

Food Webs

Lesson 2b: Food for Plants

Grade 5	Length of lesson: 45 minutes	Placement of lesson in unit: 2b of 7 two-part lessons on food webs
Unit central question: How do living things depend on one another to get the food (matter and energy) they need to live and grow?		Lesson focus question: What is food for plants? (Part 2)
Main learning goal: Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and matter from the soil (water) into energy-supplying food.		
Science content storyline: Plants need food to live and grow. To be defined as food scientifically, materials must provide matter <i>and</i> energy for living things. Water, carbon dioxide, minerals in the soil, and soil by themselves are <i>not</i> food for plants because none of them have Calories (energy) that plants can use to live and grow. Sunlight is a form of energy, but it isn't matter. Plants need sunlight, but sunlight by itself isn't food for plants because it doesn't provide matter that plants can use to build cells, leaves, stems, roots, and other structures. <i>So what is food for plants?</i> Plants take carbon dioxide from the air, water from the soil, and light from the Sun and transform them into energy-supplying food matter they can use to live and grow.		
Ideal student response to the focus question and synthesize/summarize task: Plants don't take in food from the air or from the soil. The things they take in—like water, carbon dioxide, and plant food (minerals)—are <i>not</i> food because they don't provide the energy plants need to live and grow. Instead, plants transform carbon dioxide from the air, water from the soil, and energy from sunlight into energy-supplying food they can use to live and grow.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Large class evidence chart started in lesson 2a • Sticky notes (from lesson 2a) • Grass seeds grown in light and dark (seeds, soil, and containers) Alternative: large strips of grass sod grown in light and dark • Materials for mixing-bowl analogy: large green bowl, flashlight, baggie filled with air, bottle of water, hand-crank mixer or wire whisk • <i>Optional:</i> chart paper, markers • Sugar cubes (4–5 pieces in a baggie) <p>Student Handouts</p> <ul style="list-style-type: none"> • 2.1 What Is Food for Plants? (Investigation 3) (from lesson 2a) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the Food Webs Content Background Document: sections 2.3, 2.4, and 3.6. (Focus on the parts about photosynthesis.) • Review the PowerPoint slides and modify them as you wish. • Two or three weeks ahead of class: Place some grass seeds in plastic cups. Put half in the dark (the darker, the better) and half in the light. Each small group will have one cup of seeds grown in light and one grown in the dark. Water the seeds daily, but don't overwater them. (They shouldn't be sitting in puddles of water.) Alternative: During the growing season, buy large pieces of grass sod. Cut the sod into sections and put half in light and half in dark. Water daily, but don't overwater.
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Lesson 2b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	Lesson focus question and link to previous lesson: The teacher introduces the focus question, <i>What is food for plants?</i> and students discuss what they know so far.	<ul style="list-style-type: none"> Water, carbon dioxide, minerals in the soil, and soil by themselves are <i>not</i> food for plants because none of them have Calories (energy) that plants can use to live and grow.
3 min	Setup for activity 1: The teacher elicits student ideas about evidence to support or challenge the claim that sunlight is food for plants.	
8 min	Activity 1: Students observe grass grown in the light and in the dark and use that evidence to talk and write about sunlight and plants.	<ul style="list-style-type: none"> Plants need sunlight to be healthy.
10 min	Follow-up to activity 1: Using observations and a short reading about sunlight, students debate whether sunlight is food for plants.	<ul style="list-style-type: none"> Sunlight is a form of energy. Plants need sunlight, but sunlight by itself isn't food for plants because it doesn't provide matter that plants can use to grow.
3 min	Setup for activity 2: The class reviews the evidence so far regarding what is and isn't food for plants. The teacher states that students will now learn what scientists have figured out about how plants get their food.	<ul style="list-style-type: none"> We have evidence that carbon dioxide, water, soil, minerals in the soil, and sunshine are <i>not</i> energy-providing food matter for plants.
5 min	Activity 2: The teacher uses a mixing-bowl model to demonstrate scientifically how plants make their own food.	<ul style="list-style-type: none"> Plants are called <i>producers</i> because in the presence of sunlight, they can transform carbon dioxide they take in from the air and water they take in from the soil into energy-supplying food matter. This is how plants get their food.
5 min	Follow-up to activity 2: The teacher leads students through a role-play in which they imagine themselves as plants making food.	<ul style="list-style-type: none"> Plants are called <i>producers</i> because they can take carbon dioxide from the air and water from the soil and use energy from sunlight to make their own energy-supplying food.
5 min	Synthesize/summarize today's lesson: Students write a response to the focus question, <i>What is food for plants?</i>	<ul style="list-style-type: none"> Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and matter from the soil (water) into energy-supplying food. They use this food to live and grow.
1 min	Link to next lesson: The teacher links science ideas to the next lesson.	

