SCIENCE
Environmental/Life Sciences
Grade 8
The Living Marsh

Overview

This module will focus upon Louisiana fresh marsh organisms and relationships among these organisms, particularly energy flow. This activity will take 3-5 class periods, depending upon the amount of class time given to research and to discussion of ecosystem and organism characteristics. Step-by-step sequential teacher instructions are included in both the Teacher Preparation and Body of the Lesson.

5-8 Benchmarks

SI-M-A3	Using mathematics and appropriate tools and techniques to gather, analyze, and interpret data
SI-M-A4	Developing descriptions, explanations, and graphs using data
SI-M-A5	Developing models and predictions using the relationships between data and explanations
SI-M-A8	Utilizing safety procedures during scientific investigations
SI-M-B4	Using data and logical arguments to propose, modify, or elaborate on principles and models
SE-M- A2	Demonstrating and understanding of how carrying capacity and limiting factors affect plant and animal populations
SE-M-A5	Tracing the flow of energy through an ecosystem and demonstrating a knowledge of the roles of producers, consumers, and decomposers in the ecosystem
LS-M-C2	Modeling and interpreting food chains and food webs
LS-M-C3	Investigating major ecosystems and recognizing physical properties and organisms within each
LS-M-C4	Explaining the interaction and interdependence of nonliving and living components within ecosystems

Teacher Notes

Freshwater marsh characteristics

Freshwater marshes are a common sight in Louisiana and throughout North America. While marsh inhabitants will vary somewhat with geography, water chemistry, duration of flooding, and water depth, the dominant plants typical of fresh water marshes are non-woody plants that grow partially in and partially out of the water. These plants, known as **emergents**, commonly include aquatic grasses, cattails, sedges, and rushes. (Unlike swamps where trees predominate.)

Many of Louisiana's marshes are permanently flooded and may have water as deep as six feet. In these marshes various emergent plants may be arranged in belts from shallow to deep water. There may be large areas of open water in which floating plants, such as duckweed and water hyacinth, and submerged plants such as water lilies are common. Other marshes, frequently found adjacent to deep marshes, are shallow and may be flooded for only a portion of the year. Grasses and sedges are the most common plants in these marshes.

In southwest Louisiana, just inland from the coastal marsh, is a wet meadow marsh known as the coastal or Cajun prairie. Typically the area receives high rainfall, with grasses and numerous perennial wildflower species being the major plant types. Little of Louisiana's former coastal prairie remains, much of it having been altered for grazing of cattle, and growing rice, sugar cane.

As they offer both aquatic and terrestrial habitats, freshwater marshes support not only a diverse mix of plants, but of other organisms as well. Fungi, microorganisms, and algae add to the diverse mixture. Animals include assorted birds, fish, reptiles, amphibians, crustaceans, insects, spiders and their relatives, snails, and worms. While most of these animals are permanent, residents, marshes also offer feeding and rest stops for migrating birds and breeding or nursery grounds for many animal species.

Food chains

As in any ecosystem, the three basic elements of a fresh water marsh are the

- organisms (also referred to as the biotic or living factors);
- the non-living (or abiotic) factors, such as temperature, water depth, or soil texture; and
- the primary energy source, the sun.

Interrelationships among these three drive the ecosystem. Central to these relationships is energy flow. Unlike nutrients, which can be recycled again and again, energy flows through the system, with much being lost at each transfer. Sunlight must, therefore, be regularly captured and packaged in a form (food molecules) useful to providing the driving force (the energy). This flow of energy through an ecosystem is frequently illustrated through use of graphic organizers known as food or energy chains.

Food chains begin with plants or algae that can capture sunlight and store it in the chemical bonds of sugar molecules in the process known as photosynthesis. These organisms are called **producers,** as they can produce their own stored energy sources---food molecules. These organisms are also known as **autotrophs** (from *auto* meaning “self” and *troph* meaning “to feed”).

