UNIT 2
SNAKE ECOLOGY

Explore Hibernation, Food Webs, and Ecological Connections of Rattlesnakes

Section 1: Hibernation

Activity 1.1: Snakes In the Snow

Science and Technology - Life Systems — Grade 2, Growth and Changes in Animals

Activity 1.2: A Matter of Life and Death

Science and Technology - Life Systems — Grade 2, Growth and Changes in Animals
Grade 4, Habitats and Communities
Grade 7, Interactions within Ecosystems

HIBERNATION

(Note: This section on hibernation deals with all species of Ontario snakes, including the massasauga.)

Snakes In the Winter

What happens to your fingers if you forget your gloves in the winter? Your fingers will become cold, stiff, and hard to move. This is what happens to all snakes when it gets cold outside. The snake's whole body cools down and it has difficulty moving around. When the snake can no longer stay warm enough by basking in the sun, it will seek shelter. Different species seek shelter in different spaces depending on what is locally available. In winter however, they must find refuge below the frost line to avoid freezing to death.

During hibernation snakes use very little oxygen and their hearts beat very slowly. Therefore, they do not have to eat. They also save energy by: (1) not having to grow a thick fur coat to stay warm, like some mammals and (2) not having to spend energy migrating south for the winter, like some birds. Which activity is more energy efficient: hibernating or heating the body all winter long?

Hibernaculum

Where might a snake want to hibernate for the winter? Some places include a rock crevice, a cave, a mammal burrow (such as a groundhog hole), a rock pile, a woodpile, the stone foundation of a building, or an old well. All of these give the snake access to an area where it can escape freezing temperatures. If the snake survives the winter it usually returns to the same hibernation site every year. Should a hibernaculum be destroyed, the snake will die since it has no place to go when the weather becomes too cold. (A pamphlet is available from the Toronto Zoo that explains how to construct a snake hibernaculum). Although the massasauga rattlesnake usually hibernates alone, some other snakes, including other species of rattlesnakes in the United States, gather in large numbers to hibernate. Some Ontario snakes will even congregate with other types of snakes to hibernate. You may find garter snakes, milk snakes, and brown snakes emerging together in the spring.

Emergence

In the spring the sun will warm the earth, rocks, and air in the hibernaculum. This also warms up the snakes so they can come out from their winter hibernation. Usually when ground temperatures reach 15 degrees celsius in late April, males often emerge first and watch for females with whom they will mate. When the snakes first come outside they are very sluggish and slow, making them vulnerable to predators. They must bask on the warm rocks near their hibernaculum and absorb energy from the sun. Snakes will not begin to feed unless somewhat consistent temperatures are reached. Until then, they continue to rely on their fall reserves. As a snake's metabolism becomes more efficient, it begins to move away to a favourite summer habitat.

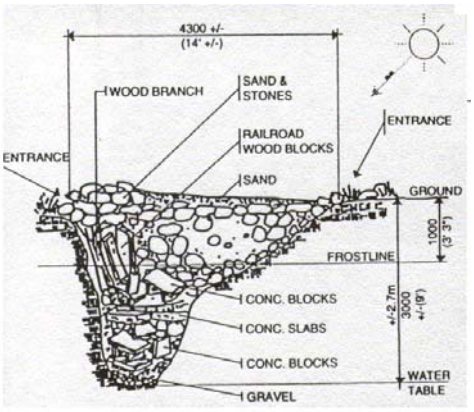


Figure 18: Diagram of an artificial rattlesnake hibernaculum

Figure 19: Natural hibernaculum in holes under trees

WHAT IS CRITICAL HABITAT?

Critical habitats include hibernation, basking sites and summer feeding sites which are vital to the survival and reproduction of snake populations.

Figure 20: Constructed hibernaculum for garter snakes

Name:_____
Date:_____

ACTIVITY 1.1
SNAKES IN THE SNOW

A L O N E Q H T S W
S E D O W N I I A I
P C T N C C B A H N
R G J N B O E R E T
I M K D P L R L G E
N F V G A D N D C R
G X B G P E A Q J R
W E A T V R T P H D
S A M E A L E V R F
B U R R O W S Q A R

Read the paragraph below. Find all of the **underlined** words in the word search above.