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5 min	<p>Lesson Focus Question and Link to Previous Lesson</p> <p>Synopsis: The teacher introduces the focus question, <i>What is food for plants?</i> and students discuss what they know so far.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Water, carbon dioxide, minerals in the soil, and soil by themselves are <i>not</i> food for plants because none of them have Calories (energy) that plants can use to live and grow. 	<p>Set the purpose with a <u>focus question</u> or goal statement.</p> <p>Link science ideas to other science ideas.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p>Show slides 1 and 2.</p> <p>Last time we started investigating the question, <i>What is food for plants?</i> That will be our focus question again today.</p> <p>NOTE TO TEACHER: <i>Make sure the focus question is posted where it's visible to students throughout the lesson</i></p> <p>What did we learn in our last lesson about this question? Did we completely answer it?</p> <p>NOTE TO TEACHER ON MISCONCEPTIONS: <i>Some students may still assert that soil, water, carbon dioxide, or minerals in the soil are food for plants. Point them back to the scientific definition of food: Are they food by this definition? Or are they just materials plants need to stay healthy? For example, plants need an environment to live in, but the environment isn't their food.</i></p>	<p>We learned that soil isn't food for plants.</p> <p>Water doesn't provide energy, so it's not food by the scientific definition.</p> <p>And air isn't food for plants because it doesn't give plants energy.</p> <p>"Plant food" isn't really food for plants!</p> <p>We said that minerals in the soil aren't food for plants, but I disagree because they make plants grow bigger. I've seen it in</p>	<p>How do we know that?</p> <p>What was our evidence for that?</p> <p>Can you say more about "air"?</p> <p>Tell me more about that.</p>

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			We know that water, carbon dioxide, minerals in the soil, and soil are not food for plants. So what is food for plants? That’s what we’ll answer today.	TV ads for Miracle-Gro.	This is a tricky one because plants <i>do</i> use minerals in the soil. But is it food by the scientific definition?
3 min	<p>Setup for Activity 1</p> <p>Synopsis: The teacher elicits student ideas about evidence to support or challenge the claim that sunlight is food for plants.</p>	Make explicit links between science ideas and activities before the activity.	<p>Show slide 3.</p> <p>We’re also going to consider another question: <i>Is sunlight food for plants?</i> What evidence can you provide to support or challenge this idea? If you have any evidence, write it on a sticky note, and we’ll post it on our class chart.</p> <p>NOTE TO TEACHER: <i>Keep this discussion brief. Just elicit student ideas and add their evidence to the class chart.</i></p> <p>Some [or many] of you think plants need light to live and grow. Let’s observe an experiment I set up that can help us think more about sunlight and plants.</p> <p>NOTE TO TEACHER: <i>Have students turn to page 4 (Investigation 3) of handout 2.1 from the previous lesson, What Is Food for Plants?</i></p> <p>Let’s read the beginning of Investigation 3 on the handout together.</p> <p>NOTE TO TEACHER: <i>Read the first paragraph of Investigation 3 and the definition of</i></p>	<p>We always put plants in the classroom near the window so they can get light.</p> <p>Plants don’t grow as well in shady areas.</p>	

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			food in the text box.		
8 min	<p>Activity 1</p> <p>Synopsis: Students observe grass grown in the light and in the dark and use that evidence to talk and write about sunlight and plants.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Plants need sunlight to be healthy. 	<p>Engage students in analyzing and interpreting data and observations.</p> <p>Make explicit links between science ideas and activities during the activity.</p>	<p>NOTE TO TEACHER: Show students plants that have been grown in the light and in the dark. You can also show slides 4–6 of plants grown in light and dark conditions.</p> <p>Show slides 4–6 (optional).</p> <p>What do you observe, or see, about these plants? How would you describe the differences between the plants grown in the light and in the dark?</p> <p>ELL support: Give ELL students time for discussion in same-language groups, or in small groups. Allow them to draw their observations.</p> <p>In small groups, read and discuss questions 2a and 2b on the handout. Think about your observations and the scientific definition of <i>food</i>. Then reach an agreement as a group about these two questions:</p> <ol style="list-style-type: none"> Do plants <i>need</i> sunlight? What is your evidence and reasoning? Is sunlight <i>food</i> for plants? What is your evidence and reasoning? <p>NOTES TO TEACHER:</p> <ol style="list-style-type: none"> Students don't need to write responses if time is short. Make sure groups (or pairs) are mixed in 	<p>The plants in the light look greener and healthier.</p> <p>The plants in the dark are white and don't have many leaves. I think they're dying.</p>	

