1.7 Food for Thought

Action Synopsis

Students sort items into food and non-food categories, then play a game to get enough food — nutrients and energy — to support six ecosystem organisms.

Session 1		**40 minutes**
1. Sort items into food and non-food categories.		*examining prior ideas*
2. Talk about definitions of food.		*examining prior ideas*
3. Burn a peanut and a vitamin pill to show that food has energy and nutrients do not.		*introducing new information*

Session 2		**40 minutes**
1. Play a game that requires six organisms to get the nutrients and energy they need to survive.		*applying knowledge*
2. Compare the flow of nutrients and energy in an ecosystem.		*reflecting*

Desired Outcomes

Throughout the lesson, check that students:

✓ Understand that all living things need nutrients and energy.

✓ Know that food is a substance that provides both nutrients and energy.

✓ Realize that nutrients alone don't contain useable energy.

✓ Realize that their bodies are made of the same substances that food is made of because food becomes part of the body — you are what you eat!

✓ Know that nutrients cycle in an ecosystem, whereas energy eventually is lost as heat.

✓ Know that plants get energy from sunlight and nutrients from soil, and animals get them both from their food.

What You'll Need

Session 1

For the class:

- ❑ various food and non-food items:
  - Food: peanuts, sugar, flour, beef jerky, potato chips, candy, vegetables, fruit, bread, oatmeal, apple juice, grass or leaves, an insect or other small critter
  - Non-food: salt, water, potting soil, sand, rock, metal, sugar-free vitamin pills, fertilizer
- ❑ pair of safety goggles
- ❑ pair of tweezers
- ❑ match or lighter
- ❑ small cup of water

Session 2

For each group of 6 students:

- ❑ set of 6 "Organism Sheets" (pages 141–146)
- ❑ set of "Game Cards" (pages 131–140) (see "Getting Ready")
- ❑ copy of "Game Rules" (page 130)

Vocabulary

CALORIE - A unit for measuring the amount of energy that food supplies to the body.

ENERGY - The ability to make things move or change.

FOOD - A substance that gives both nutrients and energy to a living thing.

NUTRIENT - A substance that does not provide energy, but supplies minerals that living things need to stay healthy.

Getting Ready

Session 1

- Collect food and non-food items and arrange them on a table so that they are intermingled.
- Cut a sheet of paper into thirds. Write *"FOOD," "NON-FOOD,"* and "?" on them to use as category labels for the sorting activity.
- Practice the peanut burning demonstration described on page 126.

Session 2

- Plan groups of six students. If the number of students in your class doesn't divide evenly by six, plan to have two students in a group work together on one "Organism Sheet," or have one student be responsible for two sheets.
- Make one set of thirty "Game Cards" for each group of six students, using a photocopy machine that can make double-sided copies. It is best if you can copy them onto card stock, or laminate them.

Action Narrative

Session 1

We've been talking a lot about the food that animals eat to survive, but we haven't talked about what FOOD is. Before I tell you a scientific definition of food, work with your group to decide which of the things on this table are food, and which are not. When you're done, write down your group's definition of food.

Hold up and name each item, or have each group send a recorder to the table to make a list of what's there. Help them articulate the criteria they used to decide which are and are not food as they write their definitions.

When they're done, put all of the items on one end of the table and display the three category labels (*"FOOD," "NON-FOOD,"* and "?") across the table.

Let's sort the food items from the non-food items.

Hold up each item and ask each group whether it decided it was food or not, and why. If the whole class agrees on its category, then place it next to the appropriate label. If they disagree, place it next to the "?" label.

Some disagreement could arise over the grass or leaves and the insect or other small critter, because they are not food for people. Tell students that you want a broad definition of food for any living thing, and let groups that had decided these aren't food change their minds. Including food for any living thing in the definition could open the door to groups changing their minds about how they categorized soil, water, and fertilizer, if they still think of these as food for plants. Other possible miscategorizations include calling potato chips, and candy non-food because they are "junk food" and food is what's good for you; calling water, salt, and vitamins food because they are part of food or because people take them into their bodies; calling apple juice a non-food because it is a drink; or calling flour and sugar non-food because they are just ingredients of food.

Once all of the items are categorized, ask for each group's definition of food and perhaps write them on the board. Point out any definitions that contradict one another and ask the groups that wrote them to try to work out their differences. Challenge the class to agree on one definition, then go back to the items in the "?" category and decide if they are food or not based on the class definition.

Now I'll tell you the scientific definition of food: Food is a substance that gives both nutrients and energy to a living thing. A NUTRIENT is a mineral that organisms need to stay healthy, but nutrients don't provide energy that living things need to be active. So for something to be food it has to have ENERGY, expressed as CALORIES, in addition to nutrients.

Let's check what you put in the food and non-food categories to see if they belong there according to this new definition.

As students reconsider how they categorized the items, you might need to tell them which items have food energy as well as nutrients, and which do not, since it is not possible to tell this by visual clues alone. They might question why you categorize "junk food" such as chips and candy as food, since they don't have nutrients in them. Tell them that it is true that most junk food has very few nutrients, but it does have some. This is why junk food is called "empty calories," because it provides energy but few nutrients.

This is also a good time to check on students' understanding of photosynthesis. They may have put potting soil, plant fertilizer, and water into the food category, as foods for plants. Explain that these things are not food because they don't have any calories — they contain nutrients, but do not provide energy to plants. The sugar that plants make has calories as well as nutrients, so it fits the definition of food.

Children's Ideas About Food, Nutrients, and Energy

Every fifth and sixth grader knows what food is. Or do they?

They readily accept and recite that *Every living things needs nutrients to grow*, and *Nutritious food gives you energy*. They know that healthy food has vitamins and minerals that are good for you, and that junk food does not. What most fifth and sixth graders don't

understand is that food without many essential vitamins and minerals can contain more energy than food with these nutrients. They don't distinguish between nutrients and energy. Whereas "nutrient" is a technical term for the building blocks of organisms, "nutritious" is an everyday term that refers both to the nutrients and energy of food.

