

LESSON 1 The Wetland Ecosystem

Lesson at a Glance

In this lesson, students learn some basic concepts about a wetland ecosystem. The lesson begins with a classroom discussion of what students already know about wetlands. Students learn about organisms within an ecosystem and their interdependence. They read about producers, consumers, and decomposers, and how these various organisms make up the food chain within an ecosystem. They also read about the carbon cycle and discover how it relates to the food chain. Students diagram a wetland food chain identifying producers, consumers, and decomposers, then they use their food chain diagrams to illustrate the flow of energy through the carbon cycle. The lesson ends with a short student research activity to assist them in further understanding a wetland ecosystem.

Lesson Duration

One 45-minute period

One 60-minute period

Essential Question(s)

What is a wetland?

How do the living things (producers, consumers, and decomposers) and nonliving things (soil, air, water, and sunlight) interact with each other in the wetlands?

How is the carbon cycle related to the food chain?

How does energy flow among producers, consumers and decomposers?

Related HCPSIII Benchmark(s):

Science SC.5.3.1
Describe the flow of energy among producers, consumers, and decomposers.

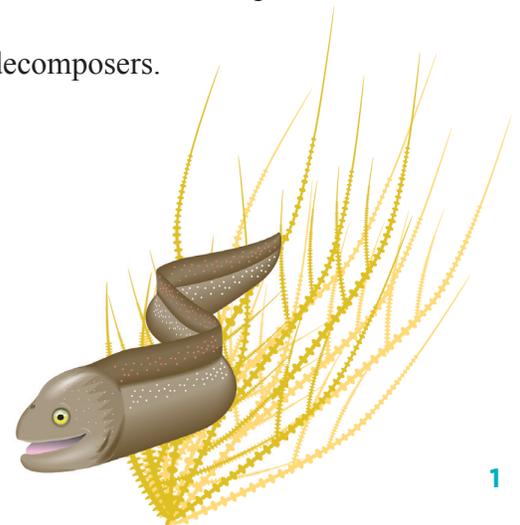
Science SC.5.3.2
Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter.

Key Concepts

- Wetlands are located between land and a natural water source, and they often act as a buffer.
- A food chain is a diagram that represents the interdependence of producers, consumers, and decomposers.
- Carbon makes its way through organisms in the food chain until it enters the atmosphere, once again, through respiration.
- The carbon cycle is a cycle of matter that portrays the flow of energy between organisms.

Instructional Objectives

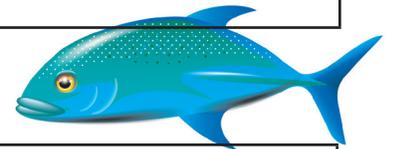
- I can describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter.
- I can describe the flow of energy among producers, consumers and decomposers.



Assessment Tools

Benchmark Rubric:

Topic		Cycles of Matter and Energy	
Benchmark SC.5.3.1		Describe the cycle of energy among producers, consumers, and decomposers	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain and give detailed examples of the cycle of energy among producers, consumers, and decomposers	Describe the cycle of energy among producers, consumers, and decomposers	Describe a part of the energy cycle with an example (e.g., describe one or two parts of a food chain)	Recognize an example of part of an energy cycle
Topic		Interdependence	
Benchmark SC.5.3.2		Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain and give examples of how specific relationships among producers, consumers, and decomposers in an ecosystem affect the cycling of matter	Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycling of matter	Identify a few relationships between producers, consumers, or decomposers in an ecosystem in terms of the cycling of matter	Recall, with assistance, that matter cycles in an ecosystem among producers, consumers, and decomposers



Assessment/Evidence Pieces

Lesson

- Student Worksheet *Food Chain and Carbon Cycle*
- *Self-Assessment Checklist*

Unit

- The wetlands concept map can be used as a monitoring device throughout the unit.



Materials Needed

Teacher	Class	Group	Student
<ul style="list-style-type: none"> Method to project PowerPoint (Optional) Transparency of Carbon Cycle diagram 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Computer with internet access Copies of Student Worksheets: <i>Ecosystem Interdependence, Food Chain and Carbon Cycle, and Wetland Note-taking</i> 	<ul style="list-style-type: none"> None

Instructional Resources

PowerPoint: *Introduction to Wetlands “Hawai‘i’s Wetland Ecosystems”*

Teacher Reading: *Wetland Ecosystems*

Student Reading: *Ecosystem Interdependence*

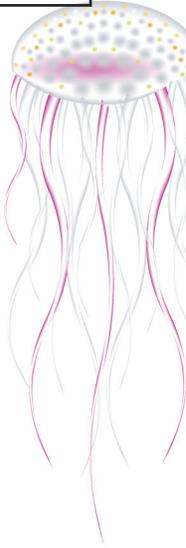
Student Worksheet: *Food Chain and Carbon Cycle*

Teacher Answer Key: *Food Chain and Carbon Cycle*

Student Worksheet: *Wetland Note-taking*

Teacher Answer Key: *Wetland Note-taking*

Assessment Tool: *Self-Assessment Checklist*



Student Vocabulary Words

ahupua‘a: a Hawaiian political land division that usually stretched from summit to sea, and included everything necessary for a community’s survival.

carbon: a chemical element that has the chemical symbol C; occurs in all organic life.

coastal marsh: also called a salt marsh; usually found along the coast and may be connected to an estuary.

