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Grade Five

Wetland Ecosystems

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Wetland Ecosystems

Before You Begin

Students learn about wetland ecosystems by studying life in a local pond, slough, marsh, fen or bog. Through classroom studies, and studies in the field, students learn about organisms that live in, on and around wetlands and about adaptations that suit pond organisms to their environment.

Through observation and research, students learn about the interactions among wetland organisms and about the role of each organism as part of a food web. The role of human action in affecting wetland habitats and populations is also studied.

Topic E: Wetland Ecosystem

(Suggested time: 6 weeks)

This unit is best done in the spring when a class field study can be done. If a field study to a nearby pond is not possible, it is suggested that pond supplies (both plant and animal) be purchased from a science supply company. (Refer to a science supply company catalogue for live specimens.) An aquarium, tub or wading pool can be used to create your classroom wetland.

Because of our responsibility as educators to teach respect for natural habitats, no living specimens or eggs should be removed from their home for classroom study. A wide variety of aquatic specimens can be obtained from science suppliers. However, this requires significant advance planning on the teacher's part. Since this is a spring unit, this is not a problem.

The field study component of this unit is imperative for a true understanding of the wetland ecosystem. If it is at all possible, you should plan on taking your students out—even if only to a local pond. However, it is vital that you contact your school jurisdiction regarding its field trip policies and plan your trip accordingly.

Safety Issues

- Always have students wash their hands after handling water where living organisms are present.
- Make sure that the strictest safety provisions are in place for any potential dangers on your field trip.

Background Information

This unit takes an in-depth look at wetlands in order to illustrate the complex nature of ecosystems. In the process, it demonstrates that an ecosystem exhibits three basic characteristics:

- a well-defined physical structure (e.g., temperature, soil type, altitude);
- a distinct community of plant and animal species that interact with the environment and with one another; and
- a flow of energy and cycling of nutrients that sustains the community.

Physical Structure

Wetlands—bogs, marshes and swamps—are interesting because they combine characteristics of terrestrial and aquatic environments. Covered in complex vegetation, wetlands often form when an open body of water—a pond, lake or stream—fills with organic debris (e.g., dead plant matter) or eroded inorganic materials (for example, sediments).

Bogs build up in areas of poor run-off where highly acidic water, deficient in oxygen and minerals, retards the decay of organic debris. There are three primary types of bog (or *moor*): cool-climate bogs dominated by mosses and heaths, also referred to as *muskegs* when trees grow on them; *fens* where the predominant growth is grasses, sedges and reeds; and tropical tree bogs composed chiefly of tree remains. In Canada, bogs are most common in the tundra and boreal forest areas, which were covered by glaciers during the Pleistocene Ice Age. A bog usually looks dry, but will wet your feet if you walk across it.

Standing water is clearly visible in *swamps* (predominantly treed wetlands) and *marshes* (predominantly grassy wetlands). Swamps and marshes exist in areas where drainage is poor and there is enough water to keep the ground waterlogged for extended periods of the year. The mineral content of this water, although low, is high enough to promote the decay of organic matter. Marshes often develop in river deltas and in the standing or sluggishly moving water of abandoned river channels and *oxbows* (small lakes located in the loops of abandoned river channels). They can also develop in closed inland basins that have no outlet for water run-off.

The Living Community

Wetland ecosystems consist of a number of living (*biotic*) and non-living (*abiotic*) components interacting. Abiotic factors include temperature, oxygen level, sunlight, rocks and wind, just to name a few. Living things, primarily plants and animals, face a variety of challenges imposed by the physical environment. Freeze-over in winter, drought in summer, spring flooding, oxygen-poor water, soft bottom soil and, in the case of bogs, extremely low mineral content set limits on the range of species that can survive. Only simple plants and the small number of animals these plants can sustain are found in bogs. The greatest number of species thrive in the inland freshwater marshes that dry up for part of the growing season.

Let's look at some of the unique adaptations plants and animals have evolved to cope with life in the wetlands. In the process, we will also see several examples of how these organisms contribute to the formation and maintenance of these habitats.

