CAROLINA® + OpenSciEd®

High-Quality Instructional Materials Just Got Even Better.

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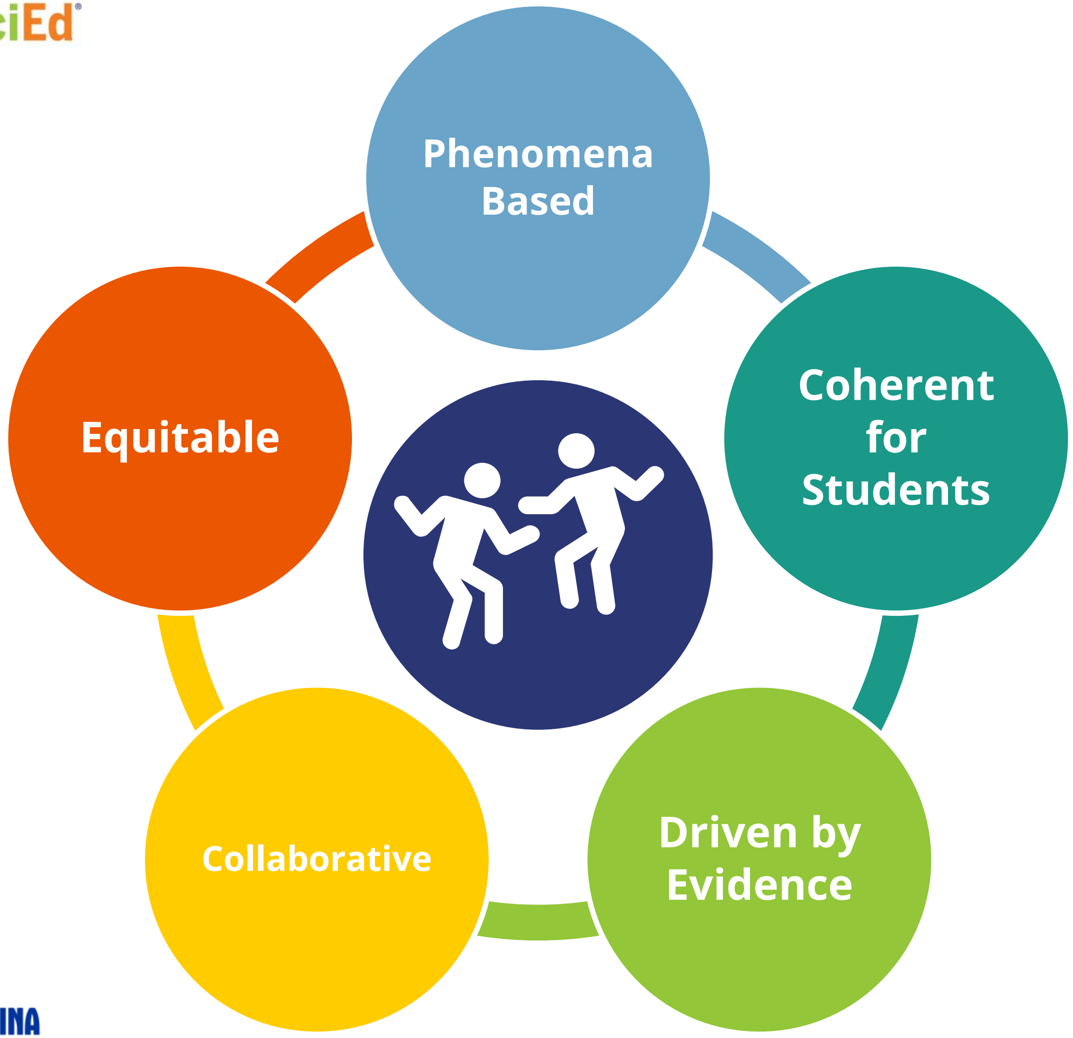
CAROLINA
UNLEASH LEARNING™

CAROLINA® + OpenSciEd®

Carolina's Certified Version of OpenSciEd® High School

High-Quality Instructional Materials Just Got Even Better.

Designed and Built with Students Front and Center



- Exploration is driven by **students'** questions and ideas
- Builds on **students'** prior knowledge and experiences
- **Students** use evidence to revise their thinking
- **Students** figure out ideas as a classroom community