As the weather gets **colder**, massasauga rattlesnakes move slower and their body temperature goes **down**. To avoid the cold and snow, rattlesnakes hibernate all **winter** long. Snakes will look for a hole in the ground or mammal **burrows** to **hibernate** in. Snakes hibernate in a hibernaculum. Once a snake finds a safe place to hibernate, it will return to the **same** place the following year. During hibernation, snakes do not **eat**. When the weather gets warmer in the **spring**, the snake's body temperature goes up. The Massasauga Rattlesnake usually hibernates **alone**.

ACTIVITY 1.1
SNAKES IN THE SNOW (Continued)

Answer

A L O N E * H * * W
S * D O W N I * * I
P * * * * C B * * N
R * * * * O E * * T
I * * * * L R * * E
N * * * * D N * * R
G * * * * E A * * *
* E A T * R T * * *
S A M E * * E * * *
B U R R O W S * * *

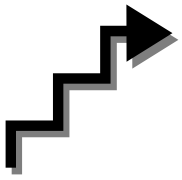
Read the paragraph below. Find all of the **underlined** words in the word search above.

As the weather gets **colder**, massasauga rattlesnakes move slower and their body temperature goes **down**. To avoid the cold and snow, rattlesnakes hibernate all **winter** long. Snakes will look for a hole in the ground or mammal **burrows** to **hibernate** in. Snakes hibernate in a hibernaculum. Once a snake finds a safe place to hibernate, it will return to the **same** place the following year. During hibernation, snakes do not **eat**. When the weather gets warmer in the **spring**, the snake's body temperature goes up. The Massasauga Rattlesnake usually hibernates **alone**.

Name:_____
Date:_____

ACTIVITY 1.1
SNAKES IN THE SNOW (Continued)

Word List



Oxy**GE**n	hib**E**rn**A**culu**M**	bur**R**ow**S**
Up	dow**N**	w**I**nt**E**r
Alo**N**e	r**ET**urn	**S**low**L**y
E**AT**	h**I**be**R**n**ATE**s	

1. From the word list provided, choose the word that best completes each sentence below:

a) When it gets cold out, massasauga rattlesnakes start to move _____ and their body temperature goes _____.

b) To avoid the cold and snow, a rattlesnake _____ all winter long.

c) Snakes will look for holes in the ground or mammal _____ to hibernate in.

d) Snakes hibernate in a _____.

e) Once a snake finds a safe and effective hibernation spot, they will _____ the following year.

f) During hibernation, snakes use small amounts of _____ and they do not _____.

f) In the spring the snake's body temperature goes _____.

g) Snakes hibernate in the _____.

g) The massasauga rattlesnake usually hibernates _____.

2. Use the **BOLD LETTERS** in the word list to complete the following sentence.

____ ____ ____ K ____ _____ A S ____ ____ ____ ____

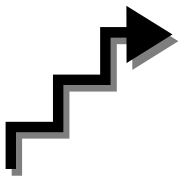
____ ____ S ____ A ____ ____ ____ ____ A

____ ____ ____ ____ ____ E ____ ____ ____ K ____ S !

ACTIVITY 1.1
SNAKES IN THE SNOW (Continued)

Answer

Word List



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Up	dow**N**	w**I**nt**E**r
Alo**N**e	r**ET**urn	**S**low**L**y
E**AT**	h**I**be**R**n**ATE**s	

1. From the word list provided, choose the word that best completes each sentence below:

a) When it gets cold out, massasauga rattlesnakes start to move **SLOWLY** and their body temperature goes **DOWN**.

b) To avoid the cold and snow, a rattlesnake **HIBERNATE** all winter long.

c) Snakes will look for holes in the ground or mammal **BURROWS** to hibernate in.

d) Snakes hibernate in a **HIBERNACULUM**.

e) Once a snake finds a safe and effective hibernation spot, they will **RETURN** the following year.

f) During hibernation, snakes use small amounts of **OXYGEN** and they do not **EAT**.

g) In the spring the snake's body temperature goes **UP**.

h) Snakes hibernate in the **WINTER**.

i) The massasauga rattlesnake usually hibernates **ALONE**.

