TEACHER GUIDE
EVALUATE LESSON 20

Food and Agriculture Center for Science Education

Module Question: *What impact does the dairy production system have on biodiversity?*

What We Figure Out:

We return to Media Claims 11 and 12 and evaluate them for their accuracy. We figure out that these media claims are both true, but one of them is missing context. The media claim about the agricultural system being the primary driver of biodiversity loss may have some truth to it, but it leaves out important details about how agricultural systems, like the dairy system are trying to redesign their systems to reduce their contributions to biodiversity loss.

3D Learning Objectives:

Students evaluate the validity of media claims about the design of the dairy system and its unintended effects on biodiversity.

Students construct an argument using evidence about the overall economic, social, environmental, and geopolitical costs and benefits of the design of the dairy system.

Students provide respectful critiques of the arguments of their peers by asking questions and probing reasoning about how the costs and benefits of the way the dairy system was designed to accomplish its tasks.

Time estimate:

50 minutes

Materials:

Lesson 20 Student Guide
Lesson Student Handout Feedback Sheet
Lesson 20 Student Handout Feedback Sheet Key

Targeted Elements

SEP:	DCI:	CCC:
ARG-H4: **Construct**, use, and/or **present an oral and written argument** or counter-arguments **based on data and evidence.** **ARG-H3:** **Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions,** responding thoughtfully to diverse perspectives, and **determining what additional information is required to resolve contradictions.** **INFO-H4:** **Evaluate the validity and reliability of** and/or synthesize **multiple claims,** methods, and/or designs **that appear in** scientific and technical texts or **media reports, verifying the data when possible.**	**LS4.D-H2:** **Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution**, introduction of invasive species, and climate change. **Thus, sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth.** Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. **ESS3.A-H2:** **All forms of** energy production and other **resource extraction have associated economic, social, environmental,** and geopolitical **costs and risks as well as benefits**. New technologies and social regulations can change the balance of these factors.	**CE-H3:** **Systems can be designed to cause a desired effect.** **SYS-H1:** **Systems can be designed to do specific tasks.**

Directions

Part 1: Our Motivation

USE OF PHENOMENA

In this lesson, students will use what they have figured out about the Module Phenomenon, how the construction of the dairy system can impact biodiversity, to return to the Anchor Phenomenon and evaluate selected media claims once again.

Prompt students to consider where the class stands in explaining the Anchor Phenomenon. What has the class learned about the dairy system's impact on the environment? In student responses, listen for the following:

- We have created models that show how the construction of the dairy system, especially monocultured crops, can impact biodiversity.
- We have figured out how to create a spreadsheet model that will calculate the biodiversity of a sample of land.
- We have gathered evidence from texts that show how biodiversity is an important feature of a functioning food system.

Direct students' attention to their media claims posters from Lesson 1. Ask students how they think what they have figured out so far will help them re-evaluate these media claims. Students can record their thoughts in their Lesson 20 Student Guide Part 1: Our Motivation.

- Listen for student responses that indicate that students should have some new information now to evaluate the media claims about the dairy industry's impact on biodiversity.

Build off student responses to share that what we have figured out about how the dairy system impact biodiversity will help us reassess the media claims and determine how the dairy production system impacts the environment. You can also point to any student questions on the Driving Question Board about Media Claims 11 and 12. Direct students' attention to these media claims and share that students will now re-evaluate the validity of these claims based on the new evidence they have gathered in the module. They will then revise their arguments for what they think the overall impact of the dairy system is on the environment.

Part 2: Evaluate Claims

Ask students to look back at the Dairy System and Biodiversity Model they created in this module. Ask students to discuss as a group how their models can help inform how they will help evaluate the validity of the media claims representing the dairy industry's impact on the environment. Share these questions with the group to help facilitate the discussion:

- What new knowledge have you gained to answer the Driving Question, ***"How does dairy production impact the environment?"***
- What new evidence did you gain about how dairy production might impact the biodiversity?

Share with students that they will complete a performance assessment in this lesson. Share that they will sometimes work in groups and, at other times, individually. Share that students can use any of the resources from the module to support them in the performance assessment tasks in this lesson.

For the first assessment task item, give students access to Media Claims 11 and 12 from the Lesson 1 Media Claims. Ask students to use the new information they gathered in their models and the rest of the evidence throughout the module to re-sort these media claims into the three categories shown on their Lesson 20 Student Guide Part 2: Evaluating Media Claims. Students can work in groups to discuss and sort these claims.

STUDENT SUPPORT

You may want to allow time for students to return to the chart they made in Lesson 1 when sorting all thirteen media claims. Students can now reflect on how their thinking has changed. You can provide a sentence stem such as, "I used to think _____, and now I think _____." to support students in this reflection.