Children tend to blur nutrients and energy not only because everyday language is vague and confusing, but also because nutrients and energy are invisible and abstract. The following statements by fifth and sixth graders show how they confuse food, nutrients, and energy:

A nutrient is healthy food.

Nutrient is like a food or like a flavor.

On the wrappers it says nutrients. It powers you up, it's energy, it boosts you.

A nutrient is something that gives energy.

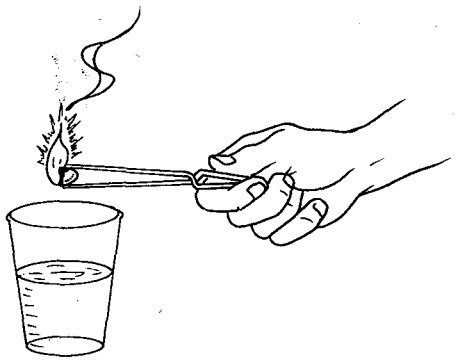
Nutrients come from the sun.

These students do not see food as chemical compounds that contain matter (atoms) and chemical energy (the molecular bonds between atoms). Energy and the particulate nature of matter are two of the most difficult, and yet most fundamental, concepts to understand in science. We can't expect students to master the principles of chemistry by sixth grade, but we can give them stepping stones towards these understandings.

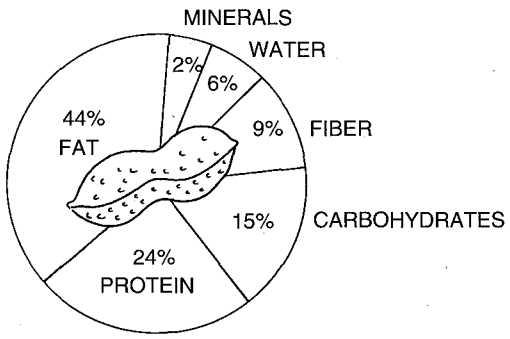
By being aware of children's everyday understanding of food, nutrients, and energy, you can help them expand these definitions to incorporate more accurate, scientific views. The technical definition of food as a substance that contains both nutrients and energy is an important underpinning of the ecological concepts of nutrient cycling and energy flow. Take advantage of the inherent interest children have in food, and lay a foundation for ecological literacy.

One way to find out if something has food energy is to burn it. Do not try this at home! If we are correct that the peanut is food, then it should burn. Let's see what happens.

Hold the peanut with tweezers over a cup of water on a cleared table or desk, well away from students. Wearing a pair of safety goggles, light the peanut with a match or lighter. It should ignite immediately and burn for about two minutes. Drop the residue into the water after the peanut burns out.



The food energy in the peanut was what burned. The black residue is the nutrients that were in the peanut. If you would have eaten the peanut, those nutrients would have become part of your body, and the energy would have been used up or stored as fat.



You might want to repeat the demonstration with a non-food item, such as a sugar-free vitamin pill or a pebble, to show that it does not contain energy.

Conclude with questions such as:

How did your definitions of food differ from the scientific definition I gave you?

What is confusing or difficult about the scientific definition of food?

What does the phrase, "You are what you eat" mean?

Session 2

Now that we know that food is a substance that provides nutrients and energy, we are ready to play "It's All in the Flow." In this game, each player is an organism in an ecosystem that needs to get nutrients and energy to survive.

Put students into groups of six, then give one copy of the "Game Rules" to each group. Read the rules aloud, and help one group demonstrate how the game is played.

Once students understand the directions, give each group a set of "Organism Sheets" and "Game Cards," and let them begin. The game usually ends up being both cooperative and competitive as students within groups help one another decide what cards to choose, but compete with other groups to get all of their "Organism Sheets" filled in first.

While students are engaged in the game, write the name of each "Organism Sheet" on the board, and under each make two columns:

Mouse

Gets Nutrients From	Gets Energy From

Circulate among the groups and listen to the reasons students mention for choosing certain cards for their organisms. Remind them to answer the bonus question on their "Organism Sheets."

When all groups are finished, fill in the columns on the board as students read off the sources of nutrients and energy for each organism.

Conclude the activity with questions such as:

How did you know which cards to pick? What reasoning did you use?

What surprised you?

What is the difference between where plants and animals get their energy and nutrients?

Plants get nutrients from soil and energy from sunlight, whereas animals get both nutrients and energy from the food they eat.

How does energy escape from an ecosystem?

Living things use the energy in their food to live (e.g., to grow, reproduce, and move). This process is a little like burning, and releases heat that escapes into the atmosphere.

What is meant by the statement "Nutrients have a round-trip ticket in an ecosystem, but energy is on a one-way trip"?

The nutrients that are in organisms get recycled by decomposers, then taken up again by plants. Energy enters an ecosystem as sunlight, but escapes as heat. It has to be replenished by more sunlight.

Ongoing Assessment

Student Reflections

Have students send a C-Mail message or record their thoughts about the lesson in their journals. Some prompts to guide their reflections are:

All the things I eat or drink that aren't food are:

The hardest Organism Sheet to fill in was _____ because:

The game we played is called "It's All in the Flow" because:

Teacher Reflections

- ❑ Did students consider one another's viewpoints about what constitutes food in order to agree on a definition?
- ❑ Were they able to adjust their intuitive definitions of food to accept a more scientific viewpoint?
- ❑ Did they share ideas and opinions productively with group members as they played the game?

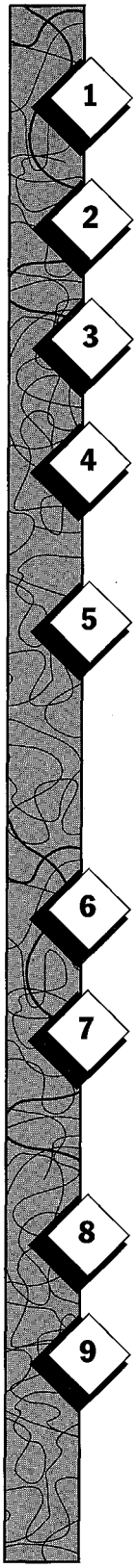
❑ Do they realize that when one thing eats another thing in a food chain that nutrients and energy are passed along?

