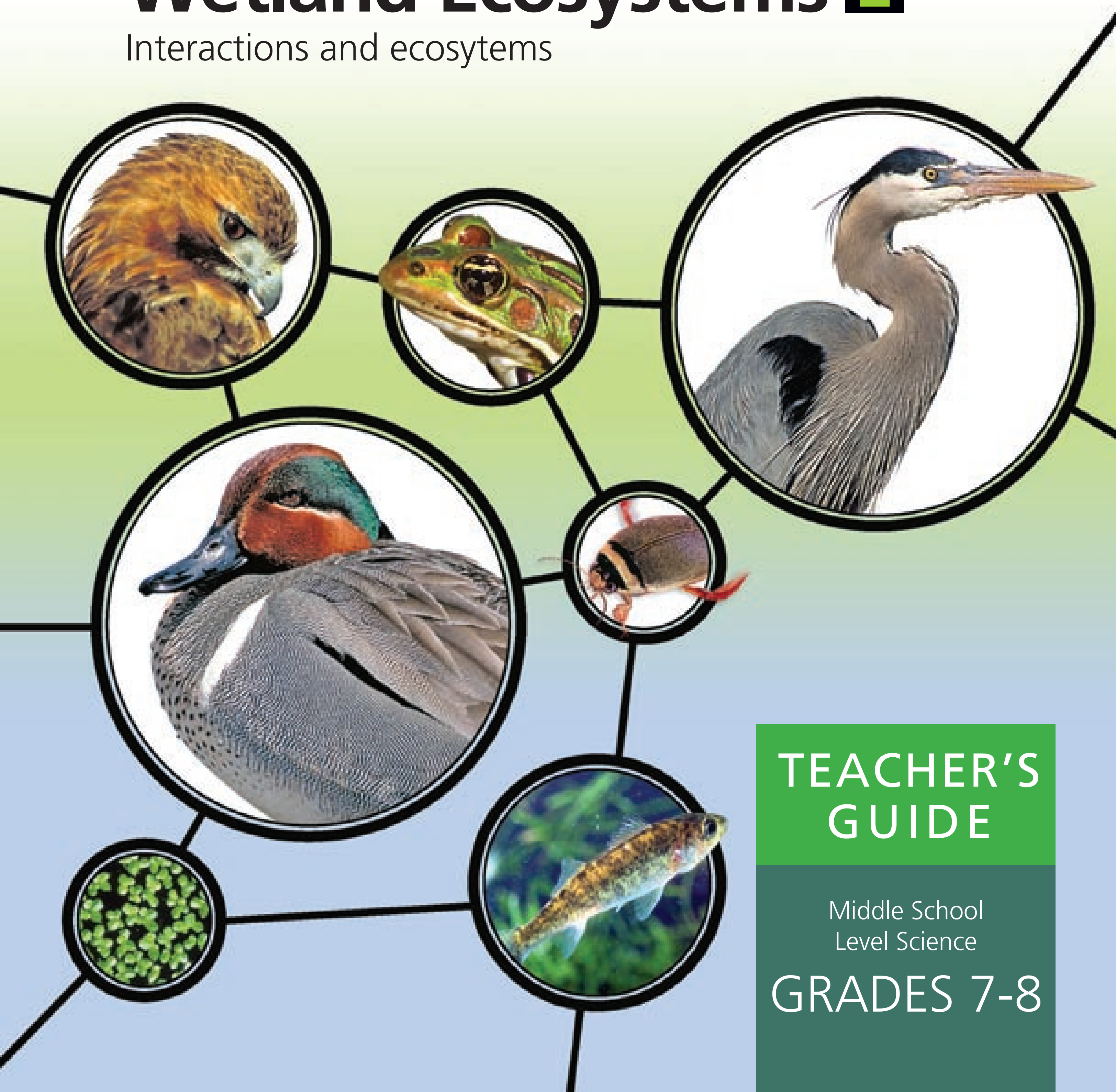
A DUCKS UNLIMITED WETLANDS EDUCATION PROGRAM

PROJECT Webfoot™

Wetland Ecosystems 2

Interactions and ecosytems



TEACHER'S GUIDE

Middle School
Level Science

GRADES 7-8

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info ZONE

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Introduction

In this unit, wetlands found close to most communities across North America are used to demonstrate a wide variety of ecological concepts. Through the activities and lessons provided, students can develop the foundation for literacy in the life sciences. You can help students enhance their understanding of the environmental, technological and social aspects of science and encourage them to work together to solve problems. At Ducks Unlimited, it is our hope that students in the middle school level (grades seven and eight) will develop an appreciation for science and a sense of wonder about wetlands.

This unit combines a field trip to a wetland ecosystem with a variety of classroom activities. The field trip can be undertaken at any point in the unit but timing will depend most on season, weather conditions and opportunity. If a field trip is not possible, the classroom lessons and some of the activities may be used in a stand-alone format.

Lesson one

The environmental puzzle and abiotic factors

Curriculum alignment

l. Environments can be described partly in terms of abiotic conditions.
Students will be expected to:

- identify, observe and measure abiotic factors in environments (e.g. temperature, moisture, available light).
- classify and describe an environment in terms of the abiotic factors that characterize it.

Materials

Per group: one piece of chart paper with the name of an ecosystem printed in the middle (see diagram 1.1), four felt pens (red, green, blue, black), pictures or diagrams of various types of ecosystems, student journal.

Activity description

1. Provide each group of four to six students with chart paper with the name of an ecosystem (e g. rain forest, prairie, estuary, boreal forest, tundra, etc.) printed in the middle of the page, felt pens and a picture or pictures of the specific ecoysystem (do not include a wetland ecosystem). Demonstrate on the board the development of idea sharing as a strategy to brainstorm and record ideas and information. Ensure that students understand that they are to choose an ecosystem that they are familiar with and identify as many components of the ecoystem as possible. Have them write the words for each component with the black pen around the outside of the chart (see diagram 1.1)

2. Have students continue to fill in their ideas by going around the table suggesting, then explaining, their ideas (e.g. where the idea should be located on the chart and why). If a student is unable to think of an appropriate response they may pass to the next student. If all students pass, the round table session is complete.

3. When all groups have completed the task (or five minutes have elapsed), have the groups neatly circle the abiotic (nonliving) components of the environment with a blue pen.

4. Once the abiotic components have been circled, have students circle the plants with a green pen and the animal life with a red pen.

5. Students should identify relationships in the ecosystem by joining components with lines. In particular they should focus on the interrelationships of the abiotic factors existing in the identified ecoystem.

6. Have students post and explain their charts to the rest of the class.

ECOSYSTEM CHART EXAMPLE
JUNGLE

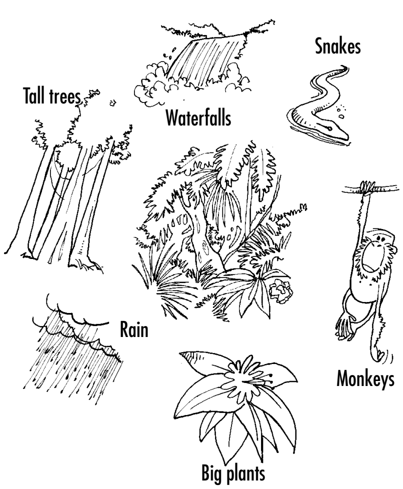
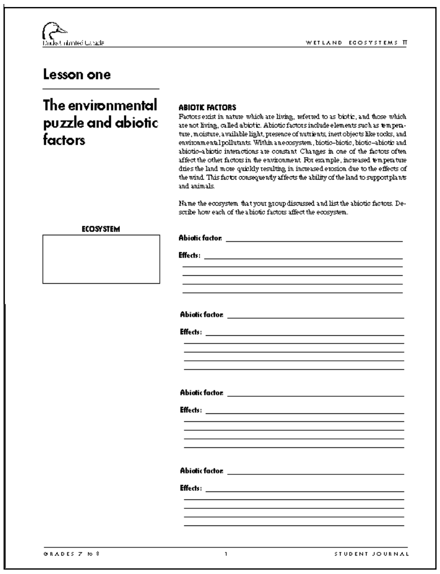


DIAGRAM 1.1

Lesson one continued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Lesson one

The environmental puzzle and abiotic factors

ABIOTIC FACTORS
Factors exist in nature which are living, referred to as biotic, and those which are not living, called abiotic. Abiotic factors include elements such as temperature, moisture, available light, presence of nutrients, inert objects like rocks, and environmental pollutants. Within an ecosystem, biotic–biotic, biotic–abiotic and abiotic–abiotic interactions are constant. Changes in one of the factors often affect the other factors in the environment. For example, increased temperature dries the land more quickly resulting in increased erosion due to the effects of the wind. This factor consequently affects the ability of the land to support plants and animals.

Name the ecosystem that your group discussed and list the abiotic factors. Describe how each of the abiotic factors affect the ecosystem.

ECOSYSTEM

Abiotic factor: ______
Effects: ______

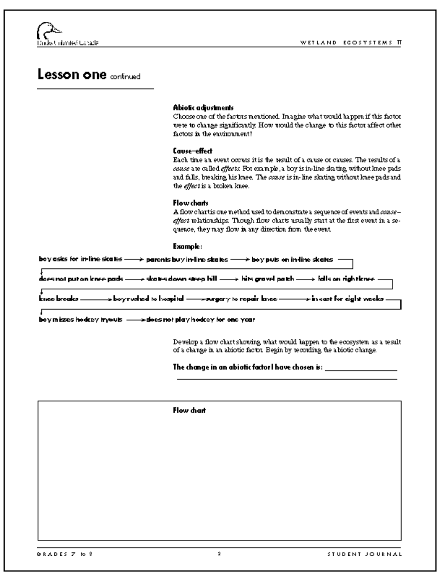
Abiotic factor: ______
Effects: ______

Abiotic factor: ______
Effects: ______

Abiotic factor: ______
Effects: ______

GRADES 7 to 8 1 STUDENT JOURNAL

STUDENT JOURNAL PAGE ONE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Lesson one continued

Abiotic adjustments
Choose one of the factors mentioned. Imagine what would happen if this factor were to change significantly. How would the change to this factor affect other factors in the environment?

Cause–effect
Each time an event occurs it is the result of a cause or causes. The results of a *cause* are called *effects*. For example, a boy is in-line skating without knee pads and falls, breaking his knee. The *cause* is in-line skating without knee pads and the *effect* is a broken knee.

