## Alignment to the PA STEELS Standards

The mySci *Using Our Resources Wisely* unit was designed for the Next Generation Science Standards (NGSS) and throughout the unit there are indications of NGSS Performance Expectations. The unit is also aligned to the Pennsylvania Science, Technology & Engineering, Environmental Literacy and Sustainability (STEELS) Standards[1]. The targeted performance expectations for this unit from both the NGSS and STEELS standards are shown in the tables below.

| **STEELS Performance Expectations Addressed** | |
|---|---|
| 3.3.4.D Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. | 3.3.5.D Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. |

| **STEELS Performance Expectations Partially Addressed** | |
|---|---|
| 3.3.5.E Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. | 3.4.3-5.A Analyze how living organisms, including humans, affect the environment in which they live, and how their environment affects them.** |
| 3.5.3-5.M Demonstrate essential skills of the engineering design process.* | 3.3.5.C Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. |
| 3.5.3-5.P Evaluate the strengths and weakness of existing design solutions including their own solutions.* | 3.2.4.B Make and communicate observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. |

*The PA Technology and Engineering standard is partially aligned to the claimed NGSS ETS performance expectation for this unit.
** The PA Environmental Literacy and Sustainability standard is partially aligned to the claimed NGSS ESS performance expectation for this unit.

## Color Coding for the Three Dimensions

The mySci *Using Our Resources Wisely* unit uses NGSS color coding to indicate specific connections to each of the three dimensions. The PA STEELS standards use different colors for the three dimensions. The colors used in both standards to refer to the three dimensions are below.

| **Color coding used for the three dimensions of the NGSS standards** | **Color coding used for the three dimensions of the STEELS standards** |
|---|---|
| **Orange text** highlights connections to DCIs (**Disciplinary Core Ideas**) | **Blue text** highlights connections to DCIs (**Disciplinary Core Ideas**) |
| **Blue text** highlights connections to the SEPs (**Science and Engineering Practices**) | **Green text** highlights connections to the SEPs (**Science and Engineering Practices**) |
| **Green text** highlights connections to the CCCs (**Cross-Cutting Concepts**) | **Purple text** highlights connections to the CCCs (**Cross-Cutting Concepts**) |

[1] Alignment is based on mySci's NGSS claims and not an in-depth evaluation for STEELS standards.

The purpose of this unit is not to be used in a PA classroom, but rather to illustrate the shifts required by STEELS. With strong science, engineering, and environment connections, it represents the integrated nature of the Pennsylvania STEELS standards while showcasing strong curriculum-based system of assessments.

mySci inspiring the next generation of scientists

***Earth and Space Systems:***
*Natural Resources, Earth Systems, Renewable and Non-Renewable Energy, Human Impacts*

# Teacher Guide

## mySci **Unit 22**:

# Using Our Resources Wisely

Washington University in St. Louis
Institute for School Partnership

Bayer Fund

HIGH QUALITY NGSS DESIGN
ACHIEVE.ORG

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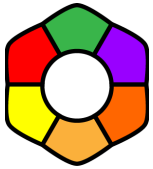
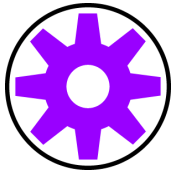
## Table of Contents

# mySci Symbols Key

| | | |
|---|---|---|
|  Indicates an opportunity for students to write |  Indicates an opportunity for assessment |  Indicates an opportunity to employ a driving question board |
|  Indicates an opportunity for the teacher to make a chart |  Indicates an opportunity to attend to equity and inclusion |  Indicates appropriate time to administer the post assessment |
|  Indicates an opportunity for reading |  Indicates an opportunity to differentiate instruction |  Indicates link to a teacher facing mySci tutorial explaining how to set up the activity for students |
|  Indicates an opportunity for discourse |  Indicates a key science idea |  Indicates a multimedia resource |

# Unit 22: Quick View **Using Our Resources Wisely**

## ANCHORING PROBLEM:

We need farms to grow food, but the process of producing food for all of us can harm Earth systems.