Extensions

Questions Jigsaw. Ask students to help you write several questions that will give them a chance to summarize their new knowledge about food, nutrients, energy, and ecosystems. List the questions on the board, then split the class into groups that contain as many students as there are questions. Have the groups write answers to each question. Then have each student take one of the questions and answers, and join a new group made up of one person from each original group who has chosen the same question (i.e., all the students with question #1 get together, all the students with question #2 get together, and so on). In their new groups, students should share their original group's answer to the question, discuss the variety of responses, then write a revised answer. Finally, have each of the new groups share its question and answer with the whole class.

Calorie Counting. Help students use a calorie chart to count the total number of calories in a school lunch. Look at an exercise chart to see how many of those calories will be burned throughout the afternoon.

IT'S ALL IN THE FLOW



The object of the game is for each team to get all of the nutrients and energy its six organisms need.

Give one Organism Sheet (Dandelion, Grass, Cricket, Mouse, Owl, or Bacteria) to each of the players on your team.

Spread out the Game Cards so that the name on the back of each card shows.

When it's your turn, think about which of the things on the cards your organism would use to get nutrients and energy. Choose one card and read it aloud.

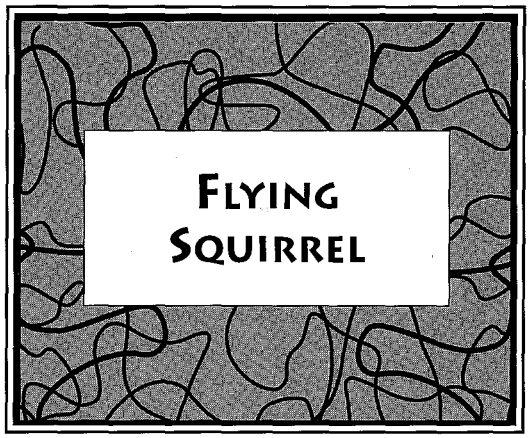
If the card gives nutrients or energy to your organism, then use a pencil to check off that number of nutrient and energy boxes, and write the name of the card on the "Source" lines. If you get more nutrients and energy than you need, keep track of extra ones in the margin to use if you lose some later. Then put the card back, facedown. No player can choose the same card twice.

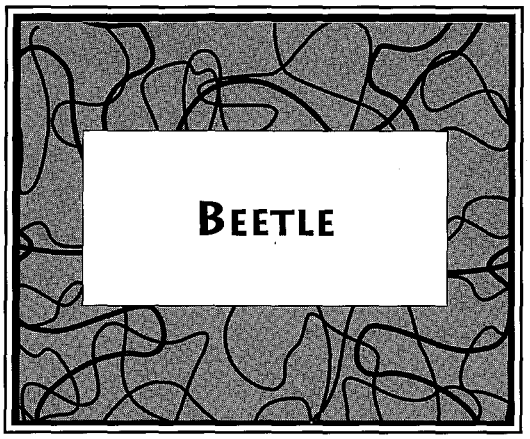
If the card you chose was not right for your organism, put the card back, facedown.

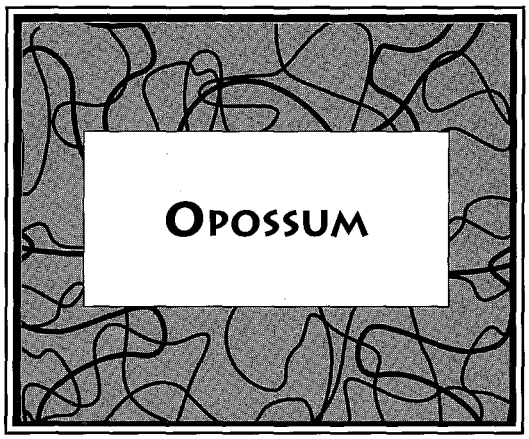
When a card says that your organism has to lose energy, then erase that number of energy checkmarks. If you do not have that many energy checkmarks, erase as many as you have, then replace the card. If you don't have any checkmarks to erase, then just put the card back.

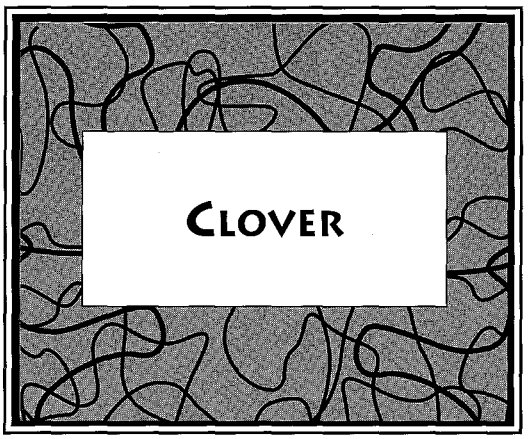
Players take turns. Since you are working as a team, you can help each other decide which would be the best card to choose for each organism.

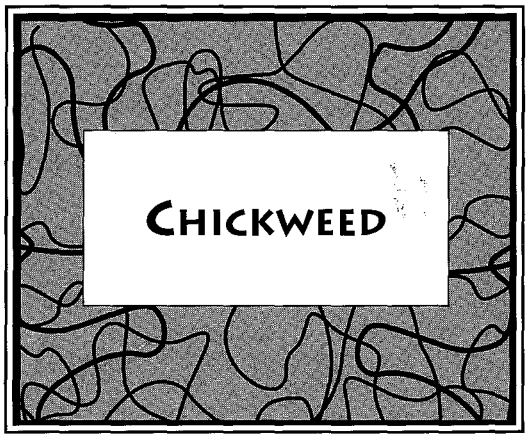
When you have filled your own Organism Sheet, continue to help your group members. The game is not over until all six sheets are filled, including the Bonus Question!