Flow charts
A flow chart is one method used to demonstrate a sequence of events and *cause–effect* relationships. Though flow charts usually start at the first event in a sequence, they may flow in any direction from the event.

Example:
boy asks for in-line skates → parents buy in-line skates → boy puts on in-line skates → does not put on knee pads → skates down steep hill → hits gravel patch → falls on right knee → knee breaks → boy rushed to hospital → surgery to repair knee → in cast for eight weeks → boy misses hockey tryouts → does not play hockey for one year

Develop a flow chart showing what would happen to the ecosystem as a result of a change in an abiotic factor. Begin by recording the abiotic change.

The change in an abiotic factor I have chosen is: ______

Flow chart

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STUDENT JOURNAL PAGE TWO

Assignment

1. Have students record and explain on page one of their journal the function (effects) of each abiotic factor in the ecoystem assigned.

2. Have students choose one abiotic change to the ecosystem and develop a flow chart (page two of the journal) of the cause–effect relationships involved between it and other biotic and abiotic factors in the environment (e.g. when the water evaporates in a wetland the minerals become more concentrated).

3. Have students make one drawing of the ecosystem (or describe it) before the abiotic factor change and one after the change (page three of the student journal).

4. Students are to complete the questions on page four of their journal for homework.

Supplementary activity

- identify, observe and measure abiotic factors in environments (e.g, temperature and available light)

Materials

Per group: one thermometer, a 1 cm x 6 cm multicolour (red, blue, green, black) plastic strip (make your own with waterproof marker pens and a piece of clear plastic), three to four sheets of black construction paper, three two-litre clear plastic pop bottles (enlarge the opening by cutting off the top), string, six tablespoons of black tempera powder, a small weight (e.g. a metal washer), a small desk lamp or sunny window location (heat source).

Activity description

1. Have students work in groups of four.

2. Students will set up three micro-environments and measure the difference in abiotic factors (temperature and turbidity).

3. Discuss with students the methods that could be used to measure these abiotic factors in a natural environment (refer to the field trip activity).

4. Discuss how these abiotic factors can affect plants and animals inhabiting wetland ecosystems.

5. Discuss how human activities might affect these abiotic features in a natural wetland.

6. Discuss how wetlands function to cleanse turbid or polluted water flowing into them overland or through an inlet stream.

Lesson one continued

info ZONE

Water flow through wetlands is slow. Particulate material suspended in the water column (e.g. eroded soil) will settle to the bottom of a wetland. Water leaving a wetland through an outlet stream will often be clearer then that entering. Wetland plants such as cattail absorb pollutants in the water, like fertilizers and heavy metals. These plants help to purify polluted water. The carp is a fish species introduced by people to North America from Europe and Asia. It feeds and breeds by rooting up aquatic vegetation on the bottom of wetlands. Carp increase the turbidity of many wetlands and reduce their value as habitat for other plants and animals.

info ZONE

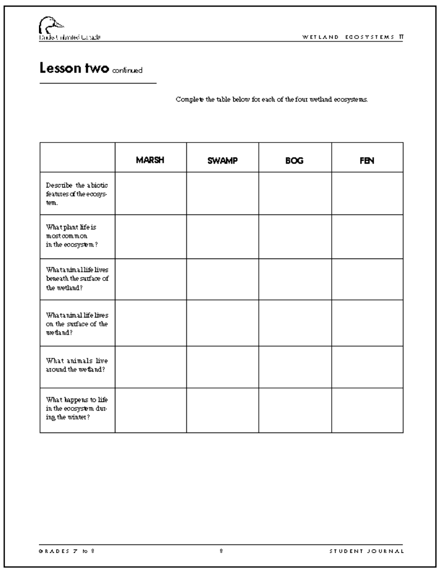
The amount of light available to reflect from an object affects the colours that are reflected from that object. Long wavelengths, such as those found in the red end of the spectrum, are unable to reflect unless there is a great deal of light. As divers descend in water, red colours appear black. As turbidity increases or light penetration is reduced, visibility of objects in water is reduced. Plant life is reduced as turbidity increases because the light energy required for photosynthesis becomes unavailable.

Setting up the micro-environments (provide these instructions to students)

- Fill two of the containers with the same amount of cold tap water and record the temperature of each.
- Into one container stir in 3 tablespoons of black tempera powder and place both of the containers near a light source (lamp or sunny window).
- Record the temperature in each container every 15 minutes and graph the results.
- Note any differences that occur over time and discuss the reasons.
- Fill the third container with tap water.
- Poke two pencil-sized holes through a sheet of black construction paper about 15 cm apart. Wrap the paper around the container and tape it in place. Cover the remainder of the container with black paper.
- Attach (tie or tape) the weight (washer) to one end of the colour strip. Tie the string to the other end of the colour strip and hang the weighted strip in the container.
- Tape black paper over the top of the container.
- Look at the colour strip through one of the holes in the black paper. What colours are visible on the colour strip?
- Cover one of the holes in the black paper and again observe the colour strip through the other hole. What colours are now visible?
- Repeat the experiment after adding one, two and then three tablespoons of black tempera powder stirred into the container.

Lesson two

Habitats and wetland types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Lesson two continued

Complete the table below for each of the four wetland ecosystems.

	MARSH	SWAMP	BOG	FEN
Describe the abiotic features of the ecosystem.				
What plant life is most common in the ecosystem?				
What animal life lives beneath the surface of the wetland?				
What animal life lives on the surface of the wetland?				
What animals live around the wetland?				
What happens to life in the ecosystem during the winter?				

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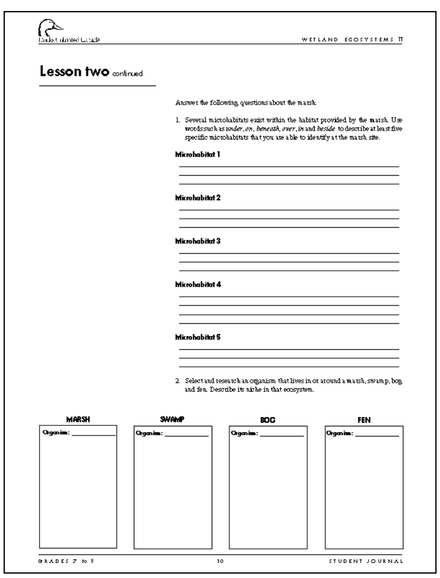
STUDENT JOURNAL PAGE EIGHT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Lesson two continued

Answer the following questions about the marsh.

1. Several microhabitats exist within the habitat provided by the marsh. Use words such as *under*, *on*, *beneath*, *over*, *in* and *beside* to describe at least five specific microhabitats that you are able to identify at the marsh site.

Microhabitat 1

Microhabitat 2

Microhabitat 3

Microhabitat 4

Microhabitat 5

2. Select and research an organism that lives in or around a marsh, swamp, bog and fen. Describe its niche in that ecosystem.

MARSH	SWAMP	BOG	FEN
Organism:	Organism:	Organism:	Organism:

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STUDENT JOURNAL PAGE 10

Curriculum Alignment

Within environments, specialized forms of life can often be found. The environmental needs of these living things can be inferred from their distribution and from their life habits.

Students will be expected to:

- become familiar with the types of wetlands and the characteristic plant and animal species that live in those habitats.
- identify and describe habitats and microhabitats.
- identify niches within an environment.

Activity description

1. Introduce the term *marsh ecosystem* by writing it on the board or overhead. Ask students to brainstorm what they would likely see in a marsh ecosystem. Copy their ideas on the board. Stimulate ideas by asking questions such as:
- What would the ecosystems look like?
- What would be the most important feature of your **marsh ecosystem**?
- What might a marsh smell like?
- What kinds of living things might you find in a marsh?
- Where can marsh ecosystems be found?

When 20 or more ideas have been generated and recorded, ask students:

- What features would be different in other types of wetlands, including swamps, bogs and fens?

2. Have students read the descriptions of the four wetland ecosystems on pages five to seven of the student journal and complete the chart on page eight.

3. When students have completed the chart, have them turn to page nine of their journal and use the two representative diagrams of a pond (aerial view and cross-sectional view) and the short descriptions of the terms *habitat*, *microhabitat* and *niche* to answer the accompanying questions on page 10.

4. Discuss answers to the questions. Be sure students understand that habitat and microhabitat refer to environmental conditions existing in a location, while niche refers to the place an organism fits in the hierarchy of organisms living within a specific habitat or microhabitat.

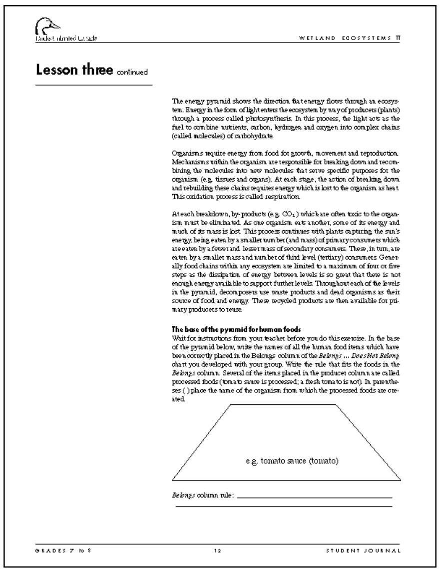
5. Have students choose one microhabitat within a marsh and produce a drawing and/or narrative describing it. Students should understand that they will be evaluated on their ability to accurately include the biotic and abiotic components of the microhabitat and the biotic-biotic and biotic-abiotic relationships existing within the microhabitat.

6. Have students choose four different organisms that live in or around each of the four wetland ecosystems (marsh, swamp, bog and fen) and describe it's niche on page 10 of the student journal.

Lesson three

Energy pyramid

Note:
This is a complex lesson that can be spread over four or five classes.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Lesson three continued

The energy pyramid shows the direction that energy flows through an ecosystem. Energy in the form of light enters the ecosystem by way of producers (plants) through a process called photosynthesis. In this process, the light acts as the fuel to combine nutrients, carbon, hydrogen and oxygen into complex chains (called molecules) of carbohydrate.

Organisms require energy from food for growth, movement and reproduction. Mechanisms within the organism are responsible for breaking down and recombining the molecules into new molecules that serve specific purposes for the organism (e.g. tissues and organs). At each stage, the action of breaking down and rebuilding these chains requires energy which is lost to the organism as heat. This oxidation process is called respiration.

