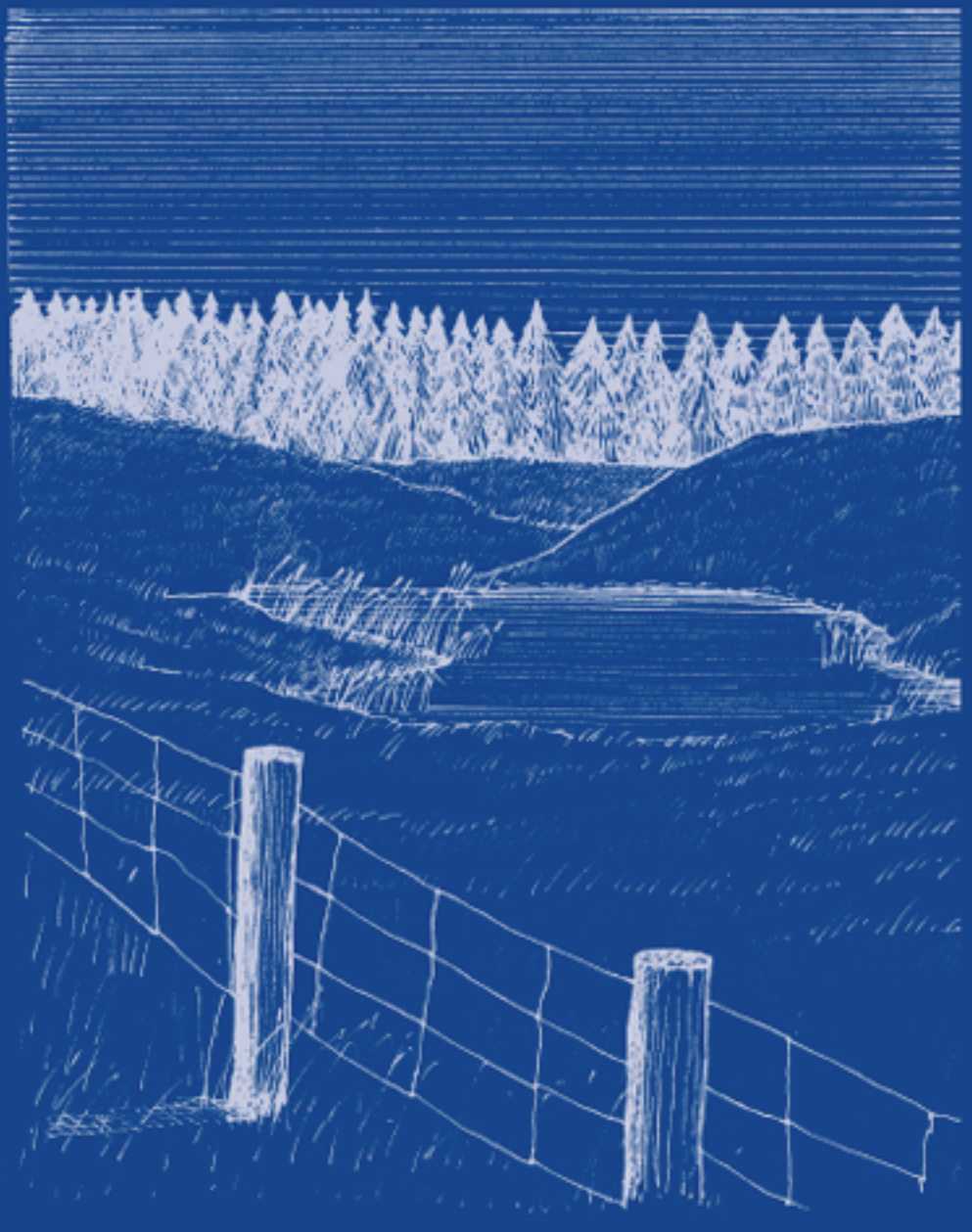
PARKS AND PROTECTED AREAS

Forest, Field, and Pond:

A Study of Ecosystems



Alberta
COMMUNITY DEVELOPMENT

Kananaskis Country

This publication is part of a series of field study programs produced by the Environmental Education Program of Parks and Protected Areas in Kananaskis Country and Fish Creek Provincial Park. These publications have been written to address the goals of Alberta Community Development and increase students' environmental awareness, understanding, interaction, and responsibility for the natural world in which they live.

The publications are developed in a close working relationship with teachers, community educators and program writers. Programs focus on the areas of environmental education, science, social studies, and language arts. They are also developed to emphasize elements of environmental literacy, lifestyle, and citizenship.

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Forest, Field, and Pond: A Study of Ecosystems

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Friends of Kananaskis Country

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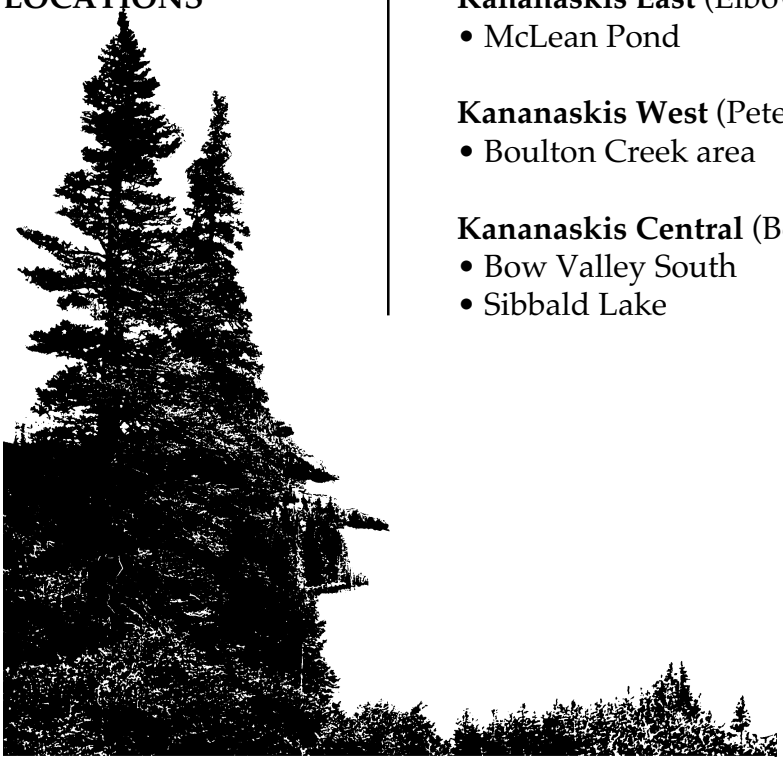
1.0 OVERVIEW

1.1 AT A GLANCE

TOPICS	Food Webs Food Chains Communities Interrelationships Ecosystems
PROGRAM LEVEL	Grades 4 - 6 / Ages 9 - 12
TIME REQUIRED	Pre-Field Study Activities: 7 hours Field Study: 1 day Post-Field Study Activities: varies with activity
STAFF REQUIRED	One teacher with one adult volunteer per 5-7 students
BEST SEASON	Spring or fall
SUGGESTED LOCATIONS	**Kananaskis East** (Elbow District) • McLean Pond **Kananaskis West** (Peter Lougheed Provincial Park) • Boulton Creek area **Kananaskis Central** (Bow Valley Provincial Park) • Bow Valley South • Sibbald Lake



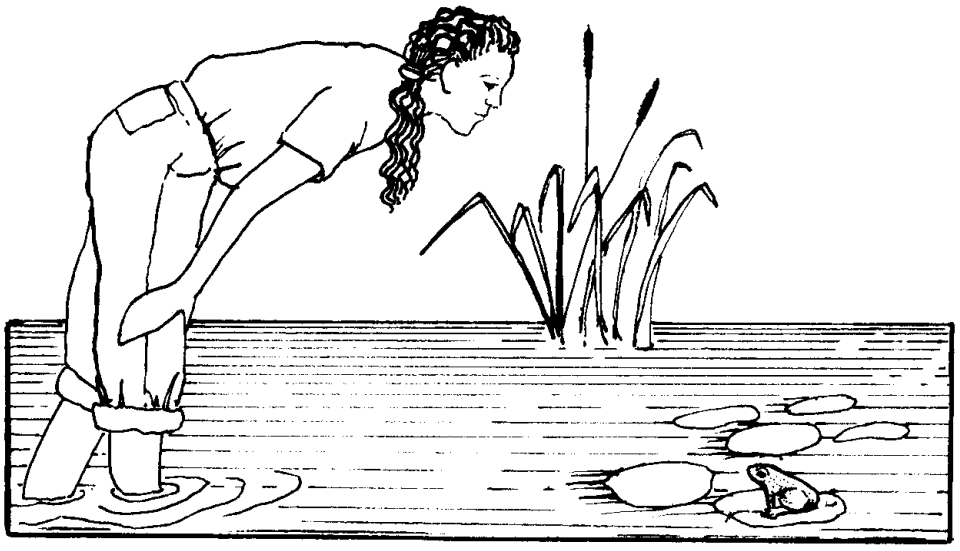
1.2 PROGRAM SUMMARY

The program, ***Forest, Field, and Pond: A Study of Ecosystems*** introduces students to the concepts of food webs, food chains, communities, and interrelationships. Students participate in hands-on activities in the classroom before going outside to examine the same concepts in three different natural communities.

This program is part of a unit written for Division II on natural ecosystems. Each program can be used separately or as a unit of study. The complete unit includes:

Where Forest meets Prairie - a field study to Bow Valley Provincial Park's Montane Trail, where students investigate the Montane ecosystem.

Forest, Field, and Pond - A Study of Ecosystems - a field study where students investigate food chains, food webs, and interrelationships that exist in three different communities.



1.3 ACTIVITY SUMMARY

This program includes the following activities:

- **Pre-test**
  The test is used as an introduction to food chains and food webs, and can be used to gauge students' current knowledge.

- **Did You Eat Grass for Lunch?**
  Students discover where their energy comes from by examining their own personal diets. By recording their weight and comparing it to the weight of food eaten, the class will examine the transfer of food energy.

- **From Grass to Fungus**
  Students classify the foods they eat as being from consumers, producers, or decomposers, and come to understand the relationship between the three groups.

- **Food Chains and Food Webs**
  Students make food chains and food webs out of paper. Class discussion and vocabulary are included in this section.

- **Calorium Sums**
  In an in-class activity, students realize that the energy they receive is used up in a variety of ways, and that less energy is available at consecutive steps in a food chain.

- **Pyramid of Power**
  Students discover the pyramid of numbers and the pyramid of energy by actually forming human pyramids based on real food chains.

- **Forest, Field, and Pond: Field Study**
  Students venture outdoors to explore forest, field, and pond communities, and to look for evidence of food chains.

- **Post-Field Study Activities**
  Students have the opportunity to choose an aspect of food chains and food webs and explore the concept in a subject area that appeals to them. These are "mini-projects" of limited duration that may or may not have a display or sharing component. These projects can be used as an evaluation of this unit.

- **Post-Test**
  Students are given the pre-test again and a comparison is made with their first test results.

1.4 PROGRAM OBJECTIVES

All the following objectives need not be met. Teachers may select certain objectives which they may wish to emphasize during the program. Students will have the opportunity to:

1. Use the concepts of interactions and interrelationships in describing a food chain.
2. Examine their own intake and use of energy.
3. Discover that energy from the sun is transferred by organisms along a food chain.
4. Classify living components in an environment as producer, consumer, or decomposer.
5. Predict what may occur in an ecosystem if a change occurs.
6. Observe and describe characteristics of a local environment.
7. Collect and record information regarding the interacting factors within an environment.
8. Expand on and work with the information gained during the field study.
9. Explore forest, field, and pond communities.

1.5 CURRICULUM TIE-INS

This program supports selected themes and objectives outlined in the Alberta Curriculum for Division II Science. These themes and objectives are covered using the natural environment as the focus. Such a focus allows students to explore the concept that they are **a part of** rather than **apart from** the world in which they live.

Curriculum tie-ins are indicated in each activity. In general, the following areas are addressed:

DIVISION	SUBJECT	SUBJECT MATTER
Two	Science	Living Things and Environment Environment and Ecosystems
Two	Language Arts	Writing, descriptive language, reading comprehension
Two	Mathematics	Measuring and recording weights, addition, using the metric system, converting from grams to kilograms, percentages, estimating amounts

2.0 PRE-FIELD STUDY

2.1 PRE-TEST

During the *Forest, Field, and Pond* program, students will be introduced to food webs and food chains. The pre-test allows teachers to determine how much the students already know about these topics.

Objective
To introduce students to food chains and food webs and to find out how much they already know about the topic.

Curriculum Tie-in
Science: Living Things and Environment - Environment and Ecosystems
The interaction of all factors involving communities of living things may be studied as an ecosystem, where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Time Required
45 - 60 minutes

Materials
- ❑ 1 copy of the Forest, Field, and Pond Pre-test and Answer Sheet for each student.

Instructions for the Teacher
1. Make one copy of the test and *Student Answer Sheet* for each student in the class.

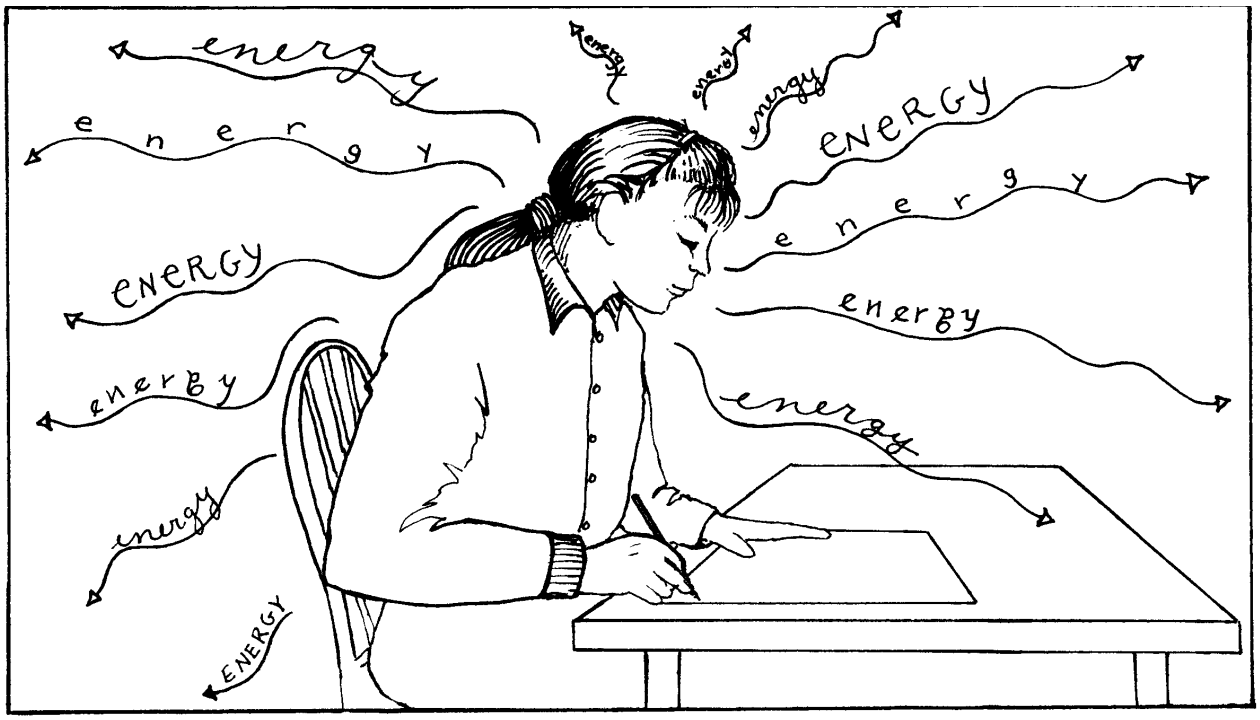
2. Give the test and an answer sheet to each student, emphasizing to them that the test is to find out how much they already know about the subject and to introduce them to the up-coming unit of study. Emphasize to them that these test results will not be counted.