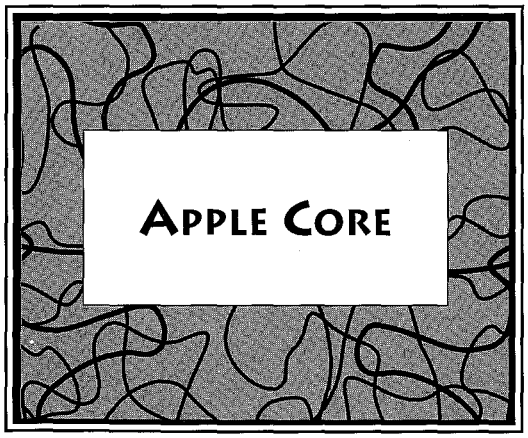












Bacteria eat a dead beetle.

Bacteria gain:

1 Nutrient
1 Energy

The Owl gets the flying squirrel one night.

Owl gains:

2 Nutrients
2 Energy

Cricket eats clover.

Cricket gains:

1 Nutrient
1 Energy

This opossum is a big, fat meal for Owl.

Owl gains:

3 Nutrients
3 Energy

Someone dropped an apple core, and Bacteria are having a feast.

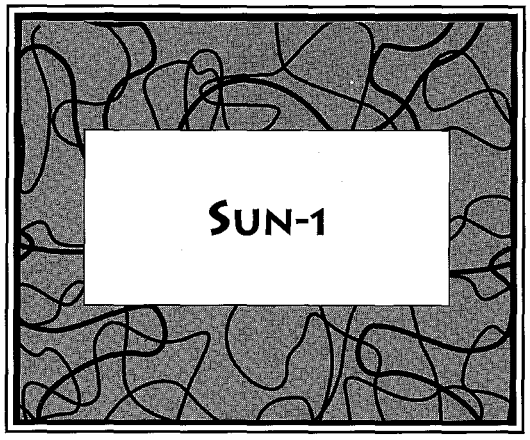
Bacteria gain:

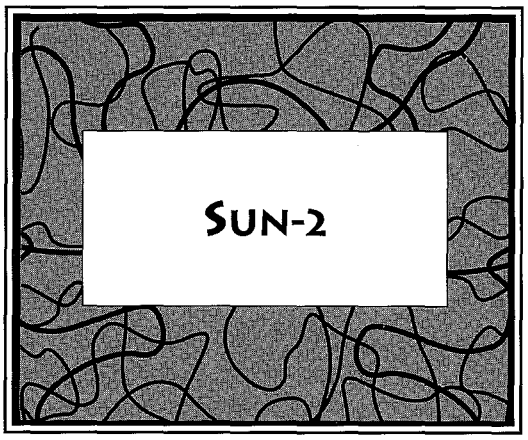
1 Nutrient
1 Energy

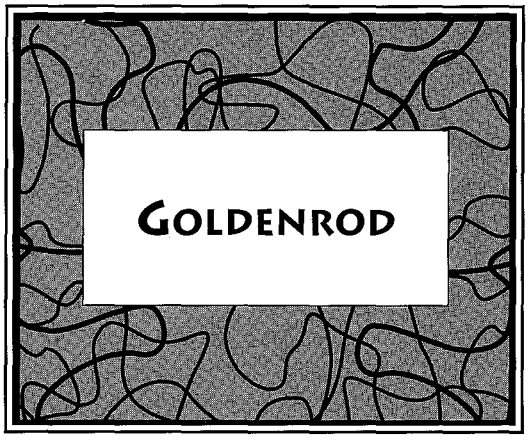
Chickweed plant dies and decomposes.

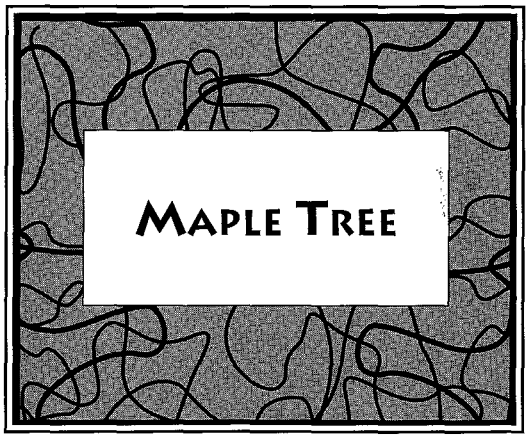
Dandelion gains:

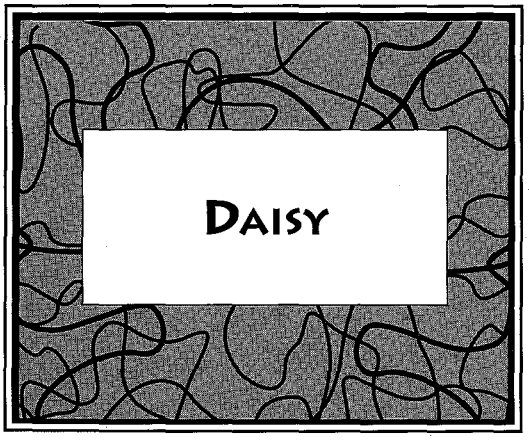
1 Nutrient











It is a partly cloudy day. Plants use sunlight to make food.

Grass or Dandelion gain:

2 Energy

It is a sunny day. Plants use sunlight to make food.

Grass or Dandelion gain:

4 Energy

Mice love acorns!

Mouse gains:

2 Nutrients

2 Energy

Goldenrod leaves die and decompose.

Dandelion gains:

1 Nutrient

Cricket eats part of a daisy.