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			<p><i>terms of reading and English-language ability.</i></p> <p>3. <i>You may want to assign someone in the group to be a facilitator who calls on others to speak and makes sure everyone gets a turn to say something.</i></p> <p>Students work in pairs or small groups.</p> <p>NOTE TO TEACHER: <i>Resist the temptation to lead each group to the desired answers while they're working. Ask only probe and challenge questions at this point.</i></p>		<p><i>Probe questions:</i></p> <ul style="list-style-type: none"> • Say more about what you mean. • How did you come to that conclusion? <p><i>Challenge questions:</i></p> <ul style="list-style-type: none"> • What is your evidence? • Can you connect that to the scientific definition of <i>food</i>? • Can you connect that to your observations?
10 min	<p>Follow-Up to Activity 1</p> <p>Synopsis: Using observations and a short reading about sunlight, students debate whether sunlight is food for plants.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Sunlight is a form of energy. Plants need sunlight, but sunlight 	<p>Engage students in constructing explanations and arguments.</p> <p>Engage students in communicating in scientific</p>	<p>Show slide 7.</p> <p><i>Is sunlight food for plants?</i> Let's hear your ideas. Remember to include reasons and evidence. Use scientific ways of communicating, such as "I agree/I disagree because ..."; "My reasons are ..."; "My evidence is ...;" and "I want to add on"</p> <p>ELL support: Model real answers to the question, <i>Is sunlight food for plants?</i></p>	<p>Sunlight is food for plants because they get sickly and die if they don't have it.</p>	<p>Plants die if they don't</p>

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	<p>by itself isn't food for plants because it doesn't provide matter that plants can use to grow.</p>	<p>ways.</p> <p>Make explicit links between science ideas and activities after the activity.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p>NOTE TO TEACHER: <i>At this point, everyone may think sunlight is food for plants. That's OK. The next page of the handout will challenge this idea.</i></p> <p>To see if we can resolve these conflicting ideas, let's read about sunlight on page 5 of the handout. What question are we trying to answer?</p> <p>NOTE TO TEACHER: <i>Have students read the paragraph about sunlight independently or aloud as a group.</i></p> <p>Show slide 8.</p> <p>Turn and Talk: Discuss handout question 3a with a partner. Do you have any new ideas to answer the question, <i>Is sunlight food for plants?</i></p> <p>Individuals: Now work independently on question 3b. Write your ideas in your science notebooks using the sentence starter on the handout.</p> <p>NOTE TO TEACHER: <i>Wander around the room and look at student work to get a sense of student thinking. Use that information in your concluding comments about this investigation. If time allows, have students share their sentences. Otherwise, just give a conclusion.</i></p> <p>Sunlight provides energy for living things, but it</p>	<p>We don't have evidence that sunlight is providing both energy and matter to the plants.</p>	<p>get sunlight. Does this mean that sunlight is food for plants? Why or why not?</p>

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			doesn't provide any matter. So by itself, it isn't food for plants.		
3 min	<p>Setup for Activity 2</p> <p>Synopsis: The class reviews the evidence so far regarding what is and isn't food for plants. The teacher states that students will now learn what scientists have figured out about how plants get their food.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> We have evidence that carbon dioxide, water, soil, minerals in the soil, and sunshine are <i>not</i> energy-providing food matter for plants. 	Make explicit links between science ideas and activities before the activity.	<p>Show slide 9.</p> <p>So we've considered whether water, carbon dioxide, minerals in the soil, soil, and sunlight are food for plants. What are your conclusions?</p> <p>Give me a thumbs-up if you think <i>all</i> of these materials are food for plants, a thumbs-down if you think <i>none</i> of them are food for plants, and a thumbs-sideways if you think some are food and some aren't.</p> <p>What's our best evidence that these materials are NOT food for plants?</p> <p>NOTE TO TEACHER: <i>Hopefully most students will agree that none of these materials are food by the scientific definition. If not, you'll need to probe their thinking to see how they're making sense of the evidence. But you'll probably be very short on time, so you might want to just move ahead and come back to this in the next lesson.</i></p> <p>To help us determine what IS food for plants, let's discover what scientists have figured out about how plants make their own food.</p>	<p>Water and carbon dioxide don't have Calories, so they aren't energy-supplying matter (food).</p> <p>Sunlight isn't matter, so it can't make things gain weight or mass by itself. Food has to provide matter that can make living things get bigger.</p>	
5 min	<p>Activity 2</p> <p>Synopsis: The teacher</p>		<p>Show slide 10.</p> <p>NOTE TO TEACHER: <i>Gather the necessary</i></p>		