consumer: an organism that consumes another organism for food as a means of energy.

cycle: an interval of time during which a sequence of events is completed.

cycles of matter: the earthly cycles of water, phosphorous, nitrogen, sulfur and carbon.

decomposer: an organism that consumes dead or decaying organisms.

ecosystem: a community of different living organisms and the physical environment in which they are found.

endemic: prevalent or present only in a particular area or region.

estuary: a semi-enclosed coastal body of water with a free connection to the open sea with one or more rivers or streams flowing into it.

food chain: a group of organisms interrelated by the fact that each member of the group feeds on the organism below it in the chain, and is, in turn, eaten by the organism above it in the chain.

impact: a significant or strong influence or effect.

interdependent: groups of organisms require each other for survival.

matter: the substance of which a physical object is composed.

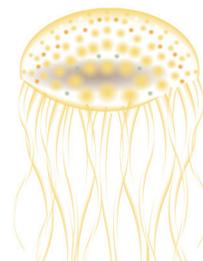
marsh: a type of wetland, featuring grasses, sedges, and other herbaceous plants in a shallow water environment.

migratory: moving regularly or occasionally from one region or climate to another.

organism: a living being.

producer: any organism that can create its own food source by converting inorganic substances into organic substances.

wetland: an area of land where water covers the soil, or is present at or near the soil surface, for all or parts of the year.



Lesson Plan

Lesson Preparation

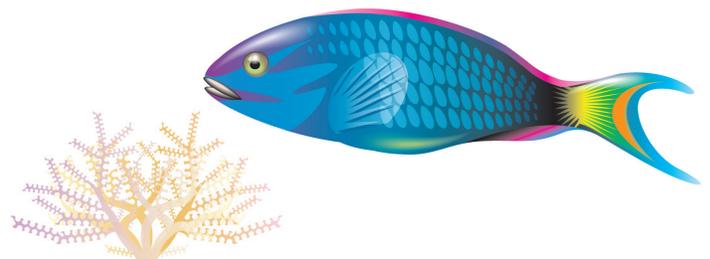
- Review the Science Background provided in the Unit’s Overview and the Teacher Reading *Wetland Ecosystems*.
- Review and prepare copies of student reading *Ecosystem Interdependence, Food Chain & Carbon Cycle* worksheet and *Wetland Note-taking* worksheet, one for each student.
- Preview PowerPoint *Introduction to Wetlands “Hawai’i’s Wetland Ecosystems”* and make arrangements to project it.
- Create a transparency of the Carbon Cycle diagram on page 24 (Optional).

I. Introduction to the Wetlands

- Write the term *wetland* on the board. Have students create a concept map around the term *wetland*. As this is the first lesson, students’ concept maps may look more like a wagon wheel type organizer or be extremely sparse. This is fine as this concept map will be built upon with each lesson. This may serve as a monitoring tool for the teacher.
- Show PowerPoint *Introduction to Wetlands “Hawai’i’s Wetland Ecosystems.”* This PowerPoint will give the students more details about a wetland and about the relationships of the organisms that reside there.

II. Introduction to the Interrelationships in an Ecosystem

- Explain to students that to study wetlands further, they need to better understand how ecosystems function.
- Pass out the *Ecosystem Interdependence* student reading to each student. Have students take turns reading aloud, while other students read along silently.
- When finished with the reading, ask students to verbally define the role of a producer, consumer, and decomposer in a wetland ecosystem. On the board, have students assist you in drawing a simple food chain diagram that shows the relationship between producers, consumers, and decomposers. Ask students to give specific examples of Hawaiian organisms found in the reading and tell you which category the organism belongs to (i.e., producer, consumer or decomposer).
- If you created a transparency of page 24, use that or draw the carbon cycle diagram on the board to help introduce the carbon cycle to the class. Discuss what the carbon cycle is and how it works among the organisms within the wetland ecosystem. Insert the examples students gave from the reading of producer, consumer and decomposer into the carbon cycle diagram. Discuss and answer student questions.
- Distribute the *Food Chain & Carbon Cycle* worksheet to each student. Part 1 of this assignment is to have each student draw a basic wetland food chain identifying producers, consumers, and decomposers. In Part 2, students will label the flow of energy in the carbon cycle between producers, consumers and decomposers. Collect completed worksheets for assessment.



III. Exploring the Wetlands

- A. Do a quick review with students, covering information in the first half of this lesson.
- B. Distribute the *Wetland Note-taking* worksheet and review it with students, emphasizing good note-taking techniques, such as writing brief phrases and key words rather than complete sentences and citing sources (Note: You may want to review any pertinent Language Arts benchmarks if you would like to use this task as an evidence piece for that benchmark.).
- C. Divide the class into small groups and have each group research basic information on wetlands.
- D. Have the groups use the *Wetlands Note-taking* worksheet as a guide for their research. You may also want to emphasize the importance of citing the source of their information (Note: You may want to review any pertinent Language Arts benchmarks if you would like to use this task as an evidence piece for that benchmark.)
- E. The students may write down information that they find that they do not understand. Debriefing with students at the end of the period may help them to see what questions they still have about wetlands and what new questions they can now think of and what additional information they may need to understand the notes they took.