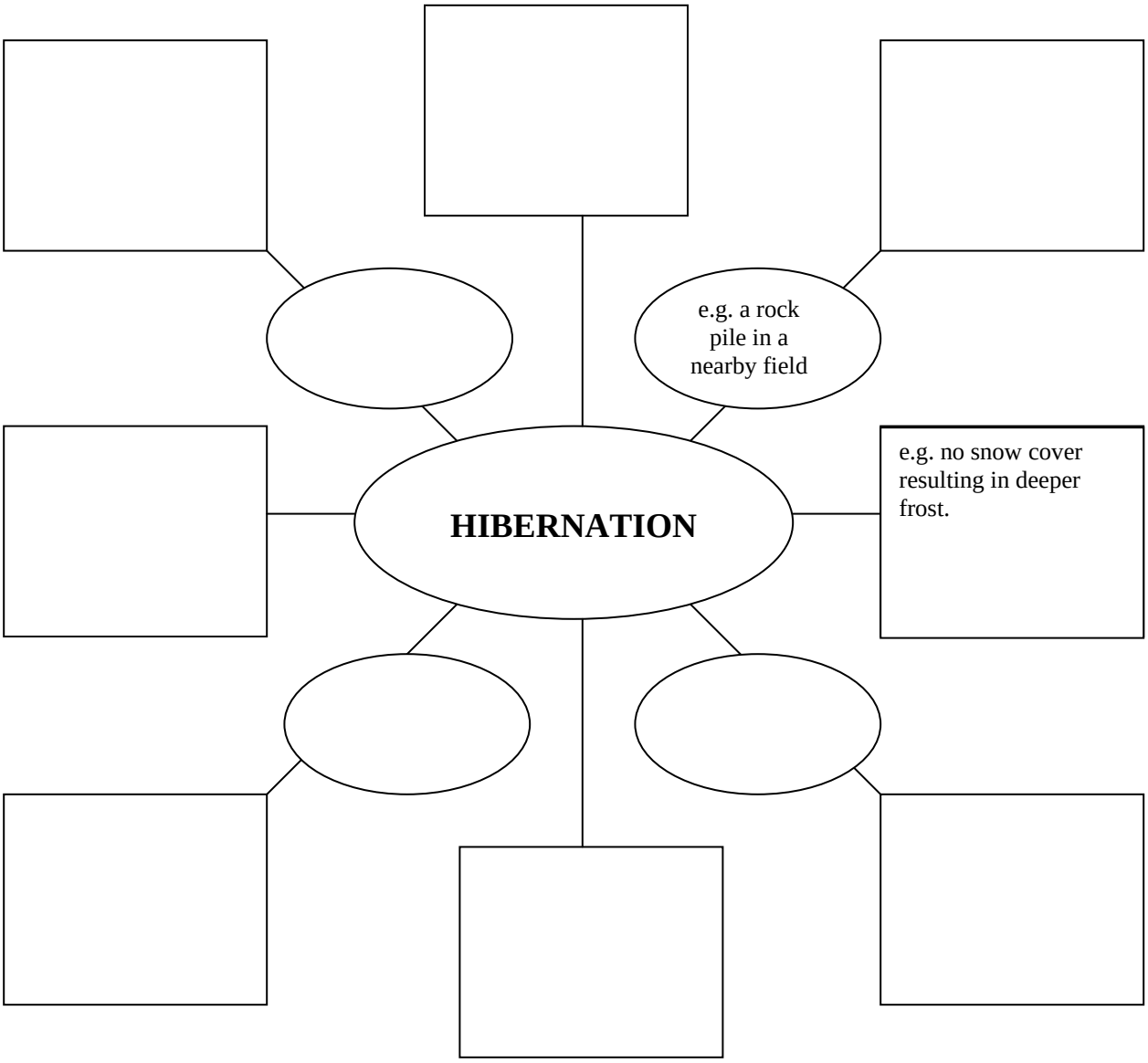
2. Use the **BOLD LETTERS** in the word list to complete the following sentence.

I LIKE EASTERN MASSASAUGA RATTLESNAKES !

Name:_____
Date:_____

ACTIVITY 1.2
A MATTER OF LIFE AND DEATH

Using a large sheet of paper and the markers provided by the teacher, design a "Mind Map" like the one shown below. In the bubbles, write all the different places that you can think of that might make a **good hibernation site** for a snake. In the squares, write all of the things that you can think of that could prevent a snake from **surviving the winter months**.