At each breakdown, by-products (e.g. CO_2) which are often toxic to the organism must be eliminated. As one organism eats another, some of its energy and much of its mass is lost. This process continues with plants capturing the sun's energy, being eaten by a smaller number (and mass) of primary consumers which are eaten by a fewer and lesser mass of secondary consumers. These, in turn, are eaten by a smaller mass and number of third level (tertiary) consumers. Generally food chains within any ecosystem are limited to a maximum of four or five steps as the dissipation of energy between levels is so great that there is not enough energy available to support further levels. Throughout each of the levels in the pyramid, decomposers use waste products and dead organisms as their source of food and energy. These recycled products are then available for primary producers to reuse.

The base of the pyramid for human foods
Wait for instructions from your teacher before you do this exercise. In the base of the pyramid below, write the names of all the human food items which have been correctly placed in the Belongs column of the *Belongs ... Does Not Belong* chart you developed with your group. Write the rule that fits the foods in the *Belongs* column. Several of the items placed in the producer column are called processed foods (tomato sauce is processed; a fresh tomato is not). In parentheses ( ) place the name of the organism from which the processed foods are created.

Belongs column rule: ____________

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STUDENT JOURNAL PAGE 12

info ZONE

Energy may be converted into matter (as occurs with plants) and matter is often converted into energy (food is converted into movement and body heat). Though energy may be lost to a particular ecosystem through heat, light or motion, it is not destroyed. Rather it is dissipated throughout several environments. The flow of energy through an ecosystem is one directional from the sun to the plants, through consumers and finally ending in the decomposers. Each trophic (living) level dissipates some energy back into the abiotic environment until the originally absorbed energy is no longer present within living members of the environment.

Curriculum alignment

The interdependence of living things is evident in the interactions of organisms with each other and with their environments.
Students will be expected to:

- classify animals within an ecosystem as producers, consumers and decomposers/scavengers
- recognize food chain relationships within an ecosystem
- identify energy flows and trophic levels within an ecosystem

Materials

Chart paper, three coloured felt pens (red, green, black), student journal

Activity description

1. Have students form groups to brainstorm and record the foods they eat on chart paper. For items that are a combination of foods, students should list as many of the foods that make up the food as possible (e.g. pepperoni pizza is made up of pizza crust, cheese, tomato sauce and pepperoni). Allow them no more than five minutes to complete and post their charts. As students generate their charts you should generate a chart of your own listing items such as mushrooms and yogurt (i.e. bacteria and fungi as members of decomposers) as well as items such as hamburger, bread, apples, cheese, etc.

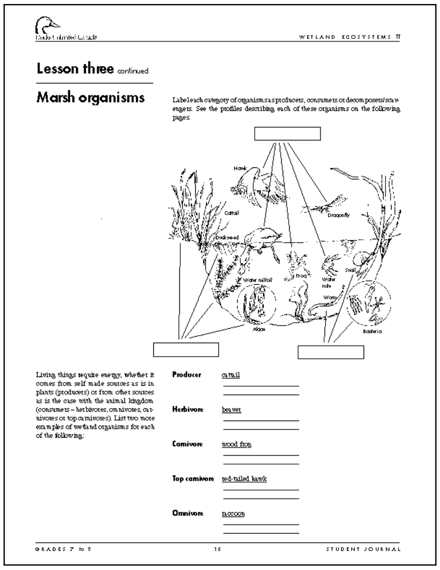
Choose one or more of the following approaches:

1. With students remaining in groups, make a T-chart on the blackboard or overhead. Place the title *belongs* as a heading on the left side of the chart and *does not belong* on the right side of the chart. Without giving students the criterion for placement of listed items from their charts, write a food from a consumer (e.g. hamburger) on the right side of the chart under the *does not belong* heading and a food from a producer such as bread under the *belongs* column. Explain to students that you are using a rule to determine the things that go in each column and that for them to demonstrate their knowledge of the rule they are to select two foods from the charts they have generated that belong in the *belongs* column. As students suggest items, place them in the appropriate column saying either “Yes that item belongs” or “That item does not belong”. Students who recognize the criterion (things which produce food) early can turn to page 12 of their journal and write the rule for inclusion in the *belongs* column, then list foods from the charts that would be correctly placed in the producers zone. Continue until a majority of students have correctly identified at least one item for the *belongs* column.

2. Refer the students to pages 11 and 12 in their journal to read and discuss the terms producer, consumer and decomposer. Have them use the coloured markers (green for producer, red for consumer and black for decomposer) to print the letters P, C or D beside each of the foods on the generated list.

3. Once students have labelled the foods have them enter their group choices in the correct boxes in the *belongs/does not belong* chart and, on a separate piece of paper, complete the pyramid on page 12 of their journal.

Lesson three continued



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Lesson three continued

Marsh organisms

Label each category of organisms as producers, consumers or decomposers/scavengers. See the profiles describing each of these organisms on the following pages.

Living things require energy, whether it comes from self made sources as is in plants (producers) or from other sources as is the case with the animal kingdom (consumers – herbivores, omnivores, carnivores or top carnivores). List two more examples of wetland organisms for each of the following:

Producer cattail

Herbivore beaver

Carnivore wood frog

Top carnivore red-tailed hawk

Omnivore raccoon

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4. Have students look at the diagram of organisms living in a marsh (page 15) and correctly label the organisms under the headings of producer, consumer or decomposer (refer to the profiles provided on pages 16 to 18 of their journal.

5. Have students read *A Day in the Life of the Frog* on pages 19 to 21 of the student journal.

6. Have students complete the questions on page 22 of the student journal and discuss the answers.

Supplementary activity

1. Ask students if there is any machine or living thing that they can think of that requires only one input of energy in order to function permanently. Students may mention living things that take only one meal and die such as adult female mosquitoes. These organisms can be explained by referring to the life cycle of the organism and informing students that earlier stages in the life cycle continually feed.

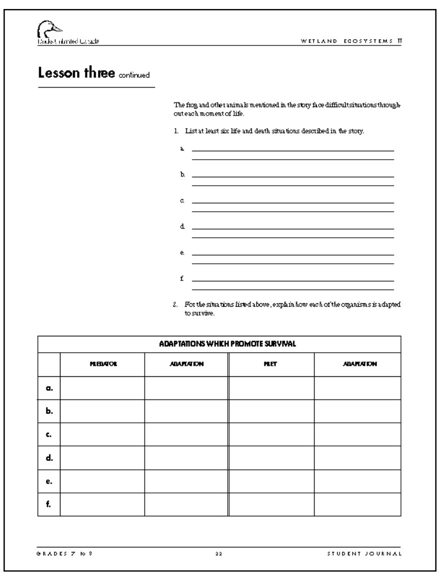
2. Ask what happens to the fuel or food (it's used up as energy for growth or movement). Inform students that the term given to fuels or foods is *energy*.

3. Have students form groups to discuss the following statement:

   Energy is neither created nor destroyed within an ecosystem.

   Their discussion should lead them to decide whether they agree or disagree with the statement. Ask them for examples and reasons for their decision.

4. Have students identify and complete the energy pyramid problems on page 13 and 14 of the student journal. This activity focuses attention on the dissipation of energy from ecosystems as well as sampling techniques to measure this.



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Lesson three continued

The frog and other animals mentioned in the story face difficult situations throughout each moment of life.

1. List at least six life and death situations described in the story.

a.

b.

c.

d.

e.

f.

2. For the situations listed above, explain how each of the organisms is adapted to survive.

ADAPTATIONS WHICH PROMOTE SURVIVAL				
	PREDATOR	ADAPTATION	PREY	ADAPTATION
a.				
b.				
c.				
d.				
e.				
f.				

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STUDENT JOURNAL PAGE 22

Lesson three continued

info ZONE

Populations of living things, particularly those of species closely related by availability of food or by common consumers above them in the food chain, are determined by competition. Two closely related amphipod species such as *Hyallela azteca* and *Gammarus linaeus* are seldom found in close association or are present in significantly differing populations. Mouth part differences (adaptations) appear to be the significant limiting factor in the population numbers of the two species and the factor that reduces competition between them.

Possible solutions to energy flow problems on pages 13 and 14 of the student journal

Have the group discuss the problems which may have the following or other solutions.

Problem one

a) The data collected has been mixed up. Re-check with the collectors of information to verify.

b) Sources of food for the consumer levels exist outside the sampling area. Determine the kind of consumers in the ecosystem and the exact time (date and time) of sampling.

c) The producer level has suffered a collapse and the other levels of consumers have not yet responded. Re-sample the location to determine if additional samplings will result in the same findings.

Problem two

a) Organisms in the marsh are extremely mobile and the top consumer was in a different location at the time of sampling. Re-sample the pond in several locations and/or use different sampling techniques.

b) Though large numbers of producers exist, there is not enough energy in the wetland to support top consumers.

c) Organisms in the wetland appear in cycles. Top consumers were absent during this cycle. Re-sample the wetland.

Lesson four

Adaptations for food gathering

info ZONE

Setup for activity two

Gather and set up the following materials in different locations throughout the room.

1. Place several grapes in a narrow mouthed jar (such as a ketchup container).
2. Place several hard nuts (walnuts, hazelnuts, etc.) on a flat plate.
3. Mix several dried peas or beans into a litre of sand and place the material in a wide-mouthed bowl.
4. Cook spaghetti noodles and place them in a bowl with enough water to keep them moist.
5. Steam a portion of rice and place it in a soup bowl.
6. Place several carrots with stems attached (or other vegetable with stems and leaves attached) on a table or desk top.
7. Place 10 marbles in the bottom of a 500 ml plastic container.
8. Place 3 to 5 small dense rubber balls (squash ball sized) in a large mayonnaise container.

Curriculum alignment

The interdependence and adaptations of living things is evident in the interactions of organisms with each other and with their environments.

Students will be expected to:

- interpret distribution patterns of living things within their environments (e.g. interpret relationship to food sources and to means of avoiding predators).
- interpret plant and animal behaviours that indicate dependencies for food or for other needs.
- recognize specializations that are appropriate to organisms in particular habitats (e.g. specialized mouth parts, surface coverings).
- predict the effect of minor changes in characteristics of an animal or plant on its ability to survive in a given environment (e.g. changes in surface covering, colouration, relative size, shape of appendages).