Extended Activities

Science:

1. Create sets of cards with images or drawings of plants, algae, herbivores, carnivores, and omnivores. Mark on the back of each card whether the image or drawing is a producer, consumer, or decomposer. Let students work in small groups to practice putting the organisms into the appropriate order in the food chain.
2. Compare the food chains from different wetland ecosystems. How are bogs vs. swamps vs. marshes vs. fens similar/different?

Language Arts:

Make flash cards of the vocabulary words, using definitions in students own words with a graphic representation.

Technology Integration Ideas:

1. Sign up for time in your school computer lab, or facilitate use of your classroom computers to allow students to read additional information about the topics introduced in Lesson 1, such as wetlands, the food chain, or the carbon cycle.
2. Have students play an interactive Pond Food Web game at the Harcourt Publishers Website to reinforce the concept of food chains: http://www.harcourtschool.com/activity/food/pond_activity.html.

LESSON 1 - Teacher Reading

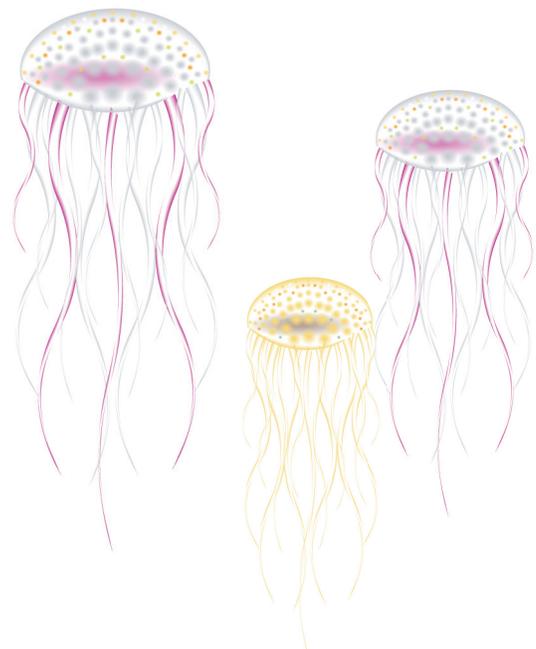
Wetland Ecosystems

A wetland is any area that is inundated (flooded), or saturated for a certain number of days in a row that add up to 7.5% of the growing season in an area. There are four main types of wetlands: swamps, marshes, bogs, and fens. With the help of modern science, we now understand that all wetlands function similarly in that they provide important habitats, they provide a natural water storage and filtration system, and they are located in areas where they serve as buffers between land and a natural water source. Organisms, especially plants, often have special adaptations to survive in such saturated soils. The wetland habitat provides homes for permanent dwellers as well as migratory organisms. Some wetlands provide an important breeding ground for marine organisms. The wetland ecosystem is more fragile than people realized in the past. Today, we better understand how wetlands are a vital part of the cycling of matter and the flow of energy necessary to maintaining healthy land and ocean ecosystems.

Any ecosystem has a diverse number of organisms that are interdependent. These organisms are producers, consumers, or decomposers. Producers are green plants that, using the chlorophyll in their leaves, harvest energy from the sun and use chlorophyll to manufacture sugars. Consumers are animals and other organisms that get their energy by digesting the living tissues of producers. Decomposers are specialized consumers that survive by digesting the tissues of non-living producers and consumers. Decomposition helps to provide the fertilizers that producers need to flourish. This interdependence is known as the food chain.

The carbon cycle explains one aspect of the interdependence between organisms. Carbon constitutes carbon dioxide molecules (CO_2) present in air and water. Carbon is absorbed during photosynthesis, and is incorporated into organic matter by chemical reactions. Carbon returns to the environment through respiration of producers, consumers, and decomposers in CO_2 form.

In a wetland ecosystem, producers are plants and algae. Wetland consumers can include marine and/or fresh water invertebrates (shrimp, clams), fish, birds, amphibians, and mammals. The wetland decomposers are bacteria and fungi that break down dead organisms into simple compounds.



Hawai'i's Wetland Ecosystems

The cycle of matter and flow of energy in Hawai'i's coastal marshes involve the abundant energy of the sun that feeds the producers, plants, and algae, which feed the consumers, fish, and birds. The decomposers in the marshes are bacteria and fungi that are helped by the many insects of the wetlands. Decomposed matter provides the nutrients to help the producers to continue the cycle.

Hawai'i's wetland ecosystems consist of many species endemic to Hawai'i (not found anywhere else in the world). The coastal marsh wetland, in particular, provides habitat for birds, such as *Ae'o* (Hawaiian Stilt), the *Alae Keokeo* (Hawaiian Coot), and the *Koloa Maoli* (Hawaiian Duck), for plants such as *Akulikuli*, *Aki aki*, *Makai Sedge*, and *Makaloa Sedge*, and for fish, such as the *Aholehole* and the *O'opu* (Goby), which are anadromous, live mostly in the sea or brackish water, but breed upstream in fresh water. Hawai'i's marshes also provide important habitat for many species of migratory birds, including the *Kolea*, *Ulili*, and *Akekeke*.

Native Hawaiian *Ahupua'a* systems of land and resource management enabled preservation of this cycle while the caretakers made use of the land for their subsistence. Within the *ahupua'a* the Native Hawaiians sometimes used marsh wetlands areas for fishponds and taro patches. They were careful to use water responsibly and, when diverting stream water, they would be sure to return the water to the streambed where it would naturally flow. Additionally, Hawaiians never used more than what they needed, so their impact on the wetlands was insignificant.