Cricket gains:

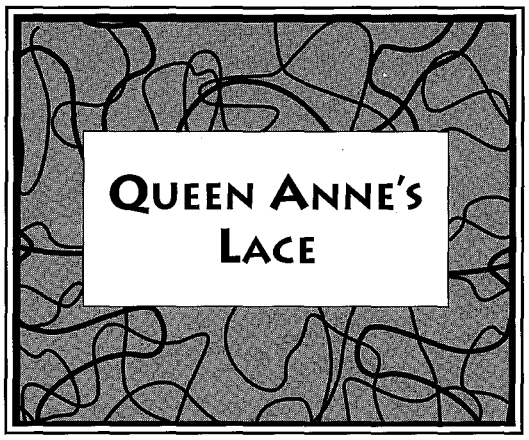
1 Nutrient

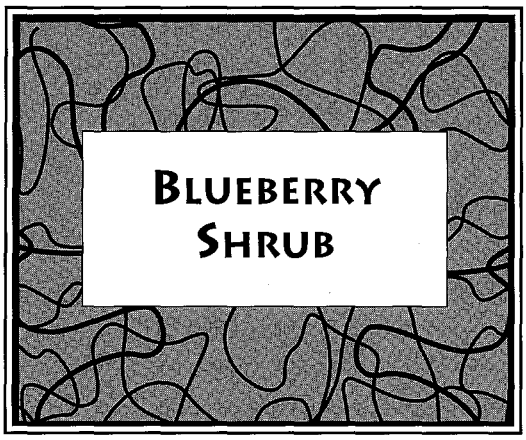
1 Energy

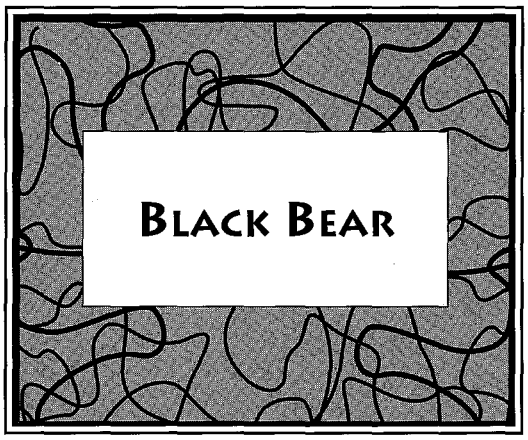
Maple tree branch falls to the ground and decomposes.

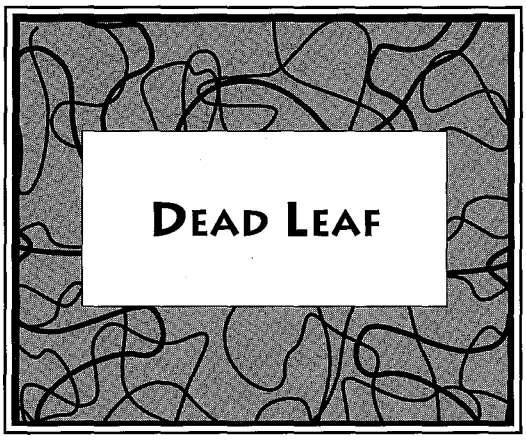
Grass gains:

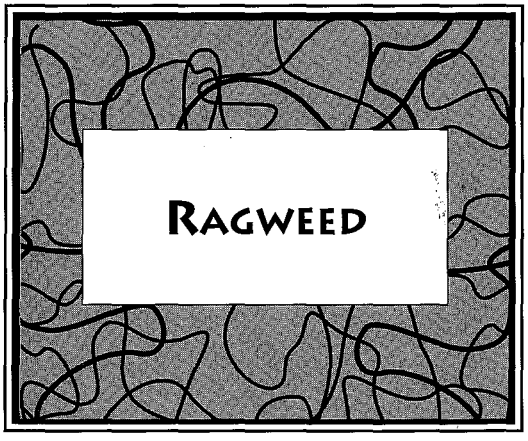
1 Nutrient

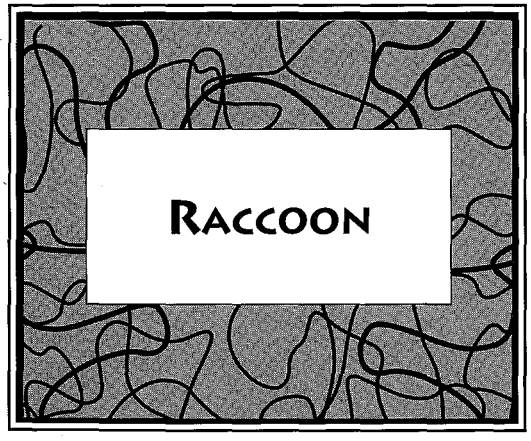












Blueberries are plump and juicy.

Mouse gains:

1 Nutrient
1 Energy

Love those little seeds!

Mouse gains:

1 Nutrient
1 Energy

Bacteria work over the dead leaf.

Bacteria gain:

1 Nutrient
1 Energy

This bear died, and Bacteria wasted no time invading the body.

Bacteria gain:

2 Nutrients
2 Energy

Raccoon urinates next to Dandelion.

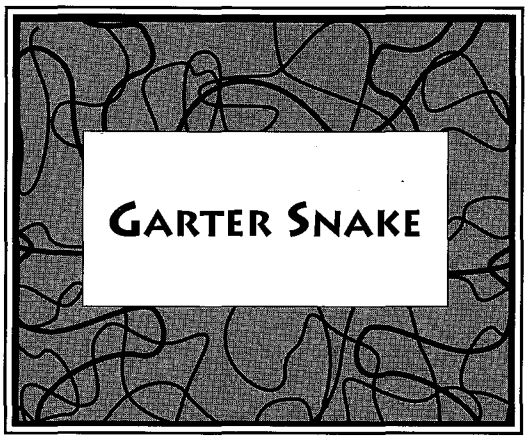
Dandelion gains:

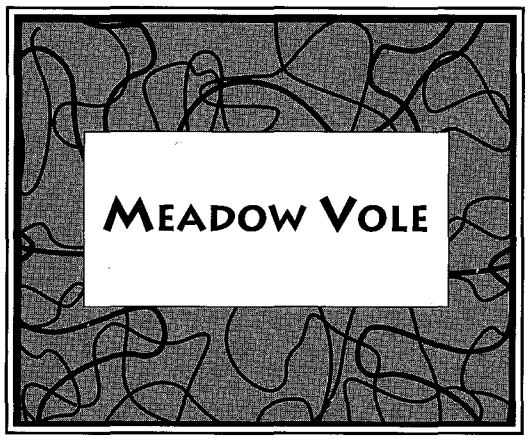
2 Nutrients

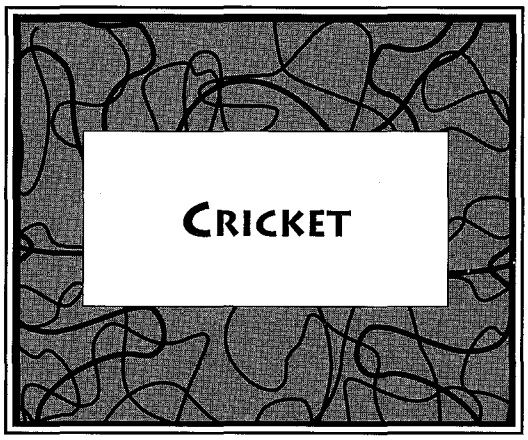
Cricket eats ragweed seeds.

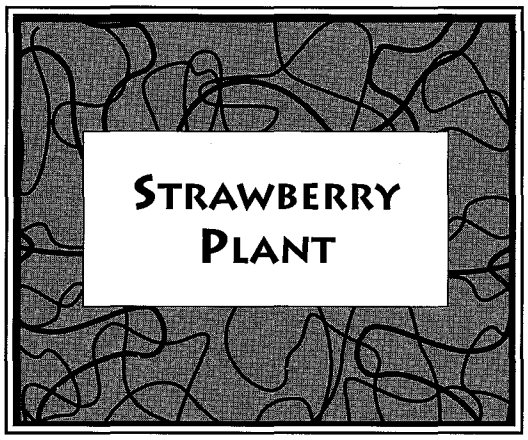
Cricket gains:

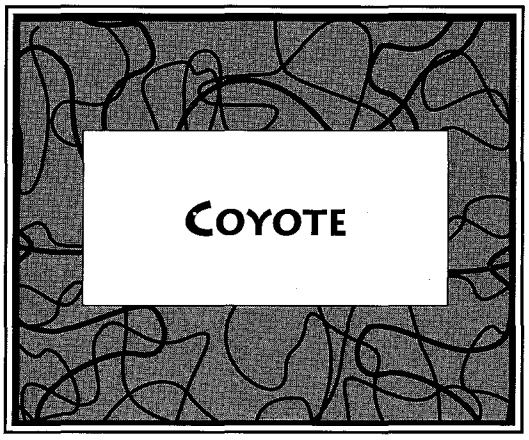
1 Nutrient
1 Energy

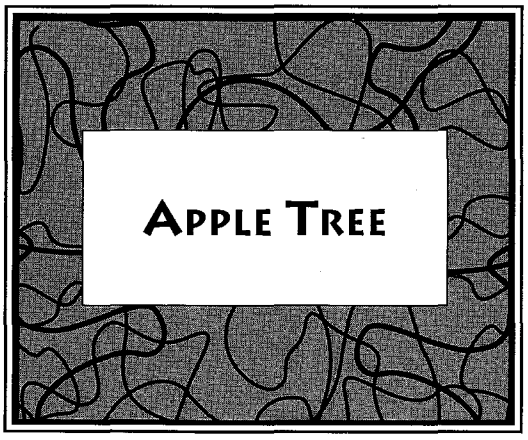












Yumm ... Owl's favorite meal.

Owl gains:

1 Nutrient
1 Energy

Snakes can be fast, but sometimes not fast enough! Owl got this one.

Owl gains:

1 Nutrient
1 Energy

Strawberries fall to the ground and rot.

Grass gains:

1 Nutrient

Cricket devours another cricket.

Cricket gains:

1 Nutrient
1 Energy

Young apple trees have tender bark—just right for Mouse's meal.

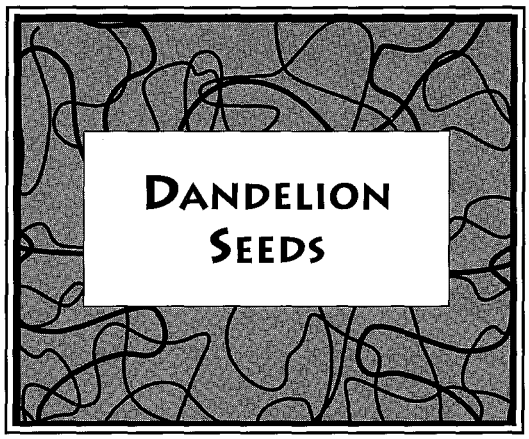
Mouse gains:

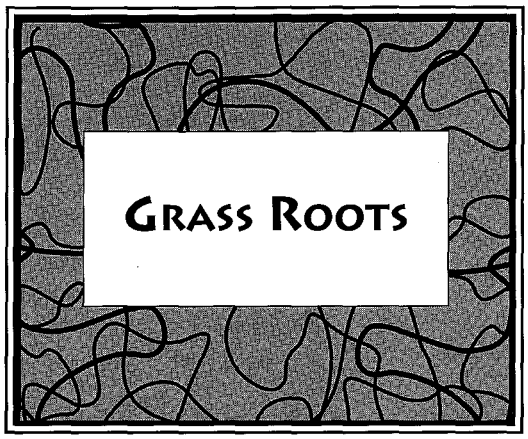
1 Nutrient
1 Energy

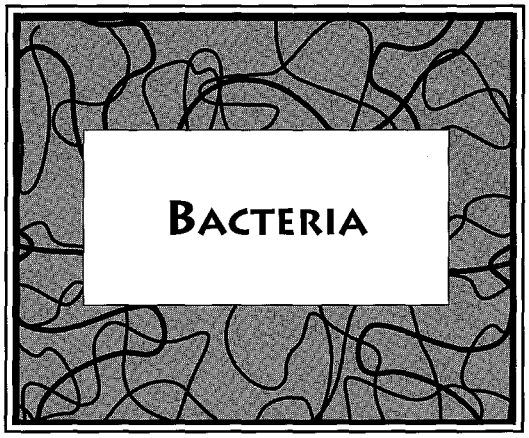
Coyote releases feces on Grass.

