

UNIT 1

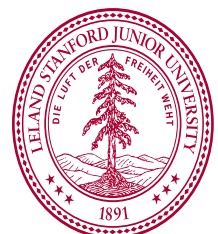
A Balanced Biosphere



How have natural processes and human activities created the ecosystems we see today?

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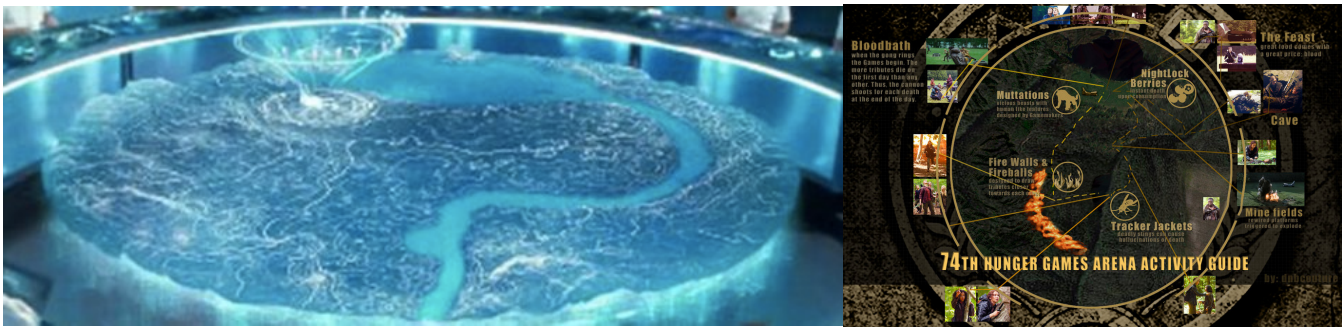
7th Grade Science Unit 1: A Balanced Biosphere

Culminating Project

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Challenge

Some of you have seen the movie or read the book, *The Hunger Games*. This book is about a country where children from 12 districts are selected to participate in a mandatory televised death match called *The Hunger Games*. In this movie, gamemakers in the powerful district create an arena that is like the biosphere you saw in the Lift-Off. The arena mimics, or looks like, a natural ecosystem and functions just like one. Below are two different pictures of an arena: a realistic digital picture on the left and an annotated map (with captions) on the right.



<http://thehungergames.skyrock.com/8.html>

<http://dnbcouture.deviantart.com/art/>

A new film based off *The Hunger Games* is coming out next year. Your task is to use what you learn about how Earth's ecosystems are formed in order to design a new arena for the film. Thus, your arena should look like an ecosystem you might see on Earth. As a group of arena designers, you will decide how its geological structures were made, what natural resources it has, and how its organisms will interact. At the end of the unit, your group will present your arena design to the director for his/her next film. You have the option of presenting your arena as a diorama or poster-sized map. As individuals, you will then create a self-guided tour of your group's arena, in the form of a brochure or flyer, so that the director has additional materials to consider as he makes his decision.

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Group Project Criteria for Success

Your arena presentation should include:

- A geographic map or diorama of your arena that is easy to understand and shows the following features with illustrations:
 - The continent where the arena is located and surrounding continents
 - Relevant geographic features, such as mountain ranges, types of rock present, glaciers, etc.
 - Which natural resources the arena has most and least of
 - The non-living things that are needed to support life in the arena
 - A contestant challenge: to locate a specific plant/animal by using information about another plant/animal

- An oral presentation that:
 - Explains the features of your arena (listed above)
 - Is organized logically
 - Is interesting to the audience

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Individual Project Criteria for Success

The self-guided tour of your arena (as a brochure or flyer) should describe all parts of your arena, including:

- Geographic Features
 - Identify the geographic features in your arena based on its location.
 - Explain how plate motions led to the geographic features in your arena.
 - Describe the patterns in data from Task 1 that provide evidence for past plate motions.
- Natural Resources
 - Identify the natural resources available in your arena.
 - Explain how geoscience processes and current human activities affect which resources are available in your arena.
 - Use evidence from Task 2 to support your explanation.
- Non-Living Things
 - Draw a model (including arrows and labels) that shows how matter and energy are cycled within your arena ecosystem.
 - Explain how you can track the flow of energy through your arena's ecosystem.
- Living Organisms
 - Describe how the contestant challenge works: Explain how each plant or animal leads the contestant to the next plant or animal.
 - In your contestant challenge, you should utilize and identify at least two different types of organism interactions, based on patterns you observed in Task 4.
- Human Impact
 - Describe the potential effects on the entire ecosystem if budget constraints result in the removal of one major resource from your arena.
 - Give examples of populations of organisms that may be affected in order to explain why removing a resource can result in a chain of effects.
 - Describe data from Task 5 that allows you to predict this outcome.

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Culminating Project**

Self-Guided Tour Peer Review Feedback

Complete after you have a full first draft of your brochure or flyer for the self-guided tour.

Self-Guided Tour Owner's Name	
Self-Guided Tour Reviewer's Name	

Review the following sections of the Self-Guided Tour:

- Geographic Features**
 - Identify the geographic features in your arena based on its location.
 - Explain how plate motions led to the geographic features in your arena.
 - Describe the patterns in data from Task 1 that provide evidence for past plate motions.
 - Positive Comment:
 - Constructive Comment:

- Natural Resources**
 - Identify the natural resources available in your arena.
 - Explain how geoscience processes and current human activities affect which resources are available in your arena.
 - Use evidence from Task 2 to support your explanation.
 - Positive Comment:
 - Constructive Comment:

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- Non-Living Things
 - Draw a model (including arrows and labels) that shows how matter and energy are cycled within your arena ecosystem.
 - Explain how you can track the flow of energy through your arena's ecosystem.

