# Introduction

## Energy Flow and Nutrient Cycling

### Unit Framework Annotation

This unit will lead students in understanding that the sun is the primary source of energy, and that organisms depend on one another as well as their environment for survival. Students will be able to use and create a food web to demonstrate that matter and energy is transferred and recycled among organisms and their environment.

### Approximate Duration for the Unit Framework:

3 weeks

## Standards

### Focus Content Standards

**S7L4 Students will examine the dependence of organisms on one another and their environments.**

a. Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments.
b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.
d. Categorize relationships between organisms that are competitive or mutually beneficial.

### Integrated Characteristics of Science Standards

**S7CS1 Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.**

a. Understand the importance of—and keep—honest, clear, and accurate records in science.
b. Understand that hypotheses can be valuable, even if they turn out not to be completely accurate.

**S7CS2 Students will use standard safety practices for all classroom laboratory and field investigations.**

a. Follow correct procedures for use of scientific apparatus.
b. Demonstrate appropriate techniques in all laboratory situations.
c. Follow correct protocol for identifying and reporting safety problems and violations.

**S7CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.**

a. Observe and explain how parts can be related to other parts in a system such as predator/prey relationships in a community/ecosystem.
b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing.

**S7CS6 Students will communicate scientific ideas and activities clearly.**

a. Write clear, step-by-step instructions for conducting particular scientific investigations, operating a piece of equipment, or following a procedure.
b. Write for scientific purposes incorporating data from circle, bar, and line graphs, two-way data tables, diagrams, and symbols.
c. Organize scientific information using appropriate simple tables, charts, and graphs, and identify relationships they reveal.

**S7CS8 Students will investigate the characteristics of scientific knowledge and how that knowledge is achieved.**

b. When new experimental results are inconsistent with an existing, well established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification.

**S7CS10 Students will enhance reading in all curriculum areas by:**

a. Reading in All Curriculum Areas
b. Discussing books
d. Establishing context

---

**Complementary Standards**

**S7L4 Students will examine the dependence of organisms on one another and their environments.**

c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.
e. Describe the characteristics of Earth’s major terrestrial biomes (i.e., tropical rain forest, savanna, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e., freshwater, estuaries, and marine).

---

**Understanding and Goals**

**Unit Understandings, Themes, and Concepts**

Students will understand that:

- The sun is the primary source of energy for the living world.
- The food web demonstrates that all energy is transferred and recycled among organisms and their environment.
- Organisms depend on one another as well as their environment for survival.
Essential Questions:

- Where does the energy in my food come from?
- Why should the health and well-being of other organisms be important to me?
- Why are there fewer animals than plants?
- Why are there so many different kinds of organisms?
- How are we related?
- Where did all that energy come from?

Misconceptions:

- A food web and a food chain are the same.
- Bears are carnivores.
- Symbiosis means that both organisms benefit.
- Food webs have to do with spiders.
- Humans do not get energy from the sun.
- Matter cannot be changed.
- 100% of energy is transferred from organism to organism.
- Energy cycles through ecosystems like nutrients cycle.

Balanced Assessments

<table>
<thead>
<tr>
<th>Informal Observations</th>
<th>Dialogue and Discussion</th>
<th>Selected Responses</th>
<th>Constructed Responses</th>
<th>Self-Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughout lessons teacher will observe students to determine level of understanding, so that instruction can be adjusted accordingly.</td>
<td>Discuss three abiotic factors found in the environment and explain how each impacts living organisms. Explain the interdependence of producers, consumers, decomposers have in an ecosystem? How does energy transfer within a food web? Explain the differences between mutualism, commensalism, and parasitism? Give an example of each. How is matter transferred within the environment? What is the difference between a food chain and a food web? (Teacher note: May use a graphic organizer to facilitate discussion)</td>
<td>Teacher created conceptual based multiple choice questions.</td>
<td>Students will create a food web. Students will write a haiku poem about commensalism, mutualism, or parasitism. How is the flow of energy like our money? (Example: Our dollars come from one source- The US mint. They are then transferred from one person to another, each person using the money for their own needs. On average, only 10% is transferred to others in need or “given to charity.”)</td>
<td>Students will use culminating activity rubric (below) for self assessment. For example, students will look at each section of the rubric and rate themselves. They will then write a journal entry or a letter to the teacher or parent about how they rated themselves, why they rated themselves the way they did, and what their next steps are.</td>
</tr>
</tbody>
</table>
Georgia Performance Standards Framework for Science – Grade 7

