**Unit Essential Question:** *How do humans impact organisms around the world and what can we do about it?*

**Introduction**

In the last task, students saw evidence that global temperatures have been rising in the past century due to human activity, like the burning of fossil fuels. They also made hypotheses about how these rising temperatures might affect Earth’s environments and various organisms. Before students can explore what rising temperatures means for Earth and its organisms, they need to understand what factors influence survival and reproduction of organisms in the first place. In this task, students will learn about the different animal behaviors and plant structures that help organisms to successfully survive and reproduce. In doing so, they will learn that these characteristics are often interrelated and thus organisms, like bees and flowering plants, rely on each other. This sets the stage for the next task where students learn how these characteristics are negatively impacted by global warming. By the end of this task, students will be able to describe the specialized plant structures or animal behaviors that help their specific organism survive and reproduce.

**Alignment Table**

|  |  |  |  |
| --- | --- | --- | --- |
| **Performance Expectations** | **Science and Engineering Practices** | **Disciplinary Core Ideas** | **Crosscutting Concepts** |
| **MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.** [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] | **Engaging in Argument From Evidence**   * Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. | **LS1.B: Growth and Development of Organisms**   * Animals engage in characteristic behaviors that increase the odds of reproduction. * Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. | **Cause and Effect**   * Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. |
| **Equity and Groupwork**   * Participate in group roles to explore stations. * Discuss *Explore* evidence as a class to build consensus. * Share ideas with a partner. | | | |
| **Language**   * Read about new scientific terminology and describe analysis in own words. * Write an argument, using evidence and scientific reasoning. | | | |

**Learning Goals**

This learning task asks students to write an argument supporting the explanation that characteristic plant structures and animal behaviors affect their probability of survival and reproduction. More specifically, the purpose is to:

* Engage prior knowledge of pollination to try to explain how flowering plants and bees rely on one another.
* Explore examples of animal behaviors and plant structures that affect reproduction.
* Write an argument explaining how flowering plants and bees rely on one another, using evidence from research stations.
* Predict what would happen to plants if the bee population continues to decline.
* Apply task knowledge and conduct research as necessary to describe the specific characteristics that help their chosen organism survive and/or reproduce.

**Content Background for Teachers**

In this task, students explore plant structures and animal behaviors that help organisms survive and reproduce. While there are many different examples of these characteristics (see PE Clarification Statement), we specifically chose nesting, migration, bright flowers, and sex pheromones because these examples are also currently affected by global warming in the organisms we focus on in this task. These effects will be explored in Task 3. By selecting these particular plant structures and animal behaviors, and the corresponding organisms, we help to ensure a more cohesive storyline connecting this PE to global warming and potential solutions to minimize detrimental human impact.

Each of the plant structures and animal behaviors students explore has some effect on the probability of successful reproduction for those organisms. With the bee and the flowering plant, students will find that often times, animal behaviors play a role in likelihood of successful reproduction in plants, and vice versa. In the next task, students will find that these relationships create a cascade of downstream effects as organisms respond to global warming.

For information on these specific characteristics, see the *Explore* station cards, as well as the associated sources listed in the Culminating Project Teacher Version.

**Academic Vocabulary**

* Animal Behavior
* Plant Structure
* Reproduce/Reproduction
* Nesting
* Offspring
* Predators
* Migration
* Habitat
* Abundance
* Breed
* Pollen
* Pollination
* Adapt
* Sex Pheromone
* Mimic

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

4 Days

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

**Materials**

* Unit 4, Task 2 Student Version

Explore

* Station Cards (1-2 copies per station) – may need to duplicate stations based on class size

Evaluate

* Project Organizer Handout
* Computers or Tablets, if research is necessary

**Instructions**

**Engage**

1. Introduce Task 2: In the last task, you saw evidence of rising global temperatures and the factors causing them. 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 2: Why does a rise in global temperatures matter? What does this mean for Earth and its organisms? Before we can explore these questions, we first need to understand what actually affects the survival of organisms on Earth. In this task, you will explore examples of different behaviors and structures that allow organisms to successfully survive and reproduce.
   * Now pass out their Task 2 student guide.
3. Ask students to recall what they learned in the Lift-Off task and call on a student to share. Students should recall that the bee population is declining.

* Introduce this task with the following statement: Scientists say that bees and flowering plants heavily rely on each other, so this could be a huge concern.

1. In partners, have students use their prior knowledge about these two organisms to discuss and try to explain what they think scientists mean by this statement. Students should record their thoughts in their Student Guides.
   * Because these are hypotheses, any responses are valid.
2. We highly recommend students share some of these ideas out in a class-wide discussion.

* We encourage using equity sticks to foster more equitable participation in class-wide discussions like these (See “How To Use This Curriculum” for more details).

**Explore**

1. To explain this statement from scientists, students need more evidence about what animal behaviors and plant structures help organisms, like bees and flowering plants, to survive and reproduce. In groups, students visit stations to gather and record this evidence in the table in their Student Guides.

* As students explain how each structure or behavior helps survival and/or reproduction, they emphasize the CCC of **Cause and Effect**. While each structure and behavior likely affects reproduction in some way, successful reproduction has several causes, so these cause-and-effect relationships can only be reflected in terms of probability.

