydrophytic* vegetation).

Water

Wetlands get their water in several different ways, including rain water and runoff from higher ground, groundwater coming to the surface from deep underground, and flooding from nearby rivers, streams or ocean tides. Some wetland may be wet all the time, such as estuaries. Other wetlands are only be wet for short periods of time like prairie potholes. Wetlands, whether wet temporarily or year-round, provide vital habitat for plants and wildlife.

Soil

The way a wetland soil looks and feels indicates its watery surroundings. Dig up a small amount of soil in a wetland, and it will either be wet (dripping water off the end of your shovel) or saturated. Saturated soils will drip if you squeeze them tightly in your hand. Wetland soil is dark brown or black near the surface and shades of gray deeper down (a foot or two). Rub the soil between your fingers, and it will feel either slick or sticky. Slick means the soil is rich in decaying plant matter or silt (fine inorganic material that settled out from flood waters). Sticky means the soil has a lot of clay in it. These soils hold lots of water and will not dry very fast. Some of the soils will smell like rotten eggs. Then you know you are in a really wet wetland!

Plants

Wetland plants have special adaptations to grow in wetland soil. Some plants, such as water lilies and bald cypress trees, grow in shallow water. Others, like cottonwood trees and many grasses, grow in wetlands where the water is visible for only part of the year. Wetland plant names can sometimes give you a hint that they grow in wet places--swamp rose, pondweed, duck potato, alligator weed, river birch, water lily, northern bog orchid, salt marsh cordgrass, sea lavender, and marsh fern.

Many Types of Wetlands

There are many different types of wetlands, and they come in all sizes. Wetlands can be as small as your bedroom or as large as the Florida Everglades which originally covered 2.3 million acres!

Freshwater marshes are the type of wetland most people think of first when someone says "wetland." They mainly have herbaceous

(non-woody) plants such as cattails growing up out of the water. These plants are called emergents. Many other types of wetlands have trees growing in them and are called forested wetlands. Swamps are a type of forested wetland. All wetlands with fresh water are in a group called *palustrine* wetlands. All wetlands with a mixture of fresh and salt water are in a group called *estuarine* wetlands.

Are There Wetlands Near You?

To find your closest wetland, first look on a map for the nearest water source. Maps will show you creeks, streams, rivers, oceans, ponds, and lakes. Some maps even have little symbols that show wetland areas. Once you have found your closest water source on the map, go out to that area and look around. Where is the ground soggy? What kinds of plants are growing there? What does the soil look, feel, and smell like? If you have water, wet soil, and water-loving plants, then you have found a wetland!



What Is Grassland?

What do you think of when you hear the word *grassland*? Do you picture grasses rolling like waves, tossed by a brisk wind? Do you see herds of bison grazing under an almost endless blue sky? Do you feel the sun beating down on you as grasshoppers buzz around your head?

Grasslands were once a vast *ecosystem* that covered much of the central and western part of the United States. Large herds of bison roamed and grazed freely. Huge colonies of prairie dogs dug through the soil, making it easier for grasses and wildflowers to sprout and grow. These creatures and the others living in the grasslands were adapted to extreme climates—cold, hard winters and blazingly hot summers. Great floods often followed droughts that dragged on for years. Wildfire, sparked by intense storms, killed the bushes and shrubs that threatened to take over the open grassland, but the deeply rooted grasses quickly grew back.

What Makes a Grassland

Just as the name suggests, grasslands are mostly made up of grass, but not the kind you find outside your front door. Big Bluestem, one of the tallest grassland grasses, grows over six feet tall and could easily hide a man on horseback. There are three types of grasslands, each named for the height of the grasses found there.

Plants

Tallgrass prairies are the wettest and run through the center of North America. They are dominated by big bluestem, little bluestem, Indian grass, switchgrass, prairie cordgrass, and wheat grass.

The *short-grass prairie* is the driest and most westerly type of

grassland, stretching east and south from the Rocky Mountains. Here you find mainly buffalo grass along with some blue grama grass, needle grass, and wheatgrass.

In between these two types of grasslands—in part of the Dakotas, south to northern Texas, and through parts of Oklahoma, Kansas, and Nebraska—the plants of the tall- and short-grass prairies mix. The *mixed grass prairie* is where you find the most plant and animal diversity.

Water

While it may seem that there is little water in grasslands, the area is dotted with shallow, temporary wetlands. These areas provide vital water and habitat for many grassland songbirds, shorebirds, and waterfowl and drinking areas for prairie mammals.

Soil

Grassland soils are dark and rich with humus (dead and decaying plant material). It was fertile soil for farming. Farmers quickly learned how to break down through the dense carpet of grass roots with their plows. The majority of prairie grasslands are now farmed.

Grasslands Today

Many of the original grasslands and temporary wetlands have disappeared today. Some states have lost over 99 percent of their tall-grass prairies. Among North American birds, grassland birds have shown the steepest population declines of any bird group and are now considered the highest conservation priority. These important ecosystems have been replaced by the needs of a growing population for development and farming. As a result, many species are doing their best to adapt to the changing habitat conditions. American Golden-Plovers and

Buff-breasted Sandpipers now use agricultural fields, highly grazed pastures, and burned fields that mimic their natural habitat. It is good they are adapting, but they are now exposed to new threats such as pesticides. Nesting shorebirds like the Mountain Plover are threatened by mowing during their breeding season. Biologists are investigating what long-term impacts these habitat changes may have on prairie-dependent species. They are also looking for ways to promote good land stewardship that will benefit landowners and shorebirds. There are many organizations working to conserve this ecosystem for the good of all species.

Are There Grasslands in Your Backyard?

Finding true grassland in your neighborhood may be harder than you think. Of all the grassland habitat that once stretched across the United States, less than 1 percent is left today. Most of the prairie we still have is missing some of the very elements that made it true grassland: bison and prairie dogs. Was your state part of the grassland ecosystem? How much is left today?



Stream and River Corridors

In many parts of the world, wetlands undergo a natural change with the seasons. In the spring, snow and ice melts in the mountains. This melt water rushes downstream causing streams and rivers to overflow their banks and fill nearby lowlands. Sometimes this seasonal flooding makes it all the way to *estuaries* where fresh and saltwater meet the sea.

This melt water carries *nutrients* that fertilize the plants growing alongside streams and rivers. These plants provide food for many different kinds of *zooplankton*, *invertebrates*, insects, and insect larvae, which are, in turn, food for the area's fish, mammals, and birds.

Inland stream and river corridors (also called riparian habitat) are good wetland habitat for shorebirds in the spring. Shorebirds, like the Solitary and Spotted Sandpiper and Yellowlegs, stop on their northward migration to *breeding grounds* south of the Arctic to probe in the mud for snails, worms, and insect larvae.