## DRIVING QUESTIONS:

How are farms part of Earth's systems?
How does our use of natural resources on farms affect Earth's systems?
How can farmers use resources wisely to protect Earth's systems?

These questions are provided for you as model driving questions to support categorizing individual student questions and organize the learning progression. Each section is designed to intentionally build toward defining the anchoring problem and designing a solution. You can use these questions to guide your instruction, however, you are encouraged to adapt these questions using the language you develop with your students.

*Throughout mySci Units color coding is used to call out specific connections to each of the 3 dimensions of the NGSS standards:*

**Orange text** highlights connections to DCIs (Disciplinary Core Ideas)

**Blue text** highlights connections to the SEPs (Science and Engineering Practices)

**Green text** highlights connections to the CCCs (Cross-Cutting Concepts)

# STORYLINE

In this unit, students will **make sense of Earth's systems and natural resources, ways that humans use natural resources, human impacts on Earth systems, and how humans can change behaviors to reduce impacts on the environment.**

This unit **intentionally develops the Crosscutting Concept of System and System Models and also uses Scale, Proportion, and Quantity and Energy and Matter for sensemaking**.

This unit **intentionally develops the Science and Engineering Practices of Developing and Using Models and Obtaining, Evaluating, and Communicating Information.**

The unit also **incorporates Using Mathematical and Computational Thinking, Constructing Explanations and Designing Solutions, and Planning and Carrying Out Investigations for sensemaking.**

1. First, students will explore the four Earth systems (hydrosphere, biosphere, atmosphere, and geosphere) and learn how these systems interact.

2. Next, students will learn about natural resources and how humans use them for things like energy, food, and shelter. They will investigate some of the impacts of using natural resources, including the effects of fossil fuel consumption. Students will also examine the hydrosphere in detail, including the distribution of water on Earth. They will learn that water is a limited resource, and the amount and quality of available water can be affected by human activities.

3. Finally, they will learn about strategies humans can use to decrease our impact on the environment. They will examine a case study of an island in Denmark that changed from using non-renewable to renewable energies and then engage in a design challenge to design, build, test, and refine a wind turbine to perform a specific task. Students will also consider how farms can repurpose animal waste to generate energy using biodigesters.

# Unit 22: Sections Quick View

| Section 1<br>**How are farms part of Earth's systems?** | Section 2<br>**How does our use of natural resources on farms affect Earth's systems?** | Section 3<br>**How can farmers use resources wisely to protect Earth's systems?** |
|---|---|---|
| *Total time: 6 days*<br><br>LESSON 1<br>**How can we describe the different parts of the Earth?**<br>*(3 days)*<br><br>LESSON 2<br>**How do Earth's systems interact?**<br>*(3 days)* | *Total time: 11 days*<br><br>LESSON 3<br>**What are natural resources and how do humans use them?**<br>*(3 days)*<br><br>LESSON 4<br>**How does our use of fossil fuels affect Earth's systems?**<br>*(3 days)*<br><br>LESSON 5<br>**How does our use of water affect Earth's systems?**<br>*(3 days)*<br><br>LESSON 6<br>**How does animal waste affect the environment, and what can we do about it?**<br>*(2 days)* | *Total time: 9 days*<br><br>LESSON 7<br>**How can people use resources in a way that is less harmful to the Earth?**<br>*(3 days)*<br><br>LESSON 8<br>**How can we use farms to harness wind energy?**<br>*(3 days)*<br><br>LESSON 9<br>**How can farms make better use of animal waste?**<br>*(3 days)* |

# Links to Resources for this Unit

**SECTION 1 SLIDE DECK** **SECTION 2 SLIDE DECK**

**SECTION 3 SLIDE DECK**

**PARENT/GUARDIAN LETTER**

English Version Spanish Version

**STUDENT JOURNAL:**

Digital Student Journal Answer Key

Print Student Journal Answer Key

**ASSESSMENT DOCS:**

Post Assessment Answer Key

**LITERACY LINKS:**

Epic Booklist Unit 22

Quizlet Unit 22

Printable Glossary

Google Slide Vocabulary Cards English

Google Slide Vocabulary Cards English/Spanish

**APPENDICES:**

Teacher Background Information: Appendix A

Read-Aloud Guides: Appendix B

Handouts/Teacher Pages: Appendix C

NGSS/MLS: Appendix D

Safety Guidelines: Appendix E

**Performance Expectations Addressed**

| |
|---|
| 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. |
| 3-5-ETS1- 3. (5.ETS1.C.1) Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |
| 5-ESS2-2. (5.ESS2.C.1) Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. |