3. After they have written the test, go over the answers with the students. Have them mark their own tests. Find out what questions they answered incorrectly and what questions they answered correctly.

4. Collect the test and answer sheets. Tell students that they will be able to compare them to the test scores at the end of the unit. Students should not be told that the same test will be given again.

ANSWERS TO *FOREST, FIELD, AND POND* PRE-TEST

1. - C	6. - D	11. - B	16. - A
2. - B	7. - D	12. - C	17. - D
3. - A	8. - C	13. - D	18. - C
4. - D	9. - B	14. - D	19. - A
5. - A	10. - A	15. - B	20. - D



FOREST, FIELD AND POND PRE-TEST

Please do not mark these sheets. Record your answers on the answer sheet provided. Some questions can be tricky. Choose the best answer for each question.

1. A **food chain** can show you
   a) where all the fast food chains are
   b) where all the food in the world is grown
   c) what is eaten by what
   d) what a person writes in a letter

2. A **producer** is a living thing that
   a) eats other living things to stay alive
   b) makes its own food out of sunlight, soil, and water
   c) stays alive by using the energy of dead plants and animals
   d) eats things from the produce section of the grocery store

3. A **consumer** is a living thing that
   a) eats other plants or animals to stay alive
   b) grows in the dark
   c) has to consume everything it sees in order to stay alive
   d) makes its own food out of sunlight, soil, and water

4. A **decomposer** is a living thing that
   a) makes its own food out of sunlight, soil, and water
   b) is usually a plant
   c) eats other living things to stay alive
   d) stays alive by using the energy of dead plants and animals

5. Most **plants** are
   a) producers
   b) consumers
   c) decomposers
   d) herbivores

6. Omnivores eat
   a) only meat
   b) only plants
   c) only dead material
   d) meat and plants

7. Most (but not all) **decomposers** are
   a) very large
   b) found in ponds and lakes
   c) consumers
   d) microscopic, and can only be seen with a microscope

8. A **food web** is
   a) found only in pond communities
   b) found only in forest communities
   c) a number of food chains interconnected
   d) simple, non-green plants

9. An animal that eats **both** plants and animals is called
   a) a herbivore
   b) an omnivore
   c) a carnivore
   d) none of the above

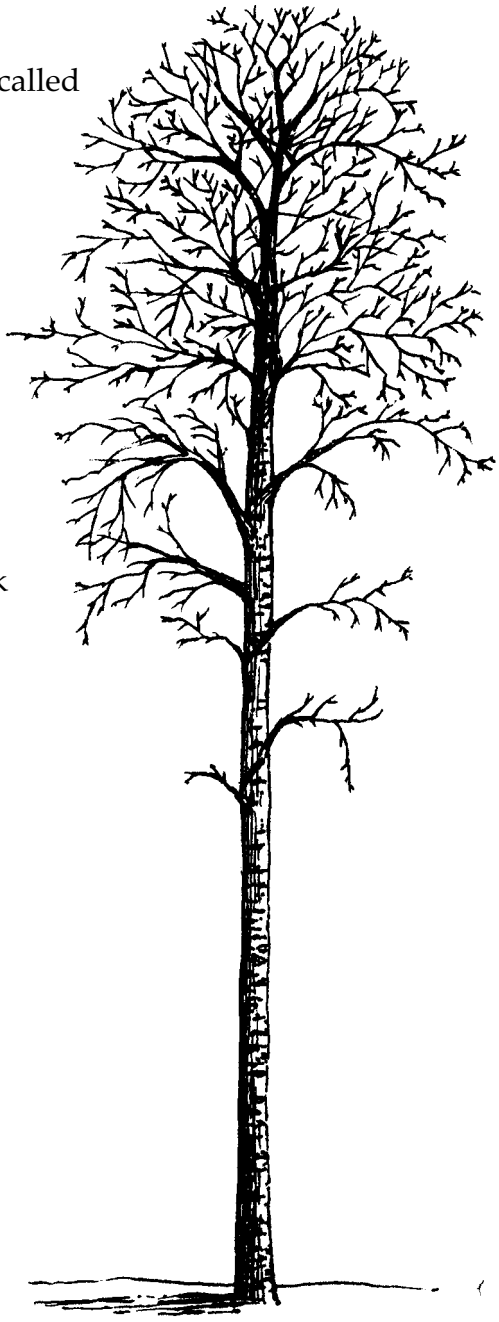
10. An animal that eats only plants is
   a) a herbivore
   b) an omnivore
   c) a carnivore
   d) none of the above

11. One forest **food chain** would be
   a) flower —> grasshopper —> meadowlark
   b) pine cone seed —> squirrel —> owl
   c) mosquito —> trout —> heron

12. One pond food chain would be
   a) cones —> mouse —> owl
   b) flower —> grasshopper —> hawk
   c) mosquito —> minnow —> trout

13. When something decomposes
   a) it gets used again
   b) it rots
   c) it decays
   d) all of the above

14. A **producer** that lives in the forest area is
   a) cattails
   b) a blade of grass
   c) a squirrel
   d) a spruce tree



15. A **consumer** that lives in a pond is
    a) a cattail
    b) a snail
    c) a gopher
    d) a field mouse

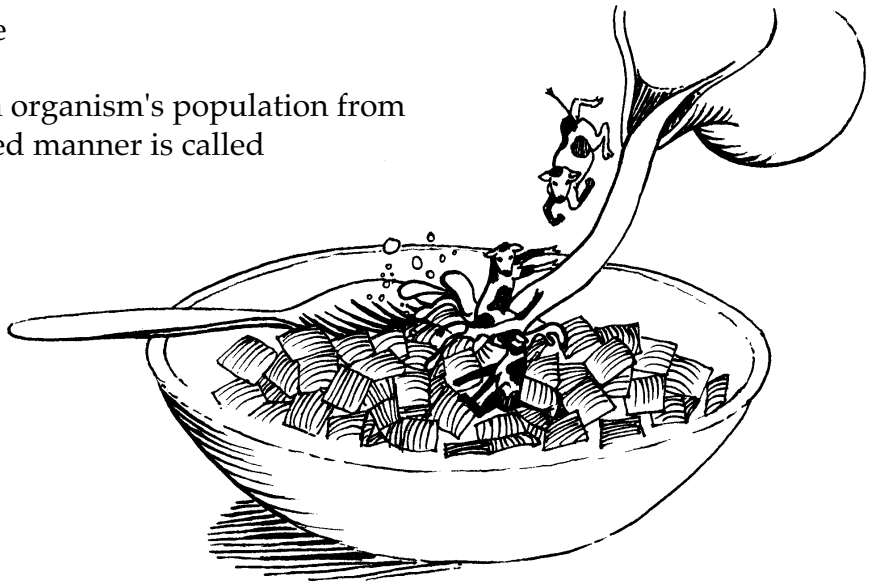
16. Plants and animals that are found together in an area and interact with each other form a
    a) a community
    b) a niche
    c) a habitat
    d) none of the above

17. A niche is
    a) a condition that keeps an organism's population from growing in an uncontrolled manner
    b) found only in the forest
    c) the ability to do work
    d) the role or function an organism plays in a natural community

18. If a plant or animal changes its behavior or physical structure, this is called
    a) an omnivore
    b) an interrelationship
    c) an adaptation
    d) a limiting factor

19. The ability to do work is
    a) energy
    b) habitat
    c) a consumer
    d) none of the above

20. A condition that keeps an organism's population from growing in an uncontrolled manner is called
    a) a decomposer
    b) a community
    c) an ecosystem
    d) a limiting factor



ANSWER SHEET FOR THE *FOREST, FIELD AND POND* PRE-TEST

Your Name: _____

Circle the correct answer below.

1. a b c d
2. a b c d
3. a b c d
4. a b c d
5. a b c d
6. a b c d
7. a b c d
8. a b c d
9. a b c d
10. a b c d
11. a b c
12. a b c
13. a b c d
14. a b c d
15. a b c d
16. a b c d
17. a b c d
18. a b c d
19. a b c d
20. a b c d

2.2 DID YOU EAT GRASS FOR LUNCH?

Plants have the ability to capture energy from the sun through a process called photosynthesis. This energy is transferred to us either directly (when we eat plants) or indirectly (when we eat meat). When we eat, we become a part of a food chain. The energy we obtain from our food allows us to perform all our bodily functions including growing, moving, keeping warm, and breathing.

Children eat a great deal of food. What kinds of foods do they eat and where does the food come from? What happens to food once we eat it? If we eat 1 kg of food, why don't we gain 1 kg of weight? What is energy, where does it come from, and how do we use it? Students will discover the answers to these questions in this activity.

Objectives

Students will...

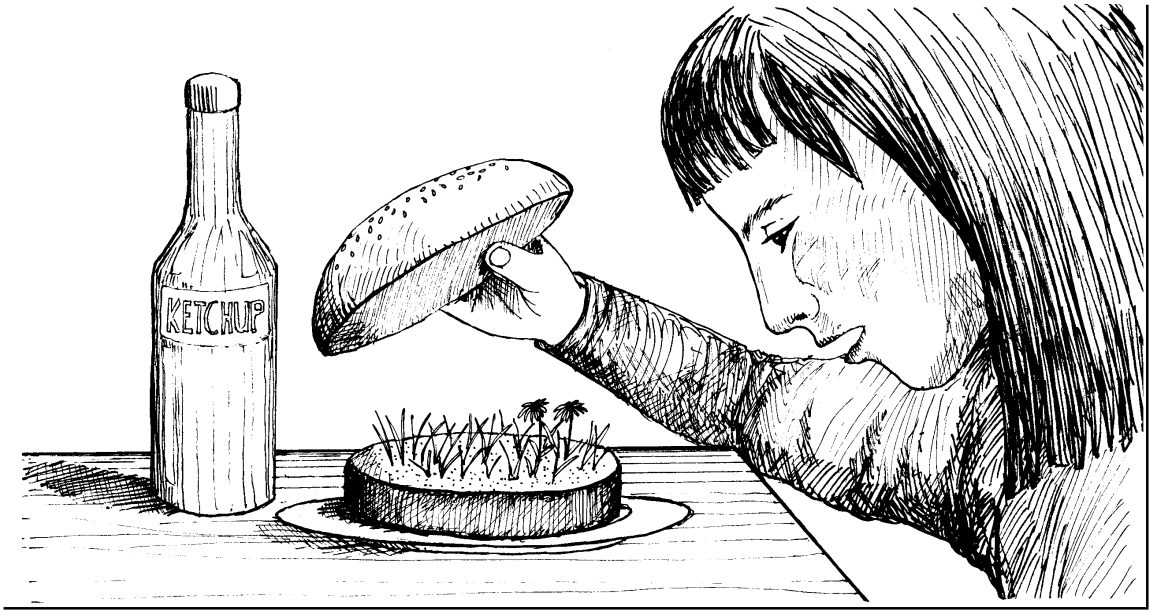
- infer interactions and interrelationships to describe a food chain within their environment.
- examine their own intake and use of energy.

Curriculum Tie-in

Science: Living Things and Environment - Environment and Ecosystems

The interaction of all factors involving communities of living things may be studied as an ecosystem where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Mathematics: Measuring and recording weights; estimating; addition; using the metric system; converting from grams to kilograms



Time Required
2-3 class periods

Materials
- ❑ 1 set of bathroom scales
- ❑ 1 set of laboratory scales
- ❑ 1 copy of the *Student Weight Chart*
- ❑ 1 copy of *How much does Food Weigh?* for each student
- ❑ 1 copy of the *What I Ate for One Day* chart for each student

Instructions for the Teacher
1. Weigh all the students in your class and record their weights on the *Student Weight Chart*.

2. In class, have students ***estimate*** the weight of common foods in their lunch (i.e., peanut butter sandwiches, yogurt, apple, etc.) and record their estimates on the worksheet titled, *"How much does your food weigh?"*. Next, ***weigh*** these foods and record the weights on a wall chart. Have students record their estimates and the actual weights on their worksheet. This exercise allows students to improve their ability to estimate weights.

   Students should also be able to estimate the weights of food eaten at breakfast and at supper. Have them bring in labels from food cans and packages. Read them to find the weights of the food. Help them find the weight of an average serving of cheese: 250 grams of cheese has 10 slices in the package, each slice is 25 grams.

   Your class chart might look like this:

CHART OF WEIGHTS	
FOOD	**WEIGHT**
250 ml milk	.25 kg or 250 grams
sandwich	60-100 grams
1 slice of bread	28 grams
average serving of meat	84 grams
average serving of vegetables	84 grams
1 serving of yogurt	200 grams
etc.	

3. After the foods have all been weighed, ask the students to record all the food they eat or drink for the next 24 hours. They can record this information on the chart provided, *What I Ate For A Day*. This chart categorizes food under the following headings: Meats, Vegetables and Fruits, Dairy Products, Grains, Cereals, and Other. Their lists will also include how much of each item they ate and how much it weighed.

   Note: the category of "Other" has been included for those hard-to-place items: i.e., beef and vegetable soup, candy bars, slushies, etc. Have students gather in small groups the next day and try to categorize some of these items - remind the students that some may fall into more than one category. You may wish to address some of the real problem items as a class.

4. After the 24 hour period, weigh all the students again. Record this second weight on the chart next to the student's first weight.

5. Have students compare the difference in their two weights to the weight of the food eaten.

6. After students have completed their worksheets, ask them the following questions and record their answers on the chalkboard:

   • **Of the foods you ate, which ones came directly from plants?**
   Fruits, vegetables, grains, cereal.

   • **Which of the foods come from animals?**
   Meats and dairy products.

   • **What do the animals who produced the food eat?**
   Plants, such as grains, and grass.

   • **Did you gain as much weight as the weight of the food you ate?**
   No.

   • **Why didn't you gain this amount?**
   Most of the food was converted to energy; gas; water; and indigestible material that passed through the body.

   • **What happens to the energy that food gives you?**
   It is used as a fuel by your body to do various things.

   • **How have you used up food energy today?**
   Students may have written in their workbook, walked to school, read a book, played basketball, made a bed, mowed the lawn, or gone swimming. Have students list as many ways as they can think of for using energy.

7. Optional: Have students keep track of all the food they eat for a week or more. At the end of the week or weeks, have students again check and record their body weights. (Alternatively, you could have the students estimate the amount of food that they would eat over a week - or over a year). How did their weight increase compare to the total weight of food eaten during this time? Have the students express this value as a percentage, as follows:

> **"x % of the food weight that I ate this week/month/year is now a part of my body weight".**
>
> **"100-x % of the food weight that I ate this week/month/year was either indigestible material or was converted into energy and used up by my body"**

Teacher's Notes:

STUDENT WEIGHT CHART

STUDENT NAME	BEGINNING WEIGHT (kg)	WEIGHT AFTER 24 Hrs. (kg)	WEIGHT CHANGE (kg)	TOTAL WEIGHT OF FOOD EATEN (kg)

HOW MUCH DOES FOOD WEIGH?

FOOD ITEM	ESTIMATED WEIGHT (G)	ACTUAL WEIGHT (G)

WHAT I ATE FOR ONE DAY

NAME: _____

CATEGORY	ITEM	AMOUNT EATEN *(describe how much you ate)*	WEIGHT *(estimate in grams)*
MEATS	*yogurt*	*small plastic container*	*200 g*
VEGETABLES AND FRUITS			
DAIRY PRODUCTS			
GRAINS AND CEREALS			
OTHER			

2.3 FROM GRASS TO FUNGUS

Every living thing on earth can be categorized into one of three groups: producer, consumer, or decomposer.

Objectives

Students will...

- classify living components of an ecosystem as producer, consumer, or decomposer.
- use the concepts of interactions and interrelationships to describe a food chain within an ecosystem.
- predict the possible effects of a change in an ecosystem.

