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

**Introduction**

In the last task, students thought about how animals and plants interact when they cycle through nonliving matter. In this task, students remember that this is not the only way organisms interact in an ecosystem. In every ecosystem, there are a large variety of organisms that interact in certain ways, maintaining the delicate balance of that ecosystem. Regardless of the type of ecosystem, there are patterns that can be noticed in the way organisms interact with each other. These patterns have been classified into five different relationships: competition, predation, commensalism, mutualism, and parasitism. In this task, students will analyze real-life examples in order to find their own patterns and make their own categories to explain interactions among organisms. They will then be able to use these patterns to identify causal relationships within other real ecosystems. As students begin to populate their arena with organisms for their culminating project, they will use these relationships to design a challenge for the game contestants.

**Alignment Table**

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| --- | --- | --- | --- |
| **Performance Expectations** | **Science and Engineering Practices** | **Disciplinary Core Ideas** | **Crosscutting Concepts** |
| **MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.] | **Constructing Explanations**   * Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. | **LS2.A: Interdependent Relationships in Ecosystems**   * Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. | **Patterns**   * Patterns can be used to identify cause and effect relationships. |
| **Equity and Groupwork**   * Share ideas to analyze photos. * Come to consensus to cluster and label organism interactions. | | | |
| **Language**   * Write descriptions of photograph scenarios. * Create classification labels. | | | |

**Learning Goals**

This learning task asks students to identify patterns of interactions among organisms in different ecosystems. More specifically, the purpose is to:

* Engage prior knowledge of how organisms interact in ecosystems.
* Explore examples of organisms interacting in different types of ecosystems.
* Cluster scenarios and explain any patterns of organism interactions across ecosystems.
* Apply patterns of organism interactions to identify causal relationships within real ecosystems.
* Apply knowledge of organism interactions to design a challenge for arena contestants.

**Content Background for Teachers**

No organism exists in a vacuum; organisms are constantly interacting with both the nonliving matter and the living organisms around them. These interactions allow the organism to survive and the ecosystem to flourish.

In the last task, students learned about how plants and animals interact as they cycle energy and matter. Refer back to the background section of Task 3 for more information on this content. In discussing cycling of matter, one of the relationships between organisms that students explored was the feeding relationship. This type of relationship is the most common type of organism interaction that comes to mind when people think about ways organisms interact. This interaction is also known as predation. Examples of predation are owls that eat mice or lions that eat gazelles.

However, there are many other ways that organisms interact in an environment. When two organisms fight over a resource, such as food, water, or territory, this interaction is known as competition. This can happen within a species or between species. For example, male deer fight each other for mates. Also, lions and hyenas compete with each for prey.

Another relationship that occurs amongst organisms is known as commensalism, where one organism benefits while the other is neither helped nor harmed. For example, barnacles grow on whales, which gives the barnacles more access to feeding opportunities, but does not affect the whale at all.

When one organism benefits and the other organism is harmed in the relationship, this is called parasitism. A common example of this is ticks on dogs or mosquitos on humans; the ticks and mosquitos survive off the blood, but the humans and dogs can get diseases and other negative symptoms.

Lastly, there is mutualism, in which both species benefit. Bees and flowers are an excellent example of this; bees are able to extract nectar from the flowers and the flowers get their pollen spread by the bees, producing more flowers.

As students know from Task 3, decomposers also play an essential role in every ecosystem in cycling matter throughout an ecosystem. However, they were not included in this task because decomposers can fit into many of the previously described relationship categories, depending on the type of decomposer. For example, different fungi can be parasitic, mutualistic, or commensalistic!

**Academic Vocabulary**

* Organism
* Interaction
* Competition
* Predation
* Commensalism
* Parasitism
* Mutualism

**Time Needed (Based on 45-Minute Periods)**

4 Days

* Engage: 0.5 period
* Explore: 1 period
* Explain: 1 period
* Elaborate: 0.5 period
* Evaluate and Reflection: 1 period

**Materials**

* Unit 1, Task 4 Student Version

Explore

* Station Cards in sheet protectors (2-3 at each station)

Explain

* Interaction Cards (laminated, cut, and put in an envelope per group)