Animals, fungi, and most microorganisms cannot produce their own food; they must eat (or consume) their energy sources. These organisms are therefore, referred to as consumers or **heterotrophs** (from *hetero-* meaning “other” and *troph* meaning “to feed on”). The consumers that eat plants or algae are called **herbivores** (*herb* meaning “plant” and *vore* meaning “to eat”). Those

heterotrophs that eat other consumers are known as **carnivores** (*carni* meaning flesh and *vore* meaning to eat). The name **decomposer** is given to those consumers, such as bacteria or fungi, which feed upon dead or weakened organisms.

Most students are aware that organisms generally eat more than one food, and that the multiple overlapping of possible food chains in an ecosystem comprise its food web. Through use of food web relationships, the role of **omnivores**, organisms that feed on both autotrophs and other heterotrophs can also be discussed.

Materials/ Equipment

Materials necessary for this module include:

- Nature guides and other resource materials that focus on fresh marsh organisms (Refer to the Reference and Resource Lists)
- Overhead transparencies, poster boards, computer graphics, or a blackboard
- 100 mini-marshmallows (pre-counted into a transparent, plastic 16 oz. cup) per group of 5 students
- 1 plastic knife per group of 5 students
- Student handouts (1 each per student)

Teacher Preparation/Directions

Open:
Ask students if they know what a marsh or estuary is. Accept all reasonable answers. Show an illustration of a marsh or swampy area if necessary to clarify.

Lesson:

1. Provide students with background information related to Louisiana ecosystems, particularly fresh water marshes. Basic information on freshwater marshes is included above. Additional information on Louisiana's various ecosystems can readily be obtained from the sources listed in the reference links section of this document. Especially useful to middle school students is the CD, *Knee Deep in Wetlands*. Each middle school library should have received one copy of the CD. Additional copies are available by request. (See the reference section.)

2. Have students (individually or in small cooperative learning groups) research one or more species native to Louisiana fresh marshes. Have them discuss these organisms, in writing and verbally. Their discussion of each organism should include its basic characteristics, how the organism gets food and what it eats, who eats this organism, any special adaptations the organism has for survival in the marsh and any other information that makes this organism interesting or important. *(This is Student Activity Sheet 1.)*

This assignment could be given as homework or as class work utilizing student-selected references or as either homework or class work with the teacher providing background information on selected species. Again, the reference links section of this document provides sources of information about common species, and the *Knee Deep in Louisiana Wetlands* CD is especially useful. You may choose to have students use the Internet for this research.

3. Introduce the vocabulary and basic concepts associated with food chains.

4. Have students, in cooperative learning groups, create freshwater marsh food chains using the organisms they researched and discussed in class. Have them draw their food chains on the black board, an overhead transparency, large paper sheets, or using a computer. *Inspiration* software for graphic organizers may be used.

   Students will need to know:
   - Food chains illustrate who is eating whom in the energy flow process.
   - An arrow symbolizes the direction of the flow of energy with the arrowhead pointing toward the recipient.
     For example, cattail → muskrat indicates that the muskrat is obtaining energy from (eating) the cattail.

5. Each group should give a presentation and discuss its food chain with the class. Trophic levels should be indicated along with the organisms' names.
   Monitor student presentations, making sure they understand who is eating whom - the energy flow.

6. Have students develop a large food web incorporating each of the food chains developed by the class. This should also be recorded on butcher paper, newsprint, a poster, an overhead transparency, or computer file to save for later discussion.

7. A great deal of energy is lost in obtaining food, digesting it, and eliminating wastes, and some is left in the material not consumed. On average only about 10% of the energy available in its food gets transferred to the consumer. This energy loss affects the number of organisms that can feed at particular trophic (feeding) levels and survive. A muskrat, for example, might need to eat 4 cattails each day in order to meet its daily energy needs. In order for both the muskrats and the cattails to survive, there must be more plants than there are muskrats—otherwise, the plants will soon be wiped out and the muskrats must move or die.