Section 2: Communities

Activity 2.1: The Chain Gang

Science and Technology - Life Systems	Grade 2, Growth and Changes in Animals Grade 4, Habitats and Communities Grade 6, Diversity of Living Things Grade 7, Interactions with Ecosystems
Language Arts - Writing	Grade 2 Grade 4 Grade 6 Grade 7

Activity 2.2: Deadly Links for Rattlesnakes

Science and Technology - Life Systems	Grade 4, Habitats and Communities Grade 6, Diversity of Living Things Grade 7, Interactions within Ecosystems
Mathematics - Data Management and Probability	Grade 4 Grade 6 Grade 7

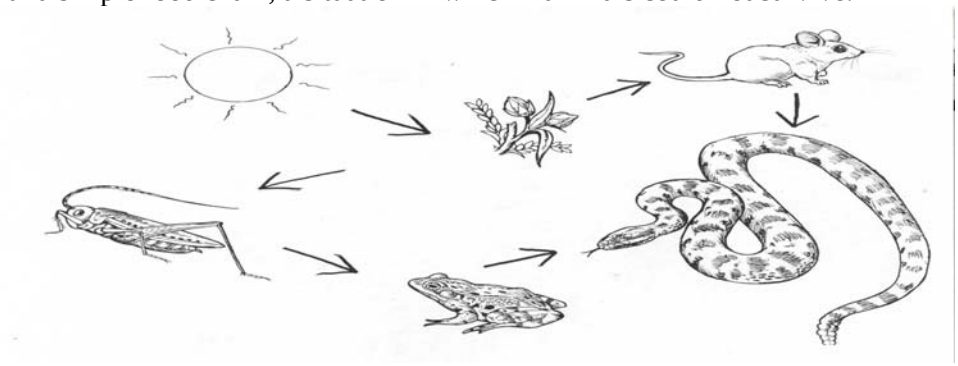
HOW THE MASSASAUGA FUNCTIONS IN ITS ENVIRONMENT AND WITH ITS COMMUNITY

One of the best ways for students to understand the role a snake plays within an ecosystem is by learning the concept of food chains. Food chains depict the flow of energy from one organism to another. All food chains begin with the energy from the sun helping plants to grow. Plants also need water, minerals, and specific growing conditions to flourish. Herbivorous and omnivorous animals then eat the plants. They may eat the whole plant or only specific parts of the plant (flower, leaves, fruit, or seeds). Plants provide the energy these animals require to forage, grow, and reproduce. In turn, some of these herbivorous animals will be eaten by carnivores or omnivores. Insects and microorganisms then decompose animal waste, dead plants, and dead animals. This decomposition releases new minerals, which will be used to grow new plants. Therefore, a food chain can have one or many links.

Students can begin by thinking of a simple food chain, starting with grass.
For example: 1. grass → deer→ wolf
2. grass → cow → humans
From there, students can begin to include the massasauga rattlesnake in a food chain.
For example: 1. plant → tadpole → dragon fly larvae → frog → massasauga rattlesnake
2. plant → fish → small snake → massasauga rattlesnake
3. decaying matter → earthworm → bird → massasauga rattlesnake
4. seed → meadow mouse → massasauga rattlesnake → weasel
5. blueberry → deer mouse → massasauga rattlesnake → hawk
(Note that the massasauga rattlesnake is often a major predator in ecosystems. Also note many large animals, at the top of the food chain, have no natural enemies.)

Many different creatures can eat most plants and animals. Simple food chains such as those listed above will overlap and form food webs. The following questions begin to evaluate the interconnectedness and complexity within these chains and webs:
1. What are possible outcomes if fish are introduced to a pond?
2. Why is control of over-fishing crucial to species survival?
3. What would be the effects if a change in climate made it too dry for earthworm populations?

Remember that reptiles require less energy to survive than warm-blooded birds and mammals. Ask the class to explain why reptiles, such as the massasauga rattlesnake, might survive on an island with a simple food chain, a situation in which mammals could not survive.



It is now time to explore the rattlesnake's BASIC SURVIVAL NEEDS…

All creatures have basic requirements for survival. Human survival requires air, water, food, shelter (from inclement weather and from predators), and opportunities for reproduction. When one of these basic survival needs is lost or disturbed, survival becomes more difficult or even impossible. This is how species decline, become isolated, or go extinct.