The following resources provide additional information:

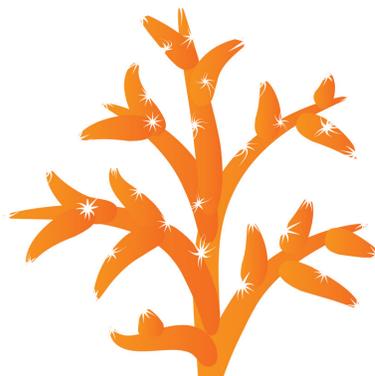
Harcourt School Publishers. (2006). *Pond web activity*. Retrieved January 15, 2007, from http://www.harcourtschool.com/activity/food/pond_activity.html

Idaho Fish and Game. (2007). *What is a wetland?* Retrieved January 18, 2007, from <http://www.idahoptv.org/dialogue4kids/season6/wetlands/facts.cfm>

Missouri Botanical Garden. (2002). *Wetlands*. Retrieved January 15, 2007, from www.mbgnet.net/fresh/wetlands/index.htm

Thomson Corporation. (2006). *Trophic levels and biomass pyramids*. Retrieved January 15, 2007, from www.waterencyclopedia.com/Da-En/Ecology-Marine.html

USGS. (2007). *Beneficial functions of the wetlands*. Retrieved January 18, 2007, from www.nwrc.usgs.gov/fringe/function.html



LESSON 1 - Student Reading

Ecosystem Interdependence

Ecosystem Organisms

An ecosystem is a system where all the living and nonliving things interact with each other in an environment. Ecosystems of all types throughout the natural world have a variety of organisms, living things, which are interdependent on one another. All of these organisms play an important role as producers, consumers, or decomposers.

Producers are green plants and many other organisms, like algae, for example, that collect energy from the sun and use it to make sugars. Consumers are animals and other organisms that get their energy by eating the producers. Decomposers break down the tissues of nonliving producers and consumers. This helps to provide the fertilizers that producers need to grow. This interdependence is also known as the food chain.

The Wetland Food Chain

In a wetland ecosystem, the producers are plants and algae. Wetland consumers can include marine and/or fresh water invertebrates (shrimp, clams), fish, birds, amphibians, and mammals. The wetland decomposers are bacteria and fungi that break down dead organisms.

Hawaiian Wetland Organisms

Hawai'i's wetland ecosystems consist of many species endemic to Hawai'i (not found anywhere else in the world). Here are some examples of:

Producers: *Akulikuli*, *Aki aki*, *Makai Sedge*, and *Makaloa Sedge*.

Consumers: the *Ae'o* (Hawaiian Stilt), the *Alae Keokeo* (Hawaiian Coot), the *Alae 'ula* (Hawaiian Moorhen), the *Koloa Maoli* (Hawaiian Duck), fish, such as the *Aholehole* and the *O'opu* (Goby).

Decomposers: bacteria and fungi.

