TEACHER GUIDE EXPLORE 2 LESSON 17



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

What We Figure Out:

We figure out that changes to biodiversity due to construction or clearing of land don't just impact plants and animals, but they also can affect humans. Humans depend on biodiversity for a variety of reasons, including for food, landscapes of recreational and spiritual value, and connection to wildlife.

3D Learning Objective: Students evaluate scientific information from multiple sources to explain why preserving biodiversity is essential to supporting human life and how the design of the dairy food system is reducing biodiversity.		Time estimate: 50 minutes	Materials: Lesson 17 Stu Articles • What • The Bi Agricu • Increa • Agroe	dent Guide <u>is Happening to Agrobiodiversity?</u> <u>odiversity That is Crucial for Our Food and</u> <u>lture is Disappearing By the Day</u> <u>sing Farm Biodiversity</u> <u>cosystems and Biodiversity</u>	
Targeted Elements					
SEP: INFO-H3: Gather, read, and evaluate scientific and/or technical information from	DCI: LS4.D-H2: Humans depend on the living world for t resources and other benefits provided b		rld for the vided by	CCC: CE-H3: Systems can be designed to cause a desired effect.	
multiple authoritative sources, assessing the evidence and usefulness of each source.	adverse impacts on biodiversity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive				

This work is licensed under a Creative Commons Attribution 4.0 License



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.

Directions



Have students review their Class Consensus Model from Lesson 15 Student Guide Part 3: Creating and Sharing Initial Models. This model shows how they think the construction of the dairy system impacts nearby plants and animals.

Ask students what they have figured out so far:

• Biodiversity seems to decrease when clearing land to make space for monocultured crops.

Confirm that this is the case, then use a Think-Pair-Share to pose a new question to students, "Why do changes to biodiversity matter to humans?" Student responses to this question may vary. Build off student responses to share that they will gather information from texts to help answer this question.

Finally, point to the Biodiversity and Environment category of questions on the Driving Question Board. Share a few selected questions that align with what students will investigate in the upcoming lesson.

Example student questions or ideas could include:

- What is the significance of the changes in biodiversity from clearing land for crops for dairy feed?
- Why is it important for humans to have more plants and animals?
- Why does biodiversity matter?

Students can record these questions in Lesson 17 Student Guide Part 1: Our Motivation. This will help students understand how this lesson connects to what they were trying to figure out about the investigative phenomenon.

Part 2: Obtaining Information from Texts

Students will gather information from texts to help answer the lesson question, "What else is changing biodiversity? Why do these changes matter to humans?" Students will gather in pairs and choose three of the four articles presented to gather evidence.

- o What is Happening to Agrobiodiversity?
- o <u>The Biodiversity That is Crucial for Our Food and Agriculture is Disappearing By the Day</u>
- o Increasing Farm Biodiversity
- o Agroecosystems and Biodiversity

While reading each article, students will record the evidence they find in their Lesson 17 Student Guide Part 2 Obtaining Information from Texts. After obtaining and evaluating the information in the texts, students will reflect on the relative usefulness and relevance of the sources provided by completing the reflection questions on their Lesson 17 Student Guide: Part 2 Obtaining Information from Texts.

TEACHER SUPPORT

To support students in doing a close reading of the article, you may wish to use a reading strategy such as a Partner Read-Aloud in which one student reads a short passage aloud, and the other student listens and shares questions, reflections, and main ideas that they thought of during the reading.

CCSS SUPPORT

RST 9-10.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. Students will engage in this standard by identifying the central ideas of each text and using the information that they find to answer the Lesson Question.

FORMATIVE ASSESSMENT OPPORTUNITY

Students evaluate scientific information from multiple sources to explain why preserving biodiversity is essential to supporting human life and how the design of the dairy food system is reducing biodiversity.

Assessment Artifacts:

- Students' evaluation of which source provided the most relevant evidence to answer the lesson question and how they answered it (Lesson 17 Student Guide Part 2 Obtaining Information From Text).
- Students' summary of the impacts of the dairy system (Lesson 17 Student Guide Part 2 Obtaining Information From Text).
- Students' reflection on the intent of the dairy system (Lesson 17 Student Guide Part 2 Obtaining Information From Text).

Look Fors:

- Students determine the impact of agricultural systems on biodiversity. (LS4.D-H2)
- Students explain how preserving biodiversity is important for humans. (LS4.D-H2)
- Students gather information from multiple sources and evaluate the usefulness of the source by determining which source provided the most relevant information to the investigation. (INFO-H3)
- Students determine if the design of agricultural systems were intended to affect biodiversity. (CE-H3)

Assessment Rubric:

	Emerging	Developing	Proficient
Sample	Evaluation of Which	Evaluation of Which Source Was Most	Evaluation of Which Source Was Most Useful:
Student	Source Was Most	Useful:	The Food and Agriculture Organization article 2
Response	Useful:	The Food and Agriculture Organization	provided the most relevant evidence to answer
	I think the Food and	article 2 provided the most relevant	the question "why does having more or less
	Agriculture	evidence to answer the question "why	biodiversity matter to humans." The reason I think
	Organization article 2	does having more or less biodiversity	that is because it gave a large, detailed list of
	provided the most	matter to humans." The reason I think that	harm biodiversity loss does and how humans
	relevant evidence to	is because it gave a large, detailed list of	actions are responsible for it. I also think that the
	answer the question.	harm biodiversity loss does and how	University of Tennessee article helps describe how
		humans actions are responsible for it.	increased biodiversity is beneficial, such as by
			having negative ecological and economic impacts.
	Reflection on Design of	Reflection on Design of the Dairy System:	Farmers can lose earnings when biodiversity is
	the Dairy System:	The design was created so that the dairy	threated.
	The dairy system makes	farmer could feed their cattle herd and	
	biodiversity go down	that impacted the plants and animals in	Reflection on Design of the Dairy System:
	due to less habitat.	that area by taking away their habitat.	The design was created so that the dairy farmer