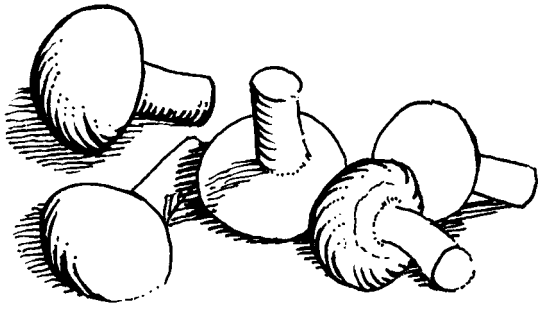
Curriculum Tie-in

Science: Living Things and Environment - Environment and Ecosystems

The interaction of all factors involving communities of living things may be studied as an ecosystem, where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

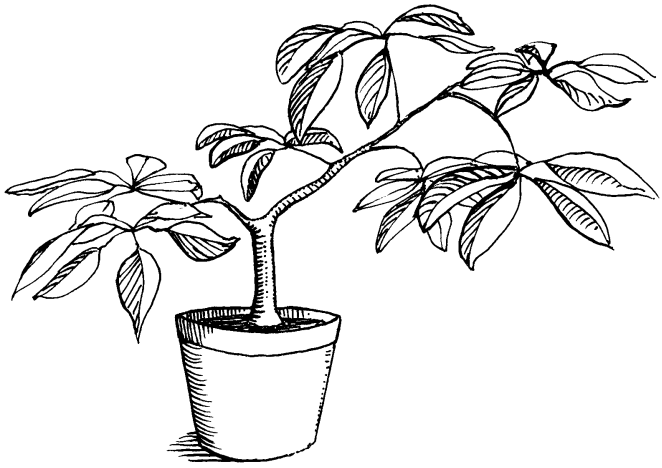
Time Required

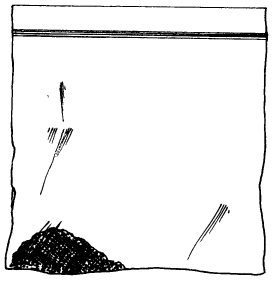
2-3 class periods



Materials

- ❑ 1 clear plastic bag with soil
- ❑ 4 - 5 store-bought mushrooms
- ❑ 1 piece of rotting wood
- ❑ 1 potted plant
- ❑ 5 - 10 pictures of plant-eating and meat-eating animals
- ❑ lists of food from Activity 2.2





Instructions for the Teacher

5. Explain what a food chain is and introduce the terms producer, consumer, and decomposer:

FOOD CHAIN: Simple to a complex series of relationships which show how energy moves from one living organism to another.

PRODUCER: Show students the potted plant. Explain that producers are green plants that are able to make their own food using energy from the sun. By converting this energy into a form that other living things can use, the producers form an essential part of a food chain. Ask for examples of producers. List these examples on the chalkboard under the heading "producers".

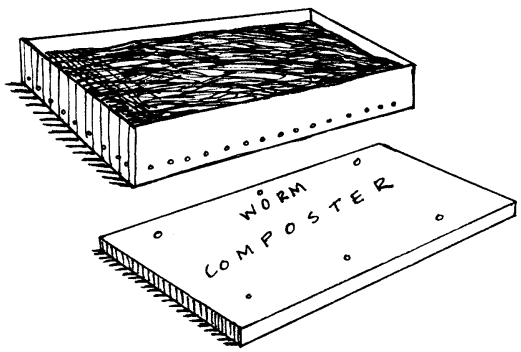
CONSUMER: A consumer is any living thing that cannot make its own food and must eat plants and other animals to get the energy it needs to survive. (Show pictures of plant-eating and meat-eating animals - have at least one picture of a human.) Consumers can be divided into 3 sub-groups:

herbivores - consumers that eat plants
carnivores - consumers that eat animals
omnivores - consumers that eat both plants and animals

On the chalkboard under the heading "consumers", list examples of living things that eat plants and/or animals. Discuss which of these are herbivores, carnivores, and omnivores. Categorize the pictures you have under these headings.

DECOMPOSER: Decomposers are living things such as bacteria and fungi that break down the remains and waste products of plants and animals. Show the students the mushrooms: these are an excellent example of a decomposer that humans use as food.

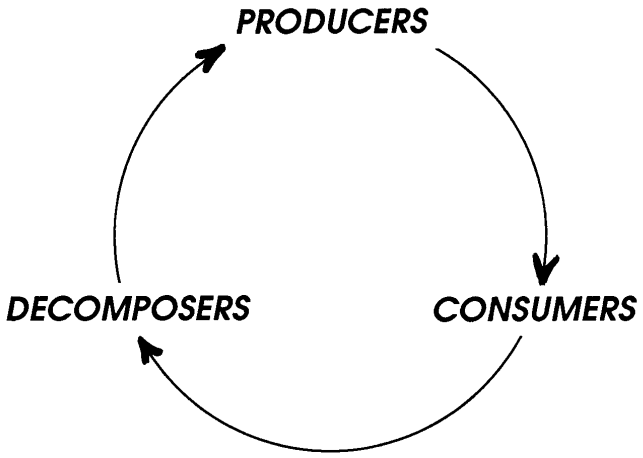
Show the students the soil. One valuable function of decomposers is to transform the remains or wastes of living things into a form that producers can use. Soil contains these recycled nutrients; producers are now able to re-use the materials to grow. Often, decomposers are microscopic (too small to be seen without a microscope).



Note: If your classroom has a worm composter, examine the living things that are found within it - they are almost all decomposers.

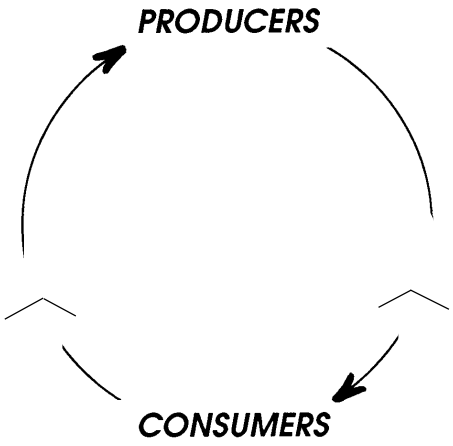
Show students the rotting log and the soil. Explain that in the log and soil are living things such as bacteria that live off the dead wood and dead animal and plant material. List examples of decomposers on the chalkboard.

6. After you have defined producers, consumers, and decomposers, draw the following diagram on the chalkboard.



Explain that each type of living thing represented in the circle depends in some way on the other types.

7. Ask the students:
   - **What would happen if there were no decomposers? (Show this concept by erasing the word decomposer and its part of the circle.)**



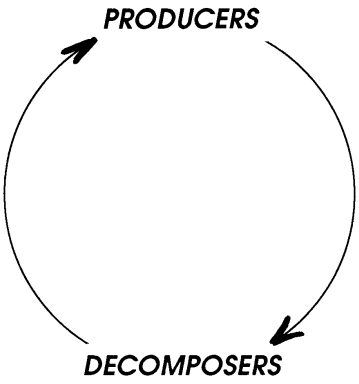
If the decomposers were removed, the circle would be broken and eventually the producers and then the consumers would die off.

Redraw the circle and the types of living things.

Ask students:

- **could any item (producer, consumer or decomposer) be removed and still leave an intact circle? (Ask them to justify their answer.)**

Consumers, such as animals and people could be removed and there could still be a circle. The circle would look like this:

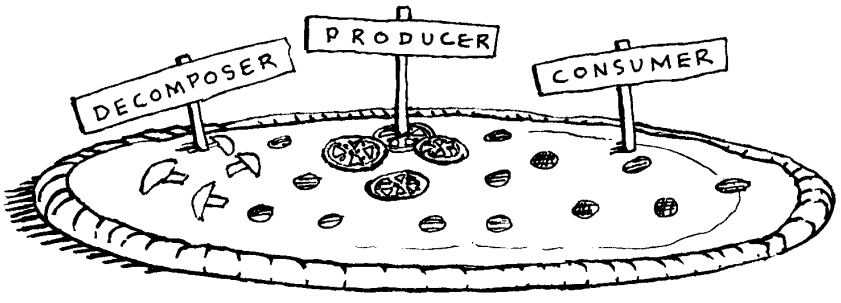


- **would this circle be self-sustaining?**

8. Have each student take the list of food they ate for one day (from Activity 2.2) and categorize each item according to whether it comes from a producer, consumer, or a decomposer. On a separate paper, list any foods that they have trouble categorizing.

9. When the students finish their lists, ask about the foods that students had trouble categorizing. Some of these foods are discussed below.

   A pizza can be broken down into all three categories as follows: the crust and tomato sauce fit under producers; the sausage or meat under consumers; and the mushrooms under decomposers. Milk is classified under consumer since a consumer, the cow, made the milk. The cheese is more difficult: although produced by a cow (consumer) it can also be classified under decomposers, since cheese is a product of bacterial decomposition of milk.



An example of a student's list might look like this:

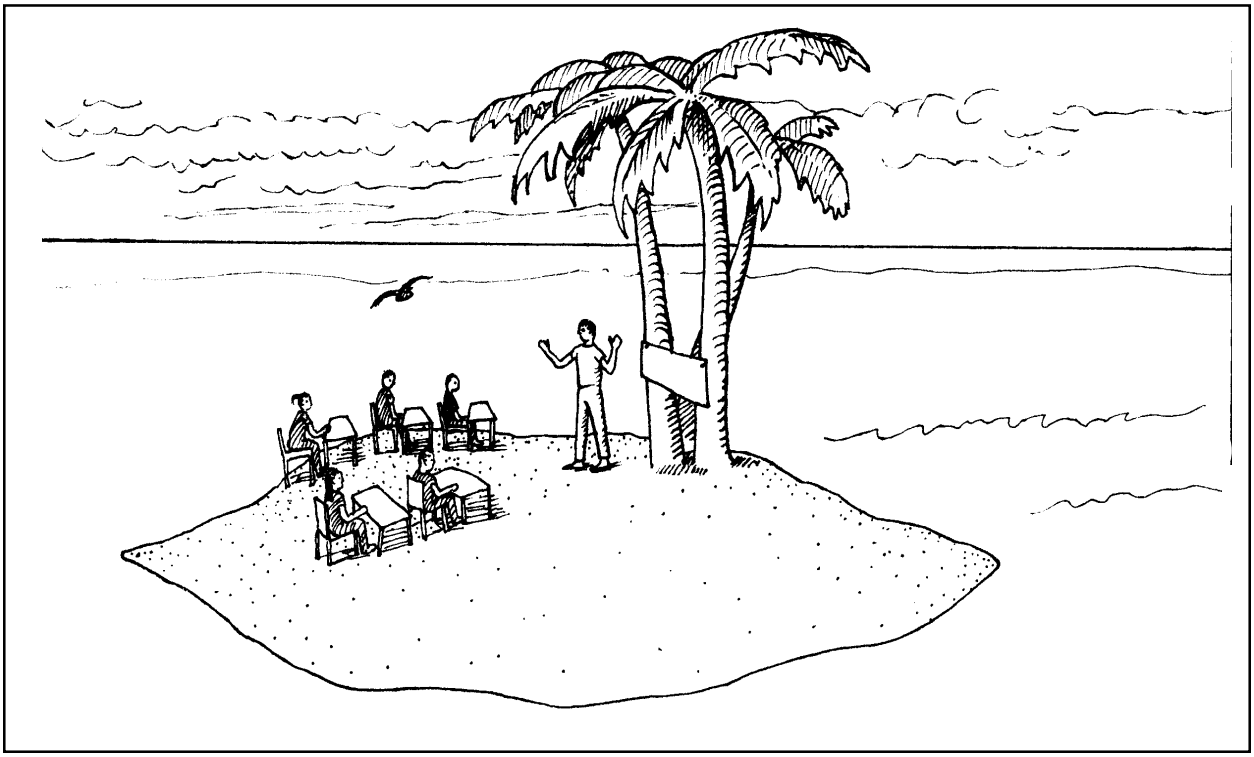
Producers:	tomatoes, french fries, pizza crust, cornflakes
Consumers:	milk, hamburger, pizza filling (i.e., pepperoni), ice cream
Decomposers:	cheese, mushrooms, pizza filling (i.e., mushrooms)

10. Make a class list of Producers, Consumers and Decomposers on the chalkboard.

11. Ask students to refer to the class list to help them answer the following questions:
    - **Were more producers eaten than consumers and decomposers?**
    - **What was the most popular food eaten? Which group was it from?**
    - **What plants are included in the list? Which was the most popular?**
    - **What animals provided the consumer-type foods?**

Extension Activities

12. Divide the class into groups and have them make up lists of food that they might eat in a day if they lived in:
    - China
    - the far north of Canada.
    - an island in the Pacific Ocean



2.4 FOOD CHAINS AND FOOD WEBS

There are thousands of different species of plants and animals on Earth. Therefore, there are thousands of pathways or food chains that energy can follow as it flows from the sun to plants to animals. A plant could be eaten by many different kinds of animals, resulting in connections between different food chains. When a series of food chains are connected, an intricate, and often complex food web is formed. In this activity, students will make up their own food chains using paper links. As they discover connections between their food chains, they will link them to form food webs.

Objectives

Students will...

- classify living components of an ecosystem as producer, consumer, or decomposer.
- use the concepts of interactions and interrelationships to describe a food chain within an ecosystem.
- appreciate the complexities of natural systems that is implicit in a food web
- predict the possible effects of a change in an ecosystem.

Curriculum Tie-in

Science: Living Things and Environment - Environment and Ecosystems

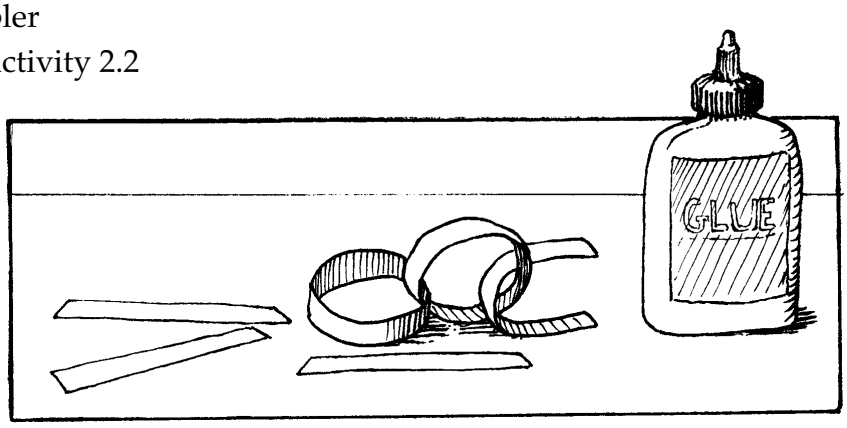
The interaction of all factors involving communities of living things may be studied as an ecosystem, where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Time Required

3 class periods

Materials

- ❏ 6-8 strips for each student. Strips are made from brightly coloured construction paper, and measure approximately 4 cm x 30 cm
- ❏ glue, tape, or a stapler
- ❏ list of foods from Activity 2.2



Instructions for the Teacher

1. Define food chain and food web for the class.

   Food chain - is a way of thinking about how producers, consumers and decomposers are connected. A food chain shows how energy from plants is passed along to an animal that eats that plant, and then on to the animal that eats that animal. A food chain can be just two steps or a complex chain of many steps.

   Food web - is a number of food chains that are interconnected. The rings that the class make and connect become food chains; when the various chains are connected they become a food web. This concept is best described using the following activity.

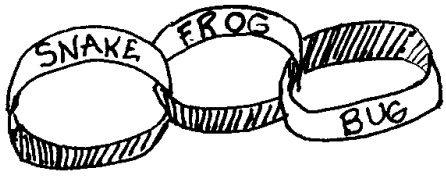
2. Use the chalkboard to show an example of a food chain:

   seeds ————> mouse ————> owl (arrows indicate the direction of
   leaves ————> insects ———> bird energy flow)

   ON the board, draw the diagram that is shown below. Ask students:

   - **Is this a food chain. Which direction does energy flow along it?**

   The energy flows from right to left in the diagram as it is shown.