**Performance Expectations Partially Addressed**

| |
|---|
| 5-ESS3-1. (5.ESS3.C.1) Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. |
| 3-5-ETS1- 2. (5.ETS1.B.1) Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. |
| 5-ESS2-1. (5.ESS2.A.1) Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. |
| 4-PS3-2.( 4.PS3.B.1) Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. |

# Unit 22: **Fast Track** Pacing Guide

## **Unit 22 Fast Track** Pacing Guide

*These suggestions can be used if you do not have the full amount of time required to dedicate to the whole unit.*

| Lesson | How to Adapt |
|---|---|
| Lesson 1 | - Explore: Omit going outside..<br>- Elaborate: Only show one video, or shorten the length of each video.<br>- Elaborate: Provide students with the Gotta Have It checklist instead of co-constructing it. |
| Lesson 2 | - Explore: Use the virtual adaptation of the activity to reduce setup time.<br>- Explain: Omit the Crash Course Kids videos.<br>- Elaborate: Only show one video, or shorten the length of each video. Provide students with the Gotta Have It checklist instead of co-constructing it. |
| Lesson 3 | - Explore: Omit comparing and sorting the self-documentation data, and only do the class chart about it.<br>- Elaborate: Provide students with the Gotta Have It checklist instead of co-constructing it. |
| Lesson 4 | - Explore: Omit the student choice research and only do the asthma research. Alternatively, skip the asthma research and allow for student choice.<br>- Explain: Based on what you omitted in the Explore section, only do one cause and effect sphere interaction activity.<br>- Elaborate: Provide students with the Gotta Have It checklist instead of co-constructing it. |
| Lesson 5 | - Omit all portions except for the Explore graduated cylinder, graphing activity, and development of a claim. |
| Lesson 6 | - Keep as is. |
| Lesson 7 | - Elaborate: Omit returning to the model. Students will revise the model again in Lesson 9. |
| Lesson 8 | - Explain: Only have students draw their model and how energy is transferred. Omit drawing an actual wind turbine for comparision.<br>- Elaborate: Read The Boy Who Harnessed the Wind or watch the video. |
| Lesson 9 | - Keep as is. |

# Section 1: Quick View **How are farms part of Earth's systems?**

| LESSON / LEARNING TARGET | VIDEO & TEXT RESOURCES | REMOTE LEARNING | | KEY TAKEAWAY | VOCABULARY Quizlet Link Glossary Link |
|---|---|---|---|---|---|
| | | INTERACTIVES & MINI LESSON VIDEOS | HANDS-ON AT HOME SUGGESTIONS | | |
| Lesson 1:<br>**How can we describe the different parts of the Earth?**<br>Observe patterns in the environment to describe the components of Earth's major systems<br>Develop a model to show the different Earth systems present on a farm.<br>*(3 days)* | Crash Course Kids #6.1<br>Crash Course Kids #6.2<br>Dairy Farm<br>Immigrant Farmers Put Down New Roots | What Are the Components of Each Earth System and How Do They Interact? Mini-Lesson | Students can go for a walk and take a photograph or sketch a picture of the different spheres around their home. | We can classify the parts of the Earth by what they are made of- hydrosphere (liquid water), atmosphere (air), geosphere (land), and biosphere (organisms). Farms are human-designed, but they still have these spheres. | atmosphere<br>biosphere<br>geosphere<br>hydrosphere |
| Lesson 2:<br>**How do Earth's systems interact?**<br>Use models to explain the complex interactions between Earth systems.<br>Revise a model to show the interactions of Earth systems on a farm.<br>*(3 days)* | Dairy Farm<br>Immigrant Farmers Put Down New Roots<br>What on Earth<br>Weathering and Erosion | How Does the Water Cycle Involve All of Earth's Systems? Mini-Lesson | Have students look for evidence of system interactions in their yard or neighborhood. | They figure out that different Earth systems interact and that the interaction of one Earth system can affect the function of another Earth system. Similar to the natural world, the Earth systems present on a farm interact. | interact<br>system |

# Lesson 1: Summary

How can we describe the different parts of the Earth?