How is the energy pyramid arranged, and what is at each level? What would happen if an organism in the food web was destroyed? (May wish to refer to a specific food web in the class room)

Unit Performance Task(s)

Mission Possible

Description/Directions:
The President has created a task force of engineers, biologists, oceanographers, architects, geologists and the greatest minds of science to study the untapped resources of our planet located in the depths of our ocean. You have been tapped to be a part of this task force. Your task, should you accept it, is to work with a team of scientists to create a blueprint of this new colony in the depths of the ocean. Your colony must be completely self-sufficient. You will be going where no man has gone before. As a matter of national security, your mission will be top-secret; therefore, no one will be able to provide supplies during your stay. You must write a proposal report and prepare an oral presentation to the president. Your proposal to the President must include a blueprint showing the self-contained energy web.

Rubric for Performance Task
Teacher Created

Student Work Sample with Teacher Commentary
(To be added as available)
### Sequence of Instruction and Learning

<table>
<thead>
<tr>
<th>Teacher Activities</th>
<th>Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor progress toward learning goals and adjust instruction accordingly</td>
<td>Food you eat</td>
</tr>
<tr>
<td>Monitor for safety at all times</td>
<td>Energy Transfer Mural</td>
</tr>
<tr>
<td>Ecosystem in a Bottle</td>
<td>Energy Transfer Mural</td>
</tr>
<tr>
<td>Direct Instruction with guided practice</td>
<td>Organism Dependency of living and nonliving factors</td>
</tr>
<tr>
<td></td>
<td>Ecosystem Food Webs</td>
</tr>
<tr>
<td></td>
<td>Recycled Matter Bracelet</td>
</tr>
<tr>
<td></td>
<td>Wheel of Life</td>
</tr>
<tr>
<td></td>
<td>Food Web Tag</td>
</tr>
</tbody>
</table>

### Sequence of Activities, Tasks, and Assessments for Unit

**Safety reminders (✔) are included but do not take the place of a school’s comprehensive safety plan which must be maintained and enforced in the laboratory and classroom.**

<table>
<thead>
<tr>
<th>Day 1</th>
<th>EQ: Where does the energy in my food come from?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Understandings:</strong> The sun is the primary source of energy.</td>
</tr>
<tr>
<td></td>
<td>The food web demonstrates that all energy is transferred and recycled among organisms and their environment.</td>
</tr>
<tr>
<td></td>
<td><strong>Food you eat:</strong> Have student bring samples of the foods they eat such as:</td>
</tr>
<tr>
<td></td>
<td>- Nonperishable packaged food item (These could be donated as a service project.)</td>
</tr>
<tr>
<td></td>
<td>- Grocery store sale flyers</td>
</tr>
<tr>
<td></td>
<td>- Menu from local restaurants</td>
</tr>
<tr>
<td></td>
<td>Discuss the origin of the food presented and relate it back to the sun as the primary source of energy.</td>
</tr>
<tr>
<td></td>
<td>Example: Tuna fish ← smaller fish ← plankton ← sun</td>
</tr>
</tbody>
</table>
Why do the arrows point from the organism being eaten to the organism eating or from the source of energy? (for example, sun to plankton)
Discuss why we have to consume energy.
Follow the energy path from the sun

Depending on time and materials, teacher or students should prepare two Ecosystems in a Bottle to be used on day 5.

Create two bottles that are identical except one should receive fertilizer.
For one ecosystem:
2 Liter bottle
2 inches soil
Moisten soil
Spread seeds (Alfalfa or Rye grows quickly).
Put top on bottle
Place in sun

Possible Journal Entry: If I had the energy, I would……..

EQ:  How are we related?

Understandings:
The sun is the primary source of energy.
The food web demonstrates that all energy is transferred and recycled among organisms and their environment.

Introduce basic concepts of predator, prey, decomposers, commensalism, mutualism, and parasitism.