Materials

Kitchen strainers, nut crackers, chopsticks, drinking straws, needlenose pliers, long-handled wooden spoons, bamboo skewers, forks, plastic pop bottles, ketchup bottle, wide mouth jar (e.g. mayonnaise jar), steamed rice, walnuts or hazelnuts (shells on), plastic soup bowl, cooked spaghetti noodles, fresh carrots (or other vegetables with stem and leaves attached), six paper bowls, dried beans or peas, sand, grapes, small dense rubber balls (e.g. squash balls), student journal (pages 23 to 25). Note: you will need enough of each type of utensil for each member of a team. Alternatively, team members can share equipment.

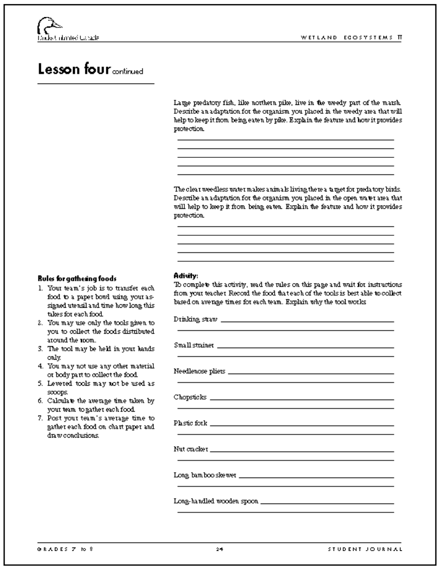
Activity one

- Have students consider the two imaginary animals on page 23 of the student journal. Which of the animals would be best suited to catching tiny microscopic bugs? Which would be best at hiding in a weedy location? Which would be best at catching worms? Which would be best at hiding on a pebbled substrate? Have students select and explain why they have made their selections. Students should add a feature to each of the imaginary organisms that would enable one of them to escape from a large fish and the other to escape from a bird (see page 24 of student journal).

Activity two

- Have students form groups of three to four, giving each of them a selection of foods that they have to access (see Info Zone above). Each group is given one of the following tools for gathering food: drinking straws, small strainers, needlenose pliers, chopsticks, plastic forks with the middle tines removed (outside tines only), nut cracker, long bamboo skewers (for shish kebabs) and a long-handled wooden spoon.

Lesson four continued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Lesson four continued

Large predatory fish, like northern pike, live in the weedy part of the marsh. Describe an adaptation for the organism you placed in the weedy area that will help to keep it from being eaten by pike. Explain the feature and how it provides protection.

The clear weedless water makes animals living there a target for predatory birds. Describe an adaptation for the organism you placed in the open water area that will help to keep it from being eaten. Explain the feature and how it provides protection.

Rules for gathering foods
1. Your team's job is to transfer each food to a paper bowl using your assigned utensil and time how long this takes for each food.
2. You may use only the tools given to you to collect the foods distributed around the room.
3. The tool may be held in your hands only.
4. You may not use any other material or body part to collect the food.
5. Levered tools may not be used as scoops.
6. Calculate the average time taken by your team to gather each food.
7. Post your team's average time to gather each food on chart paper and draw conclusions.

Activity:
To complete this activity, read the rules on this page and wait for instructions from your teacher. Record the food that each of the tools is best able to collect based on average times for each team. Explain why the tool works.

Drinking straw

Small strainer

Needlenose pliers

Chopsticks

Plastic fork

Nut cracker

Long bamboo skewer

Long-handled wooden spoon

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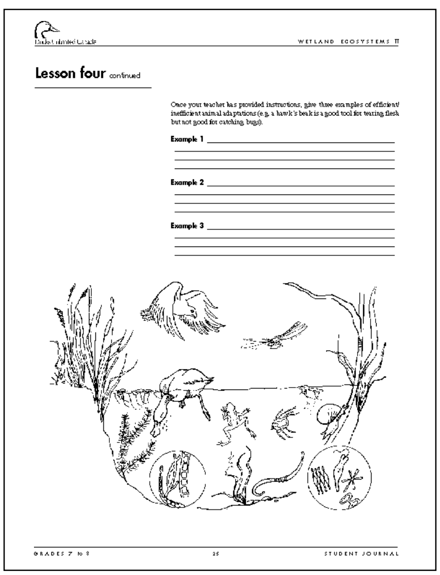
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Lesson four continued

Once your teacher has provided instructions, give three examples of efficient/inefficient animal adaptations (e.g. a hawk's beak is a good tool for tearing flesh but not good for catching bugs).

Example 1

Example 2

Example 3

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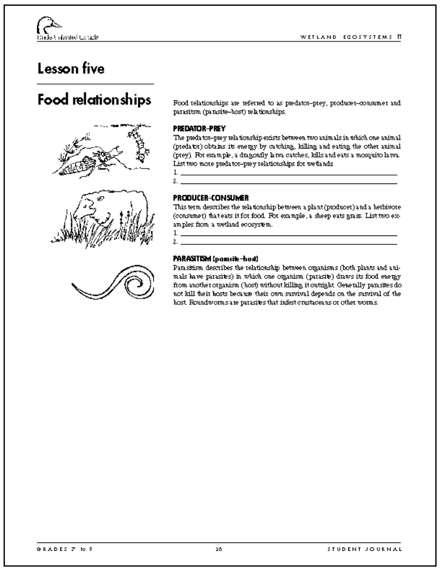
STUDENT JOURNAL PAGE 25

- Explain to students that the materials set out around the classroom are *foods* and that they are to travel around the room in teams attempting to move the *foods* until they find one of them which they can transfer most efficiently into a paper bowl. Students should time, in seconds, how long it takes for them to transfer each of the materials (three items or scoops per student). The guidelines for getting the *foods* appear on page 24 of the student journal.

- When all students have completed the activity have them explain how their particular equipment was suited to getting some of the foods and inefficient for getting others. Ask them if they can think of examples in nature that demonstrate this principle. The following format should be used:
  A hawk's beak is a good tool for tearing flesh but not good for catching bugs.
  Comparisons should be completed on page 25 of the student journal.

Lesson five

Food relationships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Lesson five

Food relationships

Food relationships are referred to as predator–prey, producer–consumer and parasitism (parasite–host) relationships.

PREDATOR–PREY

The predator–prey relationship exists between two animals in which one animal (predator) obtains its energy by catching, killing and eating the other animal (prey). For example, a dragonfly larva catches, kills and eats a mosquito larva. List two more predator–prey relationships for wetlands

1. ______

2. ______

PRODUCER–CONSUMER

This term describes the relationship between a plant (producer) and a herbivore (consumer) that eats it for food. For example, a sheep eats grass. List two examples from a wetland ecosystem.

1. ______

2. ______

PARASITISM (parasite–host)

Parasitism describes the relationship between organisms (both plants and animals have parasites) in which one organism (parasite) draws its food energy from another organism (host) without killing it outright. Generally parasites do not kill their hosts because their own survival depends on the survival of the host. Roundworms are parasites that infest crustaceans or other worms.

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STUDENT JOURNAL PAGE 26

***info* ZONE**

Relationships activity

In this activity two students are given twelve squares of paper, four bearing a 0, four a + and four a –. The papers are to be folded and placed in a can, hat or box from which they can be drawn sight unseen. Each player selects a piece of paper and shows the symbol on it. The second player to draw the paper must name the relationship shown by the two cards (see appendix on page 23 of the educator's guide and page 30 in the student journal). If this player is unable to name the relationship the other player may try. Once the relationship is named the first player to draw the paper must name on organism in a relationship shown by the papers. The other player must name the second organism in the relationship. If either is unable to answer, the other may supply the answer. One point is given for each correct answer. Students must verify answers using the wetland relationships reading. At the end of four rounds, the person with the highest score wins.

Curriculum alignment

The interdependence of living things is evident in the interactions of organisms with each other and with their environments.

Students will be expected to:

- recognize examples of parasitism/predation, commensalism, competition, neutralism and mutualism.

Environmental interventions can be found to have both intended and unintended consequences.

Students will be expected to:

- predict consequences of selective addition or removal of living things from an environment

Materials

Student journal, pages 26 to 30, relationships squares (see appendix, page 20).

Activity description

1. Discuss the relationships of hunter to hunted as the most well known form of animal interaction. This relationship is known as the predator-prey relationship. Have students list several predator-prey relationships on page 26 of their student journal.

2. Other relationships exist in the animal and the plant kingdom in which living things do not directly prey upon one another but affect the lives of others. Have students read and complete the assignments on 26 to 29 of the student journal.

3. Introduce the *relationship activity game* to students (see Info Zone). Students should participate in pairs. Allow10 to 15 minutes.

4. When students have completed playing the game, review the terms with them and ask them to consider if there are any relationships that are not necessary or are harmful to the overall ecosystem. Pose the following problem for homework or for classroom discussion if time permits (see page 29 of student journal):

   Select an organism and explain how its removal from the wetland ecosystem would affect other members of the ecosystem.

Lesson six

Factors affecting aquatic plant poplulations

Curriculum alignment

Within environments, specialized forms of life can often be found. The environmental needs of these living things can be inferred from their distribution and from their life habits.

Students will be expected to:

- identify examples of variation in light, soil and temperature needs of organisms.
- predict the effect of changes in environmental conditions on the ability of particular plants and animals to survive in that environment (e.g. changes in temperature or moisture).

Materials

Wetland plants (preferably duckweed or other free floating plants), rooted plants from local ponds or inexpensive plants from tropical fish retailers, six clear baby food jars per team (or other suitable small, clear container), plastic food wrap, sticky labels (2 cm x 2 cm) or masking tape, pond water and/or dechlorinated water, indoor plant fertilizer/s (preferably high in potassium), graduated cylinders or measuring cups, soils (peat, small aquarium gravel, pond soils), fluorescent plant growth lights (if possible), blotting paper, weigh scales.

Activity description

1. Begin the lesson by talking about the differences in environmental conditions that exist in a wetland. If necessary use the following questions for discussion:

- Is the amount of light available to organisms living in and around the wetland equal for all?

- Do all microhabitats within the wetland environment have the same temperatures?

- Is the amount of moisture available to organisms in and around the wetland the same for all organisms?

