Inquiry Lesson: 6.2.1 Unique Plants of the Biomes

Topic	Performance Expectation
6.2 Ecosystems	C4 Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis.

SCIENCE CONTENT STANDARD 6.2

CONCEPTUAL THEME: *Matter and Energy in Ecosystems – How do matter and energy flow through ecosystems?* CONTENT STANDARD: **6.2 - An ecosystem is composed of all the populations that are living in a certain space and the physical factors with which they interact.**	**GRADE-LEVEL CONCEPT 1:** ◆ Populations in ecosystems are affected by biotic factors, such as other populations, and abiotic factors, such as soil and water supply. **GRADE-LEVEL EXPECTATIONS:** 1. Within ecosystems, there are interactions between the living things and the nonliving environmental features, such as water, temperature, sunlight, soil and air. The abiotic factors impact the living organisms (for example, the temperature and availability of water affect plant and animal growth), and the living organisms impact the environment (for example, plants release oxygen to the air, or materials from decomposing leaves enrich the soil). 2. The sun is the main source of energy on Earth. During photosynthesis, green plants use light energy to make sugar molecules from the atoms of water (H_20) and carbon dioxide (CO_2). During this chemical change, green plants release oxygen needed by most organisms for respiration. 3. Plants and animals take in oxygen and use it to release the energy stored in sugars and other molecules produced during the photosynthesis. During this respiration process, CO_2 is released into the air or water. 4. Plants' ability to do photosynthesis is affected by atmospheric conditions such as precipitation amount and air temperature. 5. Soil is a mixture of materials that includes weathered rocks and decomposed organic material, as well as air and water. The composition of soils affects how air and water move through the soil, and this influences the kinds of plants that can grow and the animals that rely on those plants for food. **GRADE-LEVEL CONCEPT 2:** ◆ Populations in ecosystems can be categorized as producers, consumers and decomposers of organic matter. **GRADE-LEVEL EXPECTATIONS:** 1. Energy and matter flow through an ecosystem. Plants (producers) use the sugars produced during photosynthesis, along with minerals from the soil, to produce fats, proteins and carbohydrates. Animals (consumers) obtain the essential nutrients they need by eating plants or other organisms that eat plants.	**CMT EXPECTED PERFORMANCES** **C 4.** Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis . **C 5.** Explain how populations are affected by predator-prey relationships. **C 6.** Describe common food webs in different Connecticut ecosystems.

	2. Consumers are adapted for eating different foods: *herbivores* are consumers that eat only plants; *carnivores* are consumers that eat only animals; *omnivores* are consumers that eat both plants and animals. 3. Decomposers (mainly bacteria and fungi) consume dead plants and animals and break down the organic materials, thus returning nutrients to the environment for reuse by other organisms. 4. Interactions among organisms in an ecosystem occur in various ways. In competitive relationships, organisms compete for limited resources (for example, plants in the same garden may compete for sunlight). **CONTENT STANDARD 6.2 - continued** In predator/prey relationships, in which one animal eats another animal, an organism in a food web can be both a predator and the prey of another animal. 5. Food chains are models that show how materials and energy are transferred from one organism to another in an ecosystem. The basis of every food chain is the energy stored in green plants. Food webs are models that show the complex variety of energy sources available to most organisms in an ecosystem. 6. Regions have distinct food chains and webs that are determined by environmental conditions such as climate, elevation, topography or water quality. Connecticut has forest and park ecosystems, as well as fresh water and marine ecosystems that include a variety of plants and animals. 7. Populations of species within an ecosystem are affected by the availability of resources such as food, water, living space, or mates. Populations can be reduced or increased by environmental changes caused by nature (for example, droughts, forest fires or disease) and by humans (climate change, land development or overhunting). 8. Predators limit the size of prey populations, increasing the variety of species that can live in an area. Fewer predators can lead to overpopulation of prey species, causing increased competition for a scarcity of resources that can lead to illness or starvation. For example, without predators, Connecticut deer populations have increased to	

	unhealthy levels. 9. Organisms within a food web are interdependent, and changes in the populations of one species may affect the survival of other organisms within the web. For example, if the mice in an ecosystem are eaten by a cat, the snakes in the area will move away. Fluctuations over time in populations of interacting species can be represented in graphs. 10. An energy pyramid is a model that shows the loss of energy in an ecosystem. A large number of producers and primary consumers support a smaller number of higher-level consumers. 11. All organisms cause changes in the environment where they live. They use biotic and abiotic resources and convert the matter from those resources to different forms of matter. For example, soils can change and become depleted in a mineral when a plant population removes that mineral from the soil. Some of the changes caused by organisms can be helpful to the ecosystem and others can damage the ecosystem. **SCIENTIFIC LITERACY TERMINOLOGY:**	