There is little or no oxygen present in water-logged soil, so many wetland plants forego deep roots and obtain their oxygen from structures above water. Wetland grasses have hollow tissue in their leaves that transports oxygen to their submerged root systems. Trees that grow in permanent swamps send up special air-gathering growths from their root systems. Some plants have even evolved ways to survive for a time without oxygen. This adaptation is highly beneficial in wetland areas submerged for only part of the year. Plants must be able to get through the wet period with the soil supply of oxygen cut off. Willows and alders can go for up to two months with submerged root systems, but other species, such as cottonwood, can survive for one week at best.

Marsh grasses prefer to grow where water-logged, rich soil has a constant but slow supply of new water. Where these grasses take root, water flow is impeded, leading to the spread of the marsh environment. Wetland grasses have fibrous root systems to give them as much anchorage as possible in the soft, muddy deposits at the bottom of the marsh. The growing tips (the *rhizomes*) of these grasses is just below soil level so, even though the leaves might be sheered off by moving ice sheets in the winter and hungry animals at other times, the growing part of the plant remains intact.

The soft, muddy nature of wetland soil makes it difficult for large, heavy animals to get around. For the most part, wetlands are populated by small animals adapted to an aquatic existence and animals that live in the overgrowth. To be able to function in and around water, many birds and some mammals (the muskrat, for one) have developed webbed feet to swim, and water-resistant fur or heavier down to keep them dry and warm. Lack of oxygen is a problem for many small life forms that live in this environment. Some have special tubes they stick up above water level to breathe (e.g., mosquito larvae), others use the air spaces around plants as sources of oxygen (water boatmen), and certain nematodes (round worms) have developed an ability to go for long periods of time without oxygen.

The following provides examples of animals commonly found in the wetland community.

- **Birds:** Many bird species are attracted to marshes that provide an abundant source of food and excellent nesting, resting and feeding sites that are well protected from ground-based predators. Grebes, for example, take advantage of the unique wetland habitat by building low, wet nests in floating masses of rotting vegetation that warms their eggs. Ducks, geese, sandpipers, coots, red-winged blackbirds, herons and

numerous other bird species use wetlands as nesting grounds during the warm months. They cope with the inhospitable nature of winter on northern wetlands by migrating south in the fall.

- **Mammals:** Beavers and muskrats are two mammal species commonly found in wetlands. They have a number of characteristics in common. Both have flattened tails to aid in swimming. Both live in lodges built of cuttings that double as a food supply during winter months. And both contribute to the breakdown of plant matter by shredding grasses, reeds and trees into small bits in the process of constructing their dwellings. Beavers contribute to the formation of wetlands when their dams slow streams and create ponds that eventually fill with organic debris (such as their shredded plant material). Mink, otters and raccoons are a few more mammals that can be found in the vicinity of wetlands. Moose, which sometimes frequent bogs, are the largest of the mammals to be encountered in a wetland habitat.
- **Insects:** Fly-like insects are abundant in the wetland ecosystem. Of these, the insect most of us associate most closely with wetlands is the mosquito. Mosquitoes lay eggs on the surface of the still water. Their larvae live under water and obtain air from hollows in plant structures. Mosquito pupae are somewhat unusual because they have the ability to move around in the water. We all know and dread adult female mosquitoes, which must have a blood meal after mating in order to obtain blood protein for egg production. Mosquitoes can over-winter as eggs, larvae, pupae or adults.
- **Amphibians:** Salamanders, frogs and toads are wonderfully well adapted to the wetland habitat. Their life cycle includes a formative period in the water (the tadpole stage) and an adult stage, at least partially, if not wholly, on land. Like all other amphibians, they return to the water to lay their shell-less eggs. Frogs, toads and many varieties of salamander undergo a *metamorphosis*: in breathing, from gills to lungs; in movement, from fins to legs; and a change in diet from plants (*herbivorous*) to animals (*carnivorous*). During the winter, frogs and salamanders group together in large numbers in a moist, protected environment on land (such as a rotting log) or in the mud on the bottoms or banks of marshes. Toads over-winter in individual burrows on land. During dry periods, frogs form a mud cocoon and enter a dormant stage.
- **Fish:** Lack of sufficient oxygen in the water, the seasonal nature of the water supply and the shallowness of wetland waterways usually precludes the presence of fish or limits fish species to small varieties such as mud minnows. Nonetheless, some large species, such as the northern pike, make use of sloughs and the marshy areas that rim lakes as spawning grounds because the vegetation provides protective cover for their offspring.