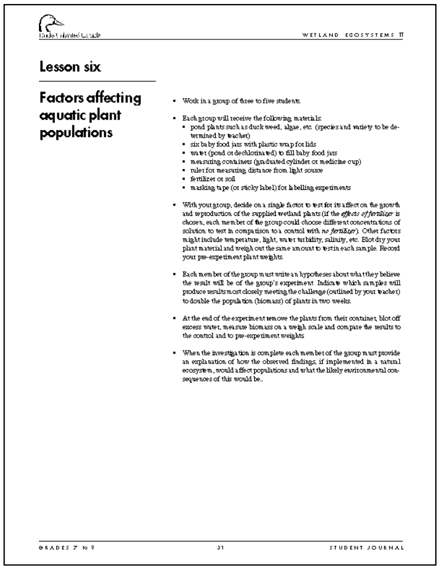
- Do all organisms in and around the wetland have the same dependence on the soil?

The purpose of the activity is to help students focus on how the environment affects adaptations and the survival of organisms.

2. Ask students how plants in the wetland ecosystem affect other living things in that ecosystem.

- What would happen to other organisms if all plants disappeared from the wetland? (It is likely that all other organisms would also disappear from the wetland.)

Lesson six continued


Ducks Unlimited Canada WETLAND ECOSYSTEMS II

Lesson six

Factors affecting aquatic plant populations

- Work in a group of three to five students.
- Each group will receive the following materials:
  - pond plants such as duck weed, algae, etc. (species and variety to be determined by teacher)
  - six baby food jars with plastic wrap for lids
  - water (pond or dechlorinated) to fill baby food jars
  - measuring containers (graduated cylinder or medicine cup)
  - ruler for measuring distance from light source
  - fertilizer or soil
  - masking tape (or sticky label) for labelling experiments
- With your group, decide on a single factor to test for its affect on the growth and reproduction of the supplied wetland plants (if the *effects of fertilizer* is chosen, each member of the group could choose different concentrations of solution to test in comparison to a control with *no fertilizer*). Other factors might include temperature, light, water turbidity, salinity, etc. Blot dry your plant material and weigh out the same amount to test in each sample. Record your pre-experiment plant weights.
- Each member of the group must write an hypotheses about what they believe the result will be of the group's experiment. Indicate which samples will produce results most closely meeting the challenge (outlined by your teacher) to double the population (biomass) of plants in two weeks.
- At the end of the experiment remove the plants from their container, blot off excess water, measure biomass on a weigh scale and compare the results to the control and to pre-experiment weights.
- When the investigation is complete each member of the group must provide an explanation of how the observed findings, if implemented in a natural ecosystem, would affect populations and what the likely environmental consequences of this would be..

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What factors might cause the disappearance of plants from the wetland ecosystem (significant changes in the amount of moisture, additions of toxic elements to the environment, large temperature changes, atmospheric alterations, over-grazing by consumer populations)?

- How might increasing the producer base in an environment affect the number and diversity of species in a wetland ecosystem?

3. Show students the materials they will be using for exploring environmental factors affecting producers in a wetland environment. Provide students with the following challenge and guidelines (see below) for determining optimum conditions for the increase in levels of producers in an aquatic environment.

4. Have students set up their experiments as described on page 31 of their journal.

Challenge

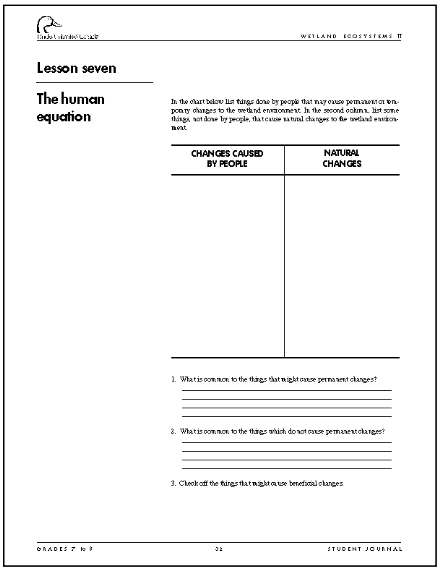
Within two weeks, double the population (biomass) of wetland producers over that of a control.

Guidelines

- Only supplied soil, nutrients, lights, water and plants may be used.
- All experiments must have a control and test only one variable at a time (e.g. the concentration of a specific or named nutrient).
- Each test must be accompanied by an hypothesis (i.e. what is believed and why).
- Each completed investigation must have the observed results of the investigation and an explanation as to what the results would mean (inference) to the populations of the plant tested and to dependent organisms within the wetland.

Lesson seven

The human equation



Ducks Unlimited Canada — WETLAND ECOSYSTEMS II

Lesson seven

The human equation

In the chart below list things done by people that may cause permanent or temporary changes to the wetland environment. In the second column, list some things, not done by people, that cause natural changes to the wetland environment.

CHANGES CAUSED BY PEOPLE	NATURAL CHANGES

1. What is common to the things that might cause permanent changes?
2. What is common to the things which do not cause permanent changes?
3. Check off the things that might cause beneficial changes.

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info ZONE

ADDITIONAL PROJECT FORMULAS

1. Tell a story about what you have learned and what needs to be done, or give a short speech about what needs to be done.
2. Use diagrams to show what will happen in the future for two possible logical outcomes to the problem.
3. Make a drawing or painting using real or abstract images to depict the problem and two possible logical outcomes to the problem.
4. Create a dance, role play or drama depicting one possible outcome for human intervention on the land.
5. Create a melody or rhythm telling the story of the land.
6. Create a dialogue between two sides of the issue. Each side should demonstrate understanding the other side's point of view and both should work toward compromise.
7. Choose one wetland, forest and grassland organism and create a word image of what these organisms see and feel while their enironment changes.

Curriculum alignment

Environmental interventions can have both intended and unintended consequences.

Students will be expected to:

- identify intended purposes and consequences (positive and negative) of human activities in local environments.
- predict consequences of selective addition or removal of living things from an environment.
- predict consequences of the addition of pesticides, herbicides or other pollutants to an environment.
- predict the consequences of forest clearing, wetland drainage, road construction and "sod busting" for crop production.
- describe the mechanisms of food chains/webs and food pyramids on the concentration of pollutants in living things.

Materials

Student journal, pages 32 to 35.

Activity description

1. Introduce the lesson with the questions:

   What things done by people can cause changes to the biotic and abiotic components of a wetland?

   What things occuring naturally can cause changes to the biotic and abiotic components of wetlands?

2. Give students three minutes to generate ideas and write them in their journal on page 32. While students are generating their ideas, make a T-chart on the blackboard or overhead. Place the headings, *changes caused by people* and *natural changes* at the top of the chart. When you are ready, ask students to give you ideas and write them in the correct column of the chart. Ask the students to define which changes might be permanent (P) versus those that might be temporary (T). Check off the changes which are beneficial to the ecoystem.

Have students form groups of four to work on the problem outlined on page 33 of the student journal.

Depending on the amount of time available and the nature of the class, this activity can be as short as one class or assigned as a take-home project to be completed outside of class time. Suggestions for adapting the activity to varying lengths of time are included below. Students will complete the assignments on pages 34 and 35 of their journal. If time permits conduct other assignments outlined in the Info Zone on this page.

Lesson seven continued

Tips for adapting the final project

One to two classes

- Have students form pairs within a larger group of four to six.

- Students take turns first reading then summarizing one paragraph of information at a time (e.g. student one reads a paragraph then explains what it means or is asking. Student two then gives an opinion of the excerpt.) This procedure is repeated for student two and the process continues until the piece is complete.

- Student pairs decide how they will present their ideas and opinions for the solution to the problem. As time is limited it is important that students realize that they must spend most of their time working on problem solving rather than on the presentation approach. By limiting the time for each phase of the activity and strictly adhering to it, it is likely you will have time to finish (10 minutes for problem sharing, five minutes for project selection, 15 minutes for preparation, 10 to 15 minutes for presentation). Times may be doubled for everything except problem sharing if two classes are used.

- When preparation time is up, have pairs present their work to their group (for one day), then select one presentation from their group that will be presented to the whole class (for two days).

Three to six classes

First class

- Each member of the group of four to six should read the problem and provide a written solution as to what should be done about the problem.

- Group members share their ideas with the group. After each group member has shared, other group members provide feedback (on things they agreed with and things that they believe need to be re-thought).

Second class

- Group members meet to decide how the problem should be solved. Students also decide how they will present their ideas. They must choose five of the seven following ways to present their feelings and ideas (see Info Zone on page 13):

a. Factual report/s, speech or story
b. Development and solution of the problem from two or more points of view
c. Use of drawing or painting to depict the outcomes of two or more solutions to the problem
d. Create a drama, role play or creative dance depicting the problem and a solution to it
e. Create a musical composition (rap, ballad, melody or rhythm), record and combine sounds into a musical presentation depicting the problem and at least one solution

Lesson seven continued

f. Create a plan for solving the problem including what must be done, the order that it must be done in, and who will do each of the activities (all students in the class may be included but empathy for individuals is one criterion for success in this activity)
g. Develop a personal inventory of things that you do as an individual that contribute to the problem and changes in life style that would help to alleviate the problem

- Group members begin work on projects

Third (to fifth) class
- Students work on projects. At the beginning of each class remind them that they should focus on the problem and its solution while developing effective products and presentations.

- Toward the end of this phase students exchange pieces and help to edit them by expressing what they like about it and what they think needs to be worked on.

- Group decides on the two projects that they will present to the class.

Fourth (to sixth) class
- Students present projects to the class.

- Other students in the class evaluate how well the presentations have addressed the problem and a solution to it.

Field trip manual

Science Building Foundations

1. Questioning
- recognizing patterns and discrepant events
- identifying and asking relevant questions

2. Proposing Ideas
- hypothesizing relationships among specific living things
- hypothesizing relationships between specific living things and abiotic conditions of their environment
- predicting the effects of given abiotic conditions on the health and distribution of living things in an environment

3. Designing Experiments
- identifying and controlling variables
- developing experimental procedures

4. Gathering Data
- observing living things in their environments
- observing the distribution of living things in environments
- measuring

5. Processing Data
- classifying living things within a study plot (in formal classification only)
- organizing and presenting data

6. Interpreting Data
- inferring evidence of relationships between living things
- inferring the effect of environmental conditions on the distribution of living things in an environment
- developing theoretical explanations

Concepts

l. Environments can be described in terms of **abiotic** conditions.