To help students visualize this energy loss, a sample activity, **Marsh Mallow Energy Activity**, can be used to model energy loss in a simple fresh water marsh food chain. Have the students complete the activity and complete the analysis problems. The activity will take only a few minutes. It may take students an additional 10-15 minutes to complete the analysis.

Close:
Discuss the analysis problems within the class. Have students apply the concepts learned in discussion of the freshwater food web they have created.

ANSWER KEY: (Assessment, page 149)
1.B 2.D 3. B 4.E 5.A

6.A 7.D 8.A 9.D 10.E

Marshmallow Energy Flow

Materials per group of 5 students:

- 100 mini-marshmallows pre-counted into a transparent, plastic 16 oz cup
- 1 non-serrated plastic knife
- Paper towels

Each student should also receive a copy of Student Activity Sheet 2.

This activity could be completed as a demonstration using only 5 students, or divide the class into groups of 5 students each. Either method is effective.

1. Have the 5 students arrange themselves in a line to represent a food chain. Give each student a paper towel on which to hold the marshmallows.
2. Read or have a student volunteer read the scenario (included on student Activity Page 2). When the reader announces that the plant has received 100 units of energy today, hand the first person in each chain a cup of 100 mini-marshmallows.

Note: Transparent, plastic cups allow students to see the marshmallows, and this seems to have an impact. Include a plastic knife in the cup as well.

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3. Continue reading, having the students determine how many marshmallow energy units will be passed on to the caterpillar. (10 are passed on)
4. It may be a good idea at this point to reinforce some math skills---- Students should be reminded that diving by 10 is the same as moving a decimal point to the right.
5. Have the students complete the sequential marshmallow (energy) passage through the food chain. They will need the plastic knife to cut .1 of a marshmallow off by the fourth organism (spider) and .1 of that (or .01 of a marshmallow) by the fifth organism (bird).
6. Have the students apply their understanding to the energy pyramid and practice problems.

Activity Sheet 1

Who lives in a Louisiana Fresh Water Marsh?

Name of organism_____

Information about this organism:

Basic characteristics_____

_____

_____

_____

_____

_____

_____

_____

_____

How does it get food? _____

What does it eat? _____

Who eats it? _____

What special adaptations does it have that help it survive in the fresh water marsh?

_____

_____

I got this information from: ___CD ___book ___magazine ___movie ___other

Name of my reference source and name of the author:

_____

ACTIVITY SHEET 2

MARSHMALLOW ENERGY FLOW

PURPOSE: The purpose of this activity is to model energy loss as it flows through a fresh water marsh food chain.

MATERIALS: per group of 5 students:
100 mini-marshmallows pre-counted into a transparent, plastic 16 oz. cup
1 non-serrated plastic knife
Paper towels

Your teacher will assign you to a group of five individuals. Each of you will represent an organism that lives in the fresh water marsh. Follow along as someone reads the story below. Answer the questions as instructed by your teacher.

In Louisiana, we have a shrub that lives along our marshes. It is a member of the hibiscus or mallow family of plants. This plant has big, showy flowers that are attractive to several types of insects. This plant is sometimes known as a marshmallow.
1. Since the marsh mallow is a plant it is a producer. It absorbs energy from the sun in order to make its own food. Today, a leaf of our plant has received 100 units of energy from the sun. **(The student representing the plant will receive a cup of 100 marsh mallow candies. These represent the 100 energy units.)**

2. A hungry caterpillar eats away at a plant leaf and in doing so, it gains about 10% of the energy stored in the leaf that it eats.

 If the plant collected 100 units of energy today, how many energy units will be passed on to the caterpillar? _____ (**The plant passes this number of marshmallows to the caterpillar.)**

3. An assassin bug feasts upon the caterpillar. Only about 10% of the energy is passed on to the bug.

How many energy units will be passed to the assassin bug? ____
(Pass this number of marshmallows to the bug.)

