

Competition for Energy in an Ecosystem

Unit: Strand BIO.1: Interactions with Organisms and the Environment	Utah SEEd Standard / NGSS Performance Expectation: (Core Guides) Develop and use a model to explain the cycling of matter and flow of energy among organisms in an ecosystem. Emphasize the movement of matter and energy through the different living organisms in an ecosystem.	Time: 70 minutes
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Access to all materials for this lesson: <https://byu.box.com/s/k9p01aiwstk2o6pcf8xd7pulvs2wc7lr>

Anchor Phenomenon	Video showing dead elk and scavenging by different animals. https://www.youtube.com/watch?v=p8FHDPZ4LdE
Driving Question(s)	- How does competition affect the flow of energy in an ecosystem? - How does the death of an animal impact the food web in their ecosystem?
Performance Task	- Students will develop a model of a food web using the video clip. - Students will model animal competition for energy resources by competing against a partner in the "Competition 4 Energy Game." - Students will explain how competition among species is ultimately competition for energy resources.

Lesson Summary:

	Time	Guiding Question / Learning Objective	How are students answering the guiding question or meeting the learning objective? (Note the SEPs, DCIs, and CCCs in the corresponding color.)
 Engage	10 min	What competition did you observe between species in the video?	Students will model a food web showing competition between species.
 Explore	40 min	Explore during participation in both Energy Models (food web and food game) for understanding that competition for food is ultimately competition for energy among species.	Students will model animal competition for energy resources by constructing a food web and by competing against a partner in the “Competition 4 Energy Game.”
 Explain	10 min	Explain the flow of energy in your food web. Identify the ultimate source(s) of energy.	Discuss as partners, groups, class, etc. how the Competition 4 Energy Game helps your understanding of competition in an ecosystem.
 Elaborate	5 min	Students will elaborate on how the models show competition for energy and matter in an ecosystem.	Student answers on the student handout have students elaborate on how competition for energy and matter happens.
 Evaluate	5 min	- Students will understand that competition among species is ultimately competition for energy resources. - Use the attached Rubric to assess if the learning target for the lesson has been met.	Student models and handouts will be evaluated with the attached rubric for the incorporation of modeling and understanding of competition among species.

Three Dimensions Focused on in This Lesson		
Disciplinary Core Idea: NGSS Appendix E LS2.B The student will be able to explain how competition among species is ultimately competition for the matter and energy needed for life.	Science and Engineering Practices: NGSS Appendix F 1: Developing & Using Models 2: Constructing Explanations	Crosscutting Concept: NGSS Appendix G Energy and Matter
Learning Objectives The student will be able to explain how competition among species is ultimately competition for the matter and energy needed for life.		
Related Knowledge and Skills from Prior Grades		
Disciplinary Core Idea: Food webs, including the roles of producers, consumers, & decomposers.	Science & Engineering Practices: Develop and/or use a model to predict and/or describe phenomena.	Crosscutting Concept: The transfer of energy can be tracked as energy flows through a designed or natural system.
Connections to Mathematics and ELA/Literacy Standards		
ELA/Literacy Standards: WHST.9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	Mathematics Standards: MP.2: Reason abstractly and quantitatively. MP.4: Model with mathematics. HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.	

Materials

Handouts	Lab Supplies	Other Resources
Student handout Student handout - Modified for SPED or ELL	Competition Game Cards (See Explore section for card game preparation)	Anchor phenomenon video, Grizzly bear & elk carcass: https://www.youtube.com/watch?v=p8FHDPZ4LdE Grading Rubric for Student Handout

ENGAGE

- Students will be able to explain how **competition** among species is ultimately competition for the matter and energy needed for life.
Example questions to guide student learning:
 - What species are impacted due to the death of this elk?
 - What **competition** did you observe between species in the video?
 - How does **competition** affect the flow of **energy** in this ecosystem?

- Before class**, write the Learning Objectives on the board for reference and use during the lesson.
- Consider previous knowledge to reference.
 Examples:
 - Energy moving through the ecosystem in trophic levels
 - Food chains & webs
 - Photosynthesis and/or cellular respiration
- Choose one or more **Bellringer/discussion** questions:
 - When we eat something, what do we get from what we eat? Why do we need to eat?
 - What evidence do you have that we get energy from what we eat?
 - What evidence do you have that we get matter from what we eat?
 - Draw how you fit into a food chain using something you ate in the last 24 hours.
- During class**, after discussing student answers to bellringer questions, use one or more of the following to engage students through their own personal experiences:
 - Raise your hand if you skipped breakfast this morning.

Teacher Tips

- Be careful with students' feelings who may not have access to food, struggle counting



b. Think about what you have eaten in the last 24 hours--has that given you sufficient energy for school today? c. Was there any competition between you and your siblings for food recently (last bowl of cereal, dessert, juice, etc.)? 5. Discussing student interest in animals can often be used by teachers to encourage engagement with personal connections. Students may. Have experience hunting, being in the forest, going to the zoo, or owning an animal to name a few. 6. Pass out to students (could be done at the beginning of class) student handout “Video Notes.” a. Before the video, ask the students: “How can we show or ‘model’ the flow of energy in an ecosystem?” b. Look for and guide students to the idea that energy flow is modeled with directional arrows in the food web. 7. Show the anchor phenomenon video. https://www.youtube.com/watch?v=p8FHDPZ4LdE a. During the video, have students write observations and living things they see in the video. b. What animals do you see? Listen for student comments on large/small, heterotroph/autotroph, carnivores, etc. c. How does the ecosystem look? Listen for student comments about such as healthy, active, etc. 8. After the video ask <u>questions</u> to have a short <u>discussion</u> as a class. Example questions: a. How are the organisms impacted by the death of the Elk? b. What competition did you observe between species? c. Why is there competition?	calories, or do not have a stable home life. Potential Video ELL etc. accommodations: • Point out a few important points for students during the video. • “Student Handout Key” has a list of animals found in the video which may help during/after the video building the food web.
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EXPLORE

The student will be able to explain how **competition** among species is ultimately competition for the matter and energy needed for life.