Students will be expected to:
- identify, observe and measure abiotic factors of wetland environments (e.g. temperature, moisture, available light)
- describe the wetland environment in terms of the abiotic factors that characterize it

2. The interdependence of living things is evident in the interactions of organisms with each other and with their environments.

Students will be expected to:
- interpret **distribution patterns** of living things within their environments (e.g. interpret relationship to food sources and to means of avoiding **predators**)
- interpret plant and animal **behaviours** that indicate dependencies for food or for other needs
- recognize examples of **parasitism**, **commensalism** and **mutualism**
- classify animals within an **ecosystem** as **producers**, **consumers** and **decomposers**
- recognize **food chain/web** relationships within a wetland ecosystem
- identify **energy flows** within the ecosystem

3. Within environments, specialized forms of life can often be found. The environmental needs of these living things can be inferred from their **distribution** and from their **life habits**.

Students will be expected to:
- identify and describe **habitats** and **microhabitats**
- recognize **specializations** that are appropriate to organisms in particular habitats (e.g. specialized mouth parts, surface coverings)
- identify **niches** within an environment
- identify examples of **variation** in light, soil and temperature needs of organisms
- predict the effect of minor changes in characteristics of an animal or plant on its ability to survive in a given environment (e.g. changes in surface covering, colouration, relative size, shape of appendages)
- predict the effect of changes in environmental conditions on the ability of particular plants and animals to survive in that environment (e.g. changes in temperature or moisture)

4. **Human and technological interventions** can have both intended and unintended consequences.

Students will be expected to:
- identify intended purposes and consequences (positive and negative) of human activities and technologies in local environments
- predict consequences of selective addition or removal of living things from an environment

Field trip manual

continued

- predict consequences of the addition of **pesticides**, **herbicides** or other **pollutants** to an environment
- describe the effects of food chains/webs and **food pyramids** on the **concentration of pollutants** in living things

Site

Select a small, shallow wetland close to your community that can be approached and entered safely. Request permission from the owner to use the wetland or seek the advice of an outdoor education facility in your area to assist in the delivery of this component.

Materials

Per group: plastic tub, tape measure, 10 stakes with coloured flags (cut coat hangers with coloured surveyor's ribbon attached at top), 30 metres of strong string, 25 clear ziplock sandwich bags, turkey baster, five petri dishes with lids, hip waders, supplies to build four sampling nets* (two pairs of used pantihose, four wire coat hangers, one pair of pliers), five clear two-litre pop bottles with lids, one pair scissors, five hand lenses, one thermometer, two hockey stick shafts (or similar size and shape object), five baby food jars with lids, two ice cream pails with lids, three white styrofoam egg cartons, one kitchen strainer, four pH test strips, soup can with lid removed.

Per class: duct tape, binocular dissecting microscope*, Secchi disc* and calibrated cord, chest waders*, canoe*, supplies for fifteen underwater scopes (five 60 cm lengths of approximately 15 cm inside diameter black PVC, five 16 cm by 16 cm plexiglass squares, small tube of silicon – see appendix for instructions).

*optional equipment. Note: Instead of building the nets, you can get inexpensive aquarium nets at any pet shop. Another inexpensive alternative is to bind or tape a small plastic flour sieve to a hockey stick handle.

Preparation

Organize the equipment, prefabricate materials and establish student teams in advance of the field trip. Prior to the field trip, have the students review pages 36 to 49 in their student journal to become familiar with the routine they will follow. Discuss this in class. You may wish to practice some of the activities at school before your field trip (see page 38).

Field Trip
Activity one

Wetland maps

Curriculum Alignment

Environments can be described in terms of abiotic conditions.

Students will be expected to:

- identify, observe and measure abiotic factors in environments (e.g, temperature, moisture, available light, human structures, etc.)
- classify and describe an environment in terms of the abiotic factors that characterize it

Materials

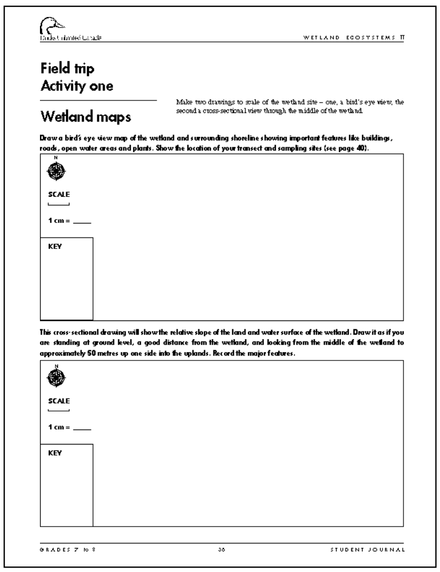
Student journal.

Activity Description

1. After students are off the bus take them on a quick tour around the wetland, posing questions such as:
- What do you think formed the wetland?
- How many different microhabitats can you identify in and around the wetland site?
- What changes to abiotic (non-living) factors might cause changes to biotic (living) elements?
- Have the students record pertinent data and observations on page 37 of their journal.

2. When the wetland has been fully circled (or you have gone as far as necessary), have students complete their bird's eye and elevation drawings of the wetland site on page 36 of their student journal.

3. When drawings are satisfactory, continue on to Activity Two.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Field trip
Activity one

Wetland maps

Make two drawings to scale of the wetland site – one, a bird's eye view, the second a cross-sectional view through the middle of the wetland.

Draw a bird's eye view map of the wetland and surrounding shoreline showing important features like buildings, roads, open water areas and plants. Show the location of your transect and sampling sites (see page 40).

N
SCALE
1 cm = ____
KEY

This cross-sectional drawing will show the relative slope of the land and water surface of the wetland. Draw it as if you are standing at ground level, a good distance from the wetland, and looking from the middle of the wetland to approximately 50 metres up one side into the uplands. Record the major features.

N
SCALE
1 cm = ____
KEY

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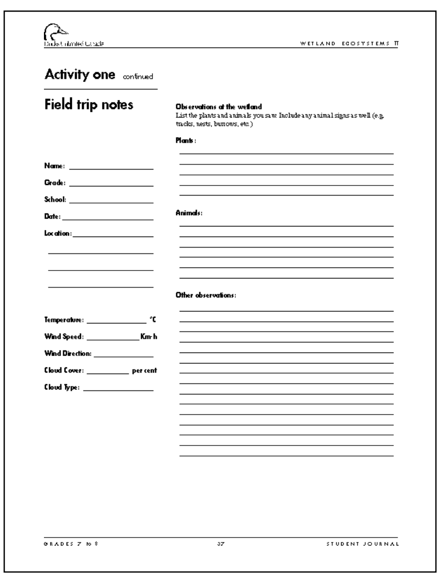
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Activity one continued

Field trip notes

Name: ____
Grade: ____
School: ____
Date: ____
Location: ____

Temperature: ____ °C
Wind Speed: ____ Km-h
Wind Direction: ____
Cloud Cover: ____ per cent
Cloud Type: ____

Observations at the wetland
List the plants and animals you saw. Include any animal signs as well (e.g. tracks, nests, burrows, etc.)

Plants:

Animals:

Other observations:

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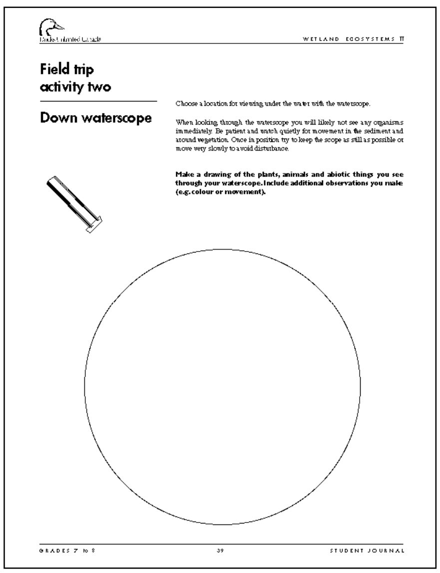
Field Trip
Activity two

Down waterscope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Field trip
activity two

Down waterscope

Choose a location for viewing under the water with the waterscope.

When looking through the waterscope you will likely not see any organisms immediately. Be patient and watch quietly for movement in the sediment and around vegetation. Once in position try to keep the scope as still as possible or move very slowly to avoid disturbance.

Make a drawing of the plants, animals and abiotic things you see through your waterscope. Include additional observations you make (e.g. colour or movement).

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STUDENT JOURNAL PAGE 39

Curriculum Alignment
Environments can be described in terms of abiotic conditions.
Students will be expected to:
- identify, observe and measure abiotic factors in environments (e.g, temperature, moisture, available light)
- classify and describe an environment in terms of the abiotic factors that characterize it

Materials
Underwater scope (see appendix, page 24), student journal.

Activity Description
1. After students have completed Activity One, ask them to choose a location for viewing under the water with the waterscope.

2. Have students make a drawing (page 39 of the student journal) of the plants, animals and abiotic things they view through the waterscope.

3. Continue to Activity Three.

Field Trip
Activity three

Wetland sampling transect

Practice at school, in the classroom or the outdoors is recommended.

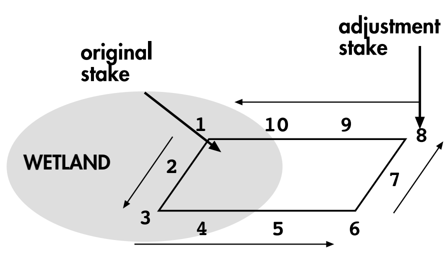


DIAGRAM A3.1

Curriculum Alignment

Gathering data
- observing living things in their environments
- observing the distribution of living things in environments
- measuring

Environments can be described in terms of abiotic conditions.
Students will be expected to:
- identify, observe and measure abiotic factors in environments (e.g, temperature, moisture, available light)
- classify and describe an environment in terms of the abiotic factors that characterize it.

Materials

Tape measure, stakes with flags, student journal, 30 metre string, eye protection, work gloves, rubber boots or hip waders.

Activity description

Classroom Preparation (one class)
1. Form student teams (four to five students per group).
2. Have students cut and straighten all but two coat hangers and attach approximately 30 cm of coloured surveyor's ribbon to one end (do this job at school before the field trip). Emphasize care and safety in this activity to avoid injury (use eye protection and work gloves).
3. Have students carefully measure and tie a knot at three metre intervals along the 30 m string.
4. Explain that the stakes and string will be used to mark an area (transect) for their group at the wetland site. Instruct studnets to record soil hardness on page 40 of their journal.
5. Show students how this measurement is done.