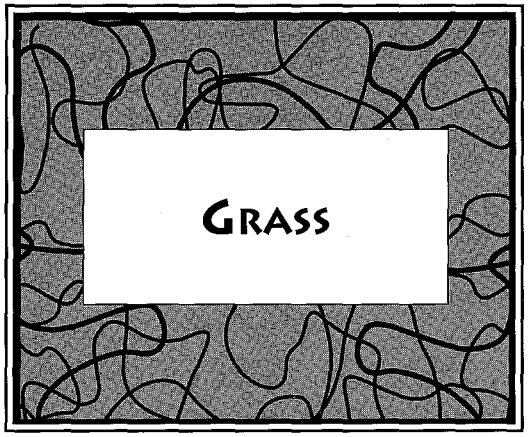
Grass gains:

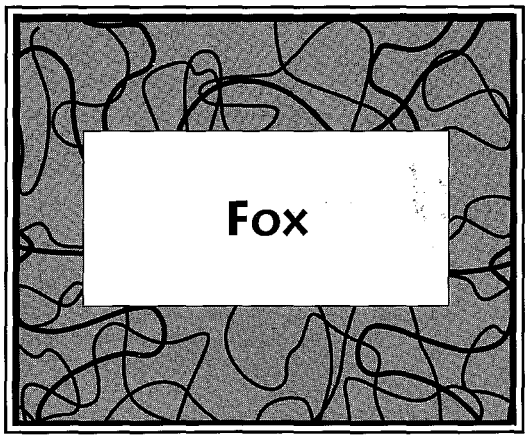
2 Nutrients

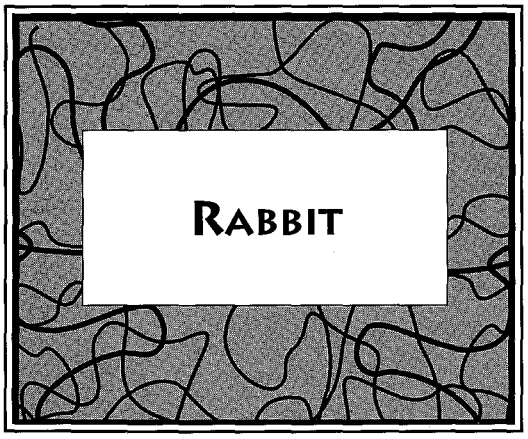












Grass uses energy
to make more roots.
Energy escapes as heat.

Grass loses:

1 Energy

Dandelion uses energy
to produce seeds.
Energy escapes as heat.

Dandelion loses:

1 Energy

Cricket uses energy
hopping through Grass.
Energy escapes as heat.

Cricket loses:

1 Energy

Bacteria used energy
reproducing more bacteria.
Energy escapes as heat.

Bacteria lose:

1 Energy

Owl uses energy
flying after a rabbit.
Energy escapes as heat.

Owl loses:

2 Energy

Mouse loses energy
running from a fox.
Energy escapes as heat.

Mouse loses:

2 Energy

Owl

Organism Sheet

Nutrients

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Energy

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Bonus Question

How does energy escape from an ecosystem?

GRASS

NUTRIENTS

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ENERGY

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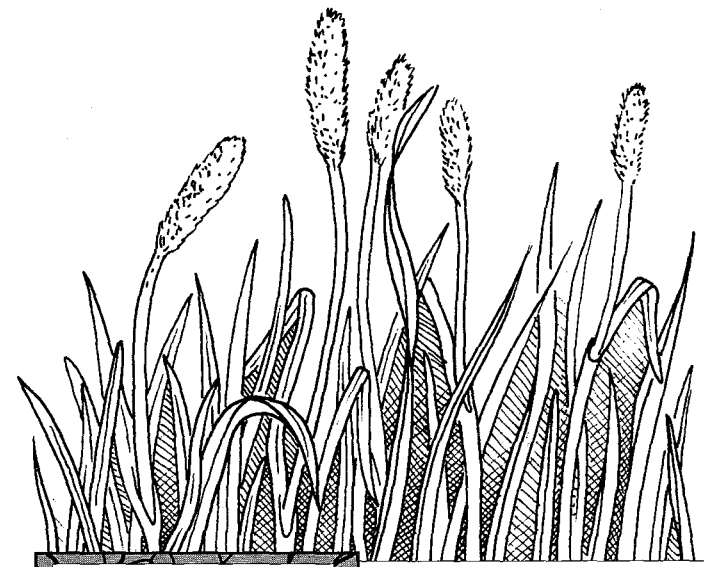


BONUS QUESTION

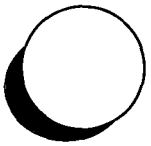
How does energy escape from an ecosystem?