4. A spider traps the bug and slurps up about 10% of the energy stored in the bug.
 How many marshmallows will be passed to the spider? _____
(Pass this number of marshmallows to the spider. HINT: YOU MIGHT NEED THE KNIFE NOW!)

5. A red- wing black bird, attracted by activity in the shrub, seizes the spider. Only about 10% of the energy from the spider is passed along to the bird.

 How much of the marshmallow will be passed along? _____

USE THE DIAGRAM TO ORGANIZE THE DATA WE HAVE COLLECTED:
Only about 10% of the energy units available are transferred between two feeding levels. Indicate the number of energy units transferred to each organism in the food chain shown.

Marsh mallow → Caterpillar → Assassin bug → Spider → Black bird
____ units _____units ____units ____units ____units

Use the information about food chains and energy flow to answer the problems.

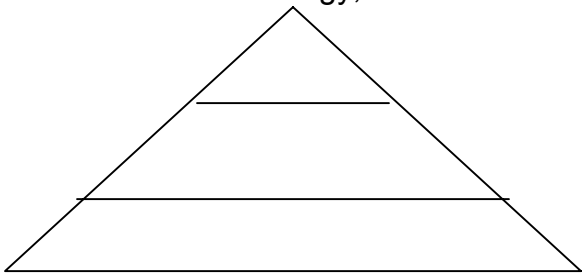
1. Why must there be more plants in an ecosystem than herbivores?

2. What would happen to the carnivores if all the herbivores die? Explain.

3. How many assassin bugs must a spider eat if it is to receive the same amount of energy that the bug received from a caterpillar? Explain your answer.

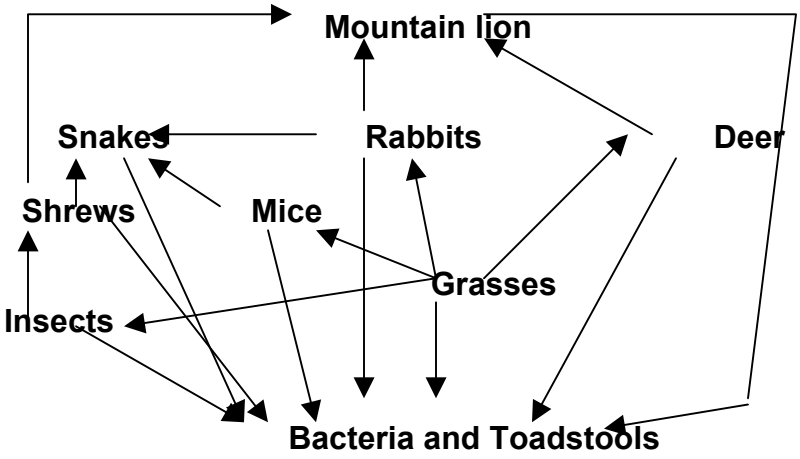
4. What happens to the energy that is not transferred? Can this energy be recycled through the food chain? Explain your answer.

Going a Step Further
Energy pyramids are frequently used to indicate the amount of energy available in any trophic (feeding) level. Using the terms *producer, herbivore*, and *carnivore*, complete the pyramid below.
The greater the amount of available energy, the wider the section of the pyramid.



Assessment

Utilize the problems included on the activity sheets as assessment tools. In addition, have students interpret a food web similar to the one below. (This example is not from a fresh water marsh.)