From July to September, depending on where you live, the spring melt water has all run downstream and soon the water levels drop. The plants and animals that live along these river corridors must be adapted to survive a couple of months of dry conditions. Eventually, fall rains come and the rivers and streams rise and flood the lowlands once more before winter. Is there a river near where you live? Look carefully for shorebirds and other birds using the banks of streams and rivers.

Looking at the illustration, list the names of the plants and animals you recognize that live in the stream and river corridor habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?



Stream and River Corridors

(Source of illustration: Wetlands and Wildlife)



Tundra

The *tundra* is a vast, treeless land found in northern and western Alaska and northern Canada. Here it is very cold in the winter, cool in the summer, and the wind almost always blows. Because of the cold and the wind, no trees grow on the tundra. Plants that do survive here grow very close to the ground where it is warmer.

Many people think that the tundra is flat. In fact, the tundra is made up of lots of little mounds of grasses and sedges that grow together like little cushions in the hard, cold ground. Low spots are wet, or even filled with water, and form little ponds or lakes that make the ground squishy. Even where it looks high and dry, it often is not.

Although very little rain or snow falls here each year the tundra always feels wet. This is because permanently frozen ground lies just under a thin layer of topsoil. This permafrost does not allow rain or snow to drain away, so moisture continues to collect on or near the surface of the tundra all year. The *permafrost* does not thaw even in summer.

Permafrost changes the way tundra plants grow. Because the ground is hard and frozen, plant roots, like those of the Dwarf Willow, grow sideways (prostrate) instead of straight down. Centuries of decaying vegetation have produced a thick, spongy layer of organic material called *peat*.

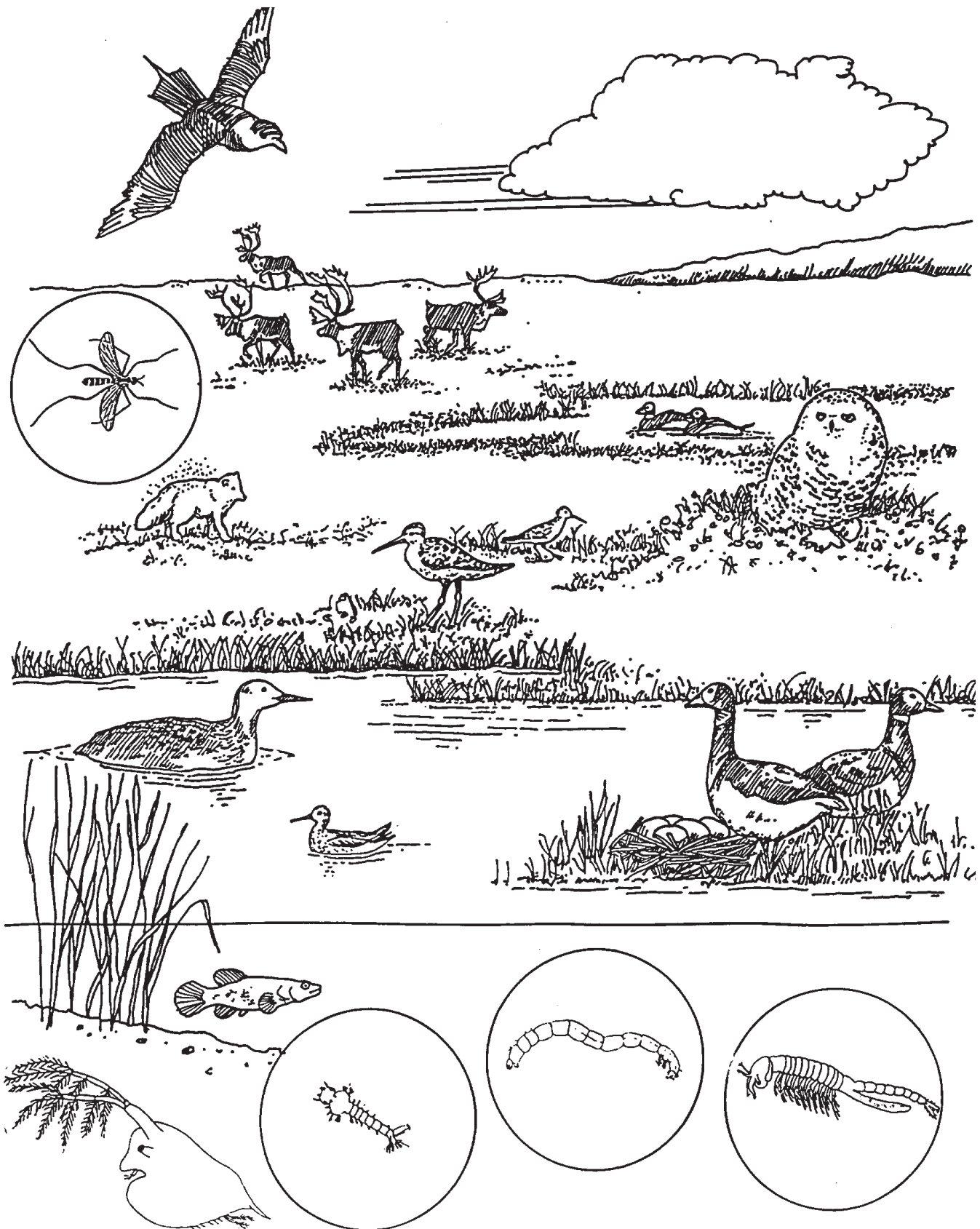
Fungi and lichens are very important tundra organisms that grow across the tundra and provide food to herds of caribou. Berry-producing plants like cloudberry and bearberry also provide food to tundra wildlife. Millions of shorebirds nest each year on the tundra. They feed on the billions of larvae, hatching insects, and on aquatic prey like copepods and fairy shrimp that appear each summer.

Looking at the illustration, list the names of the plants and animals you recognize that live in the tundra habitat.



Tundra

(Source of illustration: Wetlands and Wildlife)



Saltwater Marsh Habitat

Saltwater marshes are open, wet, treeless, grassy wetlands. They may be found along ocean coasts or inland. The rocks and soils of inland saltwater marshes are naturally high in salt. There are also inland salt lakes such as the Great Salt Lake in Utah. Coastal saltwater marshes are fed by the rise and lowering of the salty ocean tide.

Most coastal saltwater marshes are near *estuaries*, areas where salt water mixes with freshwater, such as where a river meets the ocean. A salt marsh is a transition habitat found between the water and dry land of the estuary. Tidal flooding causes the soils here to become very salty, making it difficult for most plants to grow.