3. Show how links can be made between food chains to form food webs. For example, shown below are two food chains:

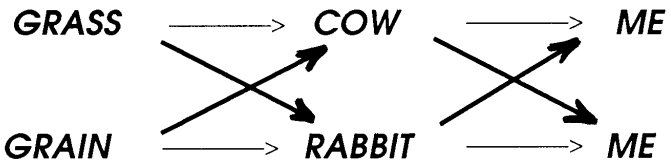
   GRASS ———> ***COW*** ———> ***ME***

   GRAIN ———> ***RABBIT*** ———> ***ME***

Ask the students:

- **Can these food chains be connected?**

Yes. Draw diagonal arrows to show where these food chains join to form a food web. Compare the resulting pattern of the lines to a spider's web so that students understand why we call this a "web".



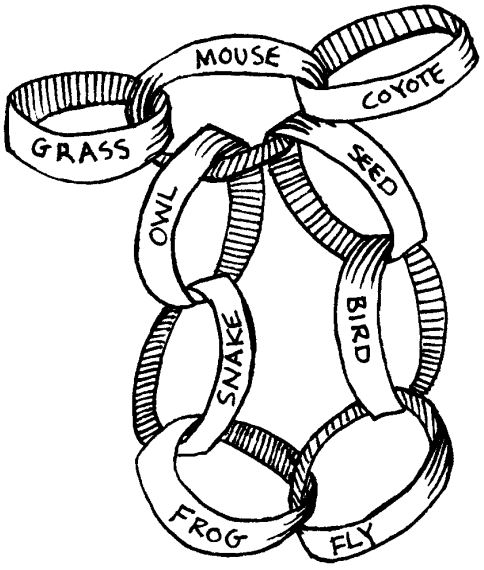
4. Cut up the construction paper into 4 cm x 30 cm strips. You may need up to 200 strips for large classes, so you may choose to have the class help to make their strips.

   Give 6 strips to each student. Have each student write the name of a plant (i.e. grass, popular, spruce) on one of their strips. Then show them how to make a paper link out of their strip by securing the ends of the strip with glue, tape, or a stapler.

5. On the second loop, have each student write the name of something that eats the plant on the first loop. On the third loop, have students complete the food chain by naming a carnivore. Tell them to use only animals that are found in your area (you may wish to write a list of suggestions on the board).

6. On a fourth strip of paper, students should write the name of a living thing that is either *eaten by* or *eats* the consumer written on their second link. The fourth strip should be looped through the second link and secured. Have them add three or four more links and connect them together to form a chain of living things that are all connected. For example:

   Coyotes eat mice, mice could also be eaten by owls; the owls eat snakes and the snakes eat frogs; the frogs eat flies, the flies are eaten by birds; the birds eat seeds, the seeds are eaten by mice...

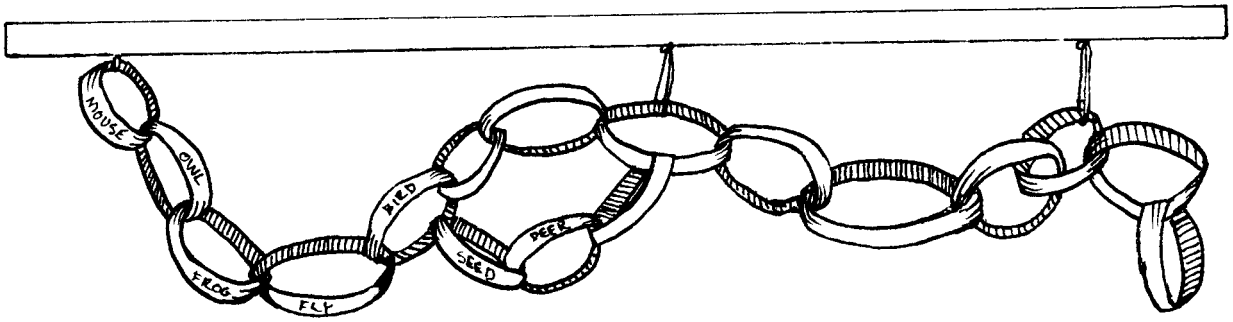


   Tell your students that this is called a food web. Have the students identify several food chains in the web included on this page. The food chains include:

   grass - mice - coyotes
   flies - birds
   grass - mice - owls
   seed - mouse
   flies - frogs - snakes - owls
   seeds - birds

7. Select one food web, check to ensure that it is a logical one, and draw it on the board using circles and arrows. Tell students that this drawing is a food web, because it resembles a spider's web.

8. Have the students choose a partner and make a web of increasing complexity by linking their chains with their partner's where it is appropriate. Emphasis should be placed upon making plausible connections. It is important that the students experience the complexity of the food chains and webs. Hang the chains up around the room.



Extension Activities

9. Have the students select 3 items from the list of foods they ate during a twenty-four hour period that originated from a consumer (e.g. meat, fish, eggs). Ask them to make up three food chains. Each one should start with the sun, the original source of energy, and end with themselves. The chain should include one of the items from their list. Ask students to make simple flow diagrams showing how the energy gets to the human:

   e.g. sun ————> grass ————> cow ————> me

Students may add drawings to their food chains.

2.5 CALORIAN SUMS

Energy from the sun is captured by plants or producers in a process called **photosynthesis**. Some of that energy is stored within the plant in the form of sugars and starches, but most of the energy is used by the plant FOR respiration, reproduction, and in its cellular processes. When an animal or consumer eats that plant, energy within the plant is used by the animal. Some of ***that*** energy is stored in the animal, but - again - most is used to breathe, reproduce, and keep warm. If that animal is eaten by another animal, the energy is transferred again.

Only a fraction of the amount of energy originally captured by plants is used by the next animal in the food chain. Most of the energy is used along the way. In this activity, students transfer an imaginary unit of energy (the Calorian) from one living form to another in an energy pyramid. In the process they will discover how energy is transferred from plants to animals and that most of the energy is used or changed to another form along the way.

Objective

Students will discover that energy from the sun passes along food chains in an ecosystem.

Curriculum Tie-in

Science: Living Things and Environment - Environment and Ecosystems
The interaction of all factors involving communities of living things may be studied as an ecosystem, where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Time Required

2 classroom periods (one outside)

Materials

- ❑ one 2 litre jar or bucket (transparent (glass or plastic) if possible)
- ❑ four large (approximately 1 litre) transparent jars (glass or plastic), labelled: "energy to live; energy to breathe; energy to reproduce; stored energy"
- ❑ 200 calorians. These are small, readily available objects that act as a unit of energy: you may choose to use marbles, large ball bearings, or natural objects such as nuts or popcorn.

Note: this activity is written for a class of 25 students. If your class is of a different size, you will have to slightly modify the numbers that appear below in order to involve the whole class.

Instructions for the Teacher

1. Prepare the labels for the four 1 litre transparent jars. Fill the large 2 litre container with calorians, and show it to the class. Tell them that each item is called a calorian and represents a certain amount of energy from the sun.

2. Tell the class that there are 200 calorians in the jar, and that they will be given to a number of students who represent green living things. These green living things can use the energy to turn it into food for themselves. Ask the students:
   - **If each grass plant needs ten calorians to survive, how many grass plants can there be in he classroom?**

   There will be 20 grass plants. Pour the calorians into a large tray, and invite 20 students from the classroom to come up one row at a time to collect their calorians.

3. Ask the students:
   - **Are all ten of the calorians that you receive from the sun available to a consumer such as a ground squirrel?**

   No. Only the energy that is stored by the grass is available. Energy is used up by the plant during its lifetime in a variety of ways, as is shown below.

   - **What does the grass plant need energy for?**

   A useful way in which students can answer this question is for them to think of ways in which **they** *use energy. Grass needs energy to grow, to respire (breathe), and to reproduce.*

4. Show the students the jar marked "energy to breathe". Remind the students that their own lung muscles use up energy in making their lungs expand and contract; in other words, breathing is one way in which humans use up energy.

   The same holds true for plants. Tell the grass students that of the ten calorians that they received from the sun, three of these have to be spent just so that each plant can respire. Have a student go around and collect three calorians from each grass student.

5. Show the students the jar marked "energy to live". Remind the students that their own cells use up energy: living cells are always at work as they expel waste products into the bloodstream, combine chemical compounds to make other ones, etc. All of these things require energy. The energy demands of a cell can be compared to the energy required to run a factory.

   The same holds true for plants. Tell the grass students that of the ten calorians that they received from the sun, three of these have to be spent just so that the cells of each plant can fulfil their normal daily workload. Have a student go around and collect three calorians from each grass student.

6. Show the students the jar marked "energy to reproduce". Grass plants expend a large amount of energy to grow flowers and seeds. This energy is not available to animals that eat grass. Tell the grass students that of the ten calorians that they received from the sun, three of these have to be spent just so that the plants can reproduce. Have a student go around and collect three calorians from each grass student.

7. Ask the students how many calorians they have left (one). This single calorian represents stored energy: the energy that is stored inside the body of a plant as it grows. Ask the students

   - **If you were to be eaten by a ground squirrel now, does the squirrel get all of the ten calorians that you started with? If not, how many does it get?**

   Of all the calorians that the grass plants started with, only one is available to give to the ground squirrel. This is consistent with most food chains, where approximately 90% of all the energy at each step along the food chain is used (lost); only 10% of the energy actually makes it to the next step of a food chain.

8. Tell the students that each ground squirrel needs to receive ten calorians during its life in order to survive. Ask them to calculate how many ground squirrels can be supported by the grass plants in the room.
   There is enough grass in the room to support two ground squirrels. In fact, a single ground squirrel would need considerably more than ten calorians to survive, since they use more energy than a grass plant. However, for the purposes of this exercise the numbers have been altered a little so that a food chain can be demonstrated.

   Point out that, of the 200 original calorians that were available, only 20 of them were available for the ground squirrels.

9. Repeat the process that was carried out above, where energy is deducted from the ground squirrels' stores for various functions. Remember that one extra energy need is now present: mammals are warm-blooded, and need to burn energy to maintain their body temperature.

10. Repeating the energy deduction process should leave the two ground squirrels with one calorian each. Tell the class that the next level in the food chain is a red-tailed hawk. The hawk also needs ten calorians in order to survive. Ask the students:

    - **Is there enough energy in the room now to support a red-tailed hawk?**
      No. To support one hawk, there would have to be at least ten ground squirrels: you would have to do this activity with at least four other classes of the same size.

Discussion

- **If a red-tailed hawk could turn energy from the sun into food, would there be enough energy available at the start of the game?**
  Yes. If red-tailed hawks could turn the sun's energy into food energy, there could have been twenty of them at the beginning of the game. But since they have to wait until the sun energy travels through the food chain to the ground squirrels, there is not even enough energy in the room to sustain one.

- **Where does energy come from in a hawk's food chain?**
  For the hawk, energy comes from ground squirrels; however, this activity shows us that all energy ultimately comes from the sun.

- **Is energy lost in a food chain?**
  Yes. The law of conservation of energy tells us that energy cannot be created or destroyed, but that it can be transformed from one form to another. Although only 10% of the energy was transferred at every step in the food chain, the remaining 90% did not disappear; rather, it was transformed into other types of energy, such as heat.

Teacher's Notes

2.6 PYRAMID POWER

At each level in a food chain, energy is used by the plant or animal for maintenance of body functions as well as growth. The fact that energy is used within successive elements of a food chain means that there has to be more "prey" than there is "predators" - that is, more biomass, more energy, and higher numbers of organisms at the start of the food chain than at the end. The concept of a pyramid works well in illustrating this concept.

Objective

Students will discover that as energy from the sun passes along food chains in an ecosystem, much of it is used and is unavailable for the next step in the chain. The numbers of organisms found at every level reflects this use of energy.

Curriculum Tie-in

Science: Living Things and Environment - Environment and Ecosystems
The interaction of all factors involving communities of living things may be studied as an ecosystem, where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Time Required

2-3 classroom periods

Materials

- ❑ character cards (next page)
- ❑ 12 plastic balls
- ❑ string

Instructions for the Teacher

1. Cut out the cards that are found on the following pages; there should be three cards that form a food chain for every pyramid that is to be formed (an example set is grass - rabbit - great horned owl). Laminate these cards and hole-punch them so that they can hang around a student's neck.

2. Divide the students into groups so that there is between six and fifteen students in each group (see **Note to teacher**, below).

SNAKE

MOUSE

SEEDS

BIRD

INSECT

GRASS

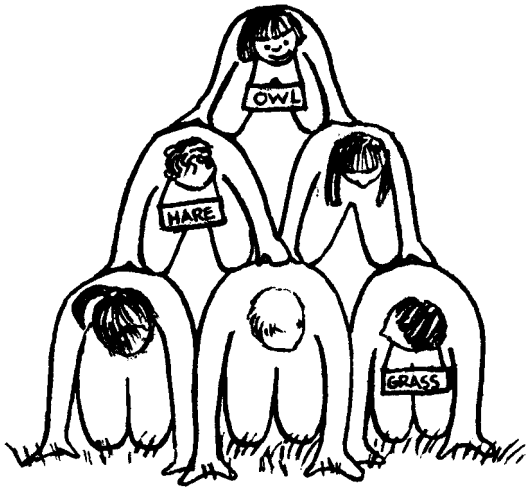
OWL

HARE

GRASS

3. Hand one set of character cards to each group of students. The students' task is to identify the relative position of the three characters in the set, and, using all students, form a structure that reflects this relationship. *Don't tell the students that a pyramid is the best structure to use.*

Tell students that the animal that is highest on the food chain also has to be highest on the structure (for one of the character card sets given here, this would mean having the grass card looped around the neck of the bottom row of students, the hare card looped around the neck of the middle row of students, and the great horned owl card looped around the neck of the highest student - as shown below). Do this on mats or carpet, or on a grassy surface outdoors. Have the groups face each other as they attempt this so that they can see each other. Tell students that the structure has to be free-standing for a period of fifteen seconds, and the cards have to be at the correct level. You may choose to have the students compete to see which group can form a structure first.



<u>Note to teacher:</u>
There are a number of ways you can orchestrate this activity. You may choose to explain to students how to make a pyramid - for example, you could begin by directing a row of the larger students in the class to kneel on the ground shoulder to shoulder, so that their backs are horizontal, to form a solid foundation for the pyramid. You may wish to allow the students to approach this activity as a co-operative task, developing and refining their technique as they try new structures.

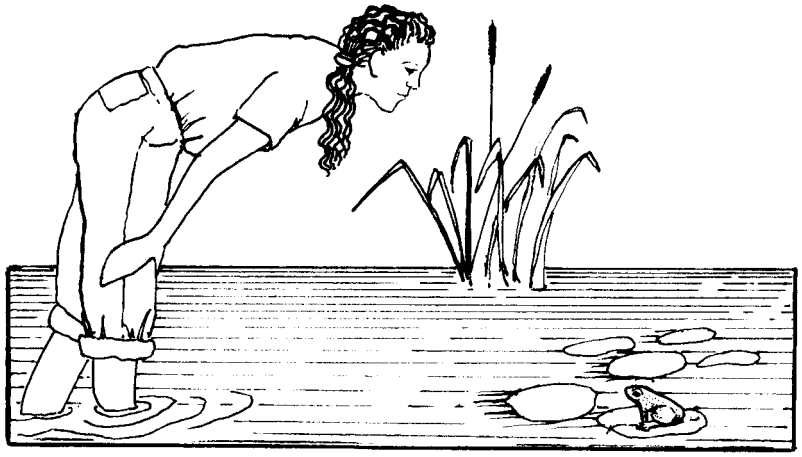
In the interests of safety, the pyramids described are only three levels high. Students may wish to form a higher pyramid; if you judge this to be safe, then simply add another character at the top or the bottom of the pyramid: either humans at the top or sun at the bottom.

4. The pyramids can also be used to demonstrate how pesticides travel upwards through a food chain and accumulate at the top, a process called ***bioaccumulation***. Hand several of the ground level students the plastic balls, explaining as you do so that you are distributing herbicides or pesticides in the area. Now have them carefully hand the balls upward through the pyramid. The organism at the top of the pyramid should end up with all of the plastic balls.