*Time: 3 days*

## Learning Targets

Observe patterns in the environment to describe the components of Earth's major systems

Develop an initial model to show the different Earth systems present on a farm.

## Summary

- Prior to this earth science unit, students may have knowledge that energy makes things happen. Students may understand that energy can move from place to place and be transformed from one form of energy to another (NGSS 4-PS3). They have considered the environment as an ecosystem of parts that interact.
- In this lesson, students research the components of the hydrosphere, atmosphere, geosphere, and biosphere. They will develop and use a model to illustrate these systems on a farm.
- **Students figure out that we can classify the parts of the Earth by what they are made of- hydrosphere (liquid water), atmosphere (air), geosphere (land), and biosphere (organisms). Farms are human-designed, but they still have these systems.**
- In the next lesson, students consider how the different spheres of the Earth interact.

### Building Towards

5-ESS2-1. (5.ESS2.A.1)

***NGSS 3-Dimensions:***

ESS2.A: Earth Materials and Systems

Developing and Using Models

System and System Models

| Lesson 1: Five E Quick View | |
|---|---|
| UNIT LAUNCH | Students view photos and data charts to make observations and ask questions about the unit ANCHORING PROBLEM. |
| ENGAGE | Students co-construct an initial model showing the different parts of our environment. |
| EXPLORE | Students make observations about the parts of the environment and classify them according to patterns. |
| EXPLAIN | Students obtain information about the systems that make up Earth. |
| ELABORATE | Students develop a model of a farm and illustrate the different Earth systems on it. |
| EVALUATE | Students evaluate each other's farm models. |

# Lesson 1: Prep List

| Inside mySci kit you will find: | Items you must supply: | Preparation: |
|---|---|---|
| | Colored pencils or markers | Review mySci Safety Guidelines<br>Send parent/guardian letter home<br>English Version Spanish Version<br>Lesson 1 Student Journal pages or Printed Student Journals |

| Literacy Connections | Remote Learning |
|---|---|
| Key Vocabulary<br>**atmosphere:** the air that surrounds the Earth<br>**biosphere:** parts of the Earth that contain organisms<br>**geosphere:** Earth's crust and mantle (soil, rocks, and molten rock)<br>**hydrosphere:** liquid water on Earth's surface, in the ground, and in the air<br>Supplemental Reading Resources<br>What is Earth's core made of? | Interactive & Mini Lesson Videos<br>What Are the Components of Each Earth System and How Do They Interact? Mini-Lesson<br>Hands-on at Home Suggestions<br>Students can go for a walk and take a photograph or sketch a picture of the different spheres around their home. |

# LAUNCHING THE UNIT

## Introducing the ANCHORING PROBLEM and DRIVING QUESTIONS

***Attending to Equity:***

Students will find the anchoring phenomenon/problem more compelling if it is presented as a meaningful, real-world scenario that connects to their lives. You could ask students what their favorite foods are. Students may make specific dietary choices for a variety of reasons (allergies, culture, health, religion). Encourage students to be respectful about these choices. This can foster productive scientific discussion about real-world problems.

If you want to change the ANCHORING PROBLEM for your context, keep the following questions in mind:

→ Is it going to be relevant to my students' lives and/or particularly engaging to them?

→ Is it going to motivate students to want to explain:

- Our use of natural resources
- How Earth's spheres

**SETTING UP YOUR DRIVING QUESTION BOARD:**

In this unit, you will use a Driving Question Board. This is a tool that allows you to organize student questions about the anchoring phenomenon or problem and track how the learning progresses throughout the unit, in order for students to make sense of the phenomenon or problem. You will revisit it after each lesson to see what you figured out as a class and add new questions.