Some plants have adapted to these high levels of salt. They are called *halophytes*, meaning “salt loving.” Because these plants spend so much of their energy trying to get rid of the salt in their cells and drawing water into their roots, they are not able to grow very large. They tend to be short with smaller leaves than plants found in freshwater marshes. Plants of the salt marsh grow in zones, depending on the amount of flooding they can tolerate. Here are some common zones in North American saltmarshes:

- Cordgrass grows in the lower marsh zone. It can tolerate being completely under water for as long as 22 hours. When it dies, it decomposes into detritus, an important food for small estuarine animals.
- The middle marsh zone is made up mostly of pickleweed. While this plant is also very salt-tolerant, it can not survive being under-water for long periods of time like cordgrass. Pickleweed gets rid of the salt that collects in its cells by moving it to the tips of its stems. The tips eventually turn red and break off.
- The most plant diversity is found in the upper salt marsh zone. Here you will find alkali heath, Australian salt bush, and salt grass. These plants sweat the extra salt out of their pores where it crystallizes on their leaves.

The salt marsh is also home to many different types of animals that are adapted to the salty conditions. Salt-tolerant bacteria, protozoa, brine flies, and brine shrimp thrive in salt marshes. Shorebirds such as Avocets and Black-necked Stilts probe the mud at low tide, searching for brine shrimp and the eggs and larvae of brine flies.

Looking at the illustration, list the names of the plants and animals you recognize that live in saltwater marshes. Some of these might not be found in your area. What other species of wildlife might you expect to see in the salt marshes in your area of the country?



Saltwater Marshes



Freshwater Marshes

Freshwater marshes are open, wet, grassy wetlands fed by creeks and streams or by rain and snow. They can fill broad, flat areas or tiny pockets that are surrounded by higher land. Freshwater marshes are often found along the edges of ponds, lakes, or rivers. Stream water or *runoff* continuously brings nutrients into them. Freshwater marshes come in many shapes and sizes, and there are many kinds, including swamps, bogs, and prairie potholes.

Freshwater marshes are very nutrient-rich. They support a great variety of plant communities that in turn support a wide variety of wildlife within this vital wetland ecosystem. In addition to their great habitat value, marshes help absorb floodwaters and filter excess nutrients from surface runoff. They are excellent natural water purifiers.

Plants that grow in a marsh are *adapted* to being wet. Their roots are always under water and grow where water is shallow and slow-moving. The sedges, rushes, and grasses that grow in the freshwater marshes of western North America resemble a wet meadow. Small shrubs and delicate, flowering herbs can also grow in freshwater marshes.

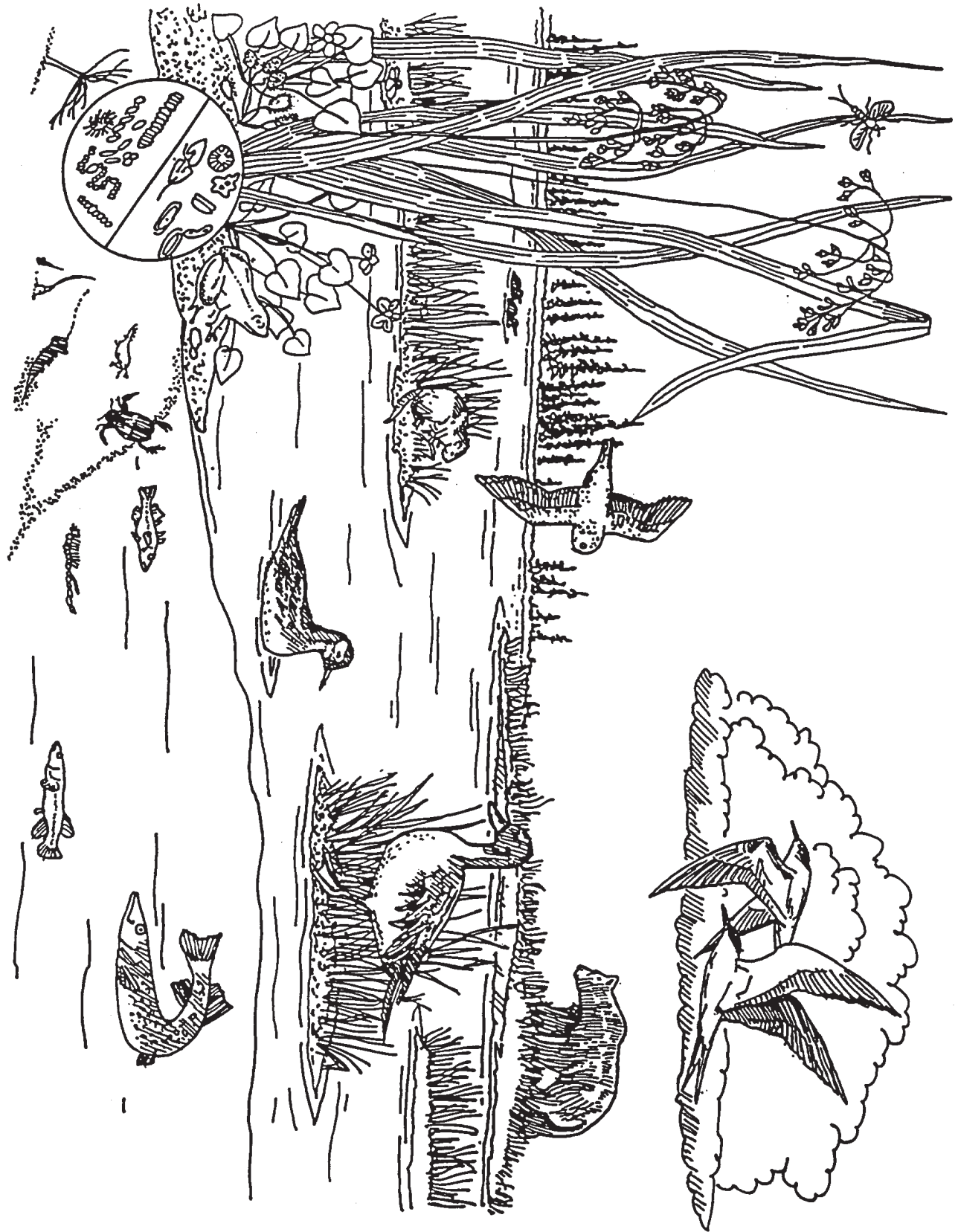
Insects, snails, and other small animals thrive among these plants in the slow-moving water. Fish and aquatic insects find shelter in the underwater parts of the plants. Shorebirds and other birds find plenty of food in a marsh and can hide from predators in the tall grass. Have you ever seen a Common Snipe, a yellowlegs, a dowitcher, or a phalarope in a freshwater marsh?

Looking at the illustration, list the names of the plants and animals you recognize that live in freshwater marshes. Some of these might not be found in your area. What other species of wildlife might you expect to see in the freshwater marshes in your area of the country?