Energy Flow

Sunshine is the ultimate source of energy that fuels wetlands and most other ecosystems. (An excellent example of an exception to this rule is the living communities that flourish around deep-sea thermal vents.) Green plants, which capture solar energy and convert it into stored organic energy via a process called *photosynthesis*, are referred to as *producers*. Peat (sphagnum) moss, sedges, rushes, bulrushes, cattails, wild rice and reed grasses are a few of the major wetland producers.

Other organisms access solar energy through a chain of nutrient sources that begins with producers as the initial link. The second link of the chain consists of *primary consumers* (or *herbivores*)—animals that eat plants. Wetland examples of primary consumers include muskrats, some types of ducks, geese, moose and immature frogs and toads. *Secondary consumers*, animals that eat other animals (also known as *carnivores*), form the third link in the chain. Herons, grebes, northern pike, mink and adult frogs and toads fall into this group. Many of these species also qualify as *omnivores* because their diet includes both plants and animals. The final link is the *decomposers*—microscopic organisms (bacteria and fungi) that break down dead plant and animal matter, releasing important nutrients and minerals back into the environment to be used again.

Nutrients cycle through an ecosystem community via a combination of straightforward *food chains* and more complex *food webs* (interrelated food chains.) One example of a simple food chain found in the wetlands is as follows: sedge plants (producers) are eaten by muskrats (primary consumers), which are eaten by mink (secondary consumers), which upon dying, are broken down by decomposers (see Fig. 1).

This chain can be extended into a web if you tie in food chains that include one or more of these species. For example, working backward, mink also eat fish, which have fed on insects or smaller fish, which have fed on other animals or plants—perhaps even the sedges eaten by muskrats—thereby tying the web together at another point in the initial chain.

Any factor that diminishes or eliminates one species in a food chain can seriously compromise the well-being of the other species. Not only are the higher consumers in the chain left with too little food, but the plants and animals lower on the chain have an opportunity to overbreed if the affected species is one of their chief predators.

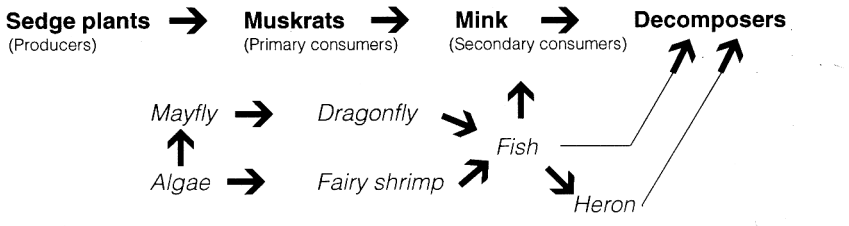

Figure 1.
An example of a wetland food web.

Long-term changes in climate and alterations to the physical environment can seriously unbalance or destroy an ecosystem. In many prairie areas, agricultural drainage systems have had a deleterious effect on the numerous small marshes that dot the landscape. The drainage of wetlands has caused numerous waterfowl and shorebird habitats to dry up and disappear. Important ground water supplies have dwindled in the absence of these natural freshwater traps. In an attempt to restore marshland areas, organizations such as Ducks Unlimited have promoted the restoration of these marshy areas over the past few decades. They also encourage farmers to leave wetland areas on their properties for wildlife.

Alberta is rich in a variety of wetland ecosystems. The following is a small sampling of the many in our province.

- *Slack Slough*, just south of Red Deer, is an extensive bulrush marsh easily accessible off Highway 2.
- *Clifford E. Lee Nature Sanctuary*, west of Edmonton, and the *Inglewood Bird Sanctuary* in Calgary offer well established interpretive trails through marsh habitat.
- The wetlands along *Vermilion Lakes* just outside the Banff townsite are highly accessible and extremely scenic. For easy viewing, visit Marsh Trail at the Cave and Basin Hot Springs or the self-guided Fenland Nature Trail along Forty Mile Creek.
- *Frank Lake* near High River is a massive wetland area containing an interpretive area and trails.
- Finally, worthy of note, but more difficult to get to, is *Wood Buffalo National Park* in northern Alberta. The enormous wetlands area along the eastern edge of this park is the largest inland freshwater delta in the world.