 - Positive Comment:

 - Constructive Comment:

- Living Organisms
 - Describe how the contestant challenge works: Explain how each plant or animal leads the contestant to the next plant or animal.
 - In your contestant challenge, you should utilize and identify at least two different types of organism interactions, based on patterns you observed in Task 4.

 - Positive Comment:

 - Constructive Comment:

- Human Impact
 - Describe the potential effects on the entire ecosystem if budget constraints result in the removal of one major resource from your arena.
 - Give examples of populations of organisms that may be affected in order to explain why removing a resource can result in a chain of effects.
 - Describe data from Task 5 that allows you to predict this outcome.

 - Positive Comment:

 - Constructive Comment:

**7th Grade Science Unit 1: A Balanced Biosphere
3-Dimensional Individual Project Rubric**

Overview: The following rubrics can be used to assess the individual project: a self-guided tour of your group’s arena. Each rubric is aligned to one section of the *Individual Project Criteria for Success*, located on your Culminating Project Student Instructions. Use these rubrics to see if you are doing your best work on your individual project.

Rubric 1: Student describes patterns in data as evidence to explain how plate motions have led to the geographic features in the arena.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately explains how plate motions have led to the geographic features in the arena.	Student describes no patterns in data as evidence to generally explain how plate motions have led to the geographic features in the arena.	Student describes partial patterns in data as evidence to accurately explain how plate motions have led to the geographic features in the arena.	Student describes multiple patterns in data as evidence to accurately explain how plate motions have led to the geographic features in the arena.

Rubric 2: Student uses evidence and cause-and-effect relationships to explain why only certain resources are available in the arena.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately explains why only certain resources are available in the arena.	Student uses no evidence, but does use cause-and-effect relationships to generally explain why only certain resources are available in the arena.	Student uses accurate evidence and cause-and-effect relationships to partially explain why only certain resources are available in the arena.	Student uses accurate evidence and cause-and-effect relationships to completely explain why only certain resources are available in the arena.

Rubric 3: Student develops a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student develops an incomplete model to inaccurately describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Student develops a partial model to partially describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Student develops a mostly complete model to partially describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Student develops a complete model to accurately describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Rubric 4: Student explains how they can track the flow of energy through the arena ecosystem.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately explains how they can track the flow of energy through the arena ecosystem.	Student generally explains how they can track the flow of energy through the arena ecosystem.	Student partially explains how they can track the flow of energy through the arena ecosystem.	Student completely explains how they can track the flow of energy through the arena ecosystem.

**7th Grade Science Unit 1: A Balanced Biosphere
3-Dimensional Individual Project Rubric**

Rubric 5: Student uses patterns of interactions among organisms to explain a contestant challenge within the arena ecosystem.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student uses no patterns of interaction among organisms to inaccurately explain a contestant challenge within the arena ecosystem.	Student uses one pattern of interaction among organisms to partially or completely explain a contestant challenge within the arena ecosystem.	Student uses multiple patterns of interactions among organisms to partially explain a contestant challenge within the arena ecosystem.	Student uses multiple patterns of interactions among organisms to completely explain a contestant challenge within the arena ecosystem.

Rubric 6: Student predicts how removing a resource might affect populations of organisms and explains why by making connections between sub-systems in the larger arena ecosystem.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student predicts how removing a resource might affect irrelevant populations of organisms.	Student predicts how removing a resource might affect one relevant population of organisms and explains why without making connections between sub-systems in the larger arena ecosystem.	Student predicts how removing a resource might affect multiple relevant populations of organisms and explains why without making connections between sub-systems in the larger arena ecosystem.	Student predicts how removing a resource might affect multiple relevant populations of organisms and explains why by making connections between sub-systems in the larger arena ecosystem.

Rubric 7: Student cites data that provides evidence of a cause-and-effect relationship between resource availability and populations of organisms.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student describes an inaccurate cause-and-effect relationship between resource availability and populations of organisms.	Student cites no data to provide evidence of an accurate cause-and-effect relationship between resource availability and populations of organisms.	Student cites a relevant data point that provides evidence of an accurate cause-and-effect relationship between resource availability and populations of organisms.	Student cites multiple relevant data points that provide evidence of an accurate cause-and-effect relationship between resource availability and populations of organisms.

**7th Grade Science Unit 1: A Balanced Biosphere
Project Organizer**



Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

You will be creating an arena that mimics an environment you may see on Earth. After each task, you will return to the table below to organize what you learn as you go through the unit. By the end of the five tasks, you will have all this information to use for your culminating project. For each activity, be sure to include answers to **ALL** the questions provided.

<p>Lift-Off Task: A Well-Functioning Biosphere</p>	<p>Your arena will be very similar to a biosphere in that you are designing your own ecosystem. Using your prior knowledge of ecosystems,</p> <ul style="list-style-type: none"> <input type="checkbox"/> What parts of an ecosystem should you be thinking about including in your arena? Make a list or draw a diagram of an ecosystem with parts labeled.
<p>Task 1: Pangaea Puzzle</p>	<p>Over the course of this task, you gathered evidence of how past plate motions have led to some geologic features you see on Earth. <u>As a group</u>, decide on a location for your arena that would have the geologic features you want. Then <u>individually</u>,</p> <ul style="list-style-type: none"> <input type="checkbox"/> Draw a map showing your arena location on Earth as well as any relevant surrounding continents, making captions that answer the questions below: <ul style="list-style-type: none"> ○ On what continent would your arena be located? Why are you locating it there? ○ What features would you find (mountain ranges, types of rock, glaciers, etc)? ○ How can you use plate motions to explain these features?