Freshwater Marshes

(Source of illustration: *Wetlands and Wildlife*)



Rocky-Intertidal Habitat

The *intertidal zone* is the part of the ocean shoreline that is covered by saltwater when the tide is high and exposed to the air when the tide is low. Life here has both challenges and rewards. Plants, animals, and other organisms like *algae*, often called seaweed, must be very tough and able to adapt to changing water levels, salinity, and pounding surf!

Plants and animals that live in this intertidal habitat have to survive being covered and then uncovered by water once or twice a day. These plants must be able to get oxygen from the air and from the water. They must also keep from drying out when the tide is low. The *salinity* (or level of saltiness) of the water constantly changes here too. As the last drops of water evaporate at low tide, salt is left behind. This can make small tidal pools even saltier than when they were completely underwater. When it rains, on the other hand, these same plants and animals must adjust to pools diluted with fresh water.

Salt marshes, sandy beaches, and mudflats can all be found within the intertidal zone. The part of this zone made up of boulders, cliffs, gravel, shale, or just plain rocks is called the *rocky-intertidal* habitat. While this rocky-intertidal zone has no soil, pools or crevices that hold water, *tidepools*, are teeming with life just like any other wetland habitat!

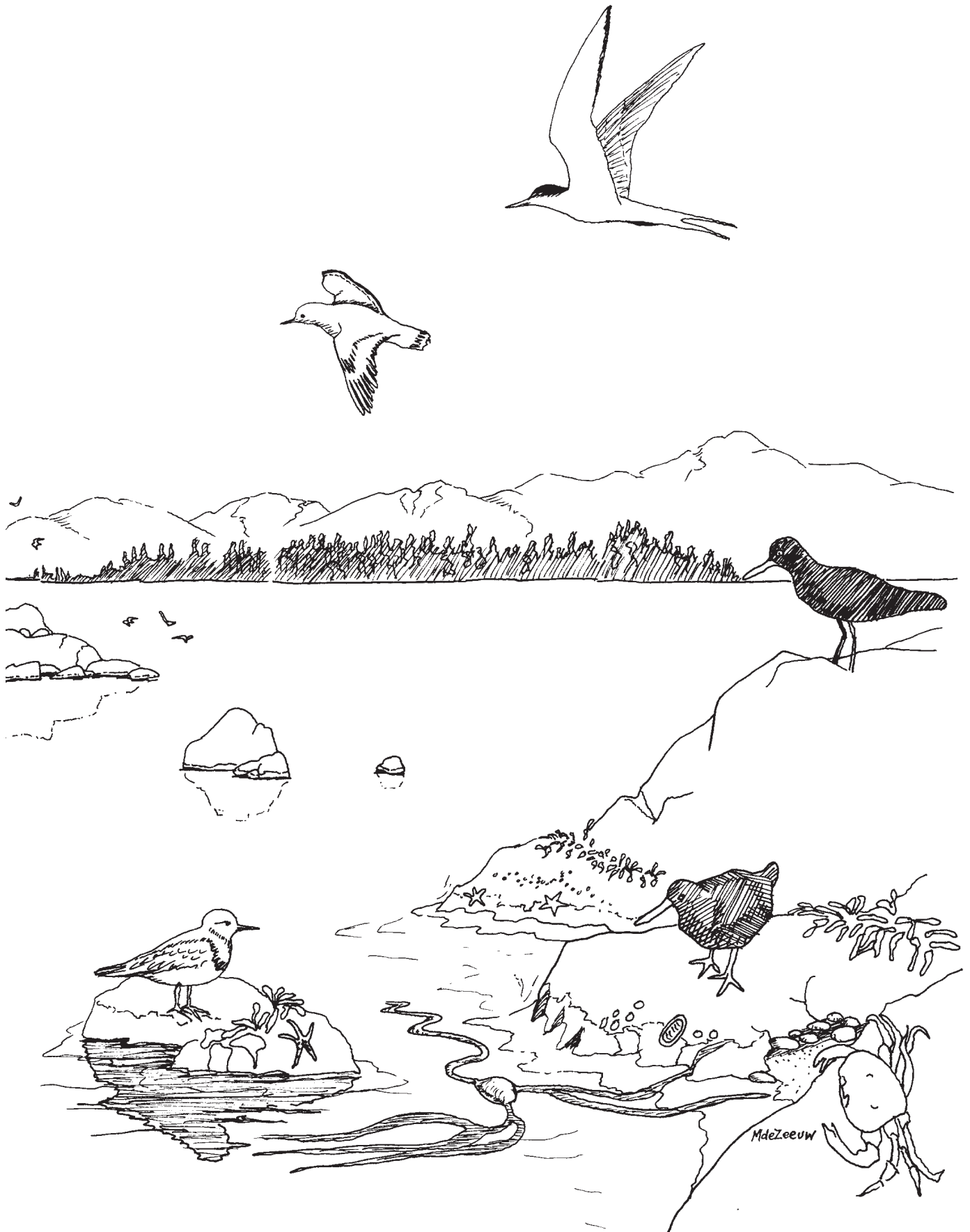
There is another challenge facing tidepool animals--rolling or even pounding ocean waves! Many have developed ways to cling to the exposed rocks and walls. Almost no plants grow here; there is no soil for their roots. Wave action keeps soil from collecting on the exposed rocks. However, large seaweed and kelp take the place of plants in the food web. They capture the sun's energy, grow, and then provide food and shelter for tiny marine animals.

The larger *predators* and *scavengers* of the rocky intertidal habitat have a hard time finding shelter from the sun, surf, and wind but are well *adapted* to find food among the rocks. Many shorebirds use the rocky-intertidal habitat. The Black Oystercatcher feeds almost nowhere but here most of the year. Its strong, red bill is specially designed for prying hard-shelled animals off rocks or cracking them open. Turnstones and surfbirds also live here during migration and winter.

Looking at the illustration, list the names of the plants and animals you recognize that live in the rocky-intertidal habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in this habitat in your area of the country?



Rocky-Intertidal Habitat



Mudflat and Sandy Beach Habitats

Mudflats and sandy beaches are important shorebird habitats. Both habitats can be found inland, bordering lakes and streams, and along the coasts within the *intertidal zone*. What else do mudflats and sandy beaches have in common?

They are both very open areas with few plants, subjected to constant change. *Organisms* that live here have to be hearty to survive! Plants and animals of coastal mudflats and sandy beaches are *adapted* to the cycle of high and low tides. They must tolerate changes in wetness and *salinity* twice a day. Water levels at inland mudflats and sandy beaches change too. Rainfall, flooding, and evaporation change water levels and nutrient concentrations. In some areas, water is actually pumped out of lakes to provide irrigation and drinking water.

Both inland and coastal mudflats and sandy beaches are nutrient-rich habitats. Salts and minerals are carried by rainwater and snowmelt into rivers. They are then swept downstream where they eventually mix with ocean or lake water. This constant input of nutrients makes mudflats and sandy beaches some

of the most *productive* areas on the earth, rich in *invertebrate* foods. If you scooped up one pail of wet mud or sand and examined it with a microscope, you would see hundreds or thousands of tiny snails, worms, and invertebrate eggs and larva. There would be larger animals like clams, shrimp, and long worms as well.