- Rattlesnakes require safe places to hibernate in the winter, such as rock crevices or animal burrows. These locations are often near water to prevent dehydration over the six months of hibernation.
- During the spring and fall, some rattlesnakes are found near their overwintering site in swampy wetland areas or depressions where water accumulates.
- During the summer, rattlesnakes require warm open areas for basking in the sun.
- Snakes must be able to move between a variety of habitats to locate new food sources that migrate or become depleted. Large warm rocks or clearings in bogs and prairies are used for brooding and birthing by the female rattlesnakes.
- To maintain genetic diversity or replenish dwindling populations, rattlesnakes must be able to migrate safely between populations. This process may now be impossible in some parts of Ontario.

What are the primary threats to each of these vital habitats? Ask students to brainstorm ideas on how to protect all of these habitats and ensure that all of the massasauga rattlesnake's survival needs are met. This includes ensuring the availability of prey (primarily mice, but other snakes, birds, and frogs may also be eaten), clean water, and clean air.

ACTIVITY 2.1
THE CHAIN GANG

METHOD

By linking up plants and animals in the correct order, you can build your own food chain. Compare your food chain with other food chains in the class and make a food web.

1. As a class, students should brainstorm the names of organisms that live in the same environment as the rattlesnake.
2. Using these names, assign students randomly to each role. (If using activity with a large class, divide students into two different groups to complete exercise.)
3. Students should create large cards depicting the assigned organism, including name and picture.
4. Students should attach string to card so they can hand the card around their neck.
5. Have students stand in a circle, facing each other.
6. With a ball of string, students can create a food web by tossing the string between different organisms in the food web.
7. After the initial food web has been created, the teacher can introduce outside factors such as pesticide use or habitat destruction in order to disrupt the food web. The teacher should remove the affected organism from the food web by cutting the string and showing that the food web has been altered. All students directly attached by the string to this student also should have their strings cut. Continue this process of cutting the strings of linked organisms.
8. The teacher can ask students to discuss the results of this exercise and the effect that loss of species has on a food web.

This activity should demonstrate that all links in the food web are interconnected and therefore equally important. The disruption of one organism in the food web affects all the other organisms within the web. The more links in a food web, the greater the amount of diversity.

Name:_____
Date:_____

ACTIVITY 2.1
THE CHAIN GANG (Continued)

METHOD

By linking up plants and animals in the correct order, you can build your own food chain. Compare your food chain with other food chains in the class and make a food web.

1. Create a list of all the organisms that live in the same habitat as a rattlesnake.
2. Choose your favourite animals and incorporate them into a food chain. Do not forget to include a producer in your food chain!
3. Cut out cardboard cards (12 cm X 9 cm), one for each animal in your food chain. Write the name and draw a picture of each animal from your list on a separate cardboard card.
4. Study your cards and decide which order they should be in.
5. Use tape and string to attach the cards in the correct order.
6. Write the role each organism plays in the food chain on the bottom of each card.
7. Explain your food chain to the class.
8. Now find classmates who have links similar to yours, but as a part of a different food chain.
9. Figure out how to join the food chains together, overlapping the links that are the same. Now you have a food web!

QUESTIONS

1. How many links are in your food chain? _____
2. How many links are in your food web? _____
3. Do you think it is better for animals to eat only one food or many different foods? Explain.

_____
_____
_____

4. Why are plants called “producers?”

_____
_____
_____

5. Is more or less energy available as you move up the food chain? Explain your answer.

_____
_____
_____

6. What is the difference between a “scavenger” and a “decomposer?”

_____
_____
_____

ACTIVITY 2.1:
THE CHAIN GANG (Continued)

ANSWERS

1. How many links are in your food chain? ***Answers will vary.***
2. How many links are in your food web? ***Answers will vary.***
3. Do you think it is better for animals to eat only one food or many different foods? Explain.

It is better for animals to eat a variety of foods. If one source of food becomes scarce, then it can rely on the other food sources in order to survive.

4. Why are plants called "producers?"

Plants are able to convert sunlight into energy through the process of photosynthesis.