- Students begin by wading into the pond testing the depth of the water with one of the stakes. Rubber boots or hip waders will be required.
- At about four metres from shore, push the first stake into the bottom of the wetland so that it stands on its own with the surveyor's ribbon approximately 15 cm above the water line.
- Attach the string to the stake then move parallel to the shore in the same depth of water until reaching a three metre knot. Place the second stake here.
- Continue to move parallel to the shore in this depth of water until reaching the next three metre knot. Place the third stake in the soil at this point.
- Turn and move directly back toward shore until reaching the next three metre knot in the string. Place the fourth stake here and attach the string.
- Continue to move in a straight line away from the wetland until reaching the next two three-metre intervals. Place a stake at each of these intervals and attach the string.
- Continue to place stakes in the soil at three metre intervals (indicated by the knots in the string) as shown in diagram A3.1. Be sure to turn left at stake number six and again at stake number eight. Attach the end of the string to the original stake. If the string does not meet the original stake, try moving stakes six and eight closer or farther away, then adjusting the intermediate stakes accordingly.

Field Trip Activity four

Data collection and analysis

Curriculum Alignment

The interdependence of living things is evident in the interactions of organisms with each other and with their environments.

Students will be expected to:

- work in teams to collect abiotic data (temperature, water clarity, pH, soil)
- work in teams to collect biotic samples
- interpret distribution patterns of living things within their environments (e.g. interpret relationship to food sources and to means of avoiding predators)
- interpret plant and animal behaviours that indicate dependencies for food or other needs
- classify animals within an ecosystem as producers, consumers and decomposers
- recognize food chain/web relationships within an ecosystem
- identify energy flow within an ecosystem

Materials

All of the materials listed on page 17.

Lesson preparation

Duplicate and place copies of the organism identification sheets (see appendix on pages 25 to 27) in the top portion of several egg cartons (at least one for each pair of students in each zone – littoral, limnetic, and benthic). Assemble all of the equipment needed, assign teams and practice field procedures.

Activity description

1. Students should decide who will be responsible for each of the tasks before they arrive at the wetland.

2. Be sure that students come with rubber boots and proper clothing. At least one student in each group should have a pair of hip waders.

Proper dress includes:

- Clothing layered for at least 5 ˚C colder than the school location
- Change of socks and footwear
- Rain jacket
- Mosquito repellent and sunscreen
- waterproof footwear

3. Each group of students will stake out a transect (Activity Two) and use an area to conduct the following measurements, observations, samplings and recordings. Procedures are outlined in the student journal on page 41 and 42.

- Take temperature measurements at the surface of the soil and at the surface and bottom of the water (where applicable) at each three metre mark and record findings in the chart on page 43 of the student journal.
- Have students record soil moisture and light conditions at each transect location as described on page 43 of the student journal.
- Collect a soil sample at each three metre mark and place it in a labelled ziplock bag for further inspection back in the lab.

Activity four continued

- Measure water turbidity (how light available to pond organisms is affected by water clarity) using a Secchi disc (optional). See page 41 for instructions.
- Take the pH of the water at two locations (shoreline and deepest starting corner mark).

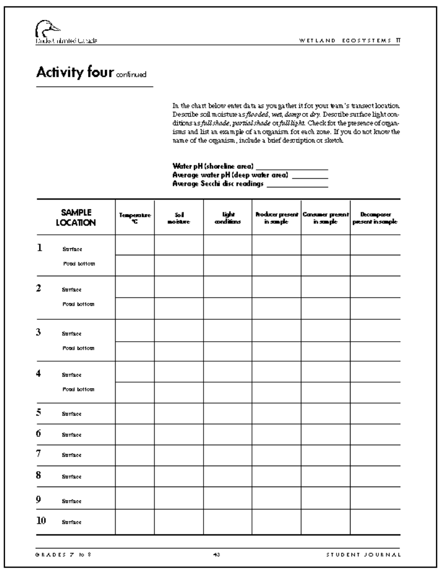
4. Monitor student progress to ensure that measurements and observations are being correctly handled (e.g. locations of temperature noted correctly, soil and organism samples correctly labelled and stored.)

5. Dry land collections should also be completed while water collections are being done. Record the location of organisms on the ground, under the soil, in grass, in dead plant material, on leaves and in or on bark.

6. For water organisms, place some water in a petri dish and place the dish on a piece of white paper for contrast. Use the hand lens to view specific organisms. As organisms are identified, place them in the corresponding egg cup.

7. Based on what you learned on the field trip, undertake Activities Five and Six back in the classroom. See pages 44 to 49 in the student journal.

8. Review Activity Five on page 44 and 45 of the student journal. Complete the exercises in class. The field exercise is optional and may be conducted in the school yard if conditions permit.


Ducks Unlimited Canada WETLAND ECOSYSTEMS II

Activity four continued

In the chart below enter data as you gather it for your team's transect location. Describe soil moisture as *flooded*, *wet*, *damp* or *dry*. Describe surface light conditions as *full shade*, *partial shade* or *full light*. Check for the presence of organisms and list an example of an organism for each zone. If you do not know the name of the organism, include a brief description or sketch.

Water pH (shoreline area) ______________
Average water pH (deep water area) ________
Average Secchi disc readings ____________

SAMPLE LOCATION		Temperature °C	Soil moisture	Light conditions	Producer present in sample	Consumer present in sample	Decomposer present in sample
1	Surface						
	Pond bottom						
2	Surface						
	Pond bottom						
3	Surface						
	Pond bottom						
4	Surface						
	Pond bottom						
5	Surface						
6	Surface						
7	Surface						
8	Surface						
9	Surface						
10	Surface						

GRADES 7 to 8 43 STUDENT JOURNAL

STUDENT JOURNAL PAGE 43

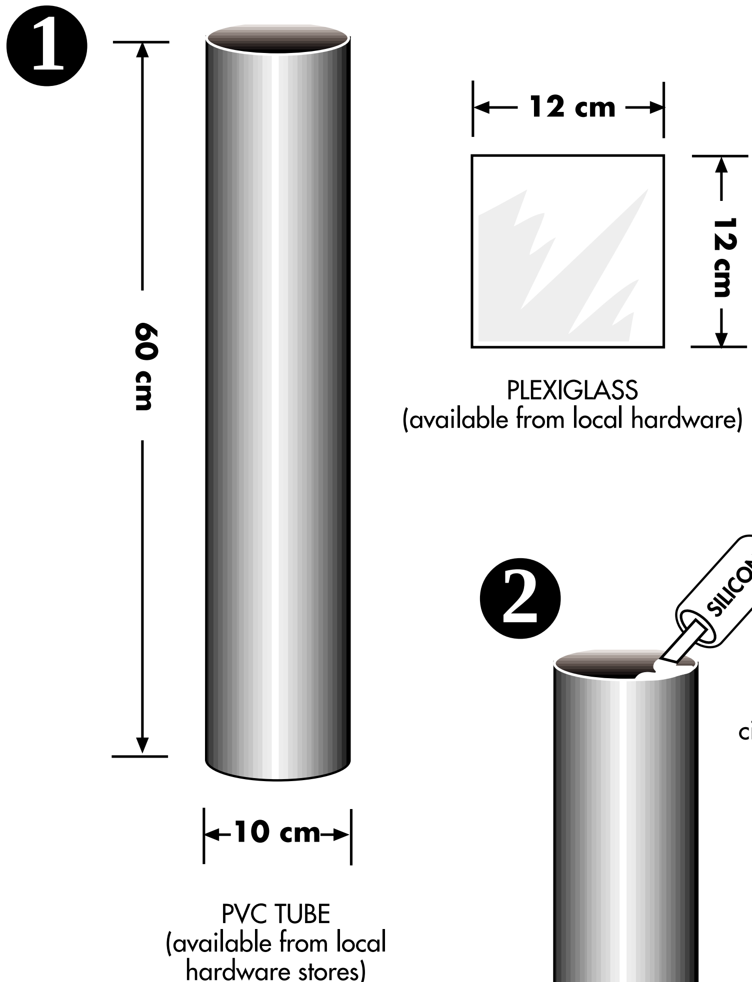
Relationship squares

Copy a set of these 12 squares for each two person team in your class. The following symbols denote a specific relationship:

00 neutralism (e.g. red-winged blackbird, snipe)
- - competition (e.g. hawk, owl)
+0 commensalism (e.g. duck, beaver)
++ mutualism (e.g. bees, flowering plants)
+ - parasitism (e.g. wood tick, deer)
or predation (e.g. fox, duck)

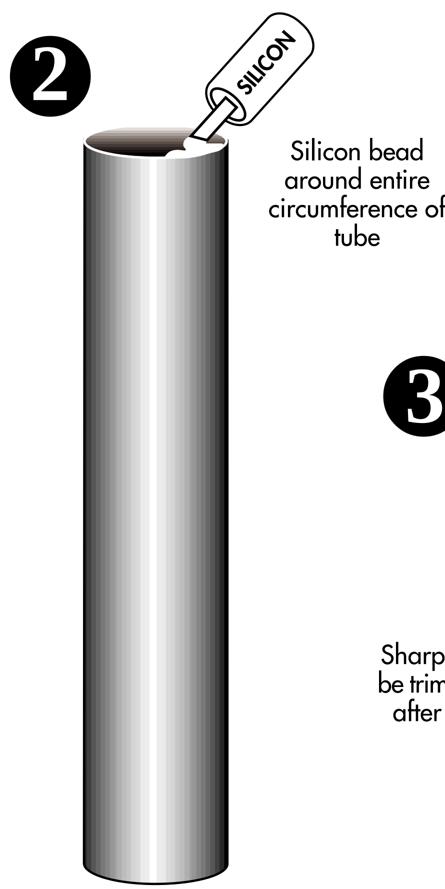
O	O	O	O
+	+	+	+
–	–	–	–

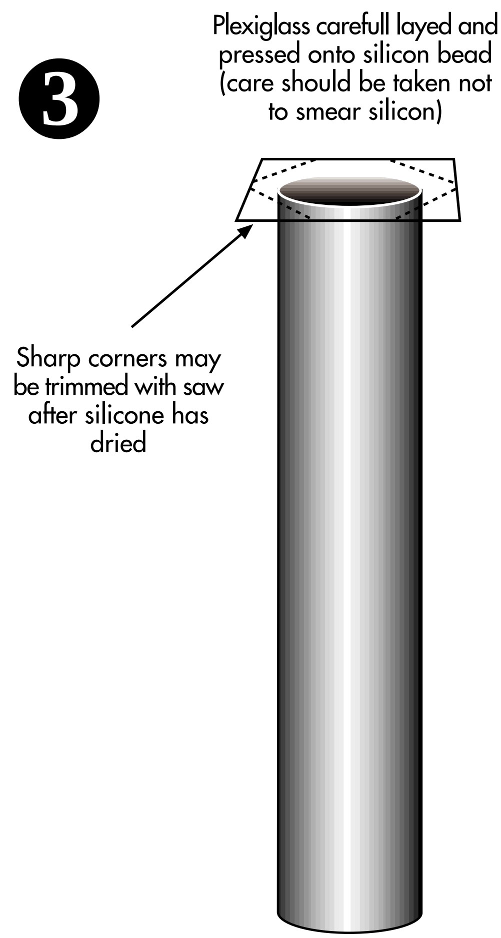
Constructing an Underwater Scope



NOTE: If plexiglass is unavailable, heavy, clear plythene can be used and attached with thick elastic bands.