Allow students time to work. As students work, circulate the room and ask pressing questions such as:

- What evidence do you have to evaluate this claim?
- Why are you placing this claim in that column?
- Are there any claims that you changed your mind on? Which ones? Why?
- How has your thinking changed since you first sorted these claims?
- What do you now know about the tasks the dairy system is designed to accomplish? What do you know about its unintended effects?

When groups have finished sorting the claims, students should work independently to assess the validity of a single media claim of their choice. Share the Lesson 20 Task Rubric Part 2 Look Fors with students and read them together. Share that students can use these Look Fors as a guide on how to achieve proficiency on the task.

TEACHER SUPPORT

This is now the third time students have evaluated the validity of media claims. In Lesson 14, you supported students in selecting and using appropriate evidence that is relevant to deciding if the claim is accurate, inaccurate, or misleading. Here, to progress students' proficiency with this SEP, you can support them in choosing multiple pieces of evidence that all together are relevant to the media claim students are trying to say is accurate, inaccurate, or misleading.

After students have completed the task, you can use the Lesson 20 Task Rubric Part 2 to assess students' performance on this task. At the bottom, this rubric also contains guidance for how to support students in using a peer feedback protocol and an activity to discuss and norm on what features of high-quality student responses look like. Use either or both of these to have students reflect on and improve their work should you decide that additional steps are needed for your class to achieve proficiency.

After returning their work to students, you can hold a reflective conversation about the veracity of the media claims. Be sure to highlight to students that it is true that dairy production, particularly clearing land to grow feed crops in monoculture, reduces the biodiversity of a sample of land. However, many of these claims do not give context to share that the dairy system is trying new methods of feeding cattle, such as grazing systems, to help to improve the biodiversity of grazing lands.

Part 3: Construct a Written Argument

Next, in Part 3, students will return to their argument from Lesson 14 Part 3: Construct a Written Argument and revise their argument to indicate if they think the dairy system has an overall positive or negative impact on the environment. Students should use the evidence they gathered in all of modules 1, 2, and 3 to do so. Share with students that this is the final time that they will be updating this argument, so they will now be pulling together evidence from across the unit and using it to come to an overall understanding of the impacts of the dairy system on the environment.

TEACHER SUPPORT
In Module 4, students will identify a specific problem with the dairy system and evaluate a series of solutions to this problem. So, while students will not be updating their arguments once again, they will be considering how the dairy system is looking to improve on its environmental impacts.

Ask students to gather their resources from the module, including models, data sets, and texts from the unit so far.

First, ask students to generate a list of considerations from this module that are important to use in revising their new arguments.
Questions to help the discussion:

- What new knowledge have you gained to answer the Driving Question, ***"How does dairy production impact the environment?"***
- What new evidence did you gain about the biodiversity impacts of the dairy system?
- What can you now add to the list of social, environmental, economic, and geopolitical costs, risks, and benefits that we already knew about the dairy system?

As students share, use a Domino Share Routine to have them build off each other's contributions.

1. Students participate in a free discussion or open exchange with a small group after being given time to think through their responses.
2. Ask one student representative from each group or pair to share what they heard in their conversations.
3. As each subsequent representative shares, they can agree with what has been said, add to it, or disagree and suggest revisions to it.

Listen for responses that describe:

- How the dairy system, including construction of buildings and cropland, impacts biodiversity.
- How new systems of cattle grazing can reduce some of the impacts of the system on biodiversity.

Next, ask students to return to their argument from Lesson 14 about what they thought the overall impact of dairy production is on the environment. Students will now revise their arguments to try to come up with a holistic view of the dairy system based on what they learned in modules one through three of this unit.

Provide students with the Lesson 20 Task Rubric Part 3: Look Fors, read them together, and again allow them to use the Look Fors to guide their responses. Allow students time to individually revise their arguments based on their new understandings from this module. Students can record their new argument in Lesson 20 Student Guide Part 3: Constructing a Written Argument.

TEACHER SUPPORT

This is now the third time that students have been able to write and revise this argument. In Lesson 14, you supported students in developing their use of evidence and reasoning. Accordingly, students may begin to feel independent in their ability to find evidence to support their claim and to use reasoning. Here, to progress their proficiency in developing these arguments, you may want to provide additional support for students in making sure their argument overall is coherent, succinct, and integrates evidence and reasoning.

STUDENT SUPPORT

If students need additional support in writing their arguments, consider:

- Reminding students that they can use any of their resources from throughout the unit to help them write their arguments.
- Focusing students' attention on pieces of evidence they may be overlooking.
- Providing a graphic organizer for writing scientific arguments or having students create their own based on the Look Fors.
- Unpacking the Look Fors together with students and discussing what features of high-quality arguments look like.