Your Driving Question Board should include the Anchoring Problem statement, with space for student questions that are generated throughout the unit, and 3 columns:

1. One to track the activities students have engaged in and their observations.
2. One for the scientific ideas they have learned.
3. One for how those ideas connect to the anchoring problem and driving questions for the unit.

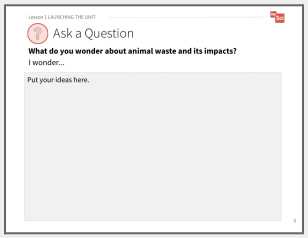
See Appendix C for an example of a driving question board with sample responses that would be filled in throughout the unit.

Use bulletin boards, chart paper or a digital resource like Google Jamboard to develop your Driving Question Board. Student questions and initial explanations about their questions can be recorded on post-its. This way once the class has addressed a question it can be removed from the DQB and you could store these in a separate space so students can see how many questions they have answered throughout the unit. Artifacts from activities can be included as well.

**ELICITING STUDENT THINKING:**

Students come to the classroom with prior knowledge, or partial knowledge from previous learning as well as life experiences. Use the Driving Question Board to elicit student thinking and access students prior knowledge.

interact
- Energy consumption
- How humans interact with our environment




Launching the Unit Student Journal Page

Take notice about what students understand about the DCIs, or how what they know could connect to the DCIs as they progress through the unit. This will help you figure out how to best meet individual student needs as you teach the unit, and gauge how much student knowledge and skills grow as a result of the unit.

**ANCHORING PROBLEM:**

We need farms to grow food, but the process of producing food for all of us can harm Earth's systems.

Students view a video to make observations and ask questions about the unit ANCHORING PROBLEM.

**Introduce the ANCHORING PROBLEM**:

Ask students:

- *What is your favorite food? Why?*

Provide students with the opportunity to think and then have them turn and talk to a partner. Call on students to share and record their responses. Take a poll to indicate common favorite foods in your classroom.

Ask students:

- *Where does this food come from?*

Provide individual think time and then ask students to share with a partner. As they share, circulate and listen for students' prior knowledge about food and farms. Identify a student or student to share their ideas during the whole class discussion. To begin the discussion ask these students to share where food comes from.

Then say to students:

- *Most of the food that we eat comes from a farm. In order to produce the food we eat, farms use resources.*
- *Have you ever thought about how farms produce the food we eat?*

***Teaching Tip:***

Try using the crosscutting concepts as a way to categorize student questions.

Also, see Appendix C for an example of a DQB.

***Guidance for engaging students in a Turn and Talk:*** Turn and talks will be used throughout the unit. If students are not already familiar, take time to introduce the Turn and Talk strategy. Emphasize that students should share their ideas, listen carefully to their partner's

- *What are the side effects of producing the food?*
- *How do you think we could reduce some of the side effects?*

Show the following: What is Farming from PBS. Watch the video all the way through the first time. Then, ask students to write down 2 observations and 2 questions from the video before showing it again.

It may be helpful to pause the video as different processes of the farm are shown (i.e. using tractors to plant seeds, watering the plants, housing for animals, etc.). Give students time to write down their observations and individual questions on Launching the Unit Student Journal Page as you go through the video.

Ask students:

- *What observations did you make?*
- *What do these observations make you wonder?*

Allow students to turn and talk to discuss their observations and questions. Then, have students record initial questions on their Post-It Notes, writing one question per Post-It.


Now that students have their questions, you will guide students in creating categories for their questions on the DQB using the following steps:

1. Select one student to share their question, create a category, and ask other students to share any questions they have that are similar and post them all on the DQB under this category.
2. Ask: "Does anyone have a question they don't think fits with these?" Place this question in a new category (and label that category). Invite other students to share similar questions that would fit in this new category and post them on the DQB.
3. Repeat this procedure until all student questions are represented on the DQB. If students come up with additional questions during this process, provide them with a Post-It note and allow them to place them on the DQB
4. Once all categories are created, you can guide the class in collapsing categories into bigger categories that have closer alignment to the driving questions provided in the unit.