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	<p>uses a mixing-bowl model to demonstrate scientifically how plants make their own food.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Plants are called <i>producers</i> because in the presence of sunlight, they can transform carbon dioxide they take in from the air and water they take in from the soil into energy-supplying food matter. This is how plants get their food. 	<p>Make explicit links between science ideas and activities during the activity.</p>	<p><i>materials for the mixing-bowl model of photosynthesis, which shows how plants make food using energy from sunlight, carbon dioxide, and water.</i></p> <p>Scientists have learned that water, carbon dioxide, and sunlight are <i>not</i> by themselves food for plants. But plants can do something with these two kinds of matter (water and carbon dioxide) and one form of energy (sunlight). Here’s one way of imagining what is happening inside a plant.</p> <p>This green bowl represents a plant leaf. The leaf takes in water from the roots. Can someone pour some water into this leaf? The leaf also takes in carbon dioxide from the air that enters through tiny holes in the leaf. I have a baggie filled with air that contains carbon dioxide. Can someone give the leaf some carbon dioxide?</p> <p>Now we need someone to be the Sun and shine this flashlight on the leaf. When water, carbon dioxide, and sunlight come together, an amazing set of chemical reactions take place in the leaf. I’ll represent those chemical reactions with this mixer. The plant rearranges the bits of carbon dioxide and water and changes them into sugar, which contains both matter and a new form of stored energy that we call <i>food energy</i>. [<i>Show some sugar or sugar cubes.</i>]</p> <p>So carbon dioxide by itself isn’t food for plants, water by itself isn’t food for plants, and sunshine by itself isn’t food for plants. But the plant can</p>		

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			<p>take these three things and <i>make</i> or <i>produce</i> food.</p> <p>Show slide 11.</p> <p>This is why scientists call plants <i>producers</i>.</p> <p>Optional: <i>Tell students that this process is called photosynthesis.</i></p>		
5 min	<p>Follow-Up to Activity 2</p> <p>Synopsis: The teacher leads students through a role-play in which they imagine themselves as plants making food.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Plants are called <i>producers</i> because they can take carbon dioxide from the air and water from the soil and use energy from sunlight to make their own energy-supplying food. 	<p>Make explicit links between science ideas and activities after the activity.</p>	<p>Show slide 12.</p> <p>Let’s engage in a role-play to help us think about how this food-making process works. Everyone stand up and pretend you’re a plant. Your legs are your roots, your body is the stem, your arms are branches, and your hands are leaves. How can you take in the matter you need to make your food?</p> <p>OK, imagine the water coming up your legs into your leaves.</p> <p>ELL support: What movements should students be doing as they imagine the water traveling from their roots to their leaves?</p> <p>Do we need any other kind of matter to make our food?</p> <p>NOTE TO TEACHER: <i>You could wave a paper fan near the students to suggest carbon dioxide coming from the air, and use a flashlight or table</i></p>	<p>We can take in water from the roots.</p> <p>No, because it doesn’t have energy.</p> <p>Carbon dioxide.</p> <p>We take it in through tiny holes in our leaves.</p>	<p>And is water our food? Why or why not?</p> <p>Tell me more about CO₂.</p>

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			<p><i>lamp to represent sunlight.</i></p> <p>Imagine the CO₂ going into your leaves.</p> <p>What else do we need before we can make our food?</p> <p>So imagine your leaves absorbing the sunlight.</p> <p>OK, now imagine chemical reactions happening in your leaves—water, carbon dioxide, and sunlight are getting rearranged to form what?</p> <p>So you are producers! What are you producing?</p>	<p>No, because it doesn't have energy.</p> <p>Sunlight for energy.</p> <p>Sugar.</p> <p>Food!</p>	<p>Is it our food?</p>
5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students write a response to the focus question, <i>What is food for plants?</i></p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and matter from the soil (water) into energy-supplying food. They use this 	<p>Engage students in making connections by synthesizing and summarizing science ideas.</p>	<p>Show slide 13.</p> <p>Look at the words on the slide [<i>matter, energy, carbon dioxide, producer, sunlight, food, and water</i>]. Use these words to answer the focus question in your science notebooks: <i>What is food for plants?</i> Make sure to use complete sentences.</p> <p>ELL support: Ask students to draw a diagram showing photosynthesis and using labels.</p> <p>Optional: Add photosynthesis to the word list on the slide.</p>		

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	food to live and grow.				
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher links science ideas to the next lesson.</p>	Link science ideas to other science ideas.	<p>Show slide 14.</p> <p>We know that food provides both matter and energy for living things. Next time we'll explore the question, <i>How do plants grow bigger?</i></p>		