Science Materials:

Student Handouts: Biome Abiotic Factors Profile (A), World Map (B), Design a Plant (C) and Plant Data (D) The last handout is optional (see extensions)
Vocabulary: abiotic factors, biome, photosynthesis, binomial nomenclature, adaptation, climate
Inquiry: In this inquiry, students will identify abiotic factors associated with different biomes and create a plant species that expresses adaptations that increase its ability to survive in their particular biome.

Procedures and Directions:

1. Each group will research the abiotic factors of a biome unique to their group designate its

location on the world map with a dotted line and complete Plant Data Sheet.

- Possible biomes include desert, tundra, coniferous forest, deciduous forest, tropical rain forest, temperate rain forest, estuary, grassland, savanna, desert, chaparral, or boreal forest
- Students can use reference books from the library or the following Web sites:

  What's It Like Where You Live?: Biomes of the World
  http://mbgnet.mobot.org/sets/index.htm

  All about Nature: Biomes/Habitats
  http://www.AllAboutNature.com/biomes/

  Tour of Biomes
  http://www.cotf.edu/ete/modules/msese/earthsysflr/biomes.html

  CyberZoo's Key to the Biomes
  http://lsb.syr.edu//projects/cyberzoo/biome.html

  Biology4Kids: Ecology
  http://www.kapili.com/biology4kids/eco/index.html

  Biomes of the World
  http://www.snowcrest.net/geography/slides/biomes/index.html

2. Each group will report their findings to the class.
3. Groups exchange Biome Abiotic Factors Profiles and design a plant which expresses adaptations that will increase its ability to survive according to the information supplied on the Profile Sheet they receive.
4. Biome Abiotic Factors Profiles are returned to original groups along with the Design a Plant Sheet.
5. The original group represents experts on their biome and as experts they will comment on the other groups design.

Questions to Guide Student Inquiry:

- How would abiotic factors of a biome influence its biotic factors?
- Which group thinks their biome has the most annual rainfall? the least annual rainfall?
- Which group has the longest growing season? the shortest growing season?
- Which group has the greatest average daily or monthly temperature? the least….?
- Did you learn of any organisms of your biome?
- Can specific plants or animals live in more than one biome?
- Are there environmental factors that consistently threaten the population size of plants in each biome?
- Is there threatened plant population whose lose is a concern for the entire world?

Science Concepts: The Earth's surface is divided into a number of biomes characterized by a distinctive climate. Plants within a biome express adaptation that help them survive that biome's particular abiotic factors.

Extensions:

- Students complete a sheet similar to "Design a Plant" but instead of creating a plant they research a unique or characteristic plant that grows their biome
- Have students include in their research biomes in peril. Then have students map the current range of the biome and the area of the biome 100 to 500 years ago. Using clear acetate overlays, students could show on their maps changes that have occurred in their biome over time. Students should also discuss the reasons for the biome's decline and any major species threatened in their biome.
- Choose an area of the world for a road trip and describe the biomes that you would encounter during your trip. For example, you might start a road trip in Washington, D.C., and travel west to California and then up the Pacific coast to Alaska. How could you distinguish one biome from another? What characteristics set each biome apart?

This lesson was adapted from "Unique Plants of the Biomes" by Mary C. Cahill at DiscoverySchool.com..
http://school.discovery.com/lessonplans/pdf/plantsofthebiomes/plantsofthebiomes.pdf Last accessed July 21, 2007.

Biome Abiotic Factors Profile

Research the abiotic factors of a biome unique to their group. The table includes some examples of abiotic factors. Continue to add other abiotic factors that you discover as you research your biome. Next, shade in the biome you studied on the world map.