**7th Grade Science Unit 1: A Balanced Biosphere
Project Organizer**



<p>Task 2: Using Available Resources</p>	<p>Every arena needs certain resources to function. Now that you have discovered how resources have been distributed on our own Earth, decide which resources your arena will have.</p> <ul style="list-style-type: none"> <input type="checkbox"/> What natural resources will your arena have the most and least of? <input type="checkbox"/> What geoscience processes will have caused these resources to be available in your arena? <input type="checkbox"/> What evidence is there for why these resources are unevenly distributed?
<p>Task 3: Produce, Reuse, Recycle</p>	<p>Your arena already has its main geological features, but as we learned today, there are also other non-living factors and living factors that make up an environment. Design the landscape of your arena, focusing on the non-living things that will be needed to support life.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Draw a visual diagram showing how this non-living matter will cycle through your environment (You do not need to pick specific plants and animals for your arena yet; you can just draw example plants and animals for this diagram). <ul style="list-style-type: none"> o Be sure to label the examples of living and non-living matter and use arrows to show where they go.

**7th Grade Science Unit 1: A Balanced Biosphere
Project Organizer**



<p>Task 4: Interactions Between Organisms</p>	<p>In your arena, you will be creating a challenge for your contestants, so the winner may win additional supplies. The challenge will be to locate a specific plant/animal by using information about another plant/animal. The contestants will use their knowledge of ecosystem interactions to connect the known plant/animal to the unknown plant/animal.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Identify what plants and animals you will include in your arena. <input type="checkbox"/> Design this challenge by making a flowchart tracing one organism to another using <u>at least two</u> different organism interactions we have studied. <input type="checkbox"/> Explain how each plant/animal leads the contestant to the next plant/animal by describing the organism interactions.
<p>Task 5: A Chain of Resources</p>	<p>Reflect back on the last two responses in your Project Organizer. Think about what key resources are needed in order to accommodate the organisms you have chosen. Based on these key resources, prepare for the worst:</p> <ul style="list-style-type: none"> <input type="checkbox"/> If budget constraints resulted in removal of one main resource, predict what will happen to the populations of different organisms in your arena. <input type="checkbox"/> Figure out as many effects as you can and explain them in a flowchart or paragraph format. Use data from the task to justify your predictions.

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Lift-Off Task: A Well-Functioning Biosphere

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*



In the 1990's a group of scientists designed and built an artificial living environment called Biosphere 2 in Arizona. The purpose of the project was to construct an environment that would allow 8 people to live and survive for two years without ever leaving the building. Scientists planned to use what they learned from this "experiment" to design and build artificial living environments on Mars. For Biosphere 2, scientists constructed a series of dome-shaped areas representing different ecosystems with the goal of providing people with the basic ingredients in order to live for two years.

As a class,

- Watch a video clip where Jane Poynter describes life in Biosphere 2.
- Explore your schoolyard as one example of an ecosystem. Look up, look down, and look around you. What do you see? What things do you not see in the schoolyard but you might see in another ecosystem?

Part A: If you wanted to know more about how biospheres function, what questions would you ask? Individually record any questions you would need to ask to get a better understanding of biospheres.

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Lift-Off Task: A Well-Functioning Biosphere

Part B: As a group,

- Discuss what questions each member wrote on his or her list.
- On a large piece of poster paper:
 - Write the phrase “A Well-Functioning Biosphere” in the middle of your poster and draw a circle around it.
 - Around the circle, record the questions that were similar across your group members.
 - Draw lines to link together questions that relate to each other.
 - Draft possible answers to the questions, using your prior knowledge. Connect these to the questions on your poster.
- Post your group poster on the wall.
- Walk around and look at each groups’ ideas.

Part C: As a whole class,

- Construct a class concept map with the phenomenon in the middle: “A Well-Functioning Biosphere”.
 - Decide which key questions you want to have on the concept map.
 - Draw lines with arrows between two key questions to show that there is a relationship.
 - Make as many connections as you can between the questions on the concept map.
- It’s important for everyone to share their ideas and it’s okay if you don’t agree.
- You will revise and add new questions and information to this concept map as you learn more about biospheres and ecosystems.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Connecting to the Culminating Project

You have been asked to create a Hunger Games arena that mimics an environment you may see on Earth. Your arena will be very similar to a biosphere in that you are designing your own ecosystem. Using your prior knowledge of ecosystems,

- What parts of an ecosystem should you be thinking about including in your arena? Make a list or draw a diagram of an ecosystem with parts labeled.

This should be completed individually in your Project Organizer.

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Lift-Off Task: A Well-Functioning Biosphere

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Reflection

Individually reflect on the Lift-Off Task, using the questions provided:

1. At the beginning of this task, you made a list of all the questions you have about biospheres. Look back at your list: think about the questions your peers asked that you did not initially write down. How are their questions different from the ones you originally asked?

2. In this unit, we will be focusing on four crosscutting concepts:
 - **Patterns:** Patterns can be used to identify cause and effect relationships and provide information about natural systems.
 - **Cause and Effect:** Cause and effect relationships may be used to predict phenomena.
 - **Systems and System Models:** Models can be used to represent systems and their interactions within and between systems.
 - **Energy and Matter:** The flow of matter and energy can be tracked through a natural system.Looking at your class concept map, give one example of how a crosscutting concept came up in today's task.

3. Now that you understand what project you'll be working on over the course of this unit, what else do you need to know? What additional questions do you have?