The high numbers of invertebrate foods make mudflats and sandy beaches critical to shorebird *migration*. Hundreds of thousands of shorebirds will concentrate here, sometimes feeding and resting for days before moving on. Shorebirds rely on these *stopover sites* for energy-rich foods to make it to their next stop, which might be hundreds or even thousands of miles away!

Mudflats and sandy beaches are also critical *breeding grounds* for several shorebird species. Snowy Plovers nest along the sandy beaches of the West Coast. Wilson's Plover, another sandy beach nester, is found in the east. Black Oystercatchers prefer the coastal and inland mudflats of Alaska while their counterparts, American Oystercatchers, nest on eastern mudflats.

Looking at the illustration, list the names of the plants and animals you recognize that live on mudflats and sandy beaches. Some of these might not be found in your area. What other species of wildlife might you expect to see in these habitats in your area of the country?



Mudflats and Sandy Beaches

(Source of illustration: Wetlands and Wildlife)



Prairie Potholes

Dotted across the northern grasslands of the United States are thousands of shallow, temporary wetlands called prairie potholes. Glaciers scraping over the landscape during the Pleistocene, thousands of years ago, formed the *prairie potholes* of Canada and the United States. They are found in North and South Dakota, Nebraska, Wisconsin, and Minnesota. They fill in the spring with snowmelt and rainwater.

Because of the numerous shallow lakes and marshes, rich soils, and warm summers, the prairie pothole region is described as being one of the most important wetland regions in the Central Pacific Flyway. This region provides birds with a feast of insects, worms, clams, snails, and other invertebrate foods for both breeding and migrating birds. Because most prairie potholes are fed by rain and snow, they vary greatly in their sizes and water levels. This also means the suitable habitat for shorebirds is unpredictable from year to year. Because these wetlands are unpredictable, shorebirds disperse across the region wherever suitable potholes can be found instead of concentrating at predictable areas as they do along the Atlantic and Pacific Coasts.

This region provides refuge for approximately 36 species of migrating and breeding shorebirds, such as the White-rumped Sandpiper, Long-billed Dowitcher, and Lesser Yellowlegs. Many of the shorebirds that occur here are found in shallow wetlands, wet pastures, flooded agricultural fields, and lake shores. The area is home to over 50 percent of North American migratory waterfowl, with many species dependent on the potholes for breeding and feeding. In addition to supporting a great diversity of wildlife, prairie potholes also absorb excess rain, snowmelt, and floodwaters, reducing downstream flooding.

Looking at the illustration, list the names of the plants and animals you recognize that live in and around the prairie potholes of the grassland habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?



Prairie Pothole



Playa Lakes

Scattered across the grasslands of West Texas, Oklahoma, New Mexico, Colorado, and Kansas are thousands of round, shallow, temporary wetlands called *playa lakes*. These special wetlands are lined with a watertight layer of bedrock. They fill with water only after spring rainstorms when freshwater collects in the round depressions of the mostly flat landscape. There are many theories as to the origin of playas, but the most widely accepted are that playas are either carved by wind or formed by sinkholes. Whatever their origin, playas are important to humans, animals, and plants.

Playas are important because they store water in a part of the country that receives as little as 20 inches of rain a year and where there are no permanent rivers or streams; so playas are the main support for an astounding array of wildlife. An estimated 15 million birds migrate through the playa lakes, and one-third commonly winter there. Mayflies, dragonflies, salamanders, bald eagles, endangered whooping cranes, jackrabbits, and raccoons also can be found at playa lakes. Because

playa lakes support such a wide variety of animals, they contribute significantly to the biodiversity of this grassland region. Playas also help support the surrounding agriculture by providing irrigation water and seasonally recharging underground water sources called aquifer. The Ogallala Aquifer is North America's largest aquifer that underlies the Southern High Plains¹ and is being used for irrigation and drinking water faster than it is being replenished. Aquifers are like huge underground sponges made of porous sediments of sand and gravel that catch the water as it percolates through the grassland soils

Some shorebird species, such as the Long-billed Curlew, Mountain Plover, and Snowy Plover, nest in the playa lakes region. Curlews breed in grassy areas often associated with playas, while Snowy Plovers nest on saline lake beds with little water and often no vegetation. Mountain Plovers prefer the sparse shortgrass prairie area near the playas.

Looking at the illustration, list the names of the plants and animals you recognize that live in and around the playa lakes of the grassland habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?

¹ Southern High Plains: This is a distinct geographic region of the United States that extends from West Texas, Oklahoma, New Mexico, Colorado, and Kansas. This region is made up of shortgrass and mixed grass and ranges in elevation from 900 to 6000 feet.



Playa Lake



Grasslands

Grasses roll in waves, tossed by a brisk wind. Winters can be very cold and summers very hot. Droughts can drag on for years and can be followed by great floods. The creatures and plants living in grasslands are adapted to an extreme climate.

There are three types of grasslands that are defined by the typical height of the grass. Tallgrass prairies are the wettest and run through the center of North America. They occur in the southern Canadian province of Manitoba, down through eastern North Dakota, western Minnesota, and parts of Oklahoma, South Dakota, Kansas, and Nebraska. The dominant grasses in the tallgrass prairie are big bluestem, little bluestem, Indian grass, switchgrass, prairie cordgrass, and wheat grass. Upland Sandpipers nest and feed within tallgrass prairies.

The shortgrass prairie is the driest and most westerly type of grassland. It stretches from the Rocky Mountains east and south through parts of the Canadian province of Saskatchewan, Montana, the Nebraska panhandle, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas. Buffalo grass is the dominant grass with some blue grama grass, needle grass, and wheatgrass. Mountain Plovers and Long-billed Curlews nest and feed here.

The mixed-grass prairie covers part of the Dakotas and extends south to northern Texas and through parts of Oklahoma, Kansas, and Nebraska. Here, the plants of the tall- and shortgrass prairies mix. The vegetation in these areas is more diverse than in either of the other two types of grasslands. During migration, Buff-breasted Sandpipers and American Golden-Plovers rest and feed in pockets of highly grazed and freshly tilled farm fields and other grassy areas within mixed-grass prairies.

Playa lakes in the south, prairie pot holes in the north, and farms are all part of the grasslands. Looking at the illustration, list the names of the plants and animals you recognize that live in and around grassland habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?



Grassland



Map Your Habitats

Grade Level: upper middle school/ high school

Duration: one 30-minute class period

Skills: vocabulary, discussion, observation, collecting and interpreting data, forming hypotheses

Subjects: social studies (geography) and science; language arts (with additional activity)

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds depend on at least three different places for habitat every year of their lives.
- Your local environment may provide important habitat for shorebirds.
- Your local environment is part of a natural ecosystem that we all depend on.