5. Is more or less energy available as you move up the food chain? Explain your answer.

Less energy is available as you move up the food chain. Only 1% of the total energy striking the Earth is captured by plants. At each stage of the food web (eg. plant to herbivore or herbivore to carnivore) 10 % of the energy is lost.

6. What is the difference between a "scavenger" and a "decomposer?"

A scavenger is an animal that feeds on dead organisms whereas a decomposer obtains its food from breaking down the remains of plants, animals or wastes.

Name:_____
Date:_____

Activity 2.2
Deadly Links For Rattlesnakes

Adapted from Project Wild

ISSUE

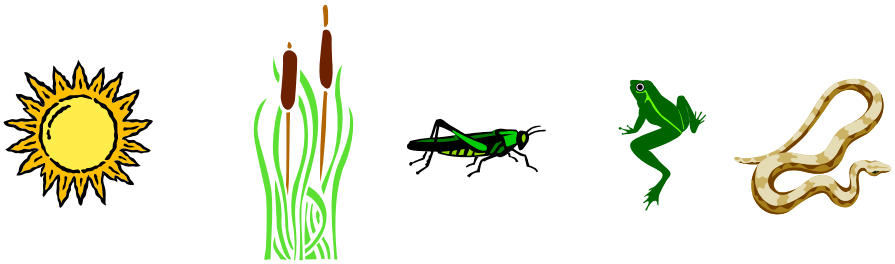
Using pyramids of numbers, students will evaluate (1) how rattlesnakes are involved in food chains and food webs and (2) how humans influence their surrounding ecosystems.

MATERIALS (class of 26)

- 2 brown coloured arm bands or bandanas (for the rattlesnakes)
- 6 green coloured arm bands or bandanas (for the frogs)
- large amount of poker/coloured chips (or anything else of many colours that can be scattered around)
- 2 or 3 grasshopper shelter areas (hula-hoops or skipping ropes)
- pylons to mark off boundaries
- 26 plastic bags for stomachs

METHOD

1. Scatter chips around the marked-off area. Make this area big enough for running around in. Next, place the grasshopper shelters randomly throughout this area.
2. Designate the students randomly as members of the ecosystem. For a class of 26, there will be 2 rattlesnakes (wearing brown armbands), 6 frogs (wearing green arm bands) and 18 grasshoppers (wearing no armbands). If the class is more or less than 26 students, then the ratio of snakes to frogs to grasshoppers is 1:3:9. The other piece of equipment that every student needs is a plastic bag, which will be the animals' stomachs.
3. Ask the students what the food chain will be in this particular case. Try to point out in the discussion that the food that the grasshopper eats is the grass (coloured chips) and the energy source for all life is the sun. The food chain should look like this:



Sun → Grass → Grasshopper → Frog → Snake

Send the grasshoppers out into the marked area to collect "food" (chips). The grasshoppers will have a minute or two to collect food without any predators. Let the grasshoppers know that shelter exists and that they are safe havens from predation, but only two grasshoppers may stay in a shelter at a time. After the two minutes are up, the frogs can be sent in to catch the grasshoppers by tagging them. When a grasshopper is tagged, it must empty its stomach into the frog's stomach. When this is done, the grasshopper may start again with an empty stomach bag. After a minute or two, send the

rattlesnakes into the area to catch frogs by tagging them and getting food from them. End the game after a minute or two.
Have the students count how much food they have by counting the number of chips they have accumulated. Those students without chips have not been able to meet their nutritional needs and are considered dead.

QUESTIONS AND DISCUSSION

1. Have the students conduct a survey of how much food each organism accumulated using a tally chart.
2. As a class, have the students calculate the average number of chips at each trophic (species) level. Using this information, have students develop a pyramid of food accumulated. Ask students why they think the snake has to consume more than the grasshopper.
3. Using the information from the pyramid of food, have students construct a graph.

For higher grades (Grade 7 and up)…

4. Designate a certain coloured chip (ie: green) as grass that has been sprayed with a pesticide or herbicide. If a grasshopper has at least one of these green chips, she is dead. If a frog has three or more chips of that colour, the pesticides have bioaccumulated enough to cause mutations in the offspring of the frog. If a rattlesnake accumulates ten or more chips of that colour, the result is that the snake is left sterile.
4. Have discussions of what ***bioaccumulation*** and ***biomagnification*** are. Discuss the difference between them and why they are important environmental concepts.