Elementary Science Program of Studies

General and Specific Learner Expectations

The following general and specific learner expectations have been taken directly from the 1996 Elementary Science Program of Studies. The specific learner expectations (SLEs) are referred to by number in the second column of the activities table.

General Learner Expectation

Students will be able to:

Describe the living and non-living components of a wetland ecosystem and the interactions within and among them.

Specific Learner Expectations

Students will be able to:

1. Recognize and describe one or more examples of wetland ecosystems found in the local area; e.g., a pond, slough, marsh, bog or fen.
2. Understand that a wetland ecosystem involves interactions between living and non-living things, both in and around the water.
3. Identify some plants and animals found in a wetland site, both in and around the water; and describe the life cycle of these plants and animals.
4. Identify and describe adaptations that make certain plants and animals suited for life in a wetland.
5. Understand and appreciate that all animals and plants, not just the large ones, have an important role in a wetland community.
6. Identify the roles of different organisms in the food web of a pond:
   - producers—green plants that make their own food using sunlight;
   - consumers—animals that eat living plants and/or animals; and
   - decomposers—organisms such as moulds, fungi, insects and worms that reuse and recycle materials that were formerly living.
7. Draw diagrams of food chains and food webs, and interpret such diagrams.
8. Recognize that some aquatic animals use oxygen from air and others from water, and identify examples and adaptations of each.
9. Identify human actions that can threaten the abundance or survival of living things in wetland ecosystems: for example, adding pollutants, changing the flow of water, trapping or hunting pond wildlife.
10. Identify individual and group actions taken to preserve and enhance wetland habitats.
11. Recognize that changes in part of an environment have effects on the whole environment.

Cross-curricular Connections

Language Learning

- Debate over a wetland that is to be drained to build a hospital.
- *Explorations in Science, Explore!* student book, Levels 5 and 6.
- *Innovations in Science, Process and Inquiry* student book, Levels 5 and 6.

Social Studies

- Canada has an incredible abundance of wetlands. In a report, describe how these have enriched our country in the past and the role they may play in our future. Consider economics, ecological diversity and other criteria you feel are pertinent.

Art

- Create murals, origami, plant and animal models.
- Sketch organisms seen in your classroom wetland or on your field trip.

Drama

- Write, rehearse and perform TV commercials and interviews.
- Create a tableau performance of a wetland destruction from the perspective of different things living there.

Children's Alternative Frameworks

Children often operate under the assumption that if you cannot see anything moving in the water, there must be nothing there. Generally, students think that small organisms are insignificant and any harm done to them is inconsequential. Studying a rich habitat such as a wetland will open their eyes to the importance of all living things, especially those that are very small.

Activities

Classroom teachers have identified the following activities that may be done to address the Specific Learner Expectations (SLEs) in the Program of Studies. The list is not prescriptive and teachers may select activities that are most appropriate for their students.

Activities have been listed under two headings: Key Activities and Extension Activities. Key activities are supported by authorized resources and identify "powerful and practical" means for achieving learner expectations. Extension activities represent alternative ways of achieving or supporting learner expectations.

Key Activities

Key Activity	SLE	Print Resources	Essential Materials	Comments
Observing pond pictures and listing all of the things found in and around ponds	2		paper, pencil	This preliminary activity should receive limited instruction. Allow students to describe and show diagrams of what they already know about ponds.
Building a model wetland in the classroom	1, 2, 3, 4, 5, 6, 7	*Innovations in Science, Level 5, Ponds and Polliwogs (Making a Pond)*, p. 8 *Innovations in Science, Level 6, Earth Team (Just Add Water)*, p. 20	aquarium (large container), dip nets, kitchen strainers (sieve), plastic bottles, margarine tubs, buckets, soil from a garden supply store, pond plants and animals, pond water and mud, sand and gravel, reference books, magnifying viewers	A mini-pond in the classroom can provide most of the benefits of a field trip, but in a controlled environment. Specimens should be collected with a generous supply of pond water and kept cool as much as possible. A mesh covering is suggested for the classroom pond.
		Explorations in Science, Level 5, Fishy Business (A Community Tank), p. 30	aquarium and necessary accessories, plants, rocks and decorations, fish food, variety of compatible fish, dip nets	