Vocabulary

Refer to the words highlighted in the *Habitat Readings*.

Overview

By examining maps of the states they live in, students discover the variety of habitats that local shorebirds might use.

Objectives

After this activity, students will be able to:

- List the different habitat types found within their home states.
- Identify, on a map of their home states, where these habitats are located.
- Describe three characteristics of each of these habitat types.
- Conclude where they might find shorebirds in their state.

Materials

- One copy of a blank outline of your state or province per student or team

- Copies of textbook maps or copies of topographical or state maps as research material for the students.

- Felt tip pens or colored pencils

- Copies of the *Habitat Readings* (found in the activity *Types of Habitats*)

Introduction

Given the migratory nature of shorebirds and the variety of habitats they use, chances are good that some representatives of this large group of birds can be found in your own “backyard.” The first step to observing shorebirds in the field is to identify suitable shorebird habitat within your community. For information on types of habitats shorebirds use, read *Shorebirds Depend on a Chain of Healthy Habitat* in the *Shorebird Primer* and the *Habitat Readings* found in the activity *Types of Habitats*.

Maps

Maps can be made by you or your students through numerous Internet resources:

National Geographic Map Machine
<http://plasma.nationalgeographic.com/mapmachine/index.html>

National Atlas of the United States
<http://www.atlas.usgs.gov>

Geography Network

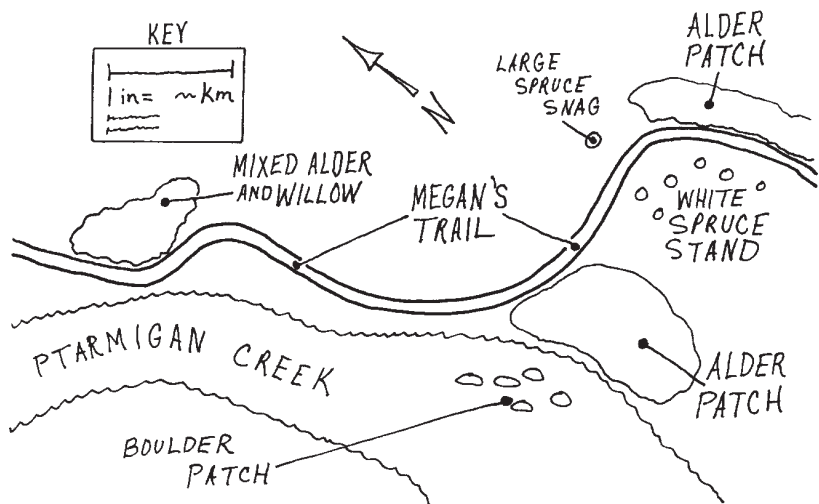
<http://www.geographynetwork.com>

MapQuest

<http://www.mapquest.com>

Procedure

1. Pass out copies of the *Habitat Readings*. Students, individually or in teams, should read each of the descriptions to become familiar with the shorebird habitat types.
2. Pass out one copy of the blank map to each student or team or have students make a local map using the Internet.
3. Have students locate as many shorebird habitat types as possible on the map(s). Ask them to draw and label these habitats on their blank maps.
4. Discuss the following questions:
 - What wildlife do you find in your state, community, or neighborhood?
 - Would your map look the same in winter? How would the habitat change?
 - Are all the habitats marked



on your map suitable for shorebirds? Why or why not?

- Where are good shorebird habitats in your state during the breeding season, during migration, and during winter?
- How many habitat terms can you find among the names on your state (or town) map? (Examples: “Shady Slough,” “Dandelion Meadow,” “Parker’s Knoll”)

Additional Activities



Cultural Connection

Ask students to research and map a habitat in an environment geographically distant from their own community. Ask that as part of the habitat mapping they include information about the cultural group that lives near that habitat.

Map Your Neighborhood

Have students draw a map of the local area where their school and home are located. Label roads, paths, buildings, and all areas of natural or human-made habitat. (Human-made habitat might include gravel beds, sewer lagoons, or dumps.)

Community Atlas Project

ESRI (Environmental Systems Research Institute) has a U.S. Community Atlas project that enables teachers and students to develop a community profile using GIS mapping tools. To learn how to participate, go to <http://www.esri.com>, click on “Education and Training”, scroll down and click GIS K-12, scroll down and click “Community Atlas.”

Community Interviews

Have students interview local community members about how nearby natural areas have changed over the years. Has anything been lost to development? How have the populations of local wildlife changed? Have special areas been set aside for wildlife?

Explore the History of Your Local Parks

Have students research to find what state or federal parks, refuges, or nature preserves are in your state, province, or within 50 to 100 miles of your town. What animals, plants, or habitat types do these parks protect? In which ones do you find shorebirds?

Internet Resources include:

All public lands:

<http://www.recreation.gov>

National Wildlife Refuge Systems:

<http://refuges.fws.gov>

National Park Service:

<http://www.nps.gov>

USDA Forest Service:

<http://www.fs.fed.us>

Bureau of Land Management:

<http://www.blm.gov>



When the Grass Was Greener

*Adapted with permission from
“One Bird-Two Habitats.”
Wisconsin Department of Natural
Resources*

Grade Level: upper middle school/
high school

Duration: 60-minute class period

Skills: critical thinking, vocabulary,
discussion, and visualization

Subjects: social studies, science,
language arts, and math (with
additional activity)

Concepts

- Shorebirds face numerous threats.
- The most serious threat to shorebirds is loss of habitat.

Vocabulary

- tallgrass prairie
- shortgrass prairie
- mixed-grass prairie
- prairie potholes
- playa lakes
- invertebrates

Overview

Through simulation, participants will see how the reduction of grassland habitat and the alteration of agricultural practices such as corn production, grazing, and mowing can affect nesting grassland shorebirds.

Objectives

After this activity, students will be able to:

- Show on a map the general area where prairie once occurred in the United States.
- Name three shorebird species that nest in grassland habitat.
- Differentiate between prairie potholes and playa lakes.
- Explain the importance of prairie potholes and playa lakes to prairie nesting shorebirds.
- List key factors limiting nesting success for grassland shorebirds.

Materials

- Transparency of *Prairie Habitat*
- Copies of the *What Are Grasslands, Prairie Potholes, Playa Lakes, and Grasslands Habitat Reading* (found in the *Types of Habitat* activity).
- Pieces of green, yellow, and orange papers to cover part of the classroom floor.
- Baseball-size, round pieces of brown paper to represent nests
- A field guide or copies of the *Shorebird Profiles* of grassland species (*Upland Sandpiper, Long-billed Curlew, American Avocet, Buff-breasted Sandpiper, and Killdeer* are included in the *Appendix*.)
- A yard stick or ruler
- A set of activity cards (provided here)

Optional

- Gum for “cows” to chew

Introduction

There are three types of grasslands found in North America, defined by the typical height of the grass. Tallgrass prairies, the wettest grasslands, run through the center of North America. They are dominated by big bluestem, little bluestem, Indian grass, switchgrass, prairie cordgrass, and wheatgrass. Upland Sandpipers nest and feed within tallgrass prairies.