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Task 1: Pangaea Puzzle

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Engage

In the Lift-Off task, we looked at an artificial environment. However, your arena should be designed to be built on real land in a real location, so you will have to take into account the large geologic features that might be there. To get a full understanding of your arena location, today we will explore geologic features around the world and how they were made.

We can start by looking at the continents. The picture below shows a map of the world with the continents labeled. When you see a map like this, what do you notice about the shape of these continents?



<http://kids.britannica.com/comptons/art-166560/Earths-seven-continents-are-Asia-Africa-North-America-South-America>

In pairs, draw arrows to show how you think the continents might have fit together. Explain why you think so below:

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Task 1: Pangaea Puzzle

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explore

In the early 1900s, a meteorologist named Alfred Wegener also thought about this question. He suggested that the continents were once closer together and moved over time to where they are today. Have the continents really moved over time? How can we be sure?

Analyzing and Interpreting Data: Let’s gather some more evidence to see if Wagener’s theory was correct. In this section of the task, you will be given two continent pieces.

1. Working with your group, examine the information on the Evidence Cards to help you decide how your two assigned continents might have shifted over time.

Names of Your Assigned Continents
Draw your assigned continents to show how they might have fit together a long, long time ago (Use arrows and captions).
Using the Evidence Cards, describe the evidence that supports your drawing above: <ul style="list-style-type: none">• Make a list of features that appear on each of your continents. How does the location of these features support your arrangement of the two continents?

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Task 1: Pangaea Puzzle

2. **Systems and System Models:** In this activity, you will place your own two continents within the larger continental system. As groups present about their continents, individually take notes on the different kinds of evidence groups use to support the arrangement of their continents.

Pattern of Evidence	Specific Examples
Mountain Ranges	
Coal Distribution	
Types of Rock	
Distribution of Glacier Deposits	
Distribution of Fossils	

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Task 1: Pangaea Puzzle



Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explain

Let's go back to Alfred Wegener's theory of continental drift.

1. As a class, watch the video.

2. Discuss the following questions in pairs.
 - What was Alfred Wegener's idea?
 - What inspired him to get to this idea?
 - Why didn't anyone accept his idea at the time?

3. **Constructing Explanations:** Individually, write an explanation agreeing or disagreeing with Wegener's theory. Based on your data analysis, do you think the continents have moved over time? Use evidence from your chart above to help support your position.

<p>Do you agree or disagree with Wegener's Theory?</p>	
<p>What evidence do you have to support your position?</p>	

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Task 1: Pangaea Puzzle

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Elaborate

Use the Stronger/Clearer method to develop and improve the explanation you just wrote.

1. **Individual Think Time:** Turn the paper over so you can't see it. Take a minute to think about how you will explain your response to a first partner.
2. **Partner Discussions 1:** You will work in pairs with another student. One of you will be Student A and the other Student B. Student A will start first:
 - **Student A:** Without looking or reading what you wrote down, describe and support the thinking you used in your explanation.
 - **Student B:** Listen and ask clarifying questions. Ask questions to help Student A provide evidence-based reasoning. For example, you might ask, "Why do you think that?" or "What evidence supports your claim?"
 - **Both Student A and Student B:** Write down any notes, thoughts, or questions that came up in this discussion.

Now switch roles and repeat the steps above.

3. **Partner Discussion 2:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your explanation. Write down new notes, insights, and questions.

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Task 1: Pangaea Puzzle

4. **Partner Discussion 3:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your explanation. Write down new notes, insights, and questions.

5. **Final Explanation:** After you have worked with partners to clarify your thinking, review your notes. Revise your explanation in the *Explore*. You may include drawings or diagrams that help you explain your answer.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Evaluate: Connecting to the Culminating Project

You have been asked to create an arena that mimics an environment you may see on Earth. Over the course of this task, you gathered evidence of how past plate motions have led to some geologic features you see on Earth. As a group, decide on a location for your arena that would have the geologic features you want. Then individually,

- ✓ Draw a map showing your arena location on Earth as well as any relevant surrounding continents, making captions that answer the questions below:
 - On what continent would your arena be located? Why are you locating it there?
 - What features would you find (mountain ranges, types of rock, glaciers, etc)?
 - How can you use plate motions to explain these features?

This should be individually in your Project Organizer.

7th Grade Science Unit 1: A Balanced Biosphere

Task 2: Using Available Resources

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Engage

In Task 1, you learned about how plate motions lead to the geological world you know today. But how does this also affect which resources are available in a region? This question is very important to us, as humans, because we take many different substances from the Earth—such as water, minerals, timber, and oil—and put them to our own uses. Because we use them so much, you will often see them written about in the news. Below are a few real news headlines from different time periods:

Mining in Tibet: The Price of Gold, *The Economist*

Saudi Arabia’s Oil Policy: Beyond OPEC, *The Economist*

Gold! Gold! Gold! Gold! Sixty-Eight Rich Men on The Steamer Portland, *The Seattle Post-Intelligencer*

US National Arrested On Sierra Leone ‘Blood Diamond’ Charges, *The Guardian*

Drying Up: The Race to Save California From Drought, *Newsweek*

In partners, discuss:

1. Newspapers talk about natural resources all the time. What do you think a natural resource is?
2. In the last task, we learned about plate motions. How do you think natural resources might be connected to plate motions?
3. Earth’s resources are very important to humans for their daily lives. What are the resources in these news headlines and why do you think each of them is so important?
4. Because natural resources are so important to humans, they often cause conflict. Why do you think there is conflict?