Key Activity	SLE	Print Resources	Essential Materials	Comments
Visiting local wetlands	1, 2, 3, 4	*The Wonders of Wetlands Teacher's Guide* (Ealey), *A Wetland Visit (A Wetland Visit)*, p. 26	Field trip materials are listed at the beginning of this activity.	Rubber boots and old clothing are necessary for field studies. Stress that children should never go pond dipping without an adult. Safety procedures and field study expectations should be reviewed before visiting the pond. The booklet, *Planning a Successful Field Study*, is available free of charge from Alberta Environment Protection, Kananaskis Country. Great field trip information is provided in the *Wonders of Wetlands* activity. Contact your school board for their field trip policies before planning your trip.
Observing, describing and identifying wetland plants and animals	3, 4, 5, 6, 7	*Innovations in Science, Level 5, Ponds and Polliwogs (Making a Pond)*, p. 8	dip nets, clear jars for observation	Creating a mural will require two class periods.
		Innovations in Science, Level 5, Ponds and Polliwogs (Who Lives Where?), p. 12	class pond or outdoor pond mural, reference books, index cards	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Identifying Wetland Organisms (Organizing Wetland Organisms)*, p. 20	wetland specimens, wetland journals, identification cards, pencils, field guides, modelling clay, reference books about wetlands	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Identifying Wetland Organisms (Wetland Organisms in the Classroom)*, p. 18	wetland specimens, straight pins, specimen trays, small slips of paper, dip nets, identification cards, bug boxes, plastic spoons, Petri dishes, field guides, wetland journals, magnifiers or microscopes, forceps	Do not get the specimens from the wild. Contact a science supply company.

Key Activity	SLE	Print Resources	Essential Materials	Comments
Investigating the importance of wetlands	1	*The Wonders of Wetlands Teacher's Guide* (Ealey), *A Wetland Visit (The Importance of Wetlands)*, p. 31	wetland journals	Students are involved in class discussion and journal writing.
		The Wonders of Wetlands Teacher's Guide (Ealey), *A Wetland Visit (How Do Wetlands Help People?)*, p. 33	three 2-L pop bottles, scissors, pieces of cloth, elastics, wetland journals, water, sand, garden soil, peat moss, measuring cup, clock with second hand	
Investigating interactions between living and non-living things in a wetland	2	*The Wonders of Wetlands Teacher's Guide* (Ealey), *Interactions in the Wetlands (Living and Non-living Things Interact in a Wetland Ecosystem)*, p. 35	wetland specimens, chart paper, wetland journals	
Investigating how aquatic animals obtain oxygen	4, 9	*Explorations in Science, Level 5, Fishy Business (Respiration Rates)*, p. 22	mini aquarium and fish dip nets, aged water, thermometer, stop watches	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Oxygen from Air and Water (The Quest for Oxygen)*, p. 81	wetland specimens, identification cards	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Oxygen from Air and Water (Getting Oxygen from the Air and Water)*, p. 78	wetland journals	
Studying the life cycle of wetland animals	3, 4, 5, 6, 7	*Innovations in Science, Level 5, Ponds and Polliwogs (A Likely Tail)*, p. 19	classroom pond, plants or animals in various life stages	If you are ordering frog eggs or other aquatic life forms for this lesson, specify the date of delivery to the supplier. News reports on the progress of the animals can be given by different students or groups of students at the beginning of every week. NOTE: Do not collect frogs, tadpoles or frog eggs from the environment.
		The Wonders of Wetlands Teacher's Guide (Ealey), *Life Cycles (Observing the Life Cycle of a Frog)*, p. 40	frog eggs, 2-L container, piece of wood, wetland water, vegetable matter for tadpoles, lean meat for frogs, wetland journals	
		Explorations in Science, Level 5, It's a Small World (Raising Brine Shrimp), p. 32	large jars, hand lenses, brine shrimp (available at a pet store), aquarium salt, dry yeast, food colour	