The shortgrass prairie is the driest and most westerly type of grassland. Here you find blue grama grass, needle grass, and wheatgrass. Mountain Plovers and Long-billed Curlews nest and feed here.

The mixed-grass prairie is sandwiched between the other two. It covers part of the Dakotas, extending south to northern Texas and through parts of Oklahoma, Kansas, and Nebraska. Here the

plants of the tall- and shortgrass prairies mix. During migration, Buff-breasted Sandpipers and American Golden-plovers rest and feed in the pockets of highly grazed and freshly tilled farm fields and other grassy areas.

Many of these grasslands are dotted with shallow, temporary wetlands that provide vital habitat and resting areas for shorebirds. Here they find the insects, worms, clams, snails, and other invertebrates that sustain them through the breeding season and migration. In the northern prairie region, these wetlands are called prairie potholes. In the southern reaches of the prairies, they are called playa lakes.

North America’s grasslands and the wildlife that lives there face many threats. Some states have lost 99.9 percent of their original tallgrass prairies to agriculture or development. Many prairie potholes and playa lakes have been drained for irrigation water. Cattle have almost completely replaced bison on shortgrass prairies. The natural cycle of wildfires that once sustained prairies is now suppressed. Shorebirds that are using areas intensely managed by people, such as golfcourses and sod farms, risk exposure to pesticides. As a result, biologists are concerned about the long-term survival of birds such as the Long-billed Curlew, Mountain Plover, and the Buff-breasted Sandpiper.

For more information about shorebird habitats and the threats they face, read *Shorebirds Depend on a Chain of Healthy Wetlands* and *Threats to Shorebirds*, both found in the *Shorebird Primer*.

Activity Preparation

1. Copy the *Prairie Habitat* map onto transparency film.

2. Make each student a copy of *What are Grasslands?*, *Prairie Potholes*, and *Playa Lakes*, and *Grasslands* habitat readings found in the activity *Types of Habitats*.
3. Photocopy and cut the activity cards. Attach a yarn loop or safety pin to each card so students can wear them.
4. Cut out a brown paper circle that represents a nest for each student.

Procedure

1. Give students a copy of the student readings to read before the activity. Show the students the *Prairie Habitat Then and Now* map, presenting the grasslands that once covered the continent from Indiana to the Rocky Mountains.
2. Explain that grassland once covered 400,000 square miles of North America. Discuss why people once called the prairie a “sea of grass.”
3. Referring to the student readings, discuss the following questions:
 - What kept the prairies open grasslands?
 - What kinds of birds nested there?
 - Where would you find their nests?
 - What types of risks did these birds face in nesting on the ground?
4. Explain to the students that they will participate in a simulation activity. For the purpose of the game, the classroom will represent a large prairie. Push the classroom furniture out of the way to create a large, open space.
5. Give each student a brown circle

of paper symbolizing a nest. Tell students to put their “nests” anywhere on the open floor, at least a yard away from any other nests. Demonstrate this distance by putting a yardstick between two nests. (If the classroom is too small, use a foot-long ruler instead.) Have them place their nests on the “prairie” and count how many nests fit there. Record this number in the appropriate column on your chart, then pick up the nests.

6. Begin to describe changes in the prairie landscape.

■ “Buffalo hunters” came and killed the bison. Railroads and roads crossed the continent, bringing more and more people. Towns and cities sprang up. *Move the classroom furniture back to represent the built environment where grassland birds find no suitable place to nest.* As you make each change, remove the nests until they have all been picked up.

■ People began suppressing fire so it would not damage their property. Forests grew in areas once kept open by fires and bison. Settlers planted trees for shade. *Set one part of the room aside to represent woodlands not suitable for grassland birds.*

■ People plowed the land and planted crops such as corn and hay. Cover a portion of the floor completely with yellow paper to represent corn. *Cover another corner with orange paper to represent hay.*

■ Now the grasslands have been fragmented—one house, one field at a time. Today less than one tenth of one percent of the eastern tallgrass prairie remains. *Cover the remaining*

floor with pieces of green paper, reducing the prairie to a small patch of pasture.

7. Give a nest back to each student. Ask the students to place their nests on this fragmented prairie. Remind them to avoid woodlands, railroads, roads, towns, and cities. Nests still have to be one yard apart (or the distance you determined earlier).

8. Count the number of nests that fit the “modern” prairie. Record this number in the appropriate column of your chart. Students who were not able to find suitable nest sites can leave their nests on the sidelines.

9. Now take one-third of the class out of the room. Divide that third into three groups—farmers cultivating corn, hay mowers, and cows. Give each group its associated activity cards to wear. Explain that they will have only 45 seconds to “harvest” or “eat” back in the classroom in the following manner:

■ **Cultivators:** Walk slowly back and forth through the corn area, picking up and removing each yellow paper as they go.

■ **Mowers:** Quickly walk back and forth over the hay area, picking up every piece of orange paper as they go and trying to cover the area twice before the time is up.

■ **Cows:** Graze in the green pasture where they are fenced in. They should pick up the green papers they either walk on or “eat.” However, cows must chew four times between picking up pieces of paper. (Give cows gum.)

10. Divide the other two-thirds of the students into “birds.”



Assign them the roles of Upland Sandpiper, Buff-breasted Sandpiper, or Killdeer. Give each student the associated activity card to wear. Instruct them to put their brown paper circles under the colored pieces of paper to represent building nests in the grass at least one yard away from other nests.

■ *Upland Sandpipers* and *Buff-breasted Sandpipers* can nest in the *green pasture* or the *orange hay areas*.

■ Only the *Killdeer* can nest in the *yellow corn area*.

Have the students hide their nests and then move away. Any birds unable to find a suitable nesting site return to the sidelines, their nesting attempts unsuccessful.

11. After the nests are hidden, invite the “mowers,” “cultivators,” and “cows” to return and follow their instructions. Let them graze and harvest for 45 seconds (or just enough time for them to destroy most nests). Nests touched or exposed by the “cultivators,” the “mowers,” or the “cows” are considered unsuccessful or destroyed. Count the number of successful nests. Add this number to the appropriate column on the chart.

12. Discuss what happened.

- How have changes in the landscape affected grassland birds? Their population has declined significantly over the past 30 years. In the Midwest, grassland birds have declined more extensively than birds associated with other habitats.)
- Do you think it is harder to find appropriate nesting sites now than it might have been 160 years ago? Yes, because there is less suitable and safe habitat for nesting shorebirds.