**DO NOT** answer questions at this time or correct their thinking – students will explore their questions and explain this anchoring phenomenon throughout the unit. For example, if a student says

| | |
|---|---|
| ideas, and build on each other's ideas. It is also important to stay on topic.<br><br>To support students to Turn and Talk, consider using: Conversational Support for Sharing and Expanding on Each Other's Ideas from STEM Teaching Tools. | something incorrect, you can say: *Hmm. How could we figure that out? How might we investigate that?* |
| | **SAMPLE DRIVING QUESTIONS:**<br>*Section 1:* How are farms part of Earth's systems?<br>*Section 2:* How does our use of natural resources on farms affect Earth's systems?<br>*Section 3:* How can farmers use resources wisely to protect Earth's systems?<br>These questions are provided for you as model driving questions to support categorizing individual student questions and organize the learning progression. Each section is designed to answer this larger question. You can use these questions to guide your instruction, however, you are encouraged to adapt these questions using the language you develop with your students.. |
| | Orient students to the categories they developed and explain that these are the Driving Questions for the unit.<br>Say to students:<br>▸ *If we want to be able to answer these driving questions, what do you think we need to know about the problem?* (We need to think about how very different locations and parts of Earth are connected, how our use of natural resources affects the environment, and how we farmers can protect the environment. We can use this knowledge to design and test solutions to this problem.) |

# L1 – Five E Lesson Plan

## ENGAGE

Students co-construct an initial model showing the different parts of our environment.

***Guidance for engaging students in modeling:*** Modeling is an important science and engineering practice in this unit. This practice is initially done as a whole class, as a scaffold for students to engage in the practice. Students will develop and revise their own models as they progress through the unit.

Begin the lesson by revisiting the Driving Question Board. Highlight questions connected to the learning goals of this lesson by calling attention to questions about **what makes up a farm**. If no questions directly relate, use prompts to build on student questions, supporting them to think about the components of a farm system.

Say to students:

- *Today's activity will support us in answering this question* (ex: **How can we describe the different parts of the Earth?***). By answering this question, we will be able to build on our understanding of how farms are a part of Earth's system.*

Say to students:

- *Think back to previous science lessons. How would you describe the different parts of a farm environment, using science ideas?*

Allow students to Turn and Talk, then share a few answers with the whole class. Listen for students discussing ideas from previous grade levels and possibly previous units in your class. They may have ideas about ecosystems, matter, and energy.

Draw a picture of the environment students describe on chart paper. Discuss with students the importance of models in science, and what parts are generally included in models. Ask students:

- W*hat labels should we put on our drawing*?
- *Why is it important to include labels?*
- *What are some different ways we can add labels to our drawing?*

Say to students:

| | |
|---|---|
| | ▸ *This is our initial model of a farm environment. We will refine our model over time in this unit and have a lot more ideas to add to it.* |

# EXPLORE

Students make observations about the parts of the environment and classify them according to patterns.

***Attending to Equity:***

When students go outside, they are considering how their own environment has the same scientific principles as a farm or other parts of the natural world. Students can use self-documentation technique to take photos of the environment around their school or at home to make the experience "inclusive and meaningful".

***Attending to Equity:***

When creating groups, we advise that the teacher creates the groups in order to make them more equitable. It is best to have students in groups of 3 or 4 that consist of mixed ability, gender, and cultural background. The article, Designing Group Work, from Ambitious Science Teaching has more information on group arrangements and facilitating discussions.

Say to students:

- *How might we learn about the different parts of a farm system?*

Listen for students to make connections to the natural environment around them and the environment of a farm. Build on these suggestions in order to support a student exploration of the environment around their school.

Say to students:

- *Let's go outside and do a nature walk! To learn about our environment we will record as many observations of natural things as possible. Before we go, let's discuss observations as a part of science.*
- *Why do you think scientists make observations?*
- *What are some observations we can make about our classroom?*

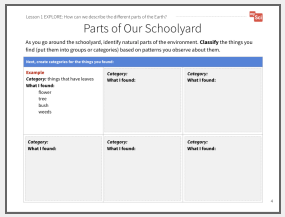
Have students work in small groups to identify natural parts of the environment. Students can create a list of their observations on a blank piece of paper. They may write or draw their observations.