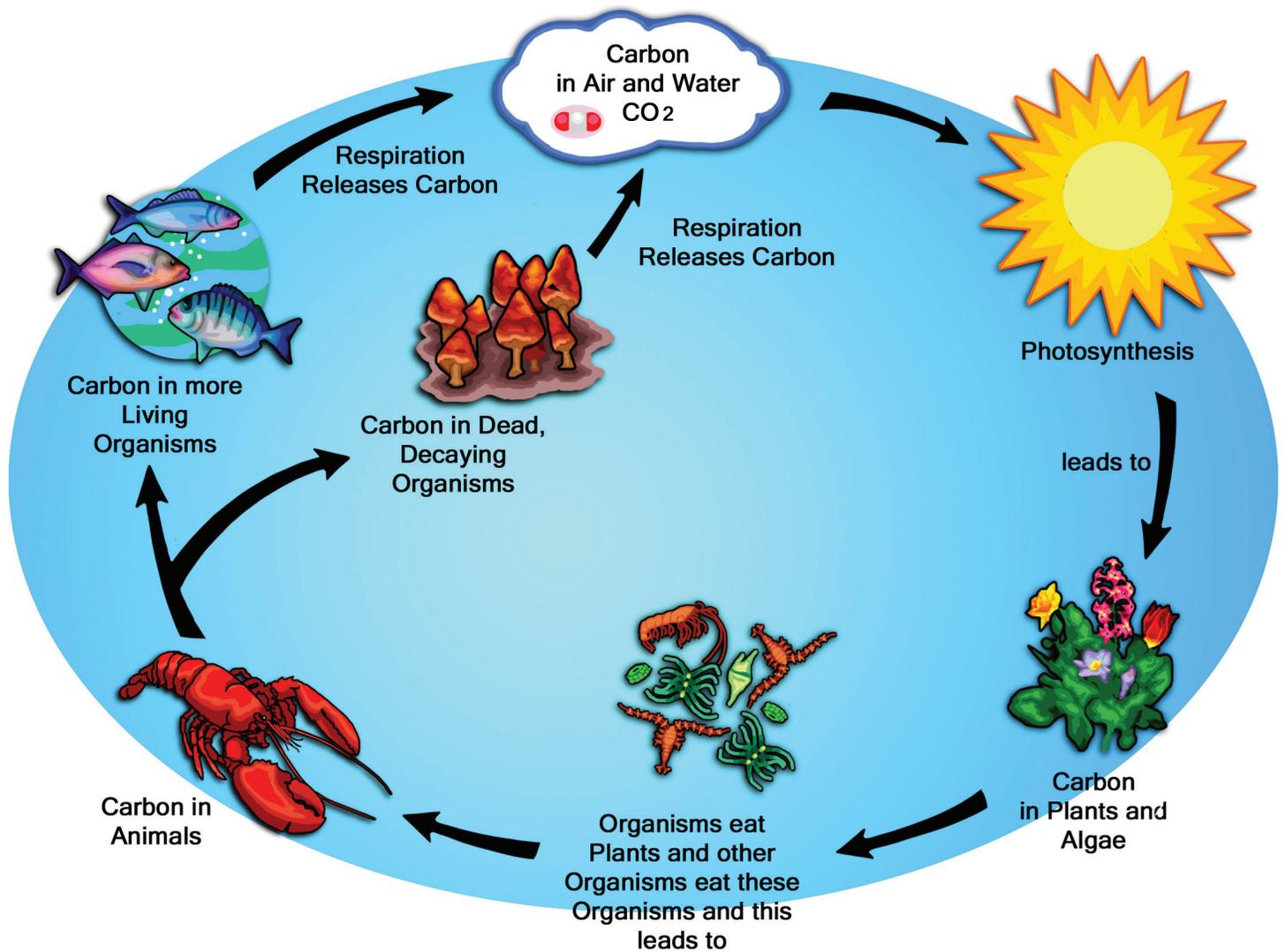
The Carbon Cycle

An ecosystem is like a giant, natural recycling machine. The main cycles of matter involved in the recycling process are the chemical elements or compounds that include oxygen, water, carbon, and nitrogen. All of the matter on Earth have one or more of these basic elements. Here, we will discuss one of the elemental cycles of matter: carbon.

Carbon is a chemical element that has the symbol "C." It is found in all organisms and is also in air and water. Plants, animals, and soil interact to make up the basic cycles of nature. In the carbon cycle, plants absorb carbon dioxide from the atmosphere and use it, combined with water they get from the soil, to make the energy they need to grow. The process of photosynthesis converts the carbon atoms from carbon dioxide into sugars. Animals, such as primary consumers, eat the plants and use the carbon to build their own tissues. These animals

return carbon dioxide into the air when they breathe and when they die, since the carbon is returned to the soil during decomposition. A new plant or small microorganisms may then use the carbon atoms in soil. Ultimately, the same carbon atom can move through many organisms and even end up in the same place where it began.

In this cycle, carbon returns to the air and the cloud through respiration of producers, consumers, and decomposers in the form of carbon dioxide (CO_2). When organisms that breathe release an *out breath*, they are letting carbon back into the air. Plants and trees also have a form of letting carbon back into the air. At this point, the carbon repeats this process over and over. This is the *carbon cycle*.



LESSON 1

Name: _____

Date: _____

Food Chain and Carbon Cycle

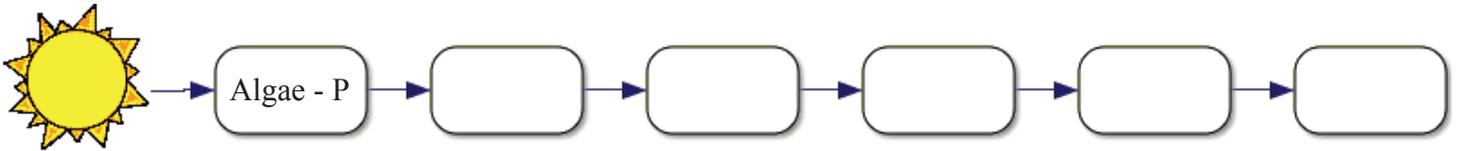
Step One: Diagram a Wetland Food Chain

Fill in the bubbles with organisms in a wetland ecosystem.

Identify each organism as a producer, consumer, or decomposer by using the first initial of each role.