Names:

Biome:

Abiotic Factor	Research Findings
Annual rainfall	
Length of Growing Season	
Average Daily Temperature	
Average Monthly Temperature	

Temperature extremes	
Seasonal changes	

Handout A

Handout B

Design a Plant

Identify adaptations that you believe are required by a plant to survive in your assigned biome. Give an explanation for your decision. Produce a sketch of your plant and give it both a common name and a scientific name.

Plant's common name

Plant's scientific name

Adaptations with explanation

1

2

3

4

5

6

Handout C

Plant Data

Choose one distinctive plant from the biome you researched and complete the following questions. All questions should be answered in complete sentences.

Biome name
Plant's common name
Plant's scientific name

1 Describe the abiotic factors of the biome.
2 Describe a unique characteristic of many of the plants living in the biome.
3 Describe the structure of your plant's roots, stems, or leaves. How tall is it? What does it look like?
4 Explain any unique adaptations of the plant you picked. How do these adaptations help it survive in this biome?
5 What abiotic factor of the biome has the greatest effect on this particular plant?
6 Do you think this plant could live in a biome with very different abiotic factors? Why or why not?

How does this plant fit into the existing food web of the biome?

Handout D

Inquiry Activity: 6.2.2 Plant Growth

Topic	Performance Expectation
6.2 Ecosystems	C4 Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis.

Science Materials:

10ml graduated cylinder	Closet
Potting soil	Window
Sand	Refrigerator
Metric ruler	Plastic Bag
Plant seeds	Plant food

Student Handouts: Background Information (A) and Lab Report Format (B)
Vocabulary: abiotic factors, biotic factors, nutrients, photosynthesis, cellular respiration, energy, metabolism
Inquiry: In this inquiry, students will explore the plant growth and how changes in abiotic factors can alter their growth.

Procedures and Directions:

1. Although there are thousands of plants which are as different as people, they all share the same requirements in order to survive, grow and flourish. These are often referred to as abiotic factors. Abiotic factors are non-living elements found within an ecosystem. There are six abiotic factors that affect plant growth: air, water, space, temperature, light and soil (nutrients). These are the basic requirements that plants need to grow.

    - For simple, very brief student reading, see "Factors Affecting Plant Growth." (www.urbanext.uiuc.edu/gpe/case1/c1facts3a.html)
    - The most significant point for them to understand is that if a factor affects plant growth then what is being disruptive is the plant's ability to acquire energy (photosynthesis) or use energy (cellular respiration).

3. Students, in groups of four, will design an experiment to determine if a plant will respond differently (i.e., varied growth) in habitats which experience different availability of abiotic factors (e.g., sun, rain, etc).

Questions to Guide Student Inquiry:

- What would happen to a plant if they altered the availability of one of these abiotic factors?
- What adaptations would lessen the amount of stress for the plant?

- In which biomes do plants usually experience this type of stress for part of the year?
- Refer to Handout B

Science Concepts: Adaptations improve an organism's ability to survive and grow given the present physical and chemical conditions of their environment. Plant species have varied ability to respond and continue to thrive in an environment that has experienced change.

Note to Teachers

Possible ways to meet the requirements of the variable are readily available.

- Air – place the variable planter in a zip-lock bag
- Water – water with different volumes (e.g., control get 10ml every 3 days while the variable planter gets 5ml every 3 days or 10 ml every 6 days)
- Space – put 3 seeds in the control planter while putting 6 or 9 in the variable planter
- Temperature is more tricky then the others because you don't want to increase the number of variables. It would seem that setting up both planters and then putting one by a window and another in the refrigerator would be reasonable but this would actually have two variables (temperature and light). One possibility is to have two freezer packs and a cooler. Set up the planters and put them near an overhead light source. Put the variable planter in the cooler with the ice pack, leaving the top open so that it still receives light. The next day the ice packs would be rotated, the one in the cooler is switched the second ice pack in the freezer.
- Light – control planter receives light while the other is placed in a closet or drawer. Attempt to not have too big of a temperature difference because that increases the number of variables.
- Soil – control planter gets potting soil while variable planter received potting soil w/ fertilizer or a mixture of potting soil and sand.

This lesson was adapted from "Abiotic Factors & Plants: A Local Pollution Study with Global Implications"" by Maureen Taylor French at Yale-New Haven Teachers Institute.
http://www.yale.edu/ynhti/curriculum/units/1999/6/99.06.06.x.html#e
Last accessed July 21, 2007.