_____

_____

DANDELION

NUTRIENTS

Check here when filled 
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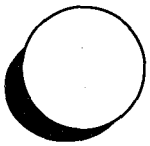
Check here when filled 
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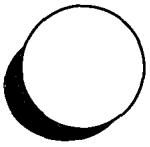
Check here when filled 
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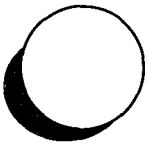
Check here when filled 
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ENERGY

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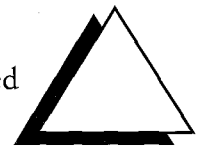
Check here when filled 
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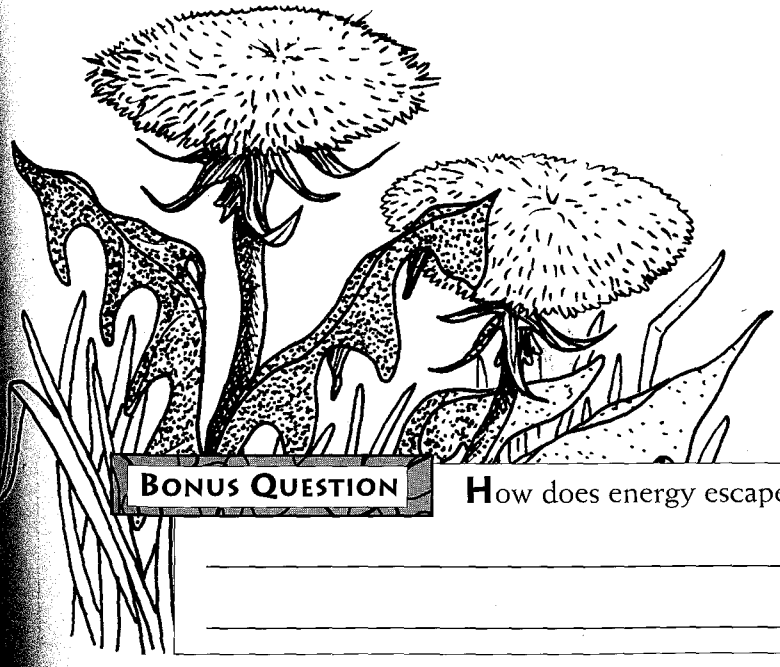

BONUS QUESTION

How does energy escape from an ecosystem?

CRICKET

NUTRIENTS

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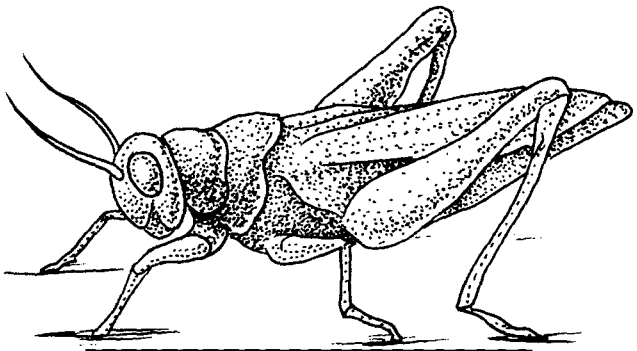

ENERGY

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BONUS QUESTION

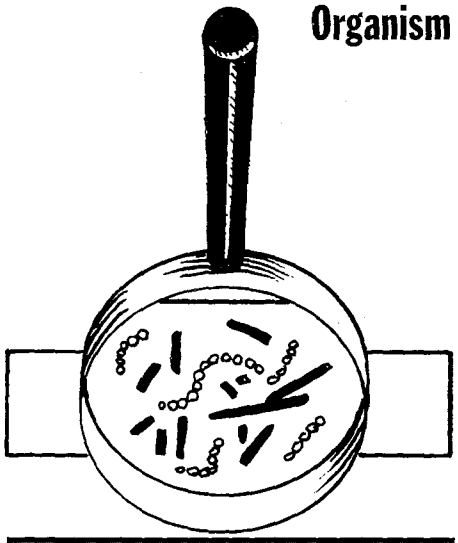
How does energy escape from an ecosystem?

_____

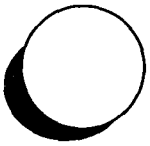
_____

BACTERIA

Organism Sheet



NUTRIENTS

Check here when filled 

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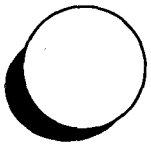
Check here when filled 

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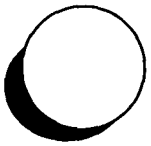
Check here when filled 

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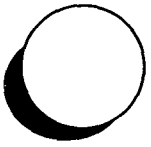
Check here when filled 

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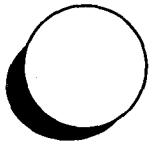
Check here when filled 

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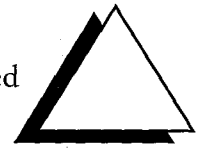
ENERGY

Check here when filled 

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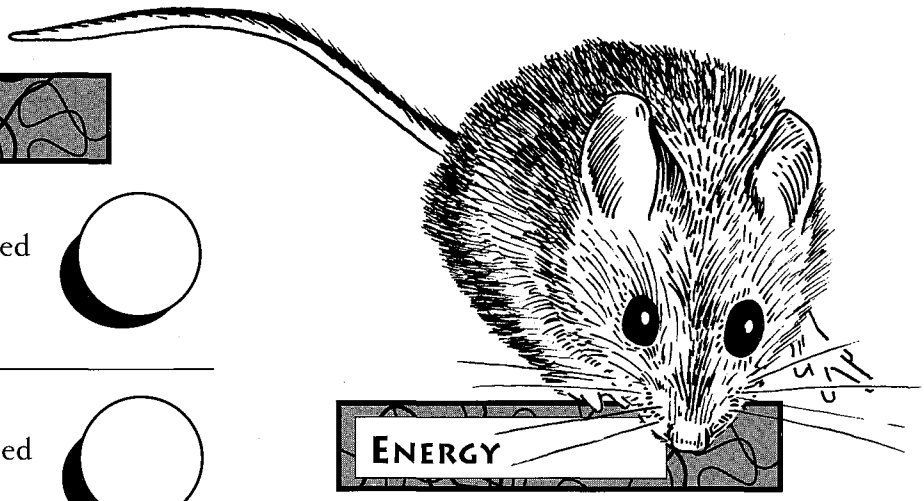
BONUS QUESTION How does energy escape from an ecosystem?

MOUSE



NUTRIENTS

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ENERGY

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BONUS QUESTION

How does energy escape from an ecosystem?

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