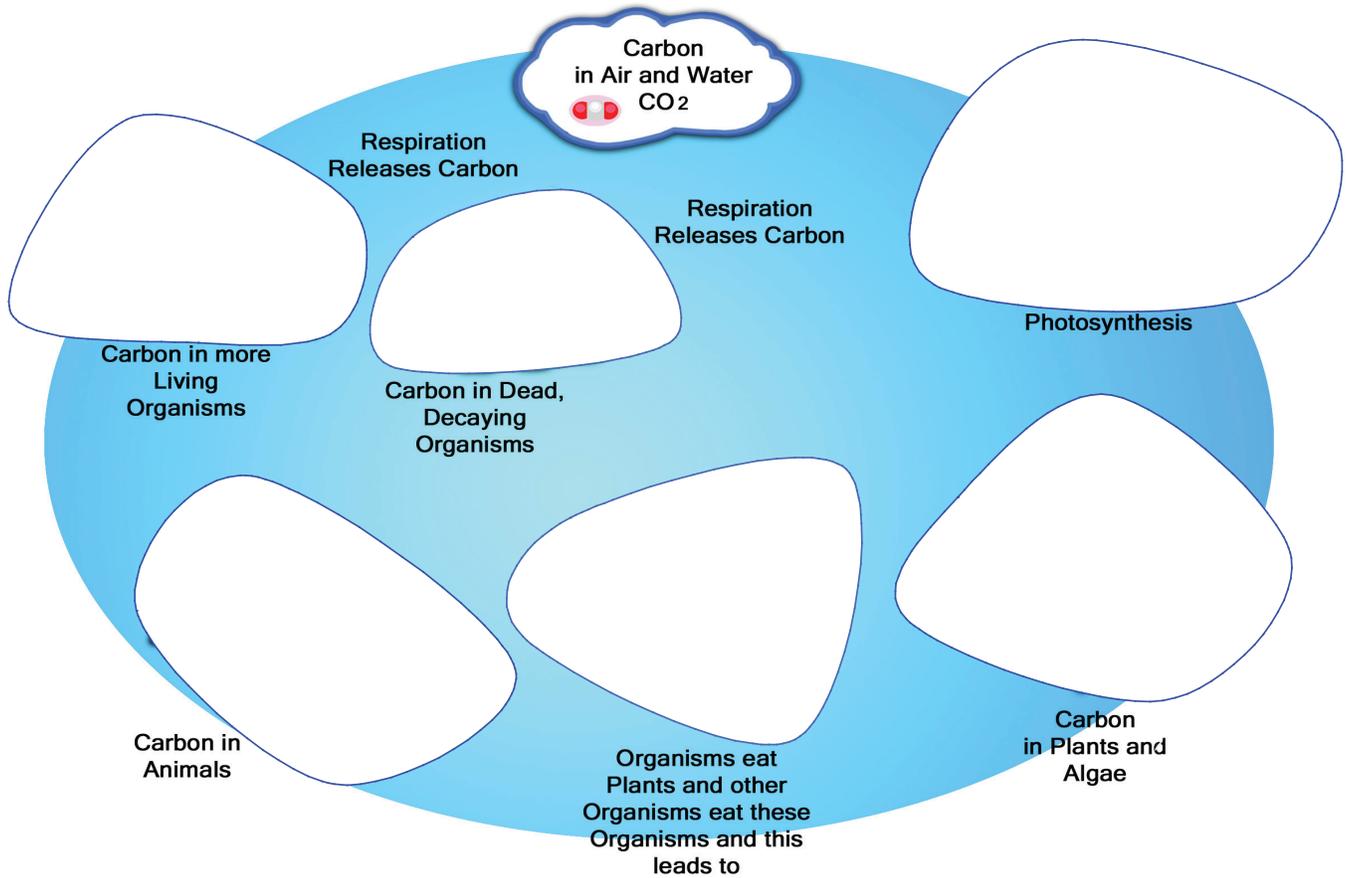
P = Producer, C = Consumer, and D = Decomposer.

For example, you might write Bird – C in one of the bubbles.



Step Two: Illustrate the Carbon Cycle Diagram

First, draw in the arrows to show how carbon (in carbon dioxide) is cycling in the environment. Then, illustrate three parts of the Carbon Cycle Diagram by drawing a picture in one of the bubbles. For example, you might draw a sun, a flower, and an animal in the appropriate places.