Relationship Scenarios Probe
Give students/groups a scenario and have them decide which relationship it represents.
1. A young girl is visiting her grandmother. The girl has noticed how her grandmother struggles to bend down to get things out of the lower cupboards. The girl then decides to assist her grandmother with collecting utensils as they prepare dinner. As the girl is helping, the grandmother notices the girl does not know some of the proper names of the utensils. The grandmother makes a game out of learning the utensils and then makes a song. The two worked together to prepare the meal. Grandma had help getting the utensils, and it was a learning experience for the young girl.

2. You are seated in class near a student. You do not “hang out” with this student, but you make conversation with him when he is there. When he is in school, you do not benefit from him in anyway. You are smarter, you are self motivated, and you are social with others without him. When he is not there, you do not miss him. He, on the other hand, returns from an absence and tells you he missed you. He always wants to be your partner and without you in the room, he does not socialize with others. He frequently asks you to help him and asks you to check his progress on activities.
3. You are walking through the woods and a tick bites you. The tick is carrying the Rocky Mountain Spotted Fever bacteria. The bacteria are transferred to you as long as the tick remains attached to your body as the tick sucks your blood to feed itself. You find the tick and remove it, thinking nothing has happened. Within one month, you begin to see a rash around the bite site and begin to run a fever. Other symptoms appear and you become very sick.

4. You and your dog are playing outside. You received the dog as a puppy when you were five years old. Your dog misses you when you’re gone and is always excited to see you when you return home. He sits on your lap while you watch TV and stroke his fur. Sometimes you even talk to your dog as if he understands your deepest feelings. Your dog is an important part of your life and you cannot imagine your life without him.

5. You are a hunter in need of providing your family with food. You go out on a hunt for deer, much like a wolf goes hunting for rabbits. What is your relationship to the deer and what is the relationship of the wolf to the rabbit?

**Informal Assessment:** Teacher observation of activity to see that the students can accurately portray the role they have been assigned.

Haiku about symbiotic relationships.
Check student understanding as illustrated in Haiku.

---

**EQ:** Why should the health and well-being of other organisms be important to me?

**Understandings:**
The sun is the primary source of energy.
The food web demonstrates that all energy is transferred and recycled among organisms and their environment.

**Food Web Tag**
This activity will take three days (See: “Catch Me If You Can”, “Get it, Got it, Gone”, and “Who Moved My Mouse”). The teacher assigns the students into groups of organisms. The groups will be mice, snakes, and owls. Each group will be given a colored clothespin or colored construction paper circle that will be attached to the students’ back that will identify the organism you represent (any other teacher ideas will be fine). The teacher will explain the rules of the game as outlined below. The students will be playing a game similar to tag according to their role in the food web.

**“Catch me if you can”** Students are given their organisms. The teacher explains that the students will be “chasing” each other as food sources in the tag area. The teacher further explains that he or she will also put grass into the “tag” area in the form of green blocks. The students may pick up the “grass” as a part of the activity. Students may play several rounds of the game and chase the organisms they want. At the end of each game, they must...
### Day 4

**EQ:** Why should the health and well-being of other organisms be important to me?

**Understandings:**
The sun is the primary source of energy.
The food web demonstrates that all energy is transferred and recycled among organisms and their environment.
Organisms depend on one another as well as their environment for survival.

**“Get it, Got it, Gone”** The students are again given their organism “identity from the day before.” The students will follow the same rules as day one. Before the game begins mice are given ten yellow blocks and snakes are given ten red blocks. The mice will pick up only the green “grass” blocks. When a snake tags a mouse, the mouse gives one of his yellow blocks to the snake and when the snake is caught by the owl the snake gives one of his red blocks to the owl. Any time a mouse or snake is caught, the predator and prey should go directly to the “safe zone” as designated by the teacher (a small area near the teacher). Here they should transfer energy. The predator is “safe” from it’s predators during this process. After the exchange, the predator returns to the game, but once a mouse or snake has been caught they can no longer participate in this round of the game. After each round, the teacher should lead a discussion about the transfer of energy. (**Teacher Note- the blocks represent the 10% of energy that is transferred from organism to organism**). Some questions for discussion should include:
- Why was one block passed instead of all of them?
- Why was the block you received not passed to the organism that caught you?
- What was the original source of energy and why?