As students are walking around, visit the groups and guide them as they explore their environment. If students need support in making observations ask:

- *What observations can you make about things above you? Below you?*
- *Remember your environment does not just include what you are walking on.*

Point out things that might not be immediately obvious to them, such as air, clouds, a puddle of water, soil, or rocks. Encourage them to look closely, and in ways that they might not normally look at the world.

Have students organize them into categories based on similarities on the Parts of Our Schoolyard



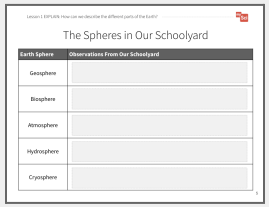

Parts of the Our Schoolyard Student Journal page

Student Journal page. If students need support you can ask:

- *Do you see any similarities between the objects you identified?*
- *How could we group these based on those similarities?*

# EXPLAIN

Students obtain information about the systems that make up Earth.




The Systems in Our Schoolyard Student Journal page

***Formative Assessment***

**ESS2.A: Earth Materials and Systems** Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things,

Once students return to class, have them share their observations and the different classifications they made. Push students to provide reasoning for how they categorized the different parts of the environment.

Say to students:

- *Scientists have words to describe the different parts of our Earth. There are four different categories, or systems, that we can use to describe our planet.*

Now is a good time to introduce **geosphere, biosphere, atmosphere, and hydrosphere** to students. You can direct their attention to the Latin roots (geo, bio, atmo, hydr).

Ask students:

- *Have you ever heard these are part of any other words?* (Students may have exposure to these roots as part of words like geode, geology, biology, biography, hydrate.)

When introducing vocabulary, refer to the vocabulary slides that provide students with images to associate with these words as well as Spanish translations to support ELL.

Next, have students watch the following videos:

| | |
|---|---|
| including humans).~~These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather~~ | 1. Four Spheres Part 1 (Geo and Bio): Crash Course Kids #6.1 (4:00)<br>2. Four Spheres Part 2 (Hydro and Atmo): Crash Course Kids #6.2 (3:30)<br><br>These videos are used to introduce the terms to students. Each video covers two systems. After each system is discussed, pause the video.<br><br>Direct students to work with a partner or small group to come up with their own definition of the term. You can then have the students share their definitions with the class to come up with a class definition of each term.<br><br>Then, return to the "investigate" portion of the video. This portion should be used as practice before they re-categorize their observations from nature.<br><br>Next, have students re-categorize the parts of the environment they observed into the appropriate sphere using The Systems in Our Schoolyard Student Journal page.<br><br>  This activity is a chance to formatively assess students' understanding of part of DCI ESS2.A. If students are struggling to categorize their observations into the different systems, rewatch the videos and go over the examples as a class. |

## ELABORATE

Students develop a model of a farm and illustrate the different Earth systems on it.

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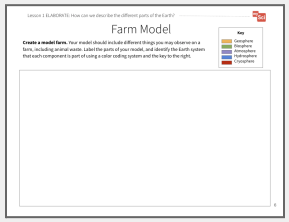
| | Show students the following videos of a farm:<br><br>Dairy Farm (5:33) by ADAMideast and<br><br>Immigrant Farmers Put Down New Roots by Maryland Farm and Harvest.<br><br>Pause the videos routinely to allow students to make observations about the things they see on the farm. |

***Attending to Equity:***

The "Gotta Have It Checklist" is a tool from the book Ambitious Science Teaching. By having students co-construct this checklist, rather than the teacher providing this up front, they are active participants in deciding what counts as important in their scientific explanations. This list can evolve over time, and you can provide an example or two at first so that you scaffold this process for them. Watch the Creating Gotta Have it Checklist Video from AST to support you in co-constructing this with your students.