■ Which nesting site was least in demand? Corn. There is a correlation between declines in Midwest grassland birds and declines in regional acreage of pastures and hay fields.

■ Would abbreviating or lengthening the time period have had any effect in the simulation? How does timing and frequency of mowing affect grassland-nesting birds? It takes a nesting pair of grassland birds four to five weeks to build the nest, hatch the eggs, and raise their young. The current predominance of alfalfa is mowed repeatedly during the nesting season (on a 30-day schedule). This provides less viable nesting habitat than the traditional grassy hay which was not mowed until later in the season, after most young birds had fledged.

■ Would increasing or decreasing the numbers of cows have an effect? More cows grazing in the same small area would likely be more damaging to nests.

■ What additional effects might fragmentation of grasslands have on birds? Predators were omitted from this activity. However, smaller fragments of grasslands and the close proximity to woods and farms would likely increase nest predation by skunks, raccoons, cats, etc. and nest Parasitism by cowbirds.

■ What can people do to conserve grassland-nesting shorebirds? Practice grazing with low cattle density or experiment with grazing practices to reduce negative impacts on grassland birds. Delay mowing until after the baby birds have fledged. Consider maintaining more open grasslands by cutting trees where grasslands historically occurred and by burning periodically. Create

and conserve grasslands that are not disturbed during the breeding season.

- Ask students to sum up some key factors in the decline of grassland bird populations. Loss and degradation of habitat, mowing, predation, and trampling.

Additional Activities

Experiment with Different Harvesting Scenarios

Graph the proportion of successful nests in each area. Simulate experiments with rotational grazing or delayed mowing by altering time factors and counting the number of successful nests.

Write Letters

Research and write the appropriate local, state, or federal regulatory agencies and land managers (such as planning and zoning boards, state departments of fish and game, and the U.S. Fish and Wildlife Service), asking for information on the status (such as land ownership and resource use designation) of local grasslands used by shorebirds. Try writing letters to the editor of your local paper on issues concerning local shorebird habitat.

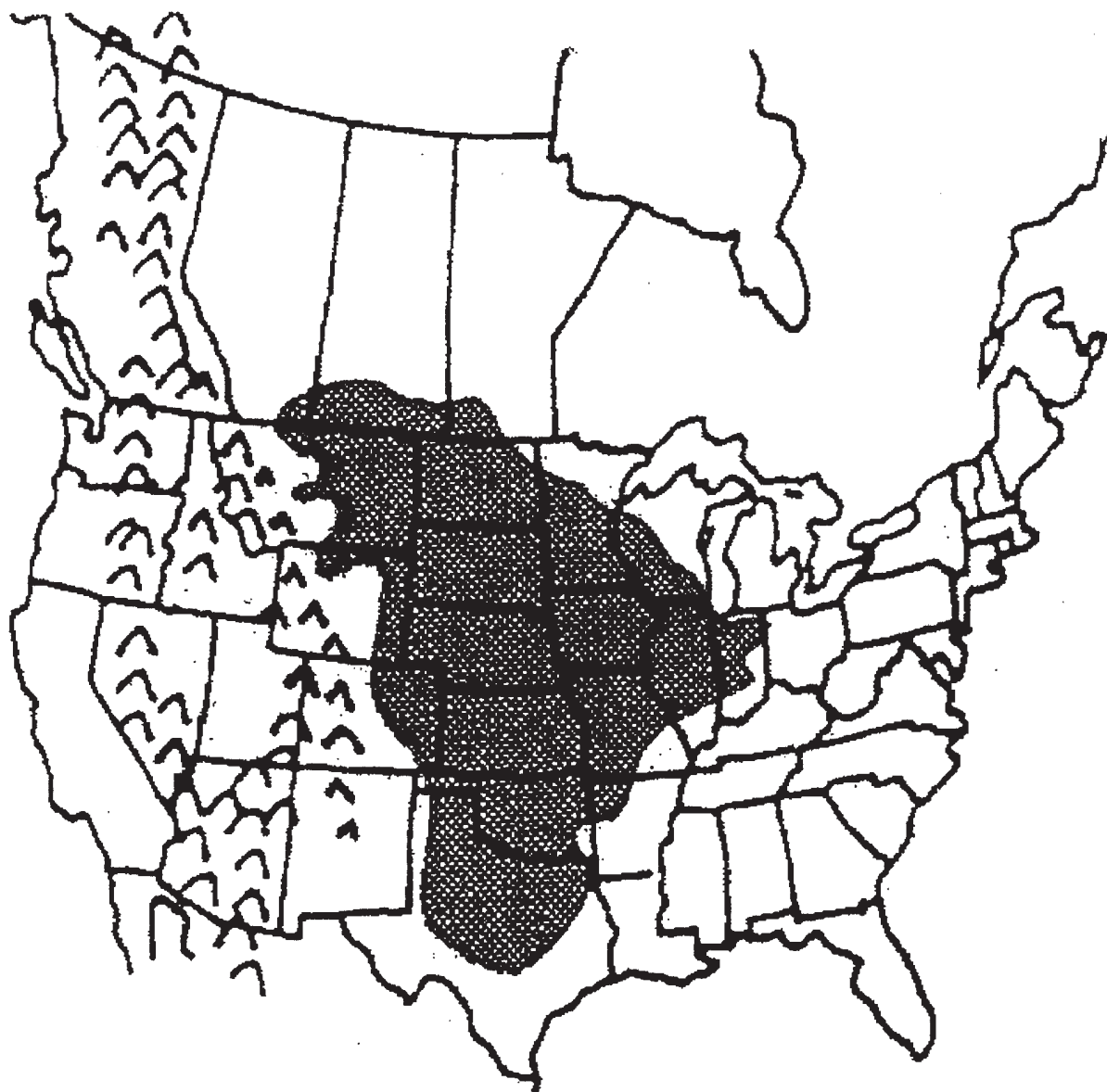
Research Grassland Shorebirds

Give each student copies of the *Upland Sandpiper*, *Long-billed Curlew*, *American Avocet*, *Buff-breasted Sandpiper*, and *Killdeer Shorebird Profiles* to read and study. Then divide the class into four shorebird teams. Have each team answer the “Something to Think About” question at the end of each shorebird profile and present their team’s answers to the entire class.

Mountain Plovers also nest in grasslands but a Shorebird Profile for this species is not included in this Educator’s Guide. Students could write their own profile of the species.



Central Prairie Prior to Settlement by Europeans



When the Grass Was Greener Activity Cards

(Photocopy so that each student will
get one card.)

Hay Mower	Farmer
Cow	Killdeer
Buff-breasted Sandpiper	Buff-breasted Sandpiper
Upland Plover	Upland Plover