To view underwater life push the plexiglass end into the water at an angle and look through the open end.





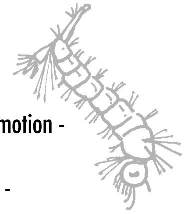
SHALLOW WATER (LITTORAL) ORGANISMS

CADDISFLY LARVAE

Locomotion -

Food -

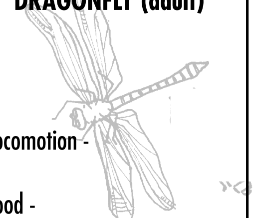
MOSQUITO (larvae)



Locomotion -

Food -

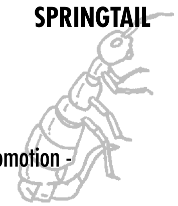
DRAGONFLY (adult)



Locomotion -

Food -

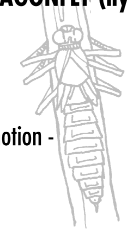
SPRINGTAIL



Locomotion -

Food -

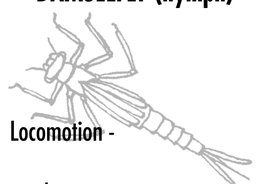
DRAGONFLY (nymph)



Locomotion -

Food -

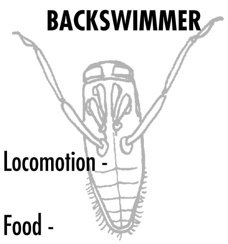
DAMSELFLY (nymph)



Locomotion -

Food -

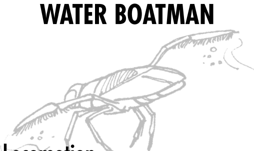
BACKSWIMMER



Locomotion -

Food -

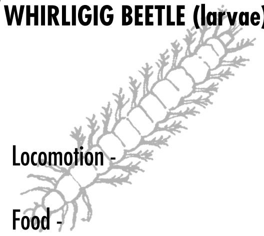
WATER BOATMAN



Locomotion -

Food -

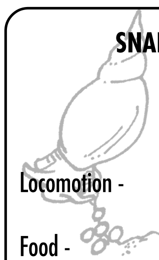
WHIRLIGIG BEETLE (larvae)



Locomotion -

Food -

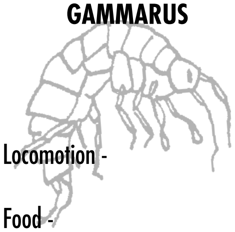
SNAIL



Locomotion -

Food -

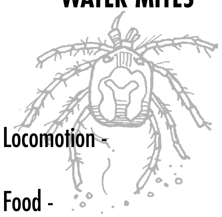
GAMMARUS



Locomotion -

Food -

WATER MITES

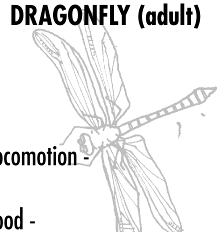


Locomotion -

Food -

DEEP WATER (LIMNETIC) ORGANISMS

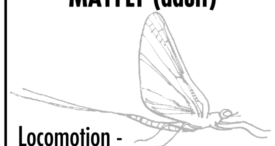
DRAGONFLY (adult)



Locomotion -

Food -

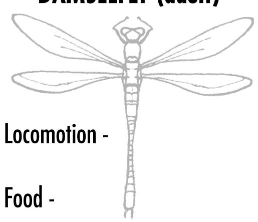
MAYFLY (adult)



Locomotion -

Food -

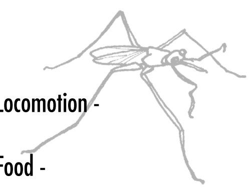
DAMSELFLY (adult)



Locomotion -

Food -

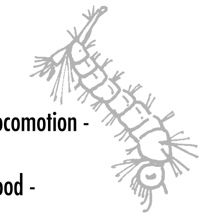
WATER STRIDER



Locomotion -

Food -

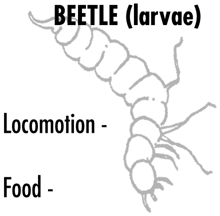
MOSQUITO (larvae)



Locomotion -

Food -

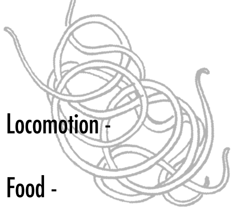
PREDACEOUS DIVING BEETLE (larvae)



Locomotion -

Food -

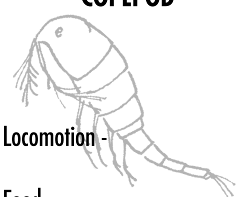
HORSEHAIR WORM



Locomotion -

Food -

COPEPOD



Locomotion -

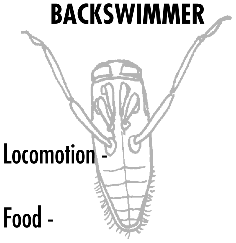
Food -

DAPHNIA (sp)

Locomotion -

Food -

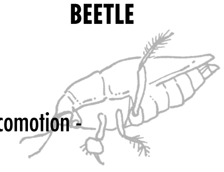
BACKSWIMMER



Locomotion -

Food -

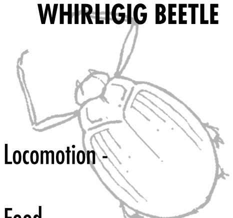
PREDACIOUS DIVING BEETLE



Locomotion -

Food -

WHIRLIGIG BEETLE

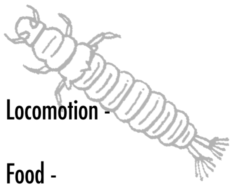


Locomotion -

Food -

BOTTOM (BENTHIC) ORGANISMS

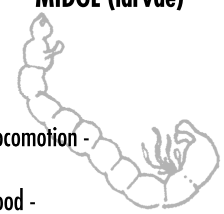
CADDISFLY LARVA



Locomotion -

Food -

MIDGE (larvae)



Locomotion -

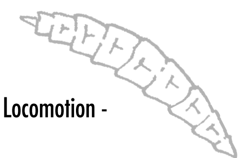
Food -

HORSEFLY (pupa)

Locomotion -

Food -

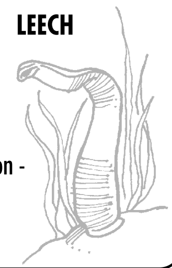
HORSEFLY (larvae)



Locomotion -

Food -

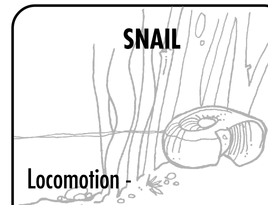
LEECH



Locomotion -

Food -

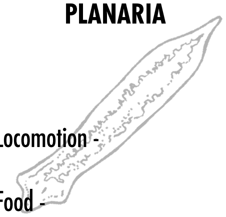
SNAIL



Locomotion -

Food -

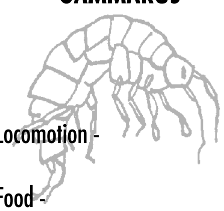
PLANARIA



Locomotion -

Food -

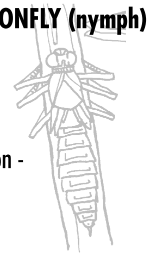
GAMMARUS



Locomotion -

Food -

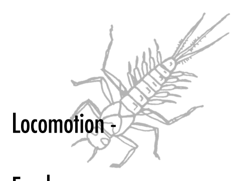
DRAGONFLY (nymph)



Locomotion -

Food -

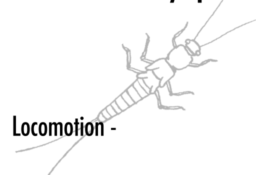
MAYFLY (nymph)



Locomotion -

Food -

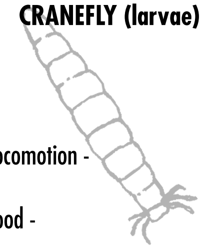
STONEFLY (nymph)



Locomotion -

Food -

CRANEFLY (larvae)



Locomotion -

Food -

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Wetland Ecosystems 1
Habitats, communities and the diversity of life

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Wetland Ecosystems 2
Interactions and ecosystems

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Evolution, diversity and sustainability of ecosystems

STUDENT JOURNAL	TEACHER'S GUIDE
High School Level Science GRADES 9-12	High School Level Science GRADES 9-12

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Because many people are unaware of the tremendous value wetlands provide for our environment, economy and well being, these amazing places continue to be destroyed at an alarming rate. The goal of Project Webfoot is to reverse this trend by raising awareness and appreciation of wetlands among students, teachers, parents and communities.

Project Webfoot is an international, interdisciplinary education outreach program and curriculum created by Ducks Unlimited to bring wetland education to students of all ages. Your support of this program in your community will help create a public that is committed to wetland conservation now and in the future.
To receive more information about Project Webfoot, contact Project Webfoot, c/o Ducks Unlimited Canada, P.O. Box 1160, Stonewall, Manitoba, R0C 2Z0.

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