Evaluate

* Project Organizer Handout

**Instructions**

**Engage**

1. Introduce Task 4: In the last task, we saw how matter and energy are cycled through ecosystems by plants and animals. Think about what you were still wondering about at the end of the last task (look back if you need to). What questions do you still have?
   * Before you pass out their student guide, give students time to reflect individually or with a partner about the questions they recorded at the end of the last task. Share a few of these out as a class, using facilitating questions to guide students toward questions that relate to this task.
2. Transition to Task 4: However, exchanging nonliving matter is not the only way plants and animals interact in an ecosystem. In this task, we will ask the question: In what other ways do organisms interact?
   * Now pass out their Task 4 student guide.
3. In this activity, students imagine any kind of ecosystem, including the types of plants and animals they would find there. After individually brainstorming at least three ways that organisms might interact in this environment, they create a drawing that shows the environment, the organisms, and their interactions.
   * All students should be able to imagine and draw an ecosystem of their choice. For example, a rainforest, a river, an ocean, a deciduous forest, etc.
   * While most students will describe predator-prey relationships, encourage students to think outside that category with facilitating questions, like: What other ways can you see animals and plants interacting besides eating? What if two animals eat the same food? Drink water at the same source? Etc.
4. Then have students share their pictures with a partner that has a different ecosystem than they have.
   * The purpose of this exercise is for students to begin to recognize patterns of similar interactions drawn even if the ecosystems are different. It will also expose students to interactions they may not have thought of themselves.
     + This starts students thinking about the crosscutting concept of **Patterns**, as they identify similar interactions across ecosystems.
   * Students should record these similarities in their student guide. Share out a few similarities as a class, using equity sticks (See “How to Use this Curriculum” for more details).

**Explore**

1. Even though students drew different environments in the *Engage*, many of the drawings depicted similar interactions amongst organisms. In this section of the task, students explore real-life examples of different ways organisms interact.

* Here, students are continuing to approach organism interactions through the lens of **Patterns**, as they identify patterns across different ecosystems. They will then be able to use these patterns to identify causal relationships in other ecosystems later in the task.

1. Set up 10 small stations around the room with 2-3 of each station card available for students to look at.
   * Optional: For a more advanced option, leave out the captions on each station card.
2. Give students 1-2 minutes per station to make observations about what they see happening in the picture and record this in their student guide.
   * We recommend the use of timers to signal students to move to the next station.
   * Continue until they have visited every station.
   * \*You will notice that each station has a short description of what is going on in the picture. These descriptions highlight the fact that every one is happening in a different type of ecosystem. In their student guide, students will describe characteristics of each ecosystem to highlight this aspect of the Performance Expectation.

**Explain**

1. In this part of the task, students return to their group to try to make sense of what they saw. Students will work together to cluster the different interactions they saw into groups of ones that seemed similar.

* Again, students are using the crosscutting concept of **Patterns** to identify similarities across ecosystems and cluster pairs of organisms accordingly. As students describe the qualitative relationships between organisms that are common across ecosystems, they are also utilizing the science and engineering practice of **Constructing Explanations**.

1. We recommend reviewing the instructions as a class and taking clarifying questions before students begin. Provide each group with Interaction Cards that show the situations they just viewed in the stations. You may also want to model the process with a few of the Interaction Cards.

* Students kinesthetically manipulate the scenarios as they make sense of their interaction groupings.
* Once students have clustered their Interaction Cards into groups according to the patterns they noticed, they should record these groups in their student guide. They will cite relevant example pairs of organisms and also assign their own labels to represent the patterns they see.
  + These labels should not be scientifically accurate, but should represent the patterns they see. For example, they may label predation as “feeding” or mutualism as “both benefit” etc.

1. Because this is a collaborative task, we recommend assigning roles to each group. You may use whatever roles you prefer. We recommend the use of the Facilitator, Materials Manager, Harmonizer, and Recorder.
   * Ask the Facilitator to read the directions and to make sure everyone understands the task.
   * Ask the Materials Manager to gather the materials needed to complete the task.
   * Ask the Harmonizer to make sure that everyone contributes their ideas and that everyone’s voice is heard.
   * Ask the Recorder to make sure the group is recording all groupings in their student guides.
2. When all students are finished grouping scenarios and assigning their labels, assign each group a few Interaction Cards that they will be responsible for.
   * Call one group up at a time to place their Interaction Cards on the board. As groups come up, they should add their Interaction Cards to other groupings or start new groupings as they see fit.
   * Analyze the class groupings as a class.
     + Ask pairs of students to discuss if they disagree with any of the classifications on the board and why. Then share these disagreements out.
     + Continue the class discussion and modify the groupings on the board until a general consensus is reached.
     + Use facilitating questions to encourage students to get to the five scientific groupings that you know, but students don’t know at this point.
   * Just like students found patterns, made groups, and assigned categories, so did scientists! Next to the interaction card groups, write the corresponding scientific names on the board. Have students write these in their student guide, matching the scientific names to their own labels.