After returning to the classroom, have students write down what they learned about the day’s activity.

As an option, the teacher can lead class in creating a graph like the one produced the day before but using today’s data. Have students use graphs to compare the results between the days. Students should explain the differences noted.

In small groups, students should also begin designing a game that they could use to teach elementary students the concept of how energy is transferred.

**Assessment:**
After each round the teacher should lead a discussion about the transfer of energy. Some questions for discussion should include:
- Why was one block passed instead of all of them?
- Why was the block you received not passed to the organism that caught you?
- What was the original source of energy and why?

explain/justify their reasoning for the organism that they caught. After returning to the classroom, have students write down their thoughts about the day’s activity in their journal. The teacher should lead whole group in creating a graph. Graph should include amount of grass as well as number of each organism that was caught.
# Georgia Performance Standards Framework for Science – Grade 7

<table>
<thead>
<tr>
<th>Day 5</th>
<th>EQ: Why should the health and well-being of other organisms be important to me?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Understandings:</strong></td>
</tr>
<tr>
<td></td>
<td>The sun is the primary source of energy for the living world.</td>
</tr>
<tr>
<td></td>
<td>The food web demonstrates that all energy is transferred and recycled among organisms and their environment.</td>
</tr>
<tr>
<td></td>
<td>Organisms depend on one another as well as their environment for survival.</td>
</tr>
<tr>
<td></td>
<td>“Who Moved my Mouse?” This day’s game will consist of two different rounds. In round one, the game should be played exactly as it was on day two. The second round will be played as well except all mice will be taken out of the game. Allow students to play the round and observe what happens. After several minutes call all students back together and discuss their observations. The teacher should lead a discussion about removing a link in the food web and its effects. An extension question for discussion might be “What would happen if we ran out of grass?” Have the students go back to the classroom and write a culminating narrative about all three day’s activities. Students may use their responses from day one and day two to write the narrative. The teacher should use these narratives to guide their instruction in determining if the students understand the concepts. The teacher should be aware that students do not have the misconception that 100% of energy is transferred but only 10% from organism to organism. Be sure all students understand that the energy originates from the sun.</td>
</tr>
<tr>
<td></td>
<td>Students should refine the rules of the game they began creating the previous day. As they complete the design of their game, students should provide another group who is finished with their rules. That group should attempt to see if the rules make since, and if the game leads to the scientific understandings desired. If possible, the 7th grade students could pair with an elementary class and teach them the game they designed. The middle school students should guide the elementary students to understand the science behind their game design.</td>
</tr>
<tr>
<td></td>
<td><strong>Assessment:</strong></td>
</tr>
<tr>
<td></td>
<td>The teacher should lead a discussion about removing a link in the food web and its effects. An extension question for discussion might be “What would happen if we ran out of grass?” Have the students go back to the classroom and write a culminating narrative about all three day’s activities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 6</th>
<th>EQ: Where did all that energy come from?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Understandings:</strong></td>
</tr>
<tr>
<td></td>
<td>The sun is the primary source of energy for the living world.</td>
</tr>
<tr>
<td></td>
<td>Organisms depend on one another as well as their environment for survival.</td>
</tr>
</tbody>
</table>
### Energy Transfer Mural

**Materials:** paper, yarn,

Use a large wall or bulletin board. Only place a picture of the sun on the board before giving the assignment. Assign students a kingdom (archaeabacteria, eubacteria, protists, fungi, plants and animals). Have students locate or draw examples of organisms in their assigned kingdom. Connect illustrations, and using yarn or colored tape, show the flow of energy. **Teacher Note:** If you do not have space available for large scale mural, students can do individual murals.

Ask students, “Using our mural as an example, think about what you ate for lunch today or supper last night.”

Have students create a series of food chains illustrating the flow of energy originating from the sun.

### EQ: Why are there so many different types of organisms?

### Understandings:

The sun is the primary source of energy for the living world.

The food web demonstrates that all energy is transferred and recycled among organisms and their environment.

Organisms depend on one another as well as their environment for survival.