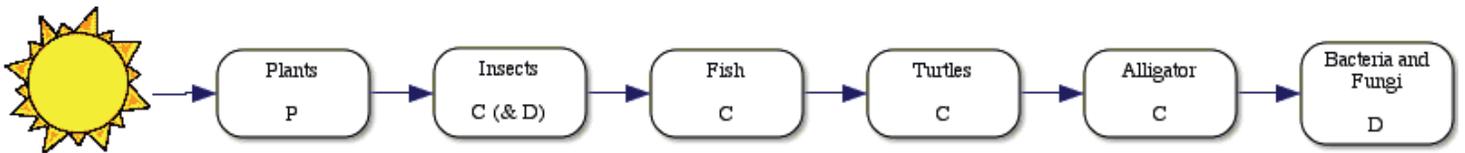


LESSON 1 - Teacher Answer Key

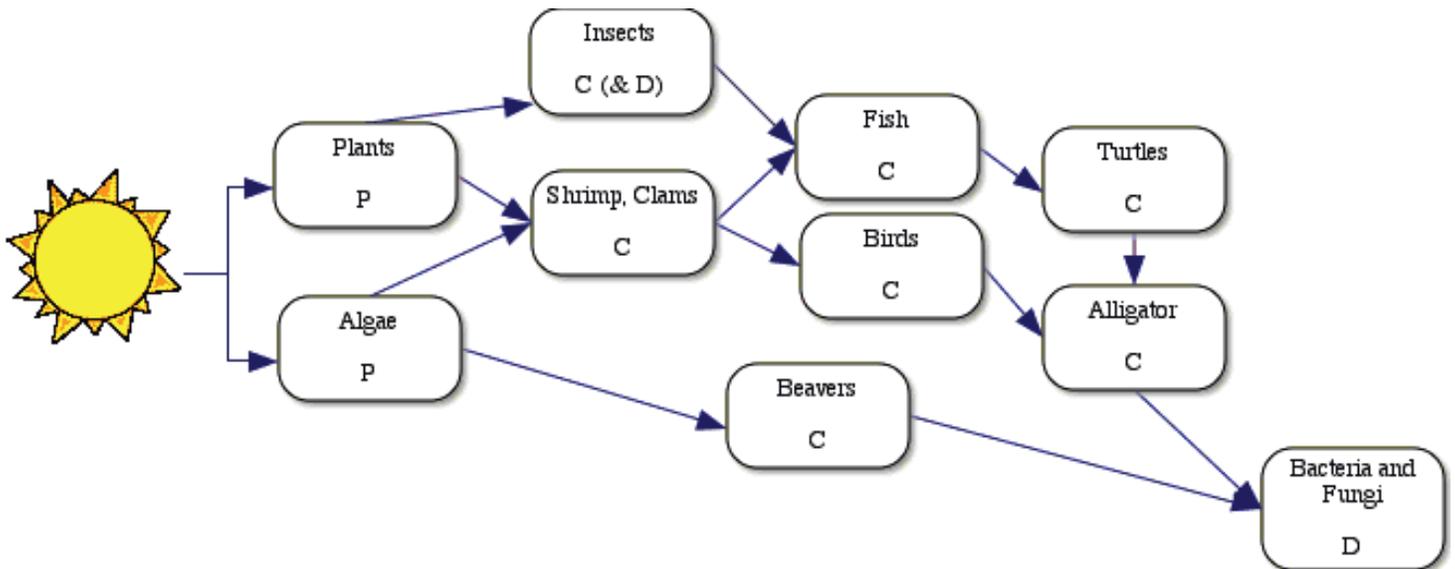
Food Chain and Carbon Cycle

Step One: Diagram a Wetland Food Chain

Simple Food Chain:



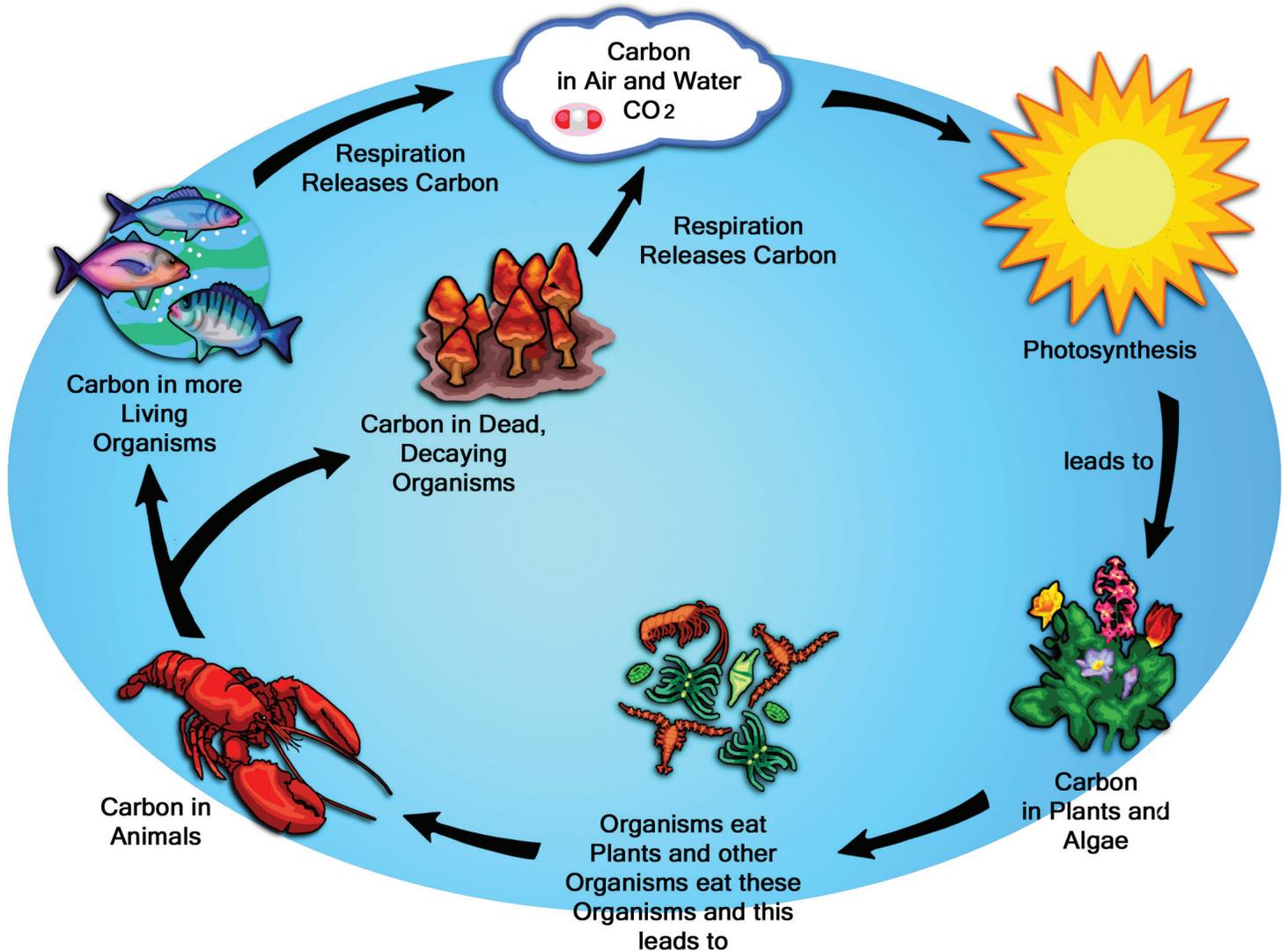
More Complex Food Web:



LESSON 1 - Teacher Answer Key (Continued)

Food Chain and Carbon Cycle

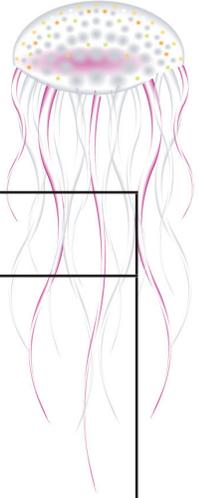
Step Two: Illustrate the Carbon Cycle Diagram



LESSON 1

Name: _____ Date: _____

Wetland Note-taking



Topic	Student Answers and Notes	Teacher Comments
<p>What are wetlands and where might you find one?</p>		
<p>What is the purpose of a wetland (i.e., filtration, nursery, protection, habitat....)?</p>		
<p>What kinds of organisms make their home in wetlands?</p>		

Topic	Student Answers and Notes	Teacher Comments
How does energy flow in a wetland among the producers, consumers and decomposers?		
Why are wetland areas decreasing?		
Questions you have about wetlands:		

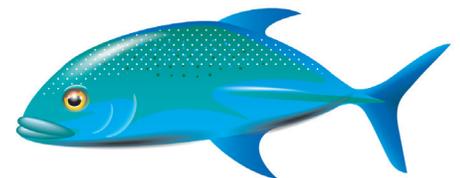
Possible website for use during wetlands research:

NOAA International Year of the Ocean. (2010) *Marine Fish Habitats*. Retrieved January 2010, from <http://www.yoto98.noaa.gov/facts/habit.htm>

Idaho Fish and Game. (2007). *What is a wetland?* Retrieved January 18, 2007, from <http://www.idahoptv.org/dialogue4kids/season6/wetlands/facts.cfm>

Missouri Botanical Garden. (2002). *Wetlands*. Retrieved January 15, 2007, from www.mbgnet.net/fresh/wetlands/index.htm

United States Environmental Protection Agency. (2007) *Wetlands*. Retrieved January 2010, from <http://www.epa.gov/owow/wetlands/>

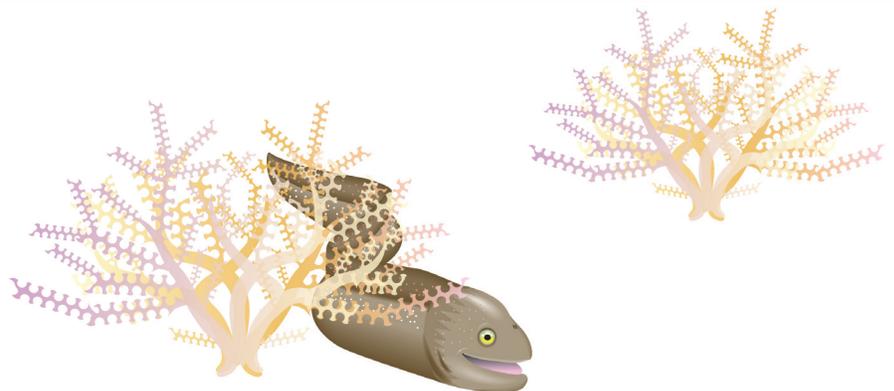


LESSON 1 - Teacher Answer Key

Wetland Note-taking (Possible Responses)

Topic	Student Answers and Notes	Teacher Comments
<p>What are wetlands and where might you find one?</p>	<p>between land and body of water or low-lying area saturated with water or between land and a natural water source</p>	
<p>What is the purpose of a wetland (i.e., filtration, nursery, protection, habitat....)?</p>	<p>Wetlands are productive ecosystems providing refuge and food to many organisms. Wetlands act as a filter, trapping sediments and excess nutrients from surface water before it reaches the ocean. Wetlands are important in flood protection, acting as sponges that slowly release surface water to the surrounding environment. Wetland plants help to hold soil in place with their roots to protect shorelines from erosion.</p>	
<p>What kinds of organisms make their home in wetlands?</p>	<p>Plants, algae, shrimp, mussels, fish, insects, birds, amphibians, snakes, rodents, alligators, crocodiles</p>	

Topic	Student Answers and Notes	Teacher Comments
How does energy flow in a wetland among the producers, consumers and decomposers?	The flow begins with the sun. It provides energy to producers. Wetland producers are plants and algae that harvest energy from the sun & manufacture sugar through photosynthesis. These plants provide energy for the consumers. Wetland consumers, such as birds and fish, feed on the producers. Microbes and fungi play an important role in the decomposition process of all the plant material in the water-saturated, oxygen depleted soil. They break down plant and animal organic matter into inorganic compounds that are used as nutrients by plants.	
Why are wetland areas decreasing?	Urbanization is the most significant impact to wetland habitats. This causes an increase in pollution and nutrients into this environment, which disrupt the habitat's quality. Introduction of invasive species by humans.	
Questions you have about wetlands:		



LESSON 1

Self-Assessment Checklist

Name: _____ Date: _____

Check the appropriate column with an X below.

Benchmark	I can	Almost	Not yet	Evidence (list where someone could find evidence of your meeting the expectation.)
I can describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter (SC.5.3.2).				
I can describe the flow of energy among producers, consumers and decomposers (SC.5.3.1).				
I can explain how carbon moves through a wetland food chain (SC.5.3.2).				