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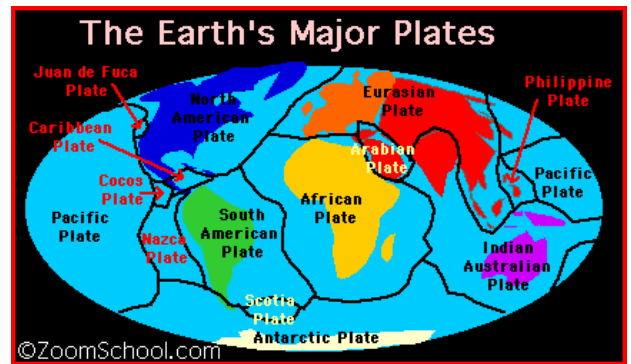
Task 2: Using Available Resources

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explore

In the last task, we learned that plate motions have led to the geological world around us. However, as we learned from the news headlines, the movement of the plates occur in different places in the world and lead to different results. Resources, like gold, oil, diamonds, and water are not distributed equally-- we have more in some places than others. Why? How does the Earth actually make these resources? Let's explore what plate movements have to do with all of this.

You may already know that our continents and oceans sit on top of large pieces of Earth's crust...these are known as tectonic plates. Tectonic plates aren't stationary—they actually move, but very very slowly. **Cause and Effect:** At their boundaries, plates can bang into, dive under, split further apart, or slide along each other. This is what creates different geologic features, like mountains, volcanoes, earthquakes, and mid-ocean ridges. Let's model how these tectonic events happen.



Developing and Using Models: With your group, use the materials provided by your teacher and the resource card at your table to model the different ways plates can interact. When you finish, draw diagrams of what you made and explain the results of each plate interaction.

Divergent	Convergent - Collision	Convergent - Subduction	Transform
Places where plates are moving apart.	Places where plates crash together.	Places where plates crash together.	Places where plates slide past each other.
Diagram (Use arrows)	Diagram (Use arrows)	Diagram (Use arrows)	Diagram (Use arrows)

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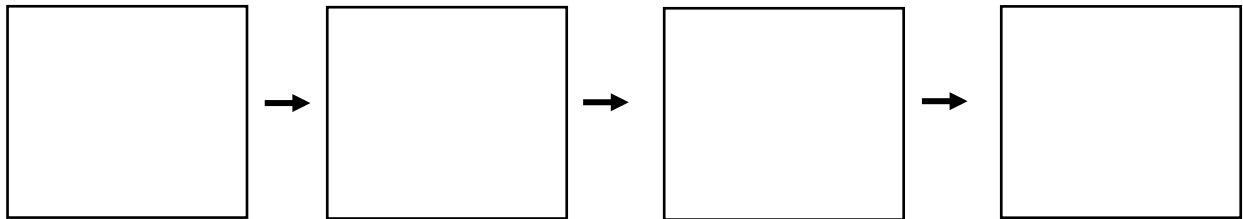
Task 2: Using Available Resources



<p>What geologic features do you think can result?</p>	<p>What geologic features do you think can result?</p>	<p>What geologic features do you think can result?</p>	<p>What geologic features do you think can result?</p>
--------------------------------------------------------	--------------------------------------------------------	--------------------------------------------------------	--------------------------------------------------------

Now read the article to learn about an example of how plate tectonics affects natural resource distribution.

1. How is oil and natural gas formed? Based on your research, use the flowchart below to explain the process.



2. **Cause and Effect:** According to the article, which types of plate interactions (which you modeled with graham crackers) help to make oil and natural gas?

3. How do you think humans are affecting the distribution of oil and natural gas? Use your prior knowledge as well as evidence from the *Engage* and the article.

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Task 2: Using Available Resources

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explain

Individually, **construct an explanation** to answer the following question: Are all resources distributed evenly throughout the world? Why or why not? Use evidence from the *Engage* and *Explore* as well as **Cause and Effect** reasoning to justify your response.

Claim	
Evidence	
Reasoning	

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Elaborate

Cause and Effect: Today we learned about how two natural resources, natural gas and oil, are not equally distributed throughout Earth. But is that also the case with other resources? Apply what you learned to another energy resource: coal. With a partner, read about how coal is made and respond to the question below:

Coal was created 300 to 400 million years ago during the Carboniferous period, which had a generally warm and humid climate. Plants in tropical swamp forests died and became buried and compressed in sediments to form coal. Mining techniques can remove the coal from earth to be used by humans.

7th Grade Science Unit 1: A Balanced Biosphere**Task 2: Using Available Resources**

Do you think this resource is evenly distributed? Why or why not?

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Evaluate: Connecting to the Culminating Project

You will be creating an arena that mimics an environment you may see on Earth. Every arena needs certain resources to function. Now that you have discovered how resources have been distributed on our own Earth, decide which resources your arena will have.

- ✓ What natural resources will your arena have the most and least of?
- ✓ What geoscience processes will have caused these resources to be available in your arena?
- ✓ What evidence is there for why these resources are unevenly distributed?

This should be completed individually in your Project Organizer.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Reflection

Individually reflect on Task 2, using the questions provided:

1. At the beginning of this task, you looked at different news headlines and hypothesized as to why certain resources are associated with specific regions. Look back at your responses: after learning everything you have about resources, how can you add to your answers? Use information from the task to better explain why America can't just get all of its resources within its own borders.

7th Grade Science Unit 1: A Balanced Biosphere**Task 2: Using Available Resources**

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2. In this task, we focused on the crosscutting concept of:
- **Cause and Effect:** cause and effect relationships may be used to predict phenomena.
Where did you see examples of **Cause and Effect** in this task?
3. Now that you have learned more about how natural resources are distributed, what questions do you still have?