Background Information

The six factors which effect plant growth are heat, water, air, soil/nutrients, light and space. A number of different variables, such as the amount or type of water, or the quality of soil can affect these factors which affect plant growth. You will design and conduct an experiment which explores the effect or quality of these factors on plant growth.

During this activity, you must design a lab plan, and record the problem you wish to investigate, your hypothesis (prediction), materials and document your procedure. Your procedure is a step-by-step plan of your experiment's directions, written for a fifth grade audience. Refer to Handout B.

Materials:

Potting soil	Window
Sand	Refrigerator
Metric ruler	Plastic Bag
Plant seeds	10ml graduated cylinder
Plant food	Closet

If you require another item then ask your teacher about the possibility of acquiring it for your experiment.

You will set up a graph to record data. Plant growth is dependent on the factor, therefore, it is the dependent variable, recorded on the "Y" axis. The independent variable, that which is recorded on the "X" axis, is the date you record plant growth.

Directions:

1. Label your planters with your initials.
2. Label the control planter "C" and the variable planter (the abiotic factor you will change) "V".
3. Pour soil into both planters until they are 3/4 full. If you are varying soil, make sure potting soil goes into the control planter and your experimental soil goes into the planter marked "Variable"!
3. Follow directions on the back of the seed. Unless you are investigating how restricting space (overcrowding) effects plant growth.
4. Water your seeds using a graduated cylinder. Measure the same amount of water for each planter. Remember if water is the experimental variable use the same amount of water but varied in the planter labeled "V"!
5. Set up a graph for recording data. Put dates when you will observe plant growth on the X (horizontal) axis. Label the Y axis in centimeters to record growth. Title your graph.
6. Record all information on the preliminary lab report.

Handout A

Name_____ Date_____

Lab Report Format

1. Clearly state the purpose of your experiment.
   The purpose states the reason why you are doing the experiment. Purposes can be stated as a question.

2. Write a hypothesis for your experiment.
   The hypothesis is stated as an If..., then... statement. The 'If' part of the statement is based on related facts that you know to be true. The 'then' part of the statement is an educated guess on the outcome.

3. Materials
   This is a list of all equipment and chemicals needed to do the experiment. Be sure to give quantities.

4. Procedure
   The procedure tells exactly what you did to achieve your results. So, it is important to be accurate in explaining what you did. The procedure is written step-by-step, numbered (like cooking directions).

5. Describe the results of your experiment on the next page. Use tables, charts, or graphs.

6. State your conclusion in the experiment.
   The conclusion explains results. It addresses the purpose and indicates if your hypothesis was correct. You conclusions should be supported by data.

7. How valid are your conclusions? Do you have of confidence in your results? Could you improve your experiment?

8. How could you apply your results to your life/ community? What did you learn?

Handout B

Inquiry Activity: 6.2.3 Food Chains

Topic	Performance Expectation
6.2 Ecosystems	C5 Explain how populations are affected by predator prey relationships. C6 Describe common food webs in different Connecticut ecosystems.

Materials:

Organism Information Cards (see attachments)
10 spools of string or yarn
Dowel that fits through of spools and long enough to hold all 10 spools at once

Student Handouts: N/A
Vocabulary: community, food web, trophic level, ecosystem, producer, consumer, decomposer, photosynthesis, herbivores, carnivores, omnivores, food chain, nutrient, energy
Inquiry: In this inquiry, students will explore energy transfer and availability in a Connecticut lake community.

Procedures and Directions:

1. Tell the students that they will construct a food web that includes organisms common to lake communities in Connecticut.
2. Pass out the "Organism Information Cards" to the students. If there are any extra cards then they should only be Chrysophyta. All other card types should be in use.
3. Give the sun the dowel with the spools.
4. "Is there any producers in the community?" These students would obtain the ends of one spooled strings and pull it some distance from the sun. If all the spools are not needed then ask the students "Does energy enter an earths atmosphere and not get used by producers?" Yes, producers at not efficient enough to use all the energy coming from the sun.
5. Ask the students "Which organisms in the community would consume the producers?" These individuals will take the end of the strings from the producer. The original spool stays with the sun and unspools as the energy is transferred.