Key Activity	SLE	Print Resources	Essential Materials	Comments
Studying the life cycle of wetland animals (cont'd)		*Explorations in Science, Level 5, Fishy Business (Life Cycles)*, p. 32	community tank, guppies, breeding net, microscope or hand lenses	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Life Cycles (Drawing Life Cycles)*, p. 38	wetland journals, identification cards, specimens, wetlands reference books	Have students write a story in the wetland journals about the life cycle of a wetland organism from beginning to adult.
Observing pond plants and animals to see how they adapted to pond life	3, 4, 9	*Innovations in Science, Level 5, Ponds and Polliwogs (Pond Personalities)*, p. 33	class pond or pond mural, heavy paper or cardboard, scissors, small sticks, masking tape	Challenge students to design an animal with an adaptation that fits an unusual habitat.
		Innovations in Science, Level 5, Ponds and Polliwogs (Pond Plant Adaptations), p. 37	pond and classroom plants, resources on pond plants, soft wire, coloured paper, cellophane, yarn, tissue, leaves and twigs, Plasticine, egg cartons	
		Innovations in Science, Level 5, Ponds and Polliwogs (Staying on Top), p. 29	clear plastic cups, pennies, newspapers or paper towels, water containers, paper clips, transparent tape	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Wetland Adaptations (Identifying Adaptations)*, p. 45	identification cards, wetland journals, pictures of wetland organisms, reference books about wetlands	
		Explorations in Science, Level 5, Fishy Business (Amazing Adaptations), p. 27	sources of information about fish, art materials	
Investigating the interaction between predator and prey by making a wetland food chain	2, 5, 6, 7, 8	*Innovations in Science, Level 5, Ponds and Polliwogs (Who Eats Whom?)*, p. 23	classroom pond, pond mural, index cards cut into 10 cm x 15 cm pieces, reference books	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Food Chains and Webs (Food Chains)*, p. 62	wetland specimens, supplementary books about wetlands, identification cards, wetland journals	

Key Activity	SLE	Print Resources	Essential Materials	Comments
Studying producers, consumers and decomposers by developing a food web	2, 5, 6, 7, 8	*Innovations in Science, Level 6, Earth Team (Makers, Takers and Breakers)*, p. 16	jar, banana, yeast, cheesecloth, reference books on North American animals, plants, and insects, blank index cards, markers, masking tape or pins, ball of string	The activity on the back of the *Wetlands* poster, *The Marsh Web of Life*, is available on an 8½″ x 11″ master and can be photocopied for groups of students to work on together.
		The Wonders of Wetlands Teacher's Guide (Ealey), *Producers, Consumers and Decomposers (Classifying the Organisms of the Wetlands)*, p. 59	wetland journals, wetland organisms, identification cards	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Food Chains and Webs (Food Webs)*, p. 65	wetland specimens, wetland reference books, identification cards, wetland journals	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Food Chains and Webs (Decomposers at Work)*, p. 57	tap water, pencils, tape, thread, clear glass jars, pond water, dead leaves from a wetland plant	
		The Wonders of Wetlands Teacher's Guide (Ealey), *Food Chains and Webs (Food Pyramids)*, p. 67	green bingo chips, two colours of pinnies, wetland journals, large open area, small bag for each person, a clock	
Looking at how changes in part of an ecosystem have effects on the whole ecosystem	6, 7, 10, 12	*The Wonders of Wetlands Teacher's Guide* (Ealey), *Changes in a Wetland Environment (Review of the Roles of Wetland Things)*, p. 75	wetland journals, identification cards	
		The Wonders of Wetlands Teacher's Guide (Ealey), *All Organisms: Great and Small (Identifying the Roles of Animals and Plants)*, p. 72	wetland journals, specimen trays, identification cards, wetland resource books, wetland insects and crustaceans, small aquarium or glass jars, predatory beetle	

Key Activity	SLE	Print Resources	Essential Materials	Comments
Examining environmental actions that could alter a wetland	10, 11, 12	*Innovations in Science, Level 5, Ponds and Polliwogs (Pondering a Pond)*, p. 41	supplies for making a classroom presentation, e.g., paper, pens, paints, props	Locating the Ducks Unlimited pamphlet on Purple Loosestrife would be helpful. This activity will require two, possibly three, class periods to research, prepare and present.
		The Wonders of Wetlands Teacher's Guide (Ealey), *Human Interaction with Wetlands (How Do Humans Affect a Wetland Ecosystem?)*, p. 85	human action cards, identification cards, wetland reference books, wetland journals	Extension: Have students choose the role of a person, e.g., farmer, council member, etc. Have students role-play situations presented by the teacher.