7th Grade Science Unit 1: A Balanced Biosphere**Task 3: Produce, Reuse, Recycle**

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Engage

In the last two tasks, we learned about non-living parts of an ecosystem, such as geologic features like mountains and natural resources like oil. However, every ecosystem also has **living parts** as well, like plants and animals. How do all these different parts interact to keep the ecosystem functioning as a whole?

With a partner, think about the following case study. Throughout this task, you will be gathering evidence to help you explain what happened:

In 1815, on the Indonesian Island of Sumbawa, the volcano Mount Tambora erupted, immediately killing thousands and causing much of the world to enter a global chill. The year that followed is known as “The Year Without Summer” because the volcano scattered tons of ash and debris into the air, blocking some of the sunlight that usually warms the Earth’s surface. In that year, thousands of plants and animals died, leaving thousands more humans to die without food.



Systems and System Models: Write a hypothesis: Why do you think so many plants and animals died?

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explore

Developing and Using Models: In order to understand what happened in the case of the Mount Tambora eruption, let’s explore the typical interactions in an ecosystem. With your group,

1. Cut apart and analyze the ecosystem cards provided by your teacher.
2. **Energy and Matter:** Discuss with your group how the different parts of the ecosystem might interact and arrange them on a piece of poster paper. Some discussion questions you might want to consider are:
 - What parts are living and what parts are non-living?
 - What non-living matter does each living organism need to live and grow?
 - What non-living matter does each living organism produce in its daily life?
 - Where does each living organism get its energy to live and grow?
 - Who eats who?

7th Grade Science Unit 1: A Balanced Biosphere**Task 3: Produce, Reuse, Recycle**

3. **Systems and System Models:** Draw arrows and labels to describe how you think the different parts interact. Make sure to use pencil so you can revise it!

Explain

Developing and Using Models: Your group has used your prior knowledge to construct an initial model of an ecosystem and its interactions.

1. Individually, read the article provided by your teacher to learn more about ecosystem interactions. Use the annotation strategies provided by your teacher.
2. As a group, use this new information to revise your model and create a final poster using glue and markers provided by your teacher. Your model should include:
 - All the parts of the ecosystem
 - Relevant labels (Ex: producer, consumer, decomposer)
 - **Systems and System Models:** Arrows that show all interactions between the different parts
 - **Energy and Matter:** Captions that explain how energy flows through the ecosystem
 - Captions that explain how matter is cycled through the ecosystem

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Elaborate

Systems and System Models: Return to the case study of the Mount Tambora eruption. Why did so many plants and animals die? Individually explain what happened using what you have learned about the cycling of matter and energy amongst parts of an ecosystem. You may write a paragraph or draw a flowchart to explain.

7th Grade Science Unit 1: A Balanced Biosphere**Task 3: Produce, Reuse, Recycle**

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Evaluate: Connecting to the Culminating Project

You will be creating an arena that mimics an environment you may see on Earth. Your arena already has its main geological features, but as we learned today, there are also other non-living factors and living factors that make up an environment. Design the landscape of your arena, focusing on the non-living things that will be needed to support life.

- ✓ Draw a visual diagram showing how non-living matter will cycle through your environment (You do not need to pick specific plants and animals for your arena yet; you can just draw example plants and animals for this diagram).
 - Be sure to label the examples of living and non-living matter and use arrows to show where they go.

This should be individually completed in your Project Organizer.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Reflection

Individually reflect on Task 3, using the questions provided:

1. At the beginning of this task, you wrote a hypothesis for the case of the Mount Tambora eruption. Look back at your initial response: were you correct? After learning everything you have about cycling of energy and matter, how could you revise or add to your hypothesis?

2. In this task, we focused on the crosscutting concepts of:
 - **Systems and System Models:** Models can be used to represent systems and their interactions within and between systems.
 - **Energy and Matter:** The flow of matter and energy can be tracked through a natural system.Where did you see examples of **Systems and System Models** and **Energy and Matter** in this task?

7th Grade Science Unit 1: A Balanced Biosphere**Task 3: Produce, Reuse, Recycle**

-
3. Now that you have learned more about how matter and energy cycle among living and non-living parts of an ecosystem, what questions do you still have?

7th Grade Science Unit 1: A Balanced Biosphere

Task 4: Interactions Between Organisms

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Engage

In the last task, we saw how matter and energy are cycled through ecosystems by plants and animals. However, exchanging non-living matter is not the only way plants and animals interact in an ecosystem.

Imagine any kind of ecosystem in your mind and think of the type of animals and plants you would find there. Individually, brainstorm at least three ways you can imagine specific organisms interacting in this environment. Draw a picture of this environment, including these organisms. Write captions or a paragraph to describe each interaction shown.

Discuss:

1. **Patterns:** Share your pictures with a partner who drew a different type of ecosystem than you. Even though your ecosystems are different, did you draw any similar interactions amongst your organisms? Describe any similarities below:

7th Grade Science Unit 1: A Balanced Biosphere

Task 4: Interactions Between Organisms

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explore

You and your classmates all drew different environments, but many of you described similar interactions amongst your organisms. Today you are going to look at real-life examples of relationships between organisms across a large variety of ecosystems to see if you notice any **patterns**.

Individually, visit each station. In the data collection chart below, record what organisms you see interacting and describe how you see them interacting in the ecosystem. Make sure to write down the correct station number. Listen for the timer or your teacher to know when to move to the next station. Continue until you have visited every station.