Important:

You will notice that there are fewer primary consumers then producers. This is a very important detail that most be explained. There is a loss of energy as energy is transferred from one organism to another. This means that there is more energy in a lower feeding level to support the next higher feeding level. This pattern of diminishing energy will continue to

the top of the highest feeding level. **This means that organisms in higher feeding levels can have more than one string going to them.**

6. The game progresses as each member of the food chain accepts energy (end of string) and passes it on.
7. Continue transferring the energy (end of string) until all ends have reached the top of the food chain.
8. Have the students draw the food web that they just modeled.

Questions to Guide Student Inquiry:

- Are there any producers in the community?
- Does energy enter the earth's atmosphere and not get used by producers?
- Which organisms in the community would consume the producers?
- What happens to the energy captured by the organisms at the top of the food web?
  It will also be lost as the organisms goes about surviving.
- Is it possible for an organism to gain access to the energy stored in the organisms at the top of the food chain?
  Decomposers when it dies.
- Why are there fewer organisms in higher feeding levels then in the lower feeding levels?
- Is there some of component of an organism that can be recycled?"
  Yes, nutrients can be recycled. Decomposers are responsible for freeing nutrients from dead organisms.
- What if a black bear was part of this community? Tell them that a black bear is similar to humans in being an omnivore.
  It would feed on all listed organisms except the Chryophyta and *Daphnia*.

Science Concepts: For an organism to survive it must acquire energy and nutrients. A food web identifies where each species within a community acquires these resources. Energy decreases in value as it is transferred through the organisms in the web making less energy available for organisms in higher trophic levels.

Extension:

You can have them add the hypothetical example of the bear or some other organism, like an osprey. Osprey feed on large fish in lake and river habitats in Connecticut. You can tell them this information or have them do research on their life-history in order to gain the knowledge to add it to their food web.

This lesson were adapted from "Food Webs/Chains" by Esther Zack at Science in the City.
http://www.laep.org/target/science/city_butterflies/food_chain.html
Last accessed July 21, 2007.
This lesson were adapted from "Forest Food Webs" at Discoveryschool.com.
http://school.discovery.com/lessonplans/programs/forests/index.html
Last accessed July 22, 2007.

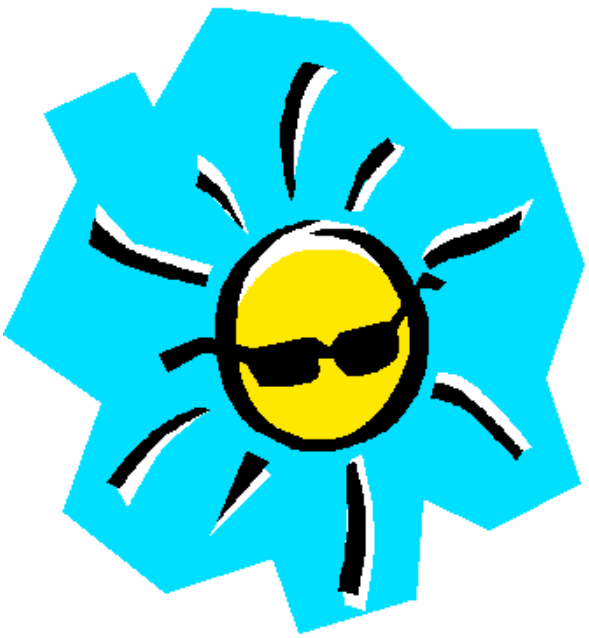
Background for the Teacher:

A group of organisms that interact with and depend upon one another is called a community. The movement of matter and energy through a community can be studied by examining its food web. As organisms eat other organisms, energy and nutrients pass through various feeding levels. These feeding levels are called trophic levels.

Three major types of organisms live in an ecosystem: producers, consumers, and decomposers. Producers create their own food through the process of photosynthesis. Consumers must hunt or forage for the nutrients they need to survive. Decomposers obtain nutrients by breaking down parts of organisms into simple forms; for example, mushrooms feed off plant tissues on tree bark, and bacteria on a forest floor feed off the leaf tissue of fallen leaves, causing them to decay.

Consumers have been classified into three types: herbivores, carnivores, and omnivores. Herbivores are animals that eat only plant material, such as the caterpillar. Carnivores eat animals; for example, forest ants eat other insects. And omnivores eat both plant material and animal flesh. Ask students to look at the consumers in Handout A and decide which type best describes each one.