Extension Activities

Extension Activity	SLE	Print Resources	Essential Materials	Comments
Identifying and examining insect habitats	3	*Explorations in Science, Level 5, Six Legs or Eight? (Insect Habitats)*, p. 12	camera, old aquarium or terrarium, nature materials	
Identifying world wetlands		*Wetlands: Webbed Feet Not Required* (Alberta Environmental Protection) *(World Wetlands)*, p. 17	world map, markers, presentation materials	
Identifying various types of wetlands that are found in local areas	1, 2, 3	*The Wonders of Wetlands Teacher's Guide* (Ealey), *A Wetland Visit (What Is a Wetland?)*, p. 14	wetland reference books, pictures of wetlands, wetland journals, student notebooks, pencils	
Investigating how wetlands are formed	11	*The Wonders of Wetlands Teacher's Guide* (Ealey), *A Wetland Visit (How Do Wetlands Form?)*, p. 32	wetland journals	
		Wetlands: Webbed Feet Not Required (Alberta Environmental Protection), Section II: *Wise About Wetlands (How Are Prairie Wetlands Formed?)*, p. 23	pan, ice cubes, sand or other fine materials	

Extension Activity	SLE	Print Resources	Essential Materials	Comments
Exploring the plant and animal life in a drop of water	4, 5, 6, 7	*Explorations in Science, Level 5, It's a Small World (Micro Zoos)*, p. 26	compound microscope, slides or well slides, methyl cellulose, corn syrup, medicine droppers, jars, pond or puddle water, grass seed, microorganism reference books	If students are not familiar with the use of microscopes, teachers may choose to do some of the microscope activities in *It's a Small World* before doing this one.
Making an outdoor pond	2, 3, 5, 10, 11, 12	*Hand-made Habitats: Pond* (Wright), p. 8	margarine tubs, shovels, plastic or rubber pond liner, pond plants and animals	Margarine tubs can make mini-ponds or a full-sized outdoor wetland can be created.
Identifying which wetland animals are insects	3	*Pond Life Discovery Pack* (Alberta Environmental Protection), *Activity Booklet (Insectmania)*, p. 13	magnifying glass, clear jar, styrene foam balls, pipe cleaners, toothpicks	Group animals according to characteristics and compare aquatic insects with those that do not live in or on water.
Exploring and measuring the acidity of a community's water	10, 11, 12	*Innovations in Science, Level 6, Earth Team (Eco-Ills)*, p. 43	containers for collecting rainwater, small plastic tubs, clear glass jars, materials for cabbage juice indicator, eyedroppers, stir sticks, 5-mL measuring spoons	After doing the activity, students can research and discuss effects of acid rain on wetlands.
Identify and evaluate possible actions to preserve or enhance a wetland	10, 11	*The Wonders of Wetlands Teacher's Guide* (Ealey), *Human Interaction with Wetlands (Putting Our Knowledge into Action)*, p. 86	newspapers, magazines, resource books on wetlands, wetland journals	
		Innovations in Science, Level 6, Earth Team (Eco-Protectors), p. 50	chart paper	The model can be used for identifying, researching and developing an action plan for environmental issues related to wetlands.
Creating an oil spill to investigate the effect of it on a wetland ecosystem	10	*The Wonders of Wetlands Teacher's Guide* (Ealey), *Human Interaction with Wetlands (Oil and Detergent in Wetlands)*, p. 84	clear bowl, cooking oil, water, spoon, dish washing detergent	
Looking at the five habitat zones of a wetland	2, 3, 4	*The Wonders of Wetlands Teacher's Guide* (Ealey), *Introduction to Wetlands (Habitat Zones of Wetlands)*, p. 16	wetland journals, pictures of wetlands	

Assessment

For a broader discussion of science classroom assessment techniques see *Assessing Student Learning* in the introduction of this publication on p. 15. Good places to begin looking for the unit-related ideas are *Explorations in Science* assessment handbooks, *Innovations in Science* teaching notes, Unit tests and Portfolio ideas, Alberta Education sample tests at **www.education.gov.ab.ca** and Alberta Assessment Consortium at **www.aac.ab.ca**

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