1. This diagram illustrates a
   (A) food chain (B) food web (C) oxygen cycle (D) energy pyramid

2. The rabbits eat
   (A) snakes (B) mountain lions (C) snakes and mountain lions (D) grasses
   (E) nothing, they make their own food

3. Which organism is an herbivore?
   (A) Mountain Lion (B) deer (C) grass (D) snake

4. The grasses consume
   (A) rabbits (B) deer (C) insects (D) rabbits, deer, insects, and mice
   (E) nothing they produce their own food

5. Which is the most important in supplying energy for the organisms represented in the diagram?
   (A) grasses (B) mice (C) bacteria (D) shrews

6. The producers shown are
   (A) grasses (B) toadstools (C) bacteria (D) all three

7. The sequence: grass→grasshopper→shrews→fox→mountain lion represents a
   (A) habitat (B) food web (C) niche (D) food chain

8. The arrow head indicates
   (A) direction of flow of energy (B) who is being eaten
   (C) which organism eats most (D) nothing in particular

9. In the relationship grasses→insects→shrews→mountain lions, if 100 units of energy are represented by a grass plant, the amount of energy ultimately passed to the mountain lions is
   (A) 1000 units (B) 90 units (C) 10 units (D) 1 unit (E) 0.1 unit

10. Which of the following is/are consumer(s)?
   (A) grasses (B) toadstools (C) mice (D) grasses, toadstools, and mice
   (E) toadstools and mice

Louisiana Wetlands References/Resources

Abrams, E., and L. Soniat. 1992. *Wetland Activities.* Louisiana Department of Wildlife and Fisheries and LA. Sea Grant College Program, Baton Rouge, LA Available through LA. Dept. Wildlife and Fisheries. Contact the wildlife educator for your region

Aquatic Project WILD. 2001. Council for Environmental Education. Available through workshop participation. Contact Cheryl Fischer, Project WILD coordinator Fischer_CL@wdlf.state.la.us

Knee Deep in Louisiana Wetlands CD-Rom
Each Middle School in the state was sent one copy. For information on obtaining additional copies contact Educational Technology Review Center, University of Louisiana at Lafayette

Project Tellus. 1996. Louisiana Sea Grant Program, Baton Rouge, LA
Contact Dr. Pam Blanchard (225-388-1558) for this set of interactive video lessons for Middle School students

The Coastal Zone: Activities for the Classroom. 1991. Louisiana Universities Marine Consortium, Chauvin, LA, and the Louisiana Department of Natural Resources, Baton Rouge, LA

Slattery, B. E. 1991. *The Wonders of Wetlands.* Environmental Concern, Inc., St. Michaels, MD. Available for purchase from Environmental Concern or through workshop participation. Contact:
Joey Breaux, Project WET coordinator joey_b@ldaf.state.la.us
or Cheryl Fischer, Project WILD coordinator Fischer_CL@wdlf.state.la.us

USGS Lacoast www.lacoast.gov
Click on Kid's Corner, Cool Stuff, and Related links for resources including free CD-ROMs and teacher's guides (Explore Coastal Louisiana with Boudreaux and LA Wetlands: Functions and Values)

Welcome to Louisiana Wetlands Educational Technology Review Center
www.challenge.state.la.us/wetlands this site includes wetland information from the CD Knee Deep in Louisiana Wetlands

Wetland Resources Educational Technology Review Center
www.etrc.louisiana.edu/wetlands/resource.html This site Includes several sets of lesson plans and student activities

And more…

Barataria-Terrebonne National Estuary Program
Nicholls State University Campus
504-447-0868 or 1-800-159-0869
Free videos, salt marsh coloring book, LA. Is for the Birds resource folder, and more

Louisiana Cooperative Extension Service
Louisiana State University
Agricultural Center
Baton Rouge, LA 70803
Numerous publications are available through the LSU and your Parish Offices.

Louisiana Department of Wildlife and Fisheries
225-765-2933 www.wlf.state.la.us
225-765-2934
Teacher workshops, Project Aquatic WILD, Wonders of Wetlands, programs and materials for classrooms

Louisiana Department of Natural Resources
www.dnr.state.la.us/topics.ssi
Programs, speakers, written resources

Louisiana Sea Grant Program
Dr. Pam Blanchard (225-388-1558)
Classroom opportunities, activities, teacher workshops, and *Ocean Commotion Festival* for kids