Discussion

1. Have the students sit in a semi-circle facing you. Review what students know about food chains. A food chain can be made up of several levels, as follows

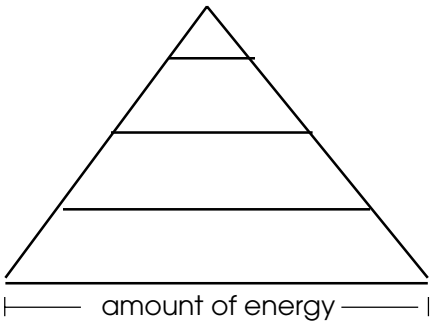
Level 1:	green plants - they have converted sunlight into stored energy (e.g., grass)
Level 2:	herbivores - their energy has been transferred twice, from the sun to plants and from plants to herbivores (e.g., grasshopper)
Level 3:	carnivores that eat herbivores - their energy has been transferred three times: from sun to plants, from plants to herbivores and from herbivores to carnivores (e.g., frog)
Level 4:	carnivores that eat other carnivores - their energy has been transferred four times: from the sun to plants, from plants to herbivores, from herbivores to carnivores and from carnivores to second carnivores (e.g., snake)



Ask students if snakes have any natural enemies (they do). A food chain can be five, six, or more links long.

2. Explain to the students that when living things feed upon each other a certain amount of food energy is not transferred along the food chain. Where does that energy go?
Energy is used to grow, keep warm, reproduce, breathe, move, and maintain body functions. Much energy is expended in the form of heat associated with muscular activity and motion. As Activity 2.5 showed, only the energy that is stored within the organism can be transferred.

3. In any food chain, there is more energy at level 3 than at level 4, and more at level 2 than at level 3, and more at level 1 than at level 2. If you were to draw a picture that represents how much energy is stored by all the organisms at each level, you would discover that the picture would look like a pyramid, with more energy being stored by the producers at the bottom of the pyramid than by the consumers at the top of the pyramid.



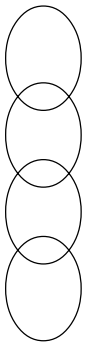
food pyramid

carnivores (snakes)

carnivores (frog)

herbivores (grasshopper)

producers (grass)



food chain

There is less energy available at each level as you go up the pyramid because energy is used by the living things at each step.

4. To help students understand how energy flows through a whole ecosystem, ask students to do a "thought experiment": imagine that the classroom is a sealed greenhouse with one snake living in it. The snake's only food must come from the greenhouse. Will the snake live?

No. Although the snake is surrounded by green plant material, if no other living things are present to convert the plants into food that the snake can eat, the food energy cannot be transferred and the snake will die.

- **What if there was one frog in the greenhouse - would this be enough to support the snake during its lifetime?**
  Again, no. There would have to be more organisms to support the next step of the food chain, in this case, more frogs to support the snake.. Whenever an organism is reduced in numbers a close look at changes in the food chain will often reveal why the decrease has occurred.

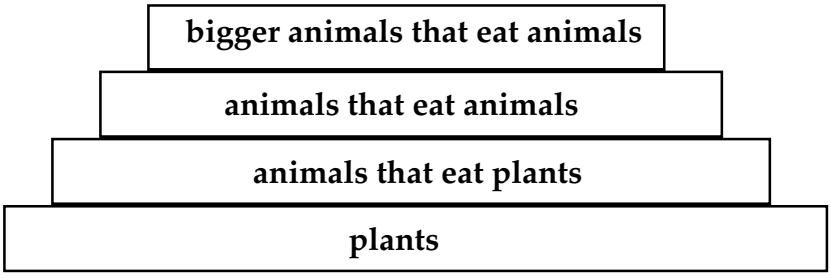
5. Introduce students to the concept of a pyramid of numbers. It might take a hundred frogs and tens of thousands of insects to support just one snake.

   Ask the students about the pyramids that they constructed using their own bodies. More students were found at the first level than the third, because that was the only way to support the weight. Similarly, a pyramid of numbers must have more members at the lower levels than the levels above them.

   Remind students about the plastic balls that were passed during the pyramid activity. Tell the students that having two or more balls at any one time can kill you, then find out how many students would have died during this activity. Examples of bioaccumulation of harmful residues are the accumulation of mercury in fish and the accumulation of the insecticide DDT in large raptors such as peregrine falcons.

Extension Activities

6. Collect pictures of plants and animals and group them into feeding levels (the scientific name for these are "trophic levels"). Glue them to milk cartons students have saved from home. Use the milk cartons to build a pyramid. White glue between the cartons will make a more permanent display.



2.7 YOU ARE WHAT YOU EAT

This activity examines the food that we eat, focusing on our own food pyramid.

Objective
Students will discover that humans play an integral part of many food chains, and that we can determine our impact on the world around us by making decisions about the food we eat.

Curriculum Tie-in
Science: Living Things and Environment - Environment and Ecosystems
The interaction of all factors involving communities of living things may be studied as an ecosystem, where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

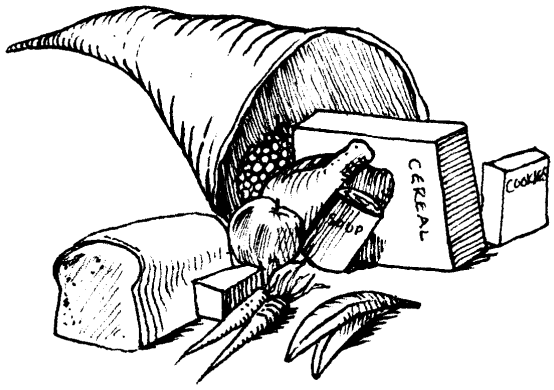
Time Required
one classroom period

Materials
- ❑ a dozen milk cartons
- ❑ white glue

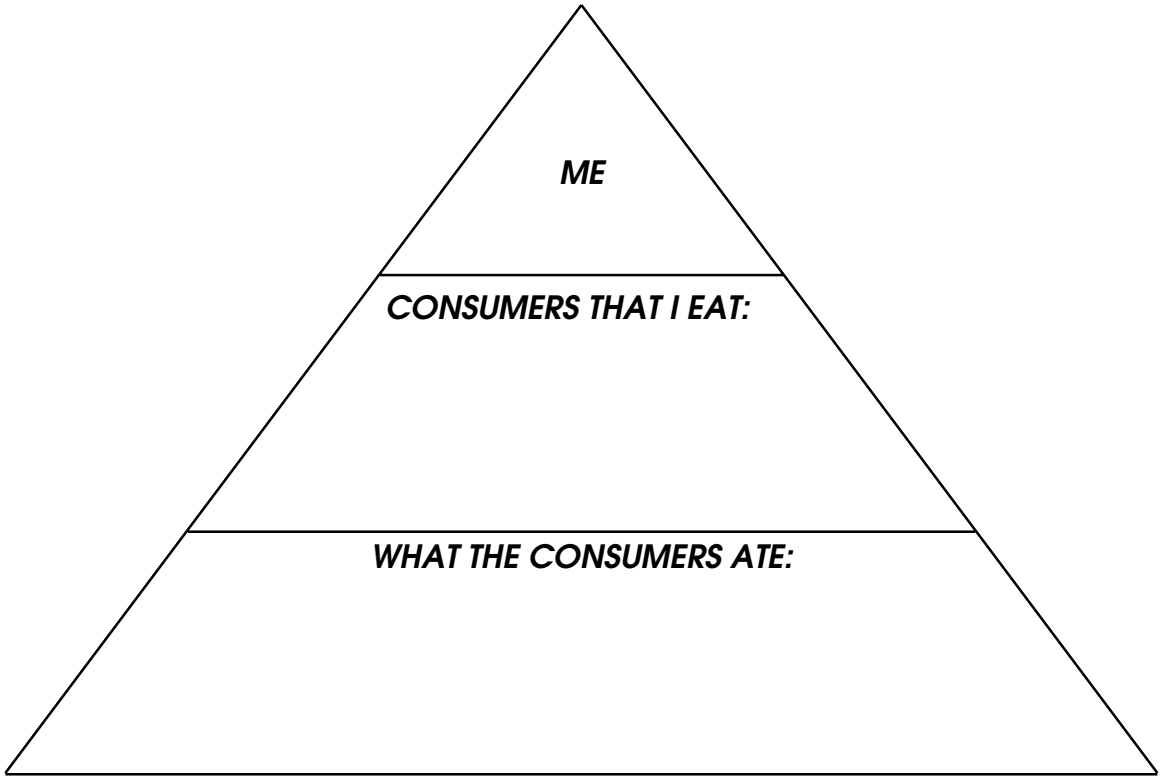
Instructions for the Teacher
1. Make a list of some of the foods that people eat that are associated with the different levels of the energy pyramid.

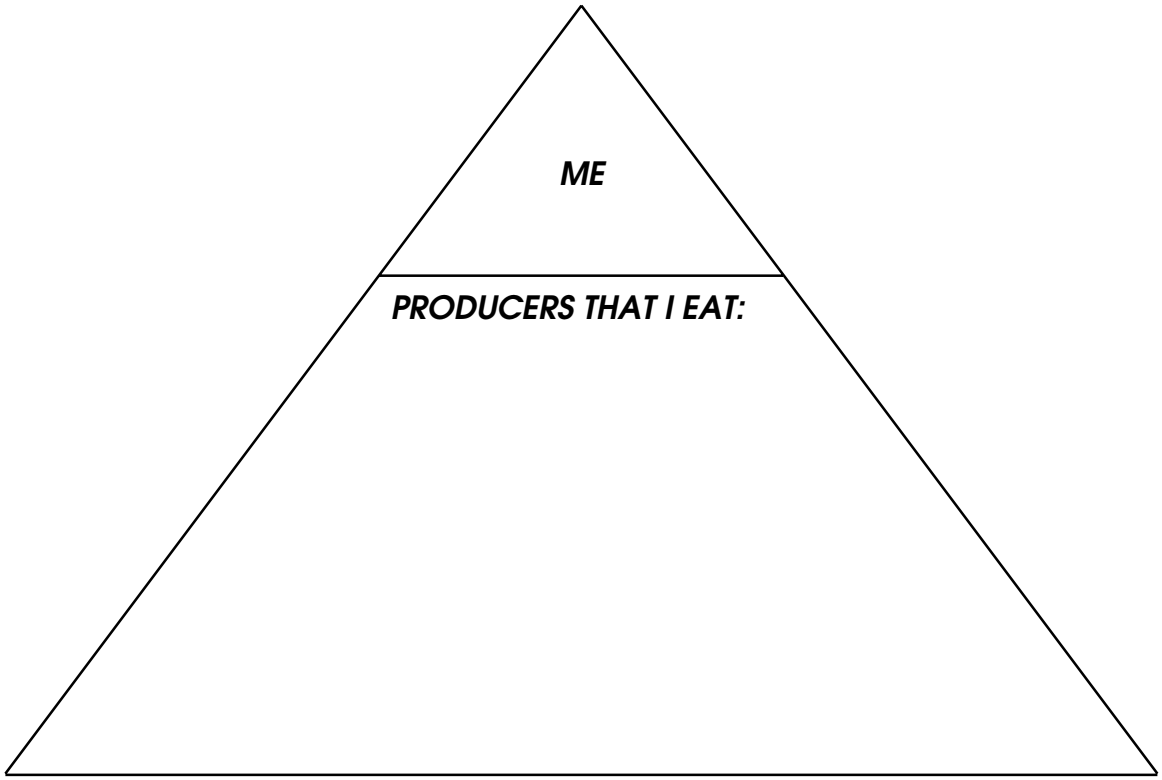
   e.g. ***producer*** - lettuce, tomato, potato, corn
   consumers - cow (beef, cheese, milk); pig (pork, bacon); chicken, lamb, fish

   Have students construct ***their*** food pyramid. Humans usually eat both producers and consumers, and are therefore classified as omnivores. For this reason, students should construct ***two*** pyramids: one entitled "My Carnivore Diet", showing only the meat portion of their diet; and a pyramid titled "My Herbivore Diet", showing only the producers that are eaten.



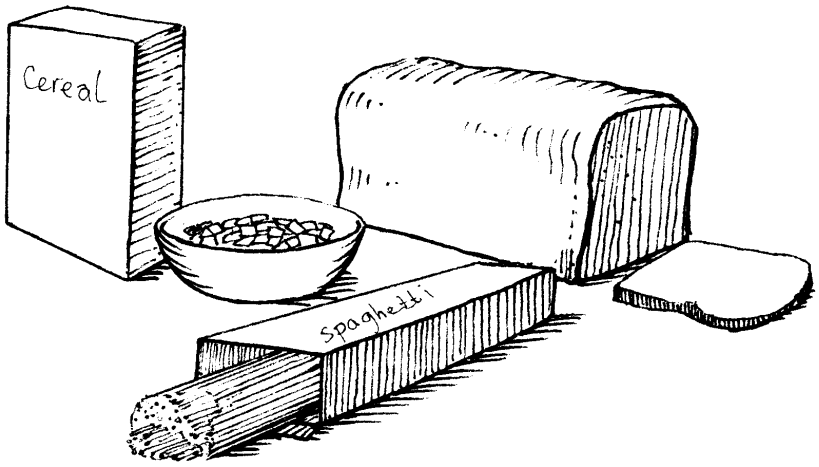
MY CARNIVORE PYRAMID





MY HERBIVORE PYRAMID

For the pyramid entitled" My Carnivore Diet", have them write their name at the top of the pyramid, and then the names of all of the consumers they can think of that they eat, (for example, cow and pig may be on this line). Directly below the consumer entries have students list all of the things that these consumers eat (i.e., grain, corn, grass, etc.).



For the pyramid entitled "My Herbivore Diet", have students list all of the producers that they eat directly (fruit and vegetables may be on this list). Note: you may wish to show students some of the diagrams of the food on this page in order to help them construct their pyramids.

2. Ask students the following questions:

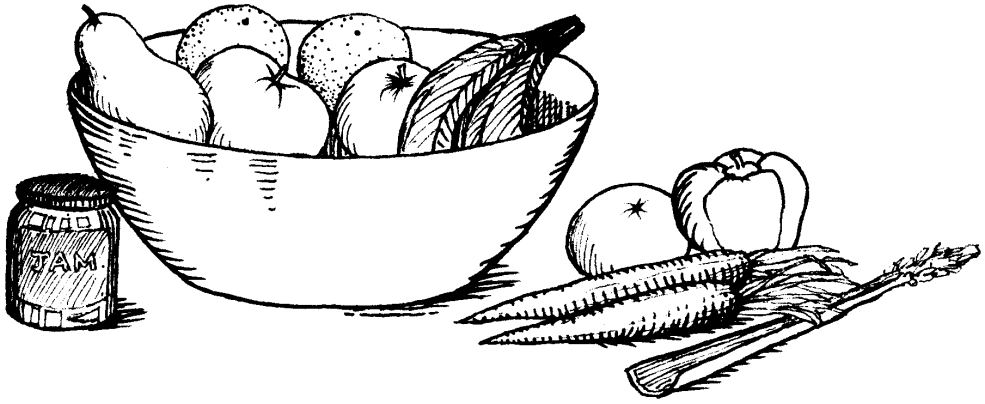
• Does most of your food come from the herbivore or the carnivore part of your diet? Give examples.

• If you have 450 kilograms of grain that you wanted to use to feed people, which of the following two procedures would you use?

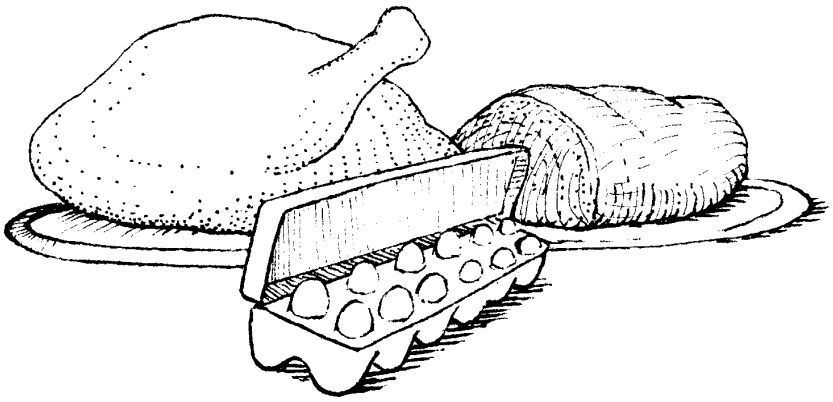
a) Make bread with the grain and feed it to people

b) Feed the grain to cows, then feed the cows to people in the form of beef

More of the food energy would be passed on by eating the grain products directly.