**Graphic organizer** to guide classroom discussion of the interdependence of living organisms and abiotic features.

In small groups, have students create a graphic organizer on how products in their everyday life are recycled. (money, plastics, aluminum)

### Observe Ecosystem in a bottle.

**Ecosystem Food Webs**

Teacher provides a picture of an ecosystem to student pairs. The students paste the picture to a half sheet of poster-board or to a large sheet of construction paper. Students are to create a chart of abiotic factors, biotic factors, producers, and consumers shown in the picture. The chart is also attached to the poster/construction paper. Students then need to identify a food web in the picture by connecting the organisms with string or drawing lines. Each line drawn, or piece of yarn attached should have an arrow to shown the energy flow from one organism to another. Out of the food web, students should then list two food chains on the poster found within the food web they identified.
# Georgia Performance Standards Framework for Science – Grade 7

<table>
<thead>
<tr>
<th>Day</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 8   | **EQ:** How is the flow of energy like a circle?  
**Understanding:** All energy is transferred and recycled among organisms and their environment.  
**Recycled Matter Bracelet**  
During teacher talk on recycling of matter, students should be guided in creating a bracelet with paper loops, pipe cleaners, or twine and beads depending on availability. Students should create enough links in their bracelet to correlate with the steps of the food chain including the sun, producers, several levels of consumers, and decomposers. Explain the flow of matter illustrated in their bracelet to their peer. |
| 9   | **EQ:** How is the flow of energy like a circle?  
**Understandings:**  
The sun is the primary source of energy for the living world.  
The food web demonstrates that all energy is transferred and recycled among organisms and their environment.  
Organisms depend on one another as well as their environment for survival.  
**Wheel of Life**  
Students will design and illustrate a food chain. They will need to include in their chain the sun, a producer, 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> level consumer, and a decomposer.  
A pattern for the wheel can be found in the Organization of Life unit.  
Teacher Note: If you wish to connect this to the biomes, you may assign students to complete food chains from different biomes.  
1. Take one wheel pattern. In each section students will draw and label the organisms used in the food chain. Students will need to take care that the follow the flow of energy originating with the sun.  
2. Take the second wheel pattern and cut out one section (like a pizza slice).  
3. Place the second wheel pattern on top of the first and connect the two using a brad in the center of the wheel.  
4. Students should be able to rotate the wheel and see the flow of energy beginning and ending with the sun.  
5. On the top of the wheel, have students write a description of how each “section” contributes to the flow and recycling of matter. |
# Georgia Performance Standards Framework for Science – Grade 7

<table>
<thead>
<tr>
<th>Days 10 - 15</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EQ:</strong> How would you create a self sustaining community?</td>
<td></td>
</tr>
</tbody>
</table>
| **Understandings:** | The sun is the primary source of energy for the living world.  
The food web demonstrates that all energy is transferred and recycled among organisms and their environment.  
Organisms depend on one another as well as their environment for survival. |
| **Culminating Activity: Mission Possible** (see description and directions above) | Provide students instructions for task.  
Teacher should assign task groups.  
Teacher should lead analysis and discussion of rubric and project requirements.  
Task groups will formulate a plan for how they will achieve the task.  
Task groups should finalize their plan, and have it approved by the teacher in progress conference.  
Students will research and gather materials.  
Create proposal and begin work on presentation.  
Peer review- Task groups of students should partner with other groups and complete a peer review of project and its progress.  
Task groups should revise and finalize their project.  
Presentation |

## Contextual Language:

Food web, matter, recycle, energy, relationships, competitive, mutualism, energy pyramid, commensalism, producer, consumer, decomposer, predator, prey, competition, herbivore, carnivore, omnivore, scavenger, symbiosis, decomposition, photosynthesis, respiration, biotic, abiotic, parasitism, parasite, host
Web Resources:

www.mobat.org/MBGnet/
Biomes of the world

http://www.bigelow.org/edhab/fitting_algae.html
Fitting Algae Into the Food Web

http://www.harcourtschool.com/activity/food/food_menu.html
Fun with food webs

http://www.gould.edu.au/foodwebs/
Activities on food webs

http://teacher.scholastic.com/activities/explorer/ecosystems/be_an_explorer/map/form_wildcats.htm
Build your own food web

http://www.vtaide.com/png/foodchains.htm
All about food chains and food webs