- Students will be able to create a **food web** showing **competition** between species.
- How does competition affect the flow of matter and energy in an ecosystem?
- Discuss as partners, groups, class, etc. how the **Competition 4 Energy Game** influences your understanding of competition in an ecosystem.

1. After the short discussion during the Engage lesson portion, use the protocol **Think-Talk-Open Exchange**.

- Think:** Ask students to *individually* use their notes and knowledge from the video to
 - Model** a food web using the organisms they observed in the video clip, they can add additional organisms if needed based on prior knowledge or internet search.
 - Answer the associated video questions.
- Talk:** When students have completed their models and answered the questions, they will work within their group to create a food web together and discuss their answers to the video questions.
- Open Exchange:** Pick two groups to present their food web to the class. Give students time to make some modifications to their web after hearing from the other groups.

Background: Students will explore **competition** between species by utilizing the “Competition 4 Energy Game” where they compete against a partner **to obtain energy**. The energy requirements for the animal cards in this game are fairly accurate for daily energy requirements for specified species. The food cards represent a certain number of calories of that type of food. For example, 50 kcal of grass (represents grazing in a larger area, not one blade), 75 kcal of mice (represents 2-3 mice).

1. Tips for game preparation:

- Print out cards on cardstock or other non-transparent paper.
- Print animal cards on a different color paper than energy cards.
- You can save time by having students in your first hour cut cards to keep for all classes.
- Keep cards separate (animal and energy) for future classes.
- Use a plastic bag to organize game cards for reuse.

2. Game & Recording Results

- Students play **Round 1** of the game and record results on a data table.
 - Ask students to look for how matter/energy will fit in this game competition model.
- After Round One, the teacher will lead a class discussion facilitating student reflection on **competition, survival, and energy needs of species**.
Examples:

Teacher Tips

- The Think-Talk-Open Exchange protocol supports English Language Learners by giving them time to process their work individually and to discuss with a classmate prior to the full class discussion.
- Web models could be group webs, individual webs, etc.
- **Accommodation:** A modified food web could be pre-drawn for students to fill in the blanks.
- Teacher could highlight/facilitate student discussion about the ultimate source of energy for their ecosystem (producers, photosynthesis) as well as losses of energy from their ecosystem (heat—see Student Handout Question 2).
- Modification of the game for students who cannot or will not play the game: Document or graphs they can read/explore on information on caloric intake and expenditure of producers and different levels of consumers.
- Help students make connections to previous learning while engaging in the game by referencing the phenomenon

i. Highlight examples of partners who experienced high competition for the same energy resources (i.e., rabbit and deer, coyote, and bald eagle). Did both partners survive? ii. Highlight examples of partners who experienced low competition for the same energy resources (i.e., rabbit and bald eagle). Did both partners survive? iii. Who was a robin? Did you survive? Why? [Don't need as much energy.] iv. What about deer? [High energy requirements but eat plentiful energy sources.] c. Students play Round 2 i. Highlight competition and energy needs. ii. Teacher may choose to visually summarize survival and death statistics of different species i.e., "Between the two games how many of you were deer? Did you live or die?" (Record statistics). iii. Adapt Game Model to reflect student learning for Round 3 or more	(video/competition food web model). • Teacher Explore Extension: Explore with students the idea of species specialization/niches for energy resources vs obtaining energy from diverse sources to avoid competition.
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EXPLAIN

- Explain the flow of energy in your food web. Identify the ultimate source(s) of energy.
- Discuss as partners, groups, class, etc. how the Competition 4 Energy Game helps your understanding of **competition** in an ecosystem.

1. Students work individually or in groups to answer the four "summary questions" at the bottom of the student handout and to explain the data gathered in the game model.
2. Lead a class discussion focused around Question 3 of the "summary questions." Students will "write an explanation of competition for energy resources using evidence from the two models (video food web and game)".

- Teacher can decide how to explain the food web.

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS

- High level learners use Google Earth to explore a different ecosystem that interests them to create a food web for that location.
- A pre-drawn food web missing only the organism's names as an adaption for diverse learners.
- Creating team pairs as an adaption for diverse learners.

ASSESSMENT MATRIX

This matrix supports three-dimensional assessment across this 5E instructional sequence. For each E phase, list the artifacts/strategies that provide evidence of what students know and can do as they work towards proficiency. These formative assessment opportunities should be used to track student progress. The dimensions that are reflected in the Evaluate are the ones that can be assessed summatively at the end of this 5E plan. Make sure these Make sure to call out these connections in the lesson above so they are explicitly addressed.

	Engage	Explore	Explain
Competition for energy resources	Students observe competition and strategies	Competition Game	
Developing and using a model Constructing an explanation	Student-created food webs, class discussion of food webs.		Students explain how competition is for energy resources.
Energy and Matter			

[Student worksheet assessment rubric](#)

This lesson was created by: Matt Cottrell, Ray Davis, Valorie Draper, Hyrum Gillespie



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