Food webs are diagrams that show how organisms living in an ecosystem depend on one another to obtain the nutrients and energy they need to live. A food chain is a smaller, less complicated diagram that examines one piece of the food web to show how specific organisms obtain their energy from other organisms. Food chains show a single line of energy transfer. An example of a food chain from the food web above would be oak tree—beetle—woodpecker—bird of prey (the beetle eats the oak tree, the woodpecker eats the beetle, and the bird of prey eats the woodpecker).



SUN

The Sun

The Sun is the most prominent feature in our solar system.

It is the largest object and contains approximately 98% of the total solar system mass. The Sun's interior could hold over 1.3 million Earths...

Diameter: 1,390,000 kilometers

Mass: 1.98×10^{30} kilograms

Surface Temperature: 5506°C

Distance from Earth: 149.6×10^{6} kilometers

The American Heritage® Dictionary http://www.ask.com/web?q=kids facts sun&o=12572&ef_id=1370:3:390db54f38bccb4cd5dc833e04153f0e_768267325:trp6jkNIYX4AABs-04oAAAAB:20070723233410

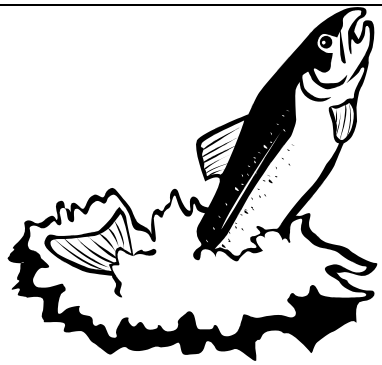
sun (n.) A star that is the basis of the solar system and that sustains life on Earth, being the source of heat and light.

Snapping Turtle

Chelydra serpentina

The snapper is our biggest freshwater turtle, up to 35 cm shell length. Recognize it by its size, its muscular limbs and long tail or by the sawtooth back edge of its carapace. Snapper's show aggressive behaviour when threatened - it cannot run or hide, so its only defense is attack. They only come out on land in late June and early July to dig a nest and lay eggs. Leave them alone. Snappers frequent shallow lakes and streams with lots of plants. They eat fish, amphibians, and some bigger and smaller creatures located with their especially keen sense of smell. Unlike Painted Turtles, they are rarely seen out of the water basking in the sun. They hibernate underwater in winter.

Source:
http://museum.gov.ns.ca/mnh/nature/turtles/snap.htm

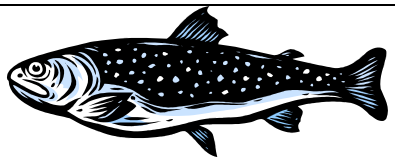


Lake Trout

Salvelinus namaycush

The lake trout is by far the largest of the trouts. It lives in deep cold lakes and is also known as Great Lakes trout, Mackinaw trout and salmon trout. It feeds on virtually all forms of flesh which abound in its home waters. Minnows, smelt, eels and any variety of small fishes are part of the lake trout's diet. Once the surface waters warm the lake trout retreats to deep water.

Source:
http://www.aa-fishing.com/ct/connecticut-trout-fishing.html

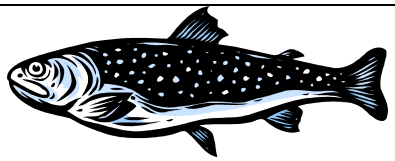


Alewife

Alosa pseudoharengus

The alewife is a sea-run fish species native to the North American continent. Spawning populations of alewives are found in rivers and streams from Newfoundland to South Carolina. Every spring, adults ascend rivers and streams to spawn in freshwater lake and pond areas. After the eggs hatch, the young-of-the-year spend two to six months in the freshwater environment, growing 1½ to 5 inches in size before they begin to migrate to sea. Adult and juvenile alewives are planktivorous (main food source is zooplankton), although they occasionally eat insects and fish larvae, including larval alewives.