- **If you had to feed a number of people and you had a small farm, what would you raise or grow to feed them?**

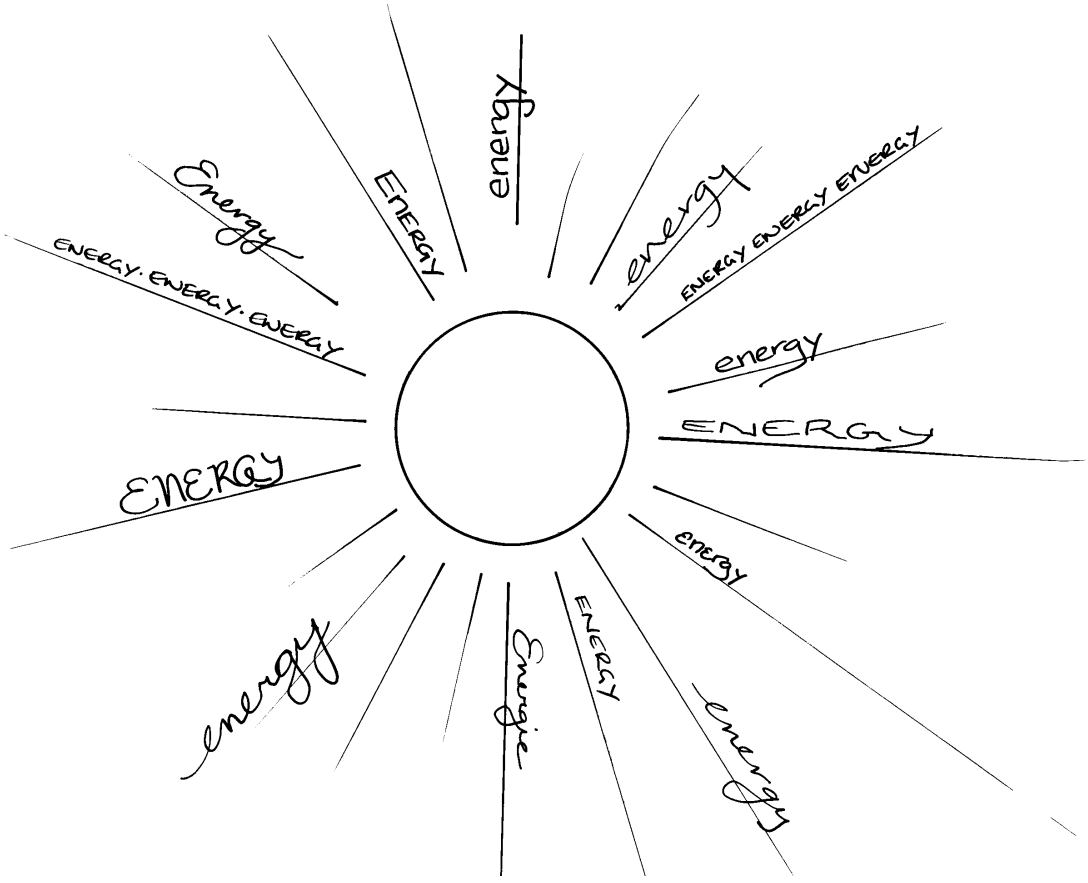


Cereal crops such as wheat and oats would be best as the return is greater.

Raising consumers to feed to people is a relatively inefficient way to produce food energy, since energy is lost at every step of the food pyramid.

- **What food problems do you think might happen if the world population continues to increase?**

Many people in the world eat mainly vegetarian meals - not through choice, but because they are faced with the problem of trying to feed many mouths with a finite crop resource. It may be that, in the future, increased numbers of humans will meet their dietary needs by eating lower on the food chain because this is a more efficient way of feeding large numbers of people.



3.0 FIELD STUDY: The Secret of the Keys

All the plants and animals living and interacting in an area form a community. Living organisms are not only affected by each other, but they are also affected by the non-living components of their environment such as the soil, water, wind, and temperature. To understand a community, it is important to investigate all of its components. In this full-day or half-day field study, students compare some of the interrelationships (food webs and food chains) between the living and non-living components of a forest, field, and pond community. The field investigations are outlined in their ***Secret of the Keys*** booklets. As they complete each activity, they will discover letters which, when unscrambled at the end, will form key community words.

Objectives

Students will...

- observe and describe characteristics of a natural environment.
- collect and record information regarding the interacting factors within an environment.
- classify components of an environment as producer, consumer, or decomposer.
- infer interactions and interrelationships to describe a food chain within an environment.
- explore forest, field, and pond communities and look for food chains and webs.

Curriculum Tie-in

Science: Living Things and Environment - Environment and Ecosystems

The interaction of all factors involving communities of living things may be studied as an ecosystem where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Time Required

1 hour for pre-field study instructions

1 day for field study (can be modified to take only a half day, especially if the field site is nearby)

Materials

A **Student Exploration Kit** for each student containing:

- ❑ 1 *Secret of the Keys* booklet (see Appendix)
- ❑ 1 bug box or magnifying glass
- ❑ 1 paper cup and 1 plastic spoon
- ❑ 1 piece of red and 1 piece of blue litmus paper

Each volunteer requires:

❑ 1 *Secret of the Keys* booklet (see Appendix)

The teacher requires:

❑ 1 *Secret of the Keys* booklet (see Appendix)

❑ 1 **Teacher's Kit** which should include:

- ❑ thermometers, enough for 1/3 of the class
- ❑ digging trowels for 1/3 of the class (sleuthing tool)
- ❑ 1 piece of string 2 metres long for 1/3 of the class
- ❑ 2 litres of distilled water
- ❑ dip nets and plastic jars for pond investigations, for 1/3 of the class
- ❑ 3 balls of yarn (optional)
- ❑ 1 whistle
- ❑ 4 boxes

Instructions for the Teacher

1. Choose an area for the field study and visit it before your class to become familiar with the site's facilities, features, and hazards.

   For further information on field study planning and implementation, contact Kananaskis Country to obtain a copy of the booklet ***Planning Successful Field Studies - A Guide.***

   The area chosen should include a forest, a field, and a pond or stream (see suggested locations for field study in Section 1.1). Be sure that you take the time in class to go through all of the activities in the Student's Booklet, in preparation for when the students have to do it themselves.

2. Arrange for program assistance by enlisting the help of school volunteers. A ratio of 1 volunteer to 5 students is recommended. It is also recommended that the teacher be free to circulate amongst the groups and provide assistance where needed. The volunteer's role is to keep their group on task, deal with questions, and to offer assistance when needed.

3. Each volunteer should receive a Volunteer Letter (see Appendix) and a copy of the *Secret of the Keys* booklet at least one week prior to the field study to allow time to review the program.

4. One week before the field study, send a letter and consent form home to the students' parents. Children will need a warm jacket, a hat, boots, and a packed lunch. You may wish to bring extra clothes for any unprepared student.

5. Collect the materials listed.

6. During the field study, students will be asked to test the acidity of the soil using litmus paper. Before you leave, give the students the opportunity to experiment with pieces of red and blue litmus paper, using the directions in the Students' Booklet.

7. Introduce the following vocabulary:

   Community: A group of plant and animal species living together within a defined area where they can meet their needs. (e.g., the forest community is composed of forest animals and plants).

   Ecosystem: An assemblage of living organisms that interact with each other and with the non-living environment (e.g., the forest ecosystem may be studied by going to a forest community).

   Habitat: The place where an organism lives and meets its needs (e.g., the habitat of a forest-dwelling thrush is among low shrubs and forest litter).

   Niche: The role that an organism plays in a community (e.g., the thrush occupies the niche of a ground-feeding insect-eater in the forest).

   Energy: Energy is the ability to do work and to cause change.

   Adaptation: Any change in the way an organism appears or behaves that makes it better suited to its environment.

8. Divide the students into three groups and assign each group to an area to be investigated (forest, field, or pond). Assign two volunteers to each group.

9. Make one copy of the *Secret of the Keys* booklet for each student. On page two of the booklet is a box which indicates which area the student will investigate. Ensure that 1/3 of the booklets are marked "pond", 1/3 are marked "field", and 1/3 are marked "forest". Distribute the booklets to the students. Have students write their name on the cover of their booklet and check inside to find out which area they will be investigating.

10. Explain to the students that they will be investigating either a forest, field, or pond. *Time permitting, they may be able to investigate more than one location.*

    Students will notice that next to the box on page 2 is an instruction that tells each group which page number to turn to next. This is where they will begin their investigations (i.e. students investigating the forest will turn to page 4, students investigating the field will turn to page 15 and students investigating the pond will turn to page 7). Have each student turn to the appropriate page. Direct their attention to the bottom of the page. The letters in the key symbols should be recorded in the appropriate spaces at the top of the columns on pages 12 and 13. (You may wish to do the first one together: the word, once the letters have been re-arranged, is "producers").

    Directions on each page will tell them what page to turn to next. Each page will have an answer or a picture to draw - in most cases, there will be a place on pages 12-13 to put this information.

    For example, the first space on page 12, upper left-hand corner, is the **F**orest's answer from page 4. All the **F**orest answers are across the top of pages 12 and 13. All the **F**ield answers are across the middle of the pages 12 and 13. Lastly, all the **P**ond answers are across the bottom of pages 12 and 13.

11. Have students turn to page 22 in their booklet. Explain that once they have finished all the activities related to the forest, field, or pond, they will do the activity outlined on page 22. This activity involves creating a new plant or animal which is adapted to live in their area. Their animal should be adapted to the area and they should specify how it is connected to other plants and animals in the area.

12. Have students turn to page 24 in their booklets. On this page they are asked to write a Cinquain poem. Go over the format of a cinquain poem as outlined in the booklet and have each student write a practice poem in class.

13. Collect the student's booklets and put them with the other materials to take on the field study. Place each student's exploration kit in the group's bag. Label the bag with the names of the students in the group and the name of the adult volunteer. Place exploration kits and the teacher's kit into separate boxes.

Instructions for the Teacher During the Field Study

1. Before departing on your field study, meet with volunteers to review any questions they may have about the field study and the booklets. Remind volunteers that their responsibilities are to help ensure proper student conduct, to help with the reading at each stop, and to help students arrive at their own answers. Ask them to avoid simply providing students with an answer; rather, encourage the students to think for themselves.

2. At the site, assemble your class in an open area. Establish boundaries for the activities. These may be delineated by rivers, creeks, pathways, or distinctive trees.

3. Introduce the field study by having the students turn to page 2 of their booklets. This will remind them which area they will be investigating. Explain to them that they will be looking for who lives in their area, what food is available to those inhabitants, what adaptations the plants and animals have which enable them to live in the area, and what food chains they can discover there.

4. Review the use of the litmus paper with the students (Follow the directions on page 10 of the booklet).

5. Divide the students into their three groups with their volunteers. A volunteer from each group will receive the box containing their group's exploration kits. Explain to the students that they will now spend some time in their exploration groups. Establish a time and place to meet at the end of the exploration. You may blow a whistle to call the groups back.

6. Send the groups out to do the activities in their booklets. Have the students record the information they collect in their booklets.

7. Once the groups have dispersed, the teacher's role is to circulate, answer questions, and be an interested observer.

NOTE TO TEACHER: In Provincial Parks and Recreation Areas, plants and animals are protected. Please encourage the students to look, touch, smell, and feel while leaving things as they found them (i.e. picking or collecting is not allowed).

Note to teacher:

- **as an option, you may wish to assign students other locations to go to when they finish their first location.**
- **depending on the size of your class and on how well they work together, you may wish to further subdivide each group into smaller working groups.**
- **students may often become excited by this new type of study, and their written work may suffer as a result. You may wish to check the students' notebook every once in a while to ensure that they are recording as well as observing**

8. When each group has finished their investigations they will work together to:
   - complete page 21 in their books.
   - select a spokesperson for the group
   - decide on the main points they want others to know about the area they investigated (forest, field, or pond).

Discussion

9. The discussion will provide students with the opportunity to share what they have discovered about their area with their classmates and volunteer leaders. When the students have completed the activities in their booklets, gather the class in a circle. Alternatively, if you broke each of the forest, field, and pond groups into smaller work groups, group these smaller groups together to share information about the different areas.

10. A spokesperson from each group will share the information that their group has collected with the other two groups. They should tell the other groups about who lives in their area, what food is available to those plants and animals, what adaptations the plants and animals have which enable them to survive in the area, and what food chains they discovered.

11. Next, have the groups pool their key letters from each column to discover the key words. These key words are linked to what was investigated. Students solve "the secret of the keys" here! The words are shown below:

COLUMN #	SECRET WORD
1	*PRODUCERS*
2	*CONSUMERS*
3	*DECOMPOSERS*
4	*HABITAT*
5	*ADAPT*

12. ONCE THE INFORMATION HAS BEEN SHARED, EXAMINE THE INFORMATION COLLECTED BY UNDERTAKING THE ACTIVITIES IN THE POST-FIELD STUDY SECTION.

4.0 POST-FIELD STUDY

Once the data has been collected on the field study, discussion and analysis can occur back in the classroom. In the following activities students will have the opportunity to choose an aspect of food chains and webs and pursue it in some depth. Students can work individually, in small groups or as a class. These are mini-projects of limited duration which may or may not have a display or sharing component.

Objectives
Students will expand on and work with the information gained on the field study.

Curriculum Tie-in
Science: Living Things and Environment - Environment and Ecosystems
The interaction of all factors involving communities of living things may be studied as an ecosystem where populations share resources of matter and energy in meeting survival needs and maintaining continuity of the community.

Time Required
Varies with the activity

Materials
- ❑ *Secret of the Keys* booklets
- ❑ other materials will vary with the activity

ACTIVITIES

On the Wall
- Cover the bulletin board with white butcher paper or poster board. Have students make drawings or a collage on the bulletin board of plants and animals in the forest, field, or pond. Use coloured yarn to connect the drawings to show food webs and chains that exist in the forest, field, or pond.

Show and Tell
- Have students report to the rest of the class on what they were able to discover about the forest, field, and pond. Encourage students to use a creative method of presentation. Some possible presentations methods include drawing models, dancing, developing a skit, or making up a musical presentation.

Part of the Whole

- Separate the class into three groups for this activity. One group will represent a pond food web, one group a forest food web, and one a field food web. Assign each student one of the following:

Pond	***Forest***	***Field***
Sun	Sun	Sun
Frog	Spruce	Coyote
Mosquito	Lodgepole Pine	Hawk
Cattails	Squirrel	Juniper
Beaver	Elk	Bearberry
Ducks	Deer	Locoweed
Bulrushes	Mushroom	Grasshopper
Snake	Deer Mouse	Field Mouse
Dragonfly	Rotting Log	Pocket Gopher
Water bugs	Woodpecker	Grass
Minnow	Beetle	Worm

Have each student make a large card with the name of the plant of animal on it that they represent.

Use a ball of yarn to make food webs. Hand the ball of yarn to one person. That person will hold onto the end of the yarn and will toss the ball to another person (plant or animal) that they depend on, or that depends on them. They should say who they are tossing the yarn to and why. Pass the ball of yarn from person to person according to the connections that can be found within the group. Continue until everyone is attached to at least three other people. Have the students pull the strings tight so that they can see the food web that exists in their community. Then one by one have them drop their strings so that they can visually see that as organisms disappear from a community, the whole food web starts to fall apart.

Optional: Explore how the three webs are interrelated by using a different coloured yarn and connecting the webs together.

Discuss the following:

As part of a food web, how do humans differ from all other organisms?

Humans, whether intentionally or unintentionally, manipulate the components which make up the food web. We do this by affecting the animal's habitat through development (e.g., highways, construction sites, farm fields, etc.) or more directly by hunting and removing animals from certain areas. Of all the animals on the earth only humans have the ability to understand something as complex as a food web, and only humans can bring around huge changes to food webs and food chains. Humans therefore are responsible for preserving the balance of the whole web.