Station Cards Explained

|  |  |  |
| --- | --- | --- |
| **Interaction** | **Description** | **Examples** |
| Competition | Two organisms fight over a resource, such as food, water, or territory. | * Squirrels: Squirrels fight over food resources, like acorns. * Plants: Plants fight over sunlight resources to grow. |
| Parasitism | One organism lives on or inside another organism and harms it in the process. | * Mosquitos and humans: mosquitos feed off the blood of humans and can give them diseases. * Ticks and dogs: ticks feed off the blood of dogs and can give them diseases. |
| Mutualism | Both species benefit from the relationship. | * Bees and plants: The bees pollinate the flowers to help them reproduce and the flowers provide the bees with nectar. * Sea anemone and clownfish: The sea anemone protects the clownfish with its poisonous tentacles and the clownfish helps to lure in prey. |
| Predation | A predator feeds on its prey. | * Wolves and deer: Wolves hunt and eat deer. * Lion and zebra: Lions hunt and eat zebra. |
| Commensalism | One member of the relationship benefits and the other is neither helped nor harmed. | * Barnacles and whales: Barnacles don’t help the whale, but they do benefit by the movement of water delivering food particles to them. * Cattle Egrets and Livestock: Cattle egrets follow cattle around and eat up the insects that get stirred up from vegetation as the cattle walks through it. |

**Elaborate**

1. Now that students understand the relationships between organisms, they can use these interactions to identify cause and effect relationships in real ecosystems. This continues to build students’ understanding of **Patterns**, as they use the patterns they have identified throughout the task to identify causal relationships within other real ecosystems.
2. Students should individually read each of the scenarios provided on their student guide and respond to the questions. Possible answers are provided below:
   * Question 1: The zebras are eating all the Red Grass, so many small animals don’t have a home. In order to prevent their extinction, we could introduce more lions into the Savannah, which will hunt the zebras. This will lead to less zebra, more Red Grass, and more homes for the small animals.
   * Question 2: Since people are buying too many clownfish, there are not enough clownfish to help lure prey into the sea anemones, causing them to die out. We must restrict the number of clownfish able to be bought from the ocean or breed them in facilities. That way, there will be more clownfish to help lure prey to the sea anemones and keep them alive.
   * This can be a good option for formative assessment. Collect student work to identify trends in students’ ability to use patterns of organism interactions to identify causal relationships in other ecosystems. See “How to Use This Curriculum” for strategies on utilizing formative assessment data to provide feedback to students and inform classroom instruction.
3. Return to the whole-class concept map from the Lift-Off Task.
   * In small groups, have students brainstorm new concepts and new connections that they have learned in this task, as well as any new questions that have come up for them. Then have groups share these aloud in a class-wide discussion and add to the class concept map. The use of equity sticks is encouraged for more equitable participation in class-wide discussions (See “How To Use This Curriculum” for more details).
     + Some facilitating questions to ask students are: What new ideas/concepts do you want to add to the map? What connections do you want to add or change? What is your reason for that addition/revision? What connections can we make between the questions/ideas already on the map? What new questions do you have about the phenomenon?
     + Draw circles around each question and boxes around each concept.
     + Write connector words to describe connections between the concept boxes.
     + For this task, students may begin to connect some of their previous question circles to concept boxes about the following: how organisms interact across different ecosystems.
   * Have students analyze the additions to the class concept map for as many examples of this task’s crosscutting concept as they can find. Once a student has identified the crosscutting concept, you can trace the circle in the corresponding color (decided on in the Lift-Off task). We recommend asking students to share key words that helped them identify the crosscutting concept for that concept or question. Some identifying words students might look for are:
     + **Patterns**: These could be phrases such as, “is the same as”, “has in common with”, “is similar to”, “shares” etc.
   * Once again, the purpose of this concept map is to facilitate generation of student questions, promote language development, and support understanding of the science content throughout the unit. Allowing students to ask their own questions and use their own words to make meaning of the concepts will not only help them make deep connections about science content, but will also help their oral and written language development.

**Evaluate: Connecting to the Culminating Project**

1. Students independently complete the Task 4 section of the Unit 1 Project Organizer in class. Revisions can be done for homework, depending upon student’s needs and/or class scheduling.
2. Students have been tasked with creating an arena that mimics an environment they may see on Earth. Their prompt is as follows: 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.

1. Example contestant challenge: A contestant could be asked to start with a bee and in order to win, would end up at the cow. This is because the bee pollinates a plant as it eats its nectar (commensalism), and the plant is then eaten by a cow (predation).

**Reflection**

1. At the end of the task, ask students to reflect on what they have learned over the course of this task by answering the following three questions in their student guide:

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

1. There are no right answers, but encourage students to look back at their student guides and their class concept map. They should not change their initial responses, but rather use this reflection space to add to their ideas and questions based on what they have learned through this task. By generating more of their own questions, students continue to engage in sense-making of the phenomenon and gathering knowledge and skills for their final projects.

**Assessment**

1. You may collect students’ Project Organizer and assess using:

* *Criteria of your choice.* We recommend using the 3-Dimensional Assessment matrix at the beginning of this document to inform your criteria.
* This can be a formative tool to periodically look for trends in student understanding after the completion of a task. You can then use this formative data to inform any re-teaching as necessary.

1. You may also give students time to make revisions with one of the two options:

* Students may make changes to their Project Organizer according to your comments OR
* Ask students to exchange Project Organizers with a partner and give partners 5 minutes to give written feedback. Then allow students time to make changes to their work according to the feedback.