Source :
http://www.maine.gov/dmr/rm/alewifefactsheet.htm



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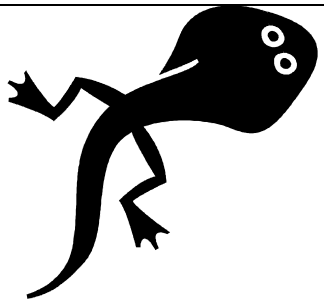
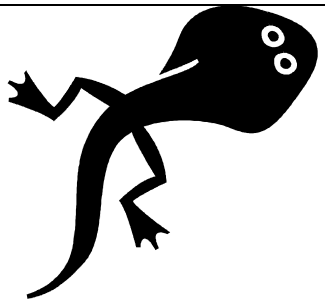


Bullfrog tadpole

Rana catesbeiana

The Bullfrog is our largest frog. They inhabitat ponds and lakes where they very often become the kings and queens of their domain.
The adults of these large amphibians have been known to eat everything from small birds to other frogs.
Their tadpoles grow very large and can reach the size of a small egg. The tadpoles are omnivores, eating producers and small primary consumers. They can sometimes take up to three years to develop. The eggs are laid by the thousands in a thin sheet on the surface of the water

Source:
http://ctamp.homestead.com/bullgreen.html



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Source:
http://ctamp.homestead.com/bullgreen.html

http://etc.usf.edu/clipart/15300/15301/waterflea3_15301.htm

This card equals 3 Ephemeroptera

Waterflea

Daphnia pulex

"The common water flea, *Daphnia pulex* can be found in almost all sorts of eutrophic (rich in nutrients) waters. *Daphnia* feeds on bacteria, fine detritus and very small algae. They reproduce in summer mostly parthenogenetic, that is, the eggs develop without undergoing fertilization. At the end of the summer, some of the eggs develop into the smaller males, capable of fertilizing the eggs in females, which then develop into the so called 'winter eggs'; mostly only one or two are present in the females. These eggs can also be found in populations under stress, such as during the drying up of a pond."

http://www.microscopy-uk.org.uk/mag/artjun99/wflea.html

http://etc.usf.edu/clipart/15300/15301/waterflea3_15301.htm

This card equals 3 Ephemeroptera

Waterflea

Daphnia pulex

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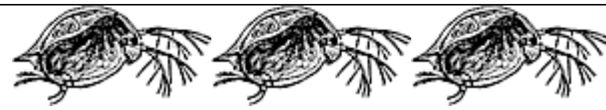

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Inquiry Activity: 6.2.4 **Connecticut Ecosystems**

Topic	Performance Expectation
6.2 Ecosystems	C5 Explain how populations are affected by predator -prey relationships. C6 Describe common food webs in different Connecticut ecosystems.

Science Materials: N/A

Student Handouts: Food Web for a New England Wetland (A)
Vocabulary: community, food web, trophic level, ecosystem, producer, consumer, primary consumer, secondary consumer, tertiary consumer, decomposer, photosynthesis, herbivores, carnivores, omnivores, food chain, nutrient, energy
Inquiry: In this inquiry, students will explore interaction between organisms in a Connecticut ecosystem and the outcome of these interactions on individual species in the community.

Procedures and Directions:

1. The class will brainstorm a list of 10 – 20 organisms common to New Haven. The list should include organism from all three groupings: producers, consumers, and decomposers.
2. Construct a food web through class discussion on the board or have individual groups produce their own food web.
3. They begin the next step their completed food web
4. A group will begin by selecting an organism of their choice to eliminate from this community and crossing it out with an "X."
5. They will then choose a second organism by circling it.
6. The group will then analyze the community interactions to decide what effect the absence of the organism with the "X" has on the circled organism.
7. Students will construct a food web of the organisms they observe in their neighborhood and make a decision as to which species, if removed, would have greatest negative effect on the community.

Questions to Guide Student Inquiry:

- Where did the energy original come from that is now moving through the community?
- What eventually happens to the energy?
  It is lost to the environment.
- Does this food web contain a food chain with producer, primary consumer, secondary consumer and tertiary consumer

- Would a community contain as many primary consumers as tertiary consumers? Why?
  No. Energy is lost as it moves through the community so there is not as much energy available for a tertiary consumer as there was for a primary consumer.
- Explain how the absence of the organism you crossed out will affect these other two organisms in this community.
  Will their population size increase/decrease? Why?
  Will a change in their population size affect any other organisms in the community? Why?

Science Concepts: Organisms in a community interact with each other to the extent that their presence or actions can have neutral, positive or negative effects on the other members of the community. These effects are linked to an organism ability or inability to influence the availability of resources in the community.