Group Sculpture

A group sculpture is an activity in which a group of students use their own bodies to make a visual representation of something, in this case, a natural community.

To do a sculpture each student must choose a plant or animal found on the field study. Draw up a list of name tags showing the various "characters" or animals that were found at the field site. Make sure that there is one animal type for every student in the group. One student is then picked to begin the sculpture. Other students then enter the "sculpture " showing their relationship to those already in position.

As an example, if the first student was a dragonfly and the next was a mosquito, then the picture formed by the students may be of the dragonfly about to pounce on the mosquito. Other students then present various relationships to the first two: i.e. the mosquito being eaten by a duckling, etc.

Once the sculptures are complete, have one group stand in front of the class while the remainder of the class decides:

- **Which things are producers?**
- **Which things are consumers?**
- **Are there any decomposers?**
- **Based on what the sculpture show, how do the organisms relate to one another?**
- **Do you disagree with the sculpture in any way?**

Food Chains

Have the group make as many simple food chains as they can. (For example: grass —> mouse —> coyote mosquito —> frog —> hawk.)

What would happen to the food chain if the producers were removed?

Food Webs

- Students make a list of animals that are found in the forest, field, or pond. Look in the booklet, *The Secret of the Keys*, for a list of animals. Don't forget to add the animals that live in all three areas, such as coyote, elk, jay, deer, bluebird, crow, and magpie. Use the chart on the following page to classify and research the main food of each animal.

- Students can compile all the information gathered for a report or display on their area. This could include food chains and webs for that area.

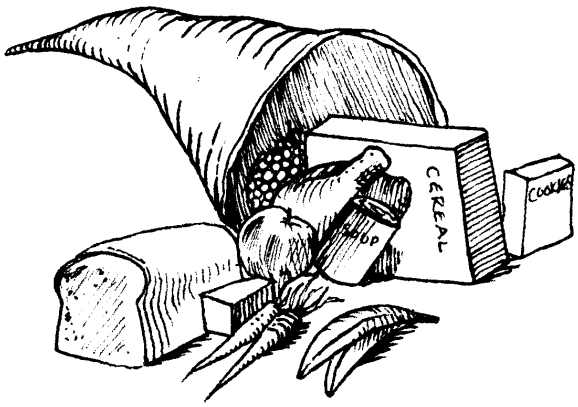
- Students can make a display or write a report on the food chains and webs. Try to use all the animals that live in the forest, field, and pond.

WHAT DO THEY EAT?

Name: _____

Area Investigated: _____
(Forest, Field, or Pond)

	NAME OF ANIMAL	MAIN FOOD
Herbivore		
Carnivore		
Omnivore		



Soil Profiles

- Divide the class into groups of three students, one from each study area, and have them compare soil cross-sections. Have them make notes on differences and similarities between the different cross-sections.

- Have students collect a sample of dirt from the school campus. Try to choose an area with lots of organic material such as under a tree, under bushes, or in a grassy meadow. Examine the sample using a magnifying glass or a microscope and look for animal life in the soil.

Classification

- Have students classify their "characters" described in their character report (see the *Secret of the Keys Student Booklet*, pages 6, 14, and 17). Show the scientific classification of this character from vertebrate or invertebrate, down to genus and species of their character. Use the drawing they made to help with the classification.

Climate and Soil

- Have students report on the wind, temperature, and soil in their area. Show, by display or report, how the wind, temperature, and soil relate to the plants in different areas. Carry this further and do a display or report on the climates and vegetation in regions in Alberta or across Canada (this provides an excellent opportunity to teach aspects of the Social Studies curriculum with this program)

Adaptations

- Have students draw or write a report describing three plants or animals that are adapted to live in the forest, field, or pond. Remind students to differentiate between structural and behavioural adaptations. Tell about or draw the plant or animal and how it is adapted, or suited to live in the area. (Note: Ask them to think about colouring and skin: an earthworm has moist skin to live in moist soil; a beetle has a hard shell to keep it from drying out, etc.)

- Make a master list of animals and plants in the forest, field and pond. What adaptations do plants and animals have that allow them to survive the winter? Draw these winter adaptations.

Consumers-Producers?

- Students have seen on the field study that most plants are producers. Some plants, however, are consumers: Venus fly-trap, bladderworts, butterwort, and sundew are examples of plants that catch insects to supplement their nutrient intake. Through drawings show how these plants trap insects. (Bladderworts and butterworts can be found in Kananaskis Country.)

- Have students choose a producer (plant) and make a poster showing how that producer is connected to other plants and animals to form food chains and webs. Use pictures from magazines or hand-made drawings to illustrate the poster.

4.1 POST-TEST

When the students have completed the activities in this program, their knowledge and understanding of food chains, food webs, communities and interrelationships can be evaluated by giving them the same test that they were given at the beginning of the program.

Objective

To determine how much students have learned about food chains and food webs.

Time Required

45 - 60 minutes

Materials

❑ 1 copy of the test and answer sheet for each student

Instructions for the Teacher

1. Make one copy of the answer sheet for each student in the class. Reuse copies of the test made at the beginning of the program.

2. Give the test to the students.

3. After they have written the test, go over the answers with the students. Find out what questions they answered incorrectly and what questions they answered correctly.

4. Record the scores and compare them to the results of the test given at the beginning of the program.

5.0 *FOREST, FIELD, AND POND*

PROGRAM EVALUATION

Kananaskis Country Environmental Education materials have been developed to provide you with teacher-directed units of study. These are *living documents* that undergo changes on a continual basis.

The purpose of this questionnaire is to find out if these materials are meeting your teaching needs. Your comments are valuable to us. Please take a few minutes to complete this evaluation so that we may continue to improve your materials.

School name	Grade level taught	Your name (optional)
_____	_____	_____

★ How did you hear about the program?
❑ workshop ❑ administration ❑ in-service ❑ newsletter ❑ fellow teacher
❑ other (please specify) _____

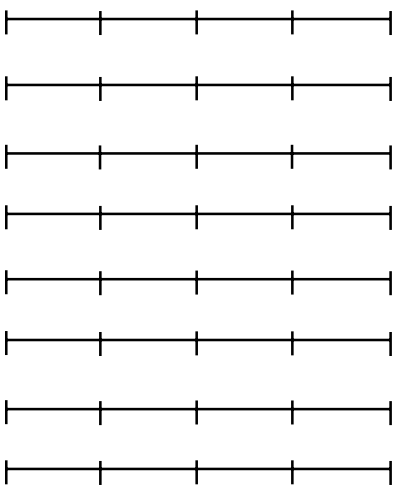
★ Did you use all of the program? ❑ yes ❑ no
If you answered **no**, which part did you **not** use and why?

_____

★ On the bar line below how would you rate the program in the following categories:

- **appropriate for grade level (✔)**
- **clear instructions**
- **text easy to follow**
- **relevant to curriculum**
- **materials easy to use**
- **did you enjoy the material**
- **did your students like the material**
- **program of appropriate length**

YES NO



★ Approximately how long did it take you to complete these materials?

❑ 1-2 weeks ❑ 3-4 weeks ❑ 5-6 weeks ❑ longer than one month

❑ program was spread over the year

★ Were you satisfied with how these materials fulfilled the curriculum objectives?

❑ yes ❑ no

If you **were not** satisfied, please elaborate: _____

_____

★ Did you require any additional information to complete any part of the program?

❑ yes ❑ no

If **yes** please tell us what was required:

_____

_____

★ Would you use these materials next year?

❑ yes ❑ no

If you answered **no** please tell us why: _____

_____

★ Any additional comments about the program in general? _____

_____

Thank you for completing this questionnaire. Please place the completed questionnaire in an envelope and mail to:

Environmental Education Coordinator
Alberta Environment, Natural Resources Service
Kananaskis Country
Suite 201, 800 Railway Avenue
Canmore, Alberta T1W 1P1

PH: 403-678-5508 FAX: 403-678-5505

APPENDICES

I Volunteer Letter
II Secret of the Keys booklet

FOREST, FIELD AND POND FIELD STUDY
- an invitation to join -

Date:

Dear

On _____, 19__ you will have the special opportunity to share with children the excitement and the wonder of investigating the natural environment. With your involvement, students will discover what plants and animals live in a forest, field, and pond, what food is available to them, what adaptations they have which enable them to survive in the area and what food chains exist amongst them.

You will have the chance to experience this environment with them, listen to them and talk to them about what they observe and what they think about the world in which they live.

The activities which the students will be doing are outlined in the enclosed ***Secret of the Keys booklet***. Please read over the activities to familiarize yourself with them and bring the booklet along for reference. Feel free to participate in the activities with the students so that you too can explore the area and share your observations. Each student will be given a copy of the booklet that you have been sent in which to record their observations.

Students should avoid trampling vegetation and removing things from the environment; encourage them to come and get you if they find something exciting, rather than having the students bringing things to you.

Thank you for volunteering your time. I am looking forward to an enjoyable day!

Sincerely,

Teacher

"If a child is to keep alive his inborn sense of wonder... he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in."

Rachel Carson, 1965

Just Before you Begin...
A note to Volunteers

The ***Secret of the Keys*** field study has been designed to encourage students to discover what plants and animals live in a forest, field, or pond, what interrelationships exist amongst them, where they get their food from, and what adaptations they have which enable them to survive in their environment.

You will be leading a small group of students through the booklet activities. **This booklet is identical to the student's except for the page that you are now reading.**

Your responsibilities are to help ensure proper student conduct, to help with the reading at each stop, and to help students arrive at their own answers. Please avoid simply providing students with an "answer"; rather, encourage the students to think for themselves. Students may often become excited by this new type of study, and their written work may suffer as a result; check the students' notebook every once in a while to make sure that they are on the right track.

Each activity should take 10 - 15 minutes. Most of their answers will be recorded on pages 12 and 13 of their booklet, ss follows:

Students examining the forest - record data on first row
Students examining the field - record data on second row
Students examining the pond - record data on third row.

Remind students that they will be observing living things. All living things should be left where they were found. Encourage students who have found something that they may wish to share to take you to their discovery.

After completing these activities, the whole class will get together for a discussion.

Thank your for your help. Have an enjoyable day!

Note to Teacher: this page is designed to be inserted into the booklet that the volunteer receives

Cinquain Poem

Write a Cinquain Poem about something you discovered or saw in your area.

A cinquain poem has 5 lines. Each line has a certain number of syllables and a purpose:

The first line is a title (noun) containing 2 syllables.
The second line describes the title has 4 syllables.
The third line has 6 syllables and tells of an action.
The fourth line has 8 syllables and gives feeling.
The fifth line has 2 syllables and the words describe the title.

Great bear
Magnificent
Movement like silk in light
My thoughts go with you in spirit
Alive

My cinquain poem

YOU HAVE NOW COMPLETED YOUR INVESTIGATION.

THE SECRET OF THE KEYS

Your Name: _____

Check ✔ the area you will be investigating today.

❑ **FOREST** - First read the instructions at the bottom of this page, then get your investigation kit, **turn to page 4** of this booklet and begin.

❑ **FIELD** - First read the instructions at the bottom of this page, then get your investigation kit, **turn to page 15** of this booklet and begin.

❑ **POND** - First read the instructions at the bottom of this page, then get your investigation kit, **turn to page 7** of this booklet and begin.

Instructions:

1. At the bottom of each page you will find a box that tells you what page to turn to next. The box looks like this:

Turn to page 8

2. You will also find a key with letters in it at the bottom of each page. The key looks like this:

The letters in the key go in the spaces provided at the very top of pages 12 and 13. Later, you will combine your letters with those collected by other study groups and unscramble them to form words. As you work on each page, write your answers in the appropriate spaces on pages 12 or 13.

If you are investigating...
... the forest, all your answers will go in the **top row**
...the field, your answers will go in the **middle row**
... the pond, your answers will go in the **bottom row**

Description of My Creature...

Remember to include:

❑ its adaptations
❑ where it lives
❑ what it eats and drinks
❑ its connections with other living things that live here
❑ how it moves
❑ where it sleeps
❑ who eats it

Name of Creature: _____

Description:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Turn to page 24

Create a Creature!

You have seen that there are many plants and animals living in the area you were investigating (forest, field, or pond).

Draw a picture of an ***imaginary*** plant or animal which could live in your area. Make sure you include both structural and behavioural adaptations that enable it to live in this area. Be sure to include its name. Draw a picture of your organism below. Add labels that explain how it lives. Describe your creature on page 23.

picture of my Creature

Turn to page 23

YOU ARE PART OF A SEARCH PARTY TO FIND THE WIND SPEED AND TEMPERATURE IN A POND

You will need:

❑ 1 thermometer

Go to the edge of the pond.

To find the wind speed:

Lick your finger and hold it high in the air. Can you feel the wind? ❑ yes ❑ no

Now lick your finger again and hold it low to the ground.

In which place was the wind speed the strongest?

❑ high in the air ❑ low near the ground

Use the Beaufort Wind Scale on page 20 to estimate the speed of the wind in the forest.

Record the wind speed on page 13.

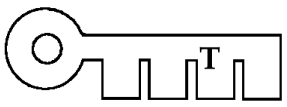
To find the temperature of the air and ground:

Shake the thermometer 2 or 3 times so that the fluid goes down into the bulb.

Take the temperature of the air by holding the top of the thermometer and stand still for 3 minutes.

To find the ground temperature, place the bottom of the thermometer on the ground for 3 minutes.

Record the air and ground temperatures on page 13.



Turn to page 8

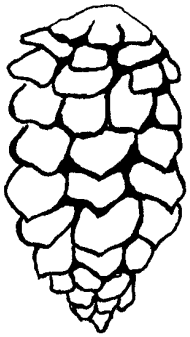
Forest Study

Find a tree whose leaves are actually long needles (another name for this type of tree is an evergreen tree, or coniferous tree).

Look carefully at the cones from this tree. Which one of the tree species below is your tree?

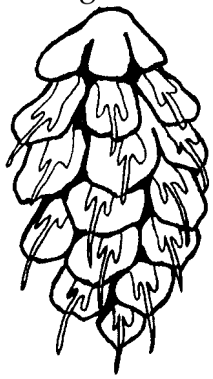
Spruce Tree -cones are open, ends of the scales are round.

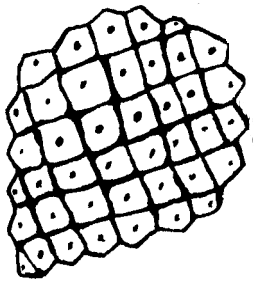
Needles are short and can be rolled between thumb and forefinger.



Douglas Fir Tree - cones have "mouse tails" sticking out from between the scales.

Needles are flat and cannot be rolled between thumb and forefinger.





Lodgepole Pine - cone scales have sharp tips and are closed with resin.
Needles are long, and grow in groups of two.

Examine other trees around you. If there are other types of evergreen species in the area, identify them. Write the name of the trees you identified on page 12.

turn to page 11

My Community

The community I am studying is the

❑ forest ❑ field ❑ pond

At least 3 producers and 3 consumers I found in my area:

Producers:

_____

_____

Consumers:

_____

_____

A food chain I found in my area:

_____

_____

The weirdest thing I found in my area:

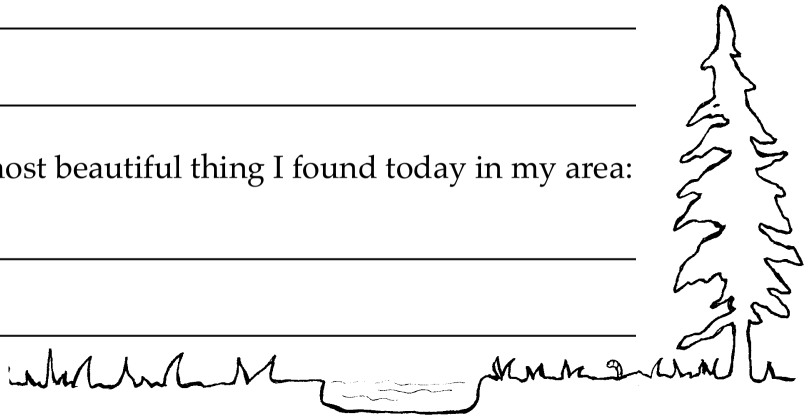
_____

_____

The most beautiful thing I found today in my area:

_____

_____



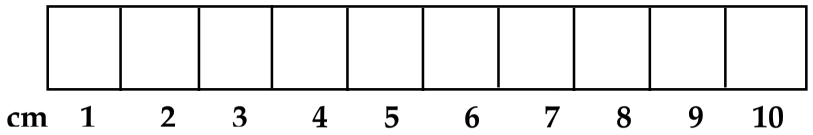
Turn to page 22

BEAUFORT WIND SCALE

Using the Beaufort Wind Scale below, estimate the wind speed.