Farm Model Student Journal page

Say to students:

- *You are now going to create your own initial model of a farm that you will revise throughout this unit.*
- *Let's develop a "Gotta Have It checklist" that tells us what we want to show on our model.*

To do this, ask students:

- *What have we learned about so far in this unit that we might want to include in our models?* Examples of things the model's "gotta have" include:
    - Representations of different things you would find on a farm
    - Labels correctly identifying the systems these things are part of

When co-constructing the "Gotta Have It" checklist with your students, actively moderate the discussion using discourse moves such as probing, turn-and-talks, follow-up questions, revoicing, and wait time. During this process, students often challenge or build on a peer's suggestion so it may be helpful to refer to your classroom norms around how to comment on another's ideas.

Emphasize to your students that the "Gotta Have It" checklist items should not be vocabulary words. They should be phrased as an idea that typically expresses a relationship. If key ideas are not mentioned by students, you must suggest or prompt students to look back at the DQB and ask them:

- *Should any ideas here be part of our final explanations?*

Students will create their models on the Farm Model Student Journal page. Students can create a digital drawing, a paper-based drawing that is uploaded, or a physical model. They can also represent their ideas through writing.

Allow students to add in components they may know about that occur on farms, but were not included in the video. Students should identify each component, and label which of Earth's systems it falls under. For example, a student may observe a cow and categorize this as being part of the biosphere, while categorizing a farm pond as the hydrosphere.

Note that students can construct these models individually, or in small groups, throughout this unit. Provide students with colored pencils, markers, or crayons so that they can use colors to identify features of their farm if they would like.

# EVALUATE

Students evaluate each other's farm models.

***Formative Assessment***

**ESS2.A: Earth Materials and Systems** Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). ~~These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather~~

**Developing and Using Models**
Develop a model using an example to describe a scientific principle.

**System and System Models**
A system can be described in terms of its components ~~and their interactions.~~

Have students share their models with a partner and give each other feedback.

- Did they have something to represent each system?
- Did they label all parts of their model?
- How do their models compare with each other's?

Bring the class back together, and ask students to share out the differences and similarities in their models. This supports students to see the different ways you can represent and label things in models. Based on their discussion, students should change their models to reflect feedback.

This is the beginning of a model that will be used across all lessons as students explain the resources used on a farm, and how they impact the environment.

Return to the class consensus model that was created in the Engage portion of lesson 1. Revise the class model to include the Earth systems students identified.

This activity is a chance to formatively assess students' understanding of the SEP Developing and Using Models, DCI ESS2.A, and the CCC System and System Models. Look for students to have met the criteria of the "Gotta Have It" checklist. See the student journal answer key for an example. If students are struggling to apply what they have learned in developing a model, use the initial class model you created in the Engage to show students how to further develop a model.

To support student sensemaking across the unit, orient students back to the DQB. Ask students:

- *What did we observe during today's activity?*

Record the activity and their observations. Next, ask students:

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| | ▸ *What did we learn today?*<br><br>Record their responses. If students need a reminder, they can reference their student journals.<br><br>Ask students:<br><br>▸ *How might this help us figure out how farms are part of Earth's systems?*<br><br>To support students in making connections, ask:<br><br>▸ *What do we know about the environment?*<br><br>▸ *What systems are present on farms?* (Students may discuss that there are different parts of the natural environment (biosphere, geosphere, atmosphere, hydrosphere), and that these parts exist on human-managed farms as well.)<br><br>Next, ask students:<br><br>▸ *What new questions do you have? (*They may have new questions, such as: How can animals and plants on a farm affect the different Earth systems? How do the parts of our environment interact with one another? What happens to one part of the environment if there is a change in another? What role do humans play in the environment?)<br><br>*Option A:* Direct students to write down 2-3 questions they have. Then, write student responses on the driving question board.<br><br>*Option B:* Have students record their questions on sticky notes and then they can post their notes on the class driving question board.<br><br>Do not provide these questions for students, instead help them start thinking about these ideas by focusing their attention to the different systems that they labeled on their models and how that could relate to the anchoring problem: We need farms to grow food, but the process of producing food for all of us can harm Earth systems. Have students place their questions into existing categories, or create new categories. |