CCSS SUPPORT

WHST 9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
Students engage with this standard as they revise their existing explanation about the impact of the dairy system on biodiversity and the environment related to the new scientific evidence they gathered about Simpson's Biodiversity Index. Using their new understanding, they need to present the information obtained from their calculations and models about biodiversity in a way that allows the audience to make sense of their revised explanation.

After students have written their arguments, provide the Lesson 20 Student Self-Assessment handout. Ask students to complete the Written Argument Self-Reflection checklist to give an opportunity for them to ensure they have met the requirements. If students don't have all the elements in the checklist, suggest they look again at the arguments they have written. Give students time to revise their written argument based on their self-reflection.

After students have completed the task, you can use the Lesson 20 Task Rubric Part 3 to assess students' performance on this task. At the bottom, this rubric also contains guidance for how to support students in using a peer feedback protocol and an activity to discuss and norm on what features of high-quality student responses look like. Use either or both to have students reflect on and improve their work should you decide that additional steps are needed for your class to achieve proficiency.

Part 4: Respectfully Critique an Argument

After students have written their arguments, instruct them to share their arguments with their peers and provide respectful critiques of their peers' ideas using the protocol below. Once again provide the Look Fors for students to review prior to beginning the task. Students can use these Look Fors to guide their responses. Students can capture their critiques that they will later share with their partner on their Lesson 20 Student Handout Part 4 Critique Notes.

TEACHER SUPPORT
This is now the third time in the unit that students have engaged in a respectful argumentation session. Accordingly, you can ask students to engage in argumentation without the support of a protocol to see how proficient they have become in respectful argumentation. If you notice students who still need the support of a protocol, you can ask them to again engage in the protocol below.

In pairs, students share their revised arguments following the protocol:

1. Student A shares their argument and the reasoning behind it. Student B listens.
2. Student B rephrases the argument shared by Student A and acknowledges the strengths of the argument. Student A listens.

3. Student A shares gratitude for Student B listening and acknowledging their ideas.
4. Switch roles.
5. Both students list areas of agreement in which their arguments overlap underneath their written argument (on the same page).
6. Both students list areas of disagreement that emerged underneath their written argument (on the same page).

Allow students some time to share each their arguments. As students work, circulate that room to ask pressing questions. For example:

- What was your peer's claim? How did they support that with reasoning?
- What evidence did your peer provide? How well do you think it supports their claim?
- What area of their argument can be improved? How will you ask them to improve it?

CCSS SUPPORT

SL 11-12.1(d): Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. Students engage in this standard when they provide a respectful critique of their peers' ideas. Their assessment of these ideas should be based on evidence and reasoning as opposed to opinion.

STUDENT SUPPORT

To differentiate this practice, the Lesson 20 Student Handout Feedback Sheet includes a blank space for students to provide evidence and reasoning for their feedback – this is for higher-level differentiation. Additional prompts such as, "Did they use the right evidence?", "What is your reasoning?", etc., are provided on another version of the feedback sheet for lower-level differentiation.

After students have completed the task, you can use the Lesson 20 Part 4 Task Rubric to assess students' performance on this task. At the bottom, this rubric also contains guidance for how to support students in using a peer feedback protocol and an activity to discuss and norm on what features of high-quality student responses look like. Use either or both to have students reflect on and improve their work should you decide that additional steps are needed for your class to achieve proficiency.

Part 5: Navigation to Next Module

After students have shared, provided feedback, and noted areas of agreement and disagreement in their arguments, summarize the areas of disagreement and build off student responses to share that how we decide if the costs outweigh the benefits, or the benefits outweigh the costs is a decision that is sometimes difficult to reach a consensus on. What is important, regardless of how we see the overall impact of

the dairy system as positive or negative, is that we have used a framework for analyzing the problem that acknowledges and lays out the benefits of the system while also pointing out its costs and risks.

Point out to students that in the previous lesson they investigated how grazing could reduce the impact of the dairy industry on biodiversity. Ask students if they think that there could be any other solutions to the costs and risks of the dairy system. Return to the Driving Question Board and point out any questions that students asked previously about the solutions the dairy system is pursuing to improve on the different environmental impacts students have identified throughout the unit. Share that students will next investigate how the dairy system is coming up with solutions to improve on its environmental impacts.

STUDENT SUPPORT

Give students the opportunity for self-assessment by having them complete the second part of Lesson 20 Student Self-Assessment, SEP Engagement Self-Reflection. This is the same **optional tool** from Lessons 6 and 14 for students to reflect on their learning in this module and their engagement with the argumentation SEP. After completing this form, students may share their responses with an elbow partner.