Station Number	Characteristics of Ecosystem	Organisms Involved	Description of Interaction

7th Grade Science Unit 1: A Balanced Biosphere

Task 4: Interactions Between Organisms



Station Number	Characteristics of Ecosystem	Organisms Involved	Description of Interaction

7th Grade Science Unit 1: A Balanced Biosphere

Task 4: Interactions Between Organisms

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explain

Constructing Explanations: As you visited the stations, you may have noticed some **patterns** between some of the situations. Use the Interaction Cards provided by your teacher which show each of the situations from the stations. With your group,

1. Cluster the Interaction Cards that show interactions that seem alike. Record these groupings in the bottom of each box below. *You do not need to use all the boxes provided.
2. In each box, describe the type of interaction that explains why you grouped pairs of organisms in the same category.
3. Lastly, assign each grouping a label that represents the type of interaction.

<p>Label: _____</p> <p>Description of Interaction:</p> <p>Example Pairs of Organisms:</p>	<p>Label: _____</p> <p>Description of Interaction:</p> <p>Example Pairs of Organisms:</p>	<p>Label: _____</p> <p>Description of Interaction:</p> <p>Example Pairs of Organisms:</p>
<p>Label: _____</p> <p>Description of Interaction:</p> <p>Example Pairs of Organisms:</p>	<p>Label: _____</p> <p>Description of Interaction:</p> <p>Example Pairs of Organisms:</p>	<p>Label: _____</p> <p>Description of Interaction:</p> <p>Example Pairs of Organisms:</p>

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Task 4: Interactions Between Organisms

Your group created your own labels for the interactions you saw. Scientists have also done the same thing! After your teacher reviews the scientific names, match your label with the scientific name for the interaction in the chart below:

Interaction Description	Your Label	Scientific Name
Two organisms fight over a resource, such as food, water, or territory.		
One organism lives on or inside another organism and harms it in the process.		
Both species benefit from the relationship.		
A predator feeds on its prey.		
One member of the relationship benefits and the other is neither helped nor harmed.		

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Elaborate

Patterns: Now that we know how organisms interact across ecosystems, we can use these interactions to identify cause and effect relationships in real ecosystems. Using what you have learned from the station cards, individually explain each of the scenarios below:

1. The zebra population is exploding in the savannah. At the same time, populations of many small animals that live in the Red Grass that zebras eat are beginning to die out. Why do you think populations of these small animals are dying out? What could we do to help prevent these small animals from going extinct?

7th Grade Science Unit 1: A Balanced Biosphere**Task 4: Interactions Between Organisms**

2. Since *Finding Nemo* came out in theaters, there has been an increased demand for pet clownfish. Now marine biologists are noticing that the sea anemone population is also decreasing. What can we do to help build up the sea anemone population? Explain why your solution would help.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Evaluate: Connecting to the Culminating Project

You will be creating an arena that mimics an environment you may see on Earth, including any relevant organisms. In your arena, you will be creating a challenge for your contestants, so the winner may win additional supplies. The challenge will be to locate a specific plant/animal by using information about another plant/animal. The contestants will use their knowledge of ecosystem interactions to connect the known plant/animal to the unknown plant/animal.

- ✓ Identify what plants and animals you will include in your arena.
- ✓ Design this challenge by making a flowchart tracing one organism to another using at least two different organism interactions we have studied.
- ✓ Explain how each plant/animal leads the contestant to the next plant/animal by describing the organism interactions.

This should be completed individually in your Project Organizer.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Reflection

Individually reflect on Task 4, using the questions provided:

1. At the beginning of this task, you were asked to brainstorm three ways you could imagine organisms interacting in an ecosystem. Look back at your brainstorm: after visiting all the stations today, how would you add to your brainstorm? What types of interactions were you missing?

7th Grade Science Unit 1: A Balanced Biosphere**Task 4: Interactions Between Organisms**

2. In this task, we focused on the crosscutting concept of:
- **Patterns:** Patterns can be used to identify cause and effect relationships and provide information about natural systems.

Where did you see examples of **Patterns** in this task?

3. Now that you have learned more about how organisms interact in an ecosystem, what questions do you still have?

7th Grade Science Unit 1: A Balanced Biosphere

Task 5: A Chain of Resources

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Engage

In the last task, we learned that all organisms interact with each other. We have also learned in this unit that all organisms need certain resources to survive. Knowing this can help us make predictions about how changing one part of an ecosystem can affect another part.

With a partner, use your observation skills and prior knowledge to answer the following questions:

1. Watch the clip about tropical rainforests. What do you see? What plants, animals, and non-living things exist in a rainforest?

2. **Cause and Effect:** Predict what may happen if we took away 95% of the rainwater from the rainforest? How would this affect all the things you listed above?

7th Grade Science Unit 1: A Balanced Biosphere

Task 5: A Chain of Resources



Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explore

As you can see, changing one aspect of an environment can create a chain of events that affects many other parts of an environment! Today we will use a computer simulation that models these processes, so you can analyze and interpret data based on real environments.

Systems and Systems Models: In pairs or as a group, follow the instructions below and record data about the ecosystem model in the data collection tables.

Setting Up the Simulation

1. Open the web browser on your computer and navigate to google.com.
 - a. Type “**Interactive Labs Ecology Lab**” into the search bar and press enter. Select the first choice that comes up.
2. Read the overview on the first page aloud with your group members.
3. Press “**Open Simulator**” above on the right.
 - a. Here you will see options of organisms to include in your ecosystem on the left. On the right, you will see your ecosystem. Each plant is represented by a different color and each animal is represented by a different symbol.

Simulation 1

1. Press “**All Off**” to clear your ecosystem. At this point, your ecosystem has a limited supply of water, nutrients, and sunlight available to be used.
 - a. Add **Plant A** and **Plant B** to your ecosystem and press **Run. Pause** at approximately 50 days. Record observations in your data table.
 - b. Use the “Reset” button to clear your ecosystem again. Add **Plant B** and **Plant C** to your ecosystem and press **Run. Pause** at approximately 50 days. Record observations in your data table.