Speed in km per hour	What is happening
0-2	Smoke rises vertically, dry dust falls vertically
2 - 5	Wind direction is indicated by the drift of smoke.
6 - 12	Leaves rustle and wind is felt on face.
13 - 19	Leaves and twigs are in constant motion, small flags are extended.
20 - 29	Loose papers, dust and small branches move.
30 - 39	Small leafy trees begin to sway.
40 - 50	Large branches move, whistling heard in overhead wires.
51 - 61	Whole large trees sway back and forth.
75 - 86	Twigs break off, it is hard to walk.

Centimetre Ruler



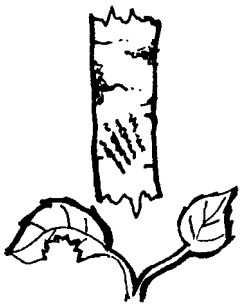
All students in the vicinity of an open, grassy area

BE ON THE LOOKOUT FOR...

evidence that a dee
mouse, coyote, or other animal has been here.

Clues to look for (check ✔ boxes)

- ❑ homes of the animals (where they might sl
  holes in the ground for voles, piles of dirt
  gophers, nests in the bushes
- ❑ chewed vegetation
- ❑ claw marks on trees
- ❑ animal droppings or animal tracks



EYEWITNESS REPORT

I found evidence that this animal was in an open, grassy area: _____

The evidence that I found was: _____

_____

_____

_____

On page 13, draw a picture of the evidence you found.

Turn to page 18

Spying On...

You will need:

❑ 1 bug box

Your assignment: Seek out and report the activities of an inhabitant of the forest.

Look for: the inhabitants of the forest on trees and branches and under rocks and logs. Check off the animals you find.

❑ spiders ❑ beetles ❑ worms

❑ ants

Collect one of these creatures in your bug box and fill in the following Character Report. Remember to return the creature to the same place you found it, as that is its home.

Character Report: (Classification: Top Secret)

How does it move around? _____

How many legs does it have?_____

Where did you find it?_____

What do you think it might eat ? (look at its mouth parts)

_____

~~Is it a producer, consumer, or decomposer? (circle one).~~

Why? _____

Draw a picture of your character on page 12.

Turn to page 8

HOT ON THE TRAIL

Your assignment:

Find evidence that a woodpecker, hare, bird, deer, elk, beaver, squirrel, coyote, or other animal lives in the forest.

Clues: Check off the boxes when you find these things:

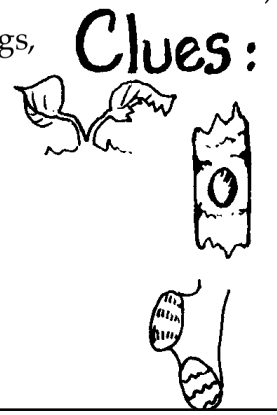
❑ remains of food that animals have eaten or chewed (e.g., squirrel midden or twigs that have been nibbled)

❑ where animals sleep (beaver cuttings, holes in trees for birds)

❑ animal droppings

❑ tracks, claw or teeth marks, elk scrapes on trees

❑ beaver teeth marks on stumps



Eyewitness Report

I found evidence that this animal was in the forest area:

Name of animal:_____

The evidence that I found was: _____

_____

_____

Draw a sketch of the evidence you found on page 13.

Return to the meeting place and complete page 21.

Capture the wind speed and temperature in an open grassy area...

You will need:

❑ 1 thermometer

To find the wind speed:

Lick your finger and hold it high in the air. Can you feel the wind? ❑ yes ❑ no

Now lick your finger again and hold it low to the ground. In which place was the wind speed the strongest?

❑ high in the air ❑ low near the ground

Use the Beaufort Wind Scale on page 20 to estimate the speed of the wind in the forest.

Record the wind speed on page 13.

To find the temperature of the air and ground:

Shake the thermometer 2 or 3 times so that the fluid goes down into the bulb.

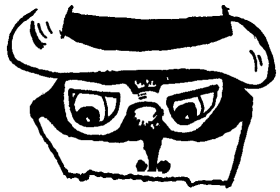
Take the temperature of the air by holding the top of the thermometer and stand still for 3 minutes.

To find the ground temperature, place the bottom of the thermometer on the ground for 3 minutes.

Record the air and ground temperatures on page 13.

Return to the meeting place and complete page 21.

Pond Study



The Line Up...

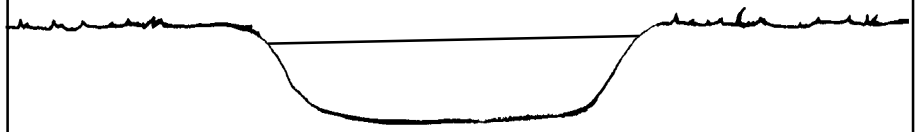
The following suspects were last seen in the vicinity of the pond. See if you can find them and draw where they grow in the pond on the **Pond Profile** below.

Alias: Rush
60 - 150 cm tall
round, hollow stems
(O)

Alias: Willow

Alias: Sedge
30 - 60 cm tall
triangular stem at base
(▲)

Pond Profile



Are the suspects producers, consumers, or decomposers? (circle one) Why? _____

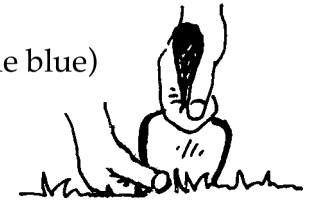
Which suspect lives in the deepest part of the pond? (Answer goes on page 12)

Turn to page 17

Dirty Work

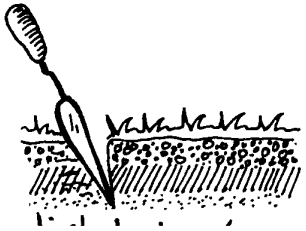
You will need:

- ❑ 1 digging trowel (sleuthing tool)
- ❑ 1 cup and spoon
- ❑ 1 thermometer
- ❑ 2 pieces of litmus paper (one red, one blue)
- ❑ 1 bug box
- ❑ 2 teaspoons of distilled water



First, push the digging trowel straight into the ground about 8 to 13 centimetres anywhere in your area. Push the tool back so that you can see a cross section of the soil.

Place the thermometer into this hole with the bulb touching the bottom. Cover with dirt and leave for 3 minutes. Record the temperature of the soil.



Check ✔ off the area you are investigating:

❑ **Forest** ❑ **Field**

❑ **Pond**

Use the guide on page 9 to help you describe your dirt. Record your findings below:

Temperature _____

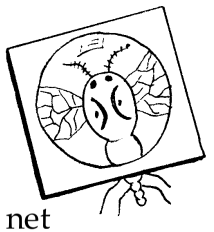
Moisture content (squeeze test) _____

Soil Composition (touch test) _____

Smell _____

Turn to page 9

CHARACTER REPORT



You will need:

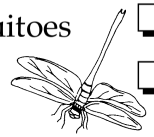
❑ 1 bug box ❑ 1 jar ❑ 1 dip net

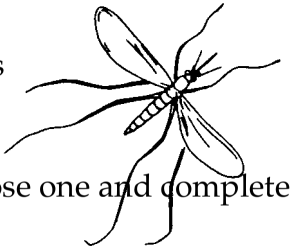
Look for: (check boxes when you see one):

❑ ants ❑ beetles ❑ dragonflies

❑ mosquitoes ❑ snails

❑ others ❑ water insects





Your assignment:

Look for inhabitants in the pond. Choose one and complete a character report on it.

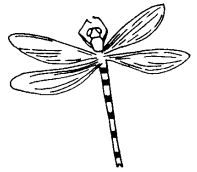
Character Report: (Classification: Top Secret)

How does it move around? _____

How many legs does it have?_____

Where does it live? (follow it home) _____

What does it eat and drink? (watch what it does and look at its mouth parts)



_____

_____

_____

It is a producer, consumer, or decomposer? (circle one).

Why?_____

Draw a picture of your character on page 12.

Turn to page 3

ALL POINTS BULLETIN

Be on the lookout for the following animals seen in the area of the pond: birds, elk, beaver, coyote, ducks, frog, muskrat

Evidence to look for:

- ❑ animal tracks
- ❑ animal droppings
- ❑ animal homes (including nests and lodges)
- ❑ chewed vegetation
- ❑ beaver claw or teeth marks on stumps

Eyewitness Report

I found evidence that this animal was in the pond area:

Animal's name:_____

The evidence that I found was: _____

_____

_____

_____

_____

_____

Draw a picture of the evidence you found on page 13.

Return to the meeting place and complete page 21.

To find the moisture content squeeze the soil

dry soil - falls apart and sifts between your fingers

slightly moist soil - appears moist but does not stick together when squeezed.

moist soil - sticks in a clump when squeezed

wet soil - water drips out of it when squeezed

To find the soil composition, touch the dirt...

sandy soil - very course, grainy and loose, made up of large particles

organic soil - loose, but not grainy, dark coloured, contains decaying plant and animal bits

clay - tends to be clumpy and hard, very tiny particles

loam - looser than clay, finer than sand, lighter colour than organic, made up of sand, silt and clay

Now, smell the dirt...

Describe how the dirt smells. Do you smell damp rotting leaves or old socks? Record your findings on page 8.

Push the dirt back into place when you have finished.

Turn to page 10

Use your spoon to scoop 2 teaspoons of soil into your cup.

Add 2 teaspoons of distilled water to the soil and mix it up until it is muddy. Place the red and blue pieces of litmus paper into the cup. Let them stand for 30 seconds. What happens to the paper? (check ✔ one for the area you are investigating

	Forest	Field	Pond
Red litmus paper turned blue which means the soil is alkaline (also known as basic) -high pH	❑	❑	❑
Blue litmus paper turned red or pink which means the soil is acid or acidic (low pH)	❑	❑	❑
No change in the colour of the litmus paper. (neutral pH)	❑	❑	❑

Certain plants grow only in certain types of soil. In the space provided describe or draw one plant that you found growing in your area.

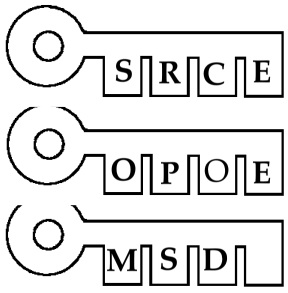
Soil Description

Now that you have worked with the soil, take a very close look at it. Find 3 things that are turning into soil and list them on page 12.

Forest: **turn to page 19**

Field: **turn to page 5**

Pond: **turn to page 16**



Field Study

WANTED, ALIVE...THE LOW DOWN GANG

Imagine a space about the size of a hula-hoop. Using your string make such a space. The space within this circle will be your study area. Look closely at your study area. Is there more than one species of plant growing here?

❑ yes ❑ no

Our area contains...

❑ plants with wide leaves
❑ plants with narrow leaves
❑ plants with long leaves
❑ plants with woody stems
❑ flowering plants
❑ tall plants
❑ plants that hug the ground

How many different types of plants can you find?_____

Is this a community that you are studying?

❑ yes ❑ no

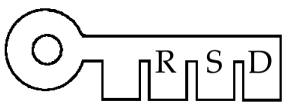
Fingerprint:

Are the gang members producers, consumers, or decomposers? (circle one)

Why?_____

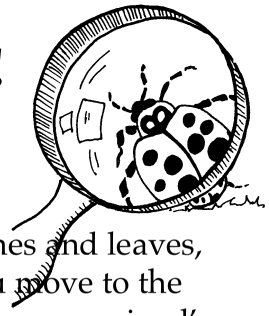
_____

After you have found one of the gang members, get its identity by taking a fingerprint. (Do not harm your suspect). Put a clipboard under one leaf or branch and place the section from page 12 over the leaf or branch and rub gently with a crayon or pencil.



Turn to page 14

The Fabulous Bug Hunt!!

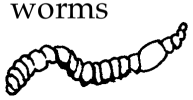


You will need:

❑ 1 bug box

Find an open, grassy area. Look on branches and leaves, under rocks and logs. Return whatever you move to the position it was in originally; remember, these are animal's homes. Which animals could you find?

❑ grasshoppers  ❑ spiders ❑ other

❑ worms  ❑ ants 

Your assignment:

Seek out and report on one of the insects you found.

Character Report:

(Classification: Top Secret)

How does it move around?

_____

How many legs does it have?_____

Where did you find it?_____

What do you think it might eat ? (look at its mouth parts)

_____

Is it a producer, consumer, or decomposer? (circle one).

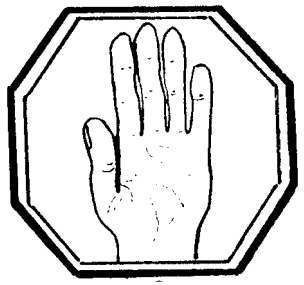
Why?

_____

Draw a picture of your character on page 12.

Turn to page 8

HALT!



Find the wind speed and air temperature in the forest.

You will need:

❑ 1 thermometer

To find the wind speed:

Lick your finger and hold it high in the air. Can you feel the wind? ❑ yes ❑ no

Now lick your finger again and hold it low to the ground.

In which place was the wind the strongest?

❑ high in the air ❑ low near the ground

Use the Beaufort Wind Scale on page 20 to estimate the speed of the wind in the forest.

Record the wind speed on page 13.

To find the temperature of the air and ground:

Shake the thermometer 2 or 3 times so that the fluid goes down into the bulb.

Take the temperature of the air by holding the top of the thermometer and stand still for 3 minutes.

To find the ground temperature, place the bottom of the thermometer on the ground for 3 minutes.

Record the air and ground temperatures on page 13.

Turn to page 6

Key letters / _ _ _ _ _ _ _ _ _ _ /	Key letters / _ _ _ _ _ _ _ _ _ _ /	Key letters / _ _ _ _ _ _ _ _ _ _ _ _ /	
Evergreen tree from page 4 name(s):_____ _____ **Turn to page 11.**	A picture of my character in the forest from page 6. **Turn to page 8.**	Soil in the forest is made of: (from page 10). 1 2. 3. **Turn to page 19.**	**FOREST**
Fingerprint from page 15. **Turn to page 14.**	A picture of my character in the grass from page 14. **Turn to page 8.**	Soil in the grassy area is made of: (from page 10) 1. 2. 3. **Turn to page 5.**	**FIELD**
"Suspect" in the deepest part of the pond from page 7: **Turn to page 17.**	A picture of my character in the pond from page 17. **Turn to page 3.**	Soil in the pond is made of: (from page 10) 1. 2. 3. **Turn to page 16.**	**POND**

Key letters _ _ _ _ _ _ _ /	Key letters _ _ _ _ _ /	
Evidence of an animal in the forest from page 19. **Turn to page 21.**	Wind speed and temperature in the forest from page 11. wind speed_____ air temperature_____ ground temperature_____ **Turn to page 6.**	**FOREST**
Evidence of an animal in the field from page 5. **Turn to page 18.**	Wind speed and temperature in an open, grassy area from page 18. wind speed_____ air temperature_____ ground temperature_____ **Turn to page 21.**	**FIELD**
Evidence of an animal in the pond from page 16. **Turn to page 21.**	Wind speed and temperature in the pond from page 3. wind speed_____ air temperature_____ ground temperature_____ **Turn to page 8.**	**POND**