	Reflection on the Intent of the Dairy System: I don't think they wanted to harm plants and animals but that happened anyway because they had to grow food for the cows.	Habitat loss makes biodiversity decrease. Reflection on the Intent of the Dairy System: The construction of the diary system was not necessarily intended to have negative effects on biodiversity and consequently on humans. The system was designed to efficiently produce dairy products, but it is having unintended consequences such as soil disturbances, declines in wild food availability, and wild pollinators.	could feed their cattle herd and that impacted the plants and animals in that area by taking away their habitat. That habitat loss is playing a bigger part in the story of human diets/safety/livelihood because the loss of habitats leads to less biodiversity which could have severe impacts on our food system. Reflection on the Intent of the Dairy System: The construction of the diary system was not necessarily intended to have negative effects on biodiversity and consequently on humans. The system was designed to efficiently produce dairy products, but it is having unintended consequences such as soil disturbances, declines in wild food availability, and wild pollinators. The article by the FAO titled, "The biodiversity that is crucial for our food and agriculture is disappearing by the day." states that "Many associated biodiversity species are also under severe threat. These include birds, bats and insects that help control pests and diseases, soil biodiversity, and wild pollinators – such as bees, butterflies, bats and birds."
How to Achieve This Level	Student completes 0-1 out of 4 Look Fors	Student completes 2-3 out of 4 Look Fors	Student completes 4 out of 4 Look Fors

To Provide Additional Support for Students:

If students are struggling to use and evaluate different scientific information, consider providing the following prompts:

- What do you think _____ means?
- Where have you heard the term _____ used before?
- What did the term _____ mean in that situation?
- What are you finding here? How does that help us answer the lesson question?
- What information in this text do you think is most important in answering the lesson question?
- What effect is the agricultural system having on biodiversity? Do you think the agricultural system was intended to have this effect on biodiversity? Why or why not?
- Was this source useful in answering the lesson question? How so?
- What did you find in the article have you observed in your community or personal experiences?

As they read, students will record two pieces of evidence in their Lesson 17 Student Guide Part 2 that help them answer the lesson question. They will also record two reasons why the article was useful or not for answering the lesson question.

SEP SUPPORT

INFO-H3: Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

To engage in the SEP for this lesson, students will both read the articles and evaluate the relevance of the evidence they find and assess the usefulness of the sources. The graphic organizer in the Student Guide will help guide the students to engage in this practice.

STUDENT SUPPORT

Some students may benefit from additional exploration of the topic. Encourage students to look for evidence of biodiversity loss in their homes or communities and reflect on the impact that might have on natural resources or public interests.

Ask students to reflect on the purpose of the design of the dairy system and determine what it was intended to do. Ask students to write ideas about the unintended effects the design of the system has on plants, animals, humans, and communities. As students develop their ideas, have them clarify any potential cause and effect relationships they find. Students will add these to their models in the next lesson.

CCC SUPPORT

CH-H3: Systems can be designed to have a desired effect.

We are using this element to describe both desired effects and undesired effects of the system design.

Part 3: Consensus Building

Students will now summarize the information they found in the texts that help answer the lesson question, "What else is changing biodiversity? Why do these changes matter to humans?" To do so, students will engage in the Think-Pair-Share Routine. As students listen to their classmate's responses, they can record any new ideas in their Lesson 17 Student Guide Part 3: Consensus Building.

- 1. Students are given time to think independently about their responses.
- 2. Students find an elbow partner.
- 3. Students take turns sharing their thoughts with their partner. Each student should be given time to respond.

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

- 1. Each group nominates a spokesperson.
- 2. As a student from group 1 shares, all other students serve in a "listener" role, noting patterns or ideas that emerge as the group continues to share.
- 3. Spokespersons from each group continue to share ideas until all groups have shared.
- 4. The facilitator holds a whole class discussion and invites the remaining students to share what they heard that was similar across all the responses or a unique response they want to elevate.

In student responses, look for the following ideas:

- The first and second articles were useful in providing new information on how the agricultural system has many different practices that harm biodiversity.
- One article confirmed that much of agriculture production is focused on fields that produce one crop (monoculture systems), which means the overall agriculture system relies on a very small number of crops for human needs.
- One article was useful in its agreement with our past learning that monocultured agricultural lands are contributing to biodiversity loss because of habitat destruction. These impacts are caused by choosing human activity and needs over those of plants and animals.
- One article was useful in providing specific agriculture activities that lead to biodiversity loss, like pollution, use of certain pesticides or fertilizers, overharvesting of wild fisheries and other wild foods, and invasive species invasion.
- Each of the articles discussed how humans depend on biodiversity for food production.

Build on student responses to introduce the following vocabulary terms:

- **Overexploitation**: Humans use a natural resource, such as wild plants or animals and associated biodiversity, faster than the resource can regenerate. Eventually, this leads to the decline or complete loss of this resource and a decline in biodiversity.
- Habitat Destruction: Many human activities, such as construction, pollution, and clearing of lands for crops lead to the loss of habitats for plants and animals.

TEACHER SUPPORT

In this part of the lesson, it is important for students to align on the factors that have led to biodiversity losses. In the next lesson, students will return to their models from the previous lesson and show how the construction of the dairy system as a whole can impact biodiversity and consequently humans.