Organisms in Ecosystem	Observations
Plant A Plant B	
Plant B Plant C	

7th Grade Science Unit 1: A Balanced Biosphere

Task 5: A Chain of Resources

Analyzing and Interpreting Data:

- What do the graphs tell you about the interaction between the plants?

Simulation 2

1. Press **“All Off”** to clear your ecosystem. At this point, your ecosystem has a limited supply of water, nutrients, and sunlight available to be used.
2. Add **Plant A** and **Plant B** to your ecosystem.
3. Now let’s add an animal to eat one of these plants. Press the **bunny** and then select **“eats Plant A.”** Run until approximately 100 days and then press **Pause**. Record observations in your data table.
4. Answer the discussion questions below.

Organisms in Ecosystem	Observations
Plant A Plant B Bunny (who eats Plant A)	

Analyzing and Interpreting Data:

1. Why do you think the results are different than Simulation 1?

2. How did the amount of Plant A change? How did this affect the population of Plant B?

7th Grade Science Unit 1: A Balanced Biosphere

Task 5: A Chain of Resources

3. Look at the graph in the bottom half of the page. The orange line represents Herbivore A (the bunny). It shows an increase in the bunny population at first, but then it decreases and levels off in a straight line. How could you explain this?

Simulation 3

1. Press “**All Off**” to clear your ecosystem. At this point, your ecosystem has a limited supply of water, nutrients, and sunlight available to be used.
2. Add **Plant C** to your ecosystem.
3. Add a Deer (Herbivore C) to eat your Plant C by pressing the **deer** and then selecting “**eats Plant C.**”
4. Add a Wolf (Top Predator) to eat your Deer by pressing the **Wolf** and selecting “**eats Herbivore C.**”
 - a. **Run** until approximately 100 days and then press **Pause**. Record observations in your data table.
5. Now remove your Wolf by pressing the **Wolf** and de-selecting “**eats Herbivore C.**”
 - a. **Run** until approximately 100 days and then press **Pause**. Record observations in your data table.
6. Answer the discussion questions below.

Organisms in Ecosystem	Observations
Plant C Deer (Herbivore C who eats Plant C) Wolf (Top Predator who eats Deer)	
Plant C Deer (Herbivore C who eats Plant C)	

Analyzing and Interpreting Data:

1. How did taking out the Top Predator (wolf) affect this ecosystem? Why?

7th Grade Science Unit 1: A Balanced Biosphere

Task 5: A Chain of Resources

2. What are some other effects that you think might occur in this ecosystem because of this?

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Explain

We know that we don't have an infinite supply of resources in the world. In every environment, there is a limited amount of water, nutrients, and other resources available to the organisms there.

Constructing Explanations: In pairs or as a group, use the data you collected above and **Cause and Effect** reasoning to come up with a general rule to the following question: How do available resources affect the populations of different organisms in an ecosystem? Use at least one example from the simulation as evidence to justify your rule.

Here are some sample sentence stems you may use to construct your rule:

- When there are more resources, this can result in _____.
- When there are less resources, this can result in _____.
- When an increased number of organisms uses up more of the resources, this may result in _____.
- For example, in the simulation, we saw that _____ led to _____.

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Elaborate

We know that the resources available affect the population of different plants and animals in ecosystems. Unfortunately, human beings don't always think about this when they need or want certain resources.

Tropical rainforests are essential ecosystems that provide all sorts of benefits to our world: clean water, abundant oxygen, sources of medicine, and incredible plant and animal diversity. However, they are currently in great danger because of the actions of many human beings. Watch the videos provided by your teacher and discuss the following questions with a partner.

7th Grade Science Unit 1: A Balanced Biosphere**Task 5: A Chain of Resources**

This first video shows a time-lapse of deforestation in the Amazon rainforest:

1. What resource is being depleted (taken away) here?
2. Why do you think this resource is necessary for organisms in this ecosystem?

The next video gives you some more background on deforestation:

3. Why are humans cutting down trees?
4. What effects does deforestation have on the population of plants and animals in that area?
5. What can we do to stop this from happening?

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Evaluate: Connecting to the Culminating Project

You will be creating an arena that mimics an environment you may see on Earth. Reflect back on the last two responses in your Project Organizer. Think about what key resources are needed in order to accommodate the organisms you have chosen. Based on these key resources, prepare for the worst:

- ✓ If budget constraints resulted in removal of one main resource, predict what will happen to the populations of different organisms in your arena.
- ✓ Figure out as many effects as you can and explain them in a flowchart or paragraph format. Use data from the task to justify your predictions.

This should be completed individually in your Project Organizer.

7th Grade Science Unit 1: A Balanced Biosphere

Task 5: A Chain of Resources

Unit Essential Question: *How have natural processes and human activities created the ecosystems we see today?*

Reflection

Individually reflect on Task 5, using the questions provided:

1. At the beginning of this task, you were asked to make a prediction about what would happen if you took away water from the rainforest. Look back at your prediction: after collecting data evidence today, how would you change or add to your prediction? Are there any additional effects to any populations you may not have initially thought of?

2. In this task, we focused on the crosscutting concepts of:
 - **Cause and Effect:** How cause and effect relationships can be used to make predictions.
 - **Systems and System Models:** Models can be used to represent systems and their interactions within and between systems.

Where do you see examples of **Cause and Effect** and **Systems and System Models** in this task?

3. Now that you have learned about how availability of different resources affects the populations of different organisms, what questions do you still have?