1. Assign 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 and read 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 their analysis in their Student Guide.
2. You can choose to set up the stations any way you’d like. However, because there are only four stations, we recommend making duplicates of each station, so that each station only has one group present at a time.
3. A sample evidence table is provided below:

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **What Organisms Do/Have This?** | **Explain how this helps survival and/or reproduction.** |
| Nesting  *Animal Behavior* | *Shorebird*  *Finnish Bird*  *Magpie Lark* | *This behavior helps animals reproduce by protecting their offspring from danger when they are vulnerable as eggs. Nests hide eggs from predators and shield them from natural elements so more offspring survive.* |
| Migration  *Animal Behavior* | *Salmon*  *Whooping Cranes*  *Caribou*  *Hummingbirds* | *This behavior helps animals reproduce by helping organisms find better breeding locations. These locations are often safer, have better weather, or more food available for the offspring when they are born. This leads more offspring to survive.* |
| Bright Flowers  *Plant Structure* | *Lilac*  *Spider Orchid*  *Glacier Lily* | *This plant structure helps plants reproduce because it attracts pollinators, like bees and insects. They land on the flowers to get food, thus picking up the flower’s pollen and transferring it to another plant.* |
| Sex Pheromones  *Plant Structure* | *Spider Orchid* | *This plant structure helps plants by attracting the male bee with a scent very similar to a female bee. This causes them to land on the flowers and pick up pollen to transfer to another plant.* |

1. After their evidence table, students are given the following discussion question: In what examples did animal behaviors and plant structures seem related? Explain. This question is intended to highlight how animals and plants often rely on each other, which will be emphasized as students explore effects of global warming in Task 3.

* We recommend having students discuss this question in groups and then share out ideas as a class. This not only provides you with a quick check to gauge student understanding, it also is a good equity practice.

**Explain**

1. Now that students have seen all the evidence, they can return to *Engage* scenario: Scientists say that bees and flowering plants heavily rely on each other. Individually, students write an argument that supports or refutes this statement, using evidence from the *Explore* stations and scientific reasoning.

* Here students are using the SEP of **Engaging in Argument From Evidence**, as they write an argument using evidence and scientific reasoning to support an explanation for the bee and flowering plant phenomenon.
* Students will only be incorporating evidence from the “Bright Flowers” resource, but they may be using at least one of the other resources for their Culminating Project, depending on the organism they choose. This also emphasizes the practice of selecting only the evidence that is pertinent to the question.

1. Optional Sentence Frames to Provide:

* I agree/disagree (pick one) with the scientists that say that…
* Based on what I learned in the stations, I think that…
* This means that…
* The bees rely on the flowers for…
* The flowers rely on the bees for…
* Other plants and animals seem to have a similar relationship, like…

1. Possible Student Sample: *I agree with the scientists that say that bees and flowering plants heavily rely on each other. Based on my own prior knowledge and the Explore stations, I know that bees are pollinators. This means that they help flowering plants reproduce by moving pollen between flowers as they look for food. The bees rely on the flowers for food (nectar), which they need to survive. The flowers rely on the bees to reproduce, so they can create more offspring. Other plants and animals seem to have a similar relationship, like the hummingbird and glacier lily.*
2. For additional language support, consider using the *Stronger Clearer* as an opportunity for students to share and revise their arguments. A template is provided below:

|  |  |  |  |
| --- | --- | --- | --- |
| Use the *Stronger Clearer* protocol below to get feedback for your argument and make revisions.   1. **Individual Think Time:** Turn your student guide over so you can’t see it. Take a minute to think about how you will describe your argument to a first partner. 2. **Partner Discussion 1:** You will work in pairs. 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 your argument. * **Student B:** Listen and ask clarifying questions. Ask questions to help Student A describe their argument. For example, you might ask, “How do you think bees and plants rely on each other?” or “What evidence can you use to support that?” * **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.   1. **Partner Discussion 2:**  Repeat the partnering process with another student. Remember to try to strengthen and clarify your argument. Write down new notes, insights, and questions.  |  | | --- | |  |  1. **Partner Discussion 3:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your argument. Write down new notes, insights, and questions.  |  | | --- | |  |   **Revision:** After you have worked with partners to clarify your argument, review your notes and go back to revise your argument. |

1. The revised argument is a good option for formative assessment. Collect student work to identify trends in students’ ability to write an accurate argument supported by evidence and scientific reasoning. See “How to Use This Curriculum” for strategies on utilizing formative assessment data to provide feedback to students and inform classroom instruction.

**Elaborate**

1. Students know from the Lift-Off task that the bee population is declining. Using what they have just learned, students can make a probable prediction about what they think will happen to plants if the bee population continues to decline.

* Here, students are again emphasizing the CCC of **Cause and Effect**. Successful survival and reproduction has several causes, so these cause-and-effect relationships related to plant structures and reproduction can only be reflected in terms of probability.

1. Students should discuss and record their prediction and reasoning in partners, but we highly recommend sharing out predictions in a class-wide discussion. This discussion provides a transition towards the next task, as students will be thinking about how global warming affects multiple organisms because of their relationships with each other.
2. 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: plant structures that affect reproduction, animal behaviors that affect reproduction, and relationships between environments, plants, and animals.
   * 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:
     + **Cause and Effect:** These could be phrases such as, “that results in,” “that causes,” “that explains why,” “is due to,” 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 2 section of the Unit 4 Project Organizer in class. Revisions can be done for homework, depending upon student’s needs and/or class scheduling.
2. You have been asked to create an advocacy video that describes the human impact on an organism and gives a potential solution. Their prompt is as follows: Consider your chosen organism and do additional research, as necessary:

* What specialized structures OR behaviors does your organism have that help it survive and reproduce? Describe how these characteristics specifically help with survival and/or reproduction.

**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 explain what you thought scientists mean when they say plants and bees rely on each other. Look back at your responses in the *Engage* and your argument in the *Explain*. How has your thinking changed or remained the same over the course of this task?
* In this task, we focused on the crosscutting concept of **Cause and Effect**: Phenomena may have more than one cause, and sometimes relationships can only be described using probability. Where did you see examples of **Cause and Effect** in this task?
* Now that you have learned more about the characteristics that affect organisms’ survival and reproduction, 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.