Transforming Science Education

Funded by Renowned Philanthropic Organizations

Bill & Melinda Gates Foundation

Carnegie Corporation of New York

Charles and Lynn Schusterman Family Foundation

William and Flora Hewlett Foundation

Developed by Leading Education and Research Institutions

BSCS Science Learning Team

Dana Center Team

Northwestern University Team

University of Colorado Boulder Team

Boston College Team

Field Tested by Teachers and Students Across the Country

OpenSciEd Teachers & Students

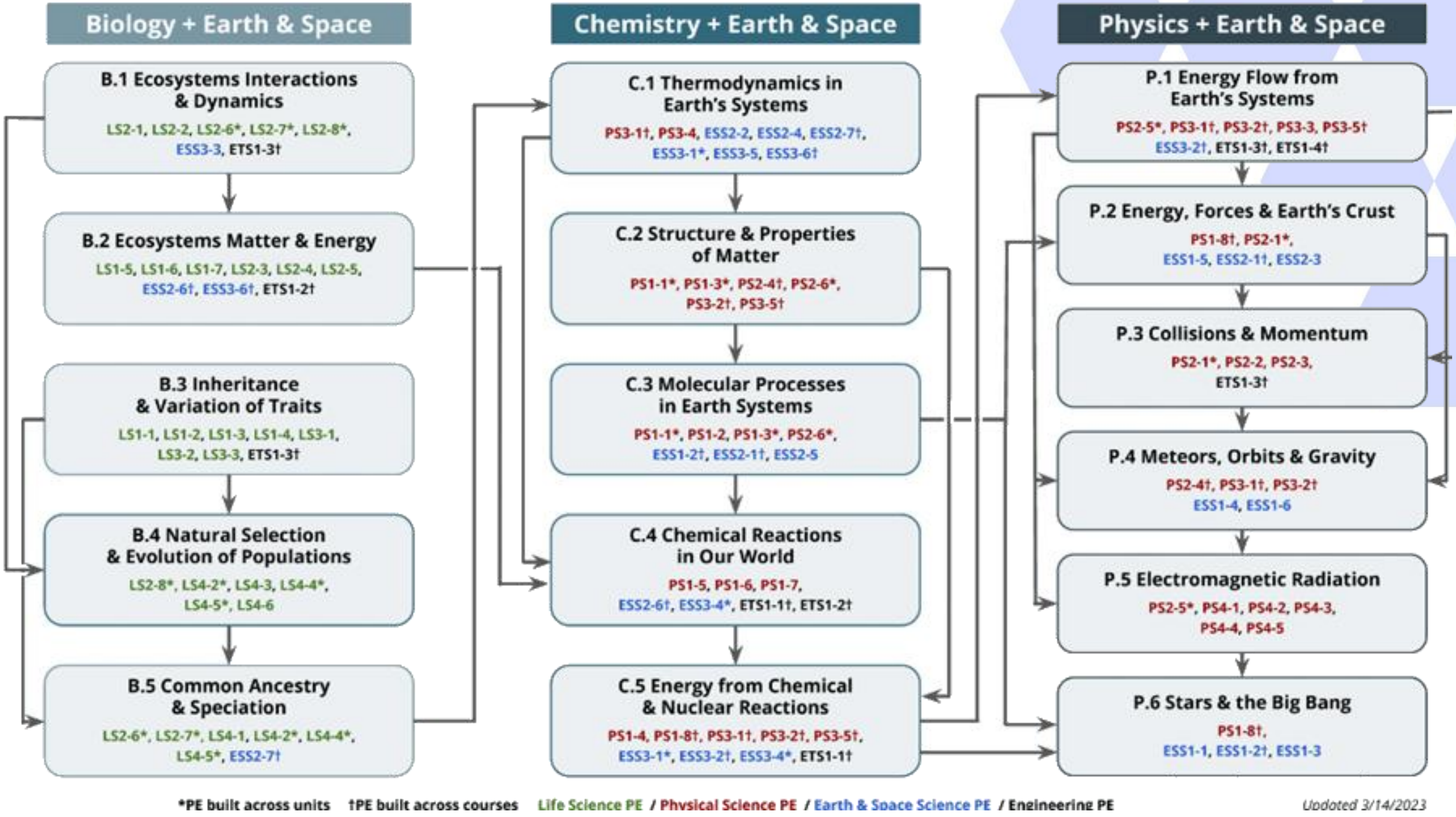
265 field test teachers
and
5800 participating students
in
115 school districts
in
10 states

teach the OpenSciEd units and provide feedback.

The 10 OpenSciEd Partner States

Transforming Science Education

High School Scope & Sequence



CAROLINA
UNLEASH LEARNING

OpenSciEd

High School Scope & Sequence

Biology + Earth & Space

B.1 Ecosystems Interactions & Dynamics
LS2-1, LS2-2, LS2-6*, LS2-7*, LS2-8*, ESS3-3, ETS1-3†

B.2 Ecosystems Matter & Energy
LS1-5, LS1-6, LS1-7, LS2-3, LS2-4, LS2-5, ESS2-6†, ESS3-6†, ETS1-2†

B.3 Inheritance & Variation of Traits
LS1-1, LS1-2, LS1-3, LS1-4, LS3-1, LS3-2, LS3-3, ETS1-3†

B.4 Natural Selection & Evolution of Populations
LS2-8*, LS4-2*, LS4-3, LS4-4*, LS4-5*, LS4-6

B.5 Common Ancestry & Speciation
LS2-6*, LS2-7*, LS4-1, LS4-2*, LS4-4*, LS4-5*, ESS2-7†

This unit builds toward these performance expectations

HS-ESS2-6†: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Carolina and OpenSciEd Have Partnered to Make High-Quality Instructional Materials Even Better

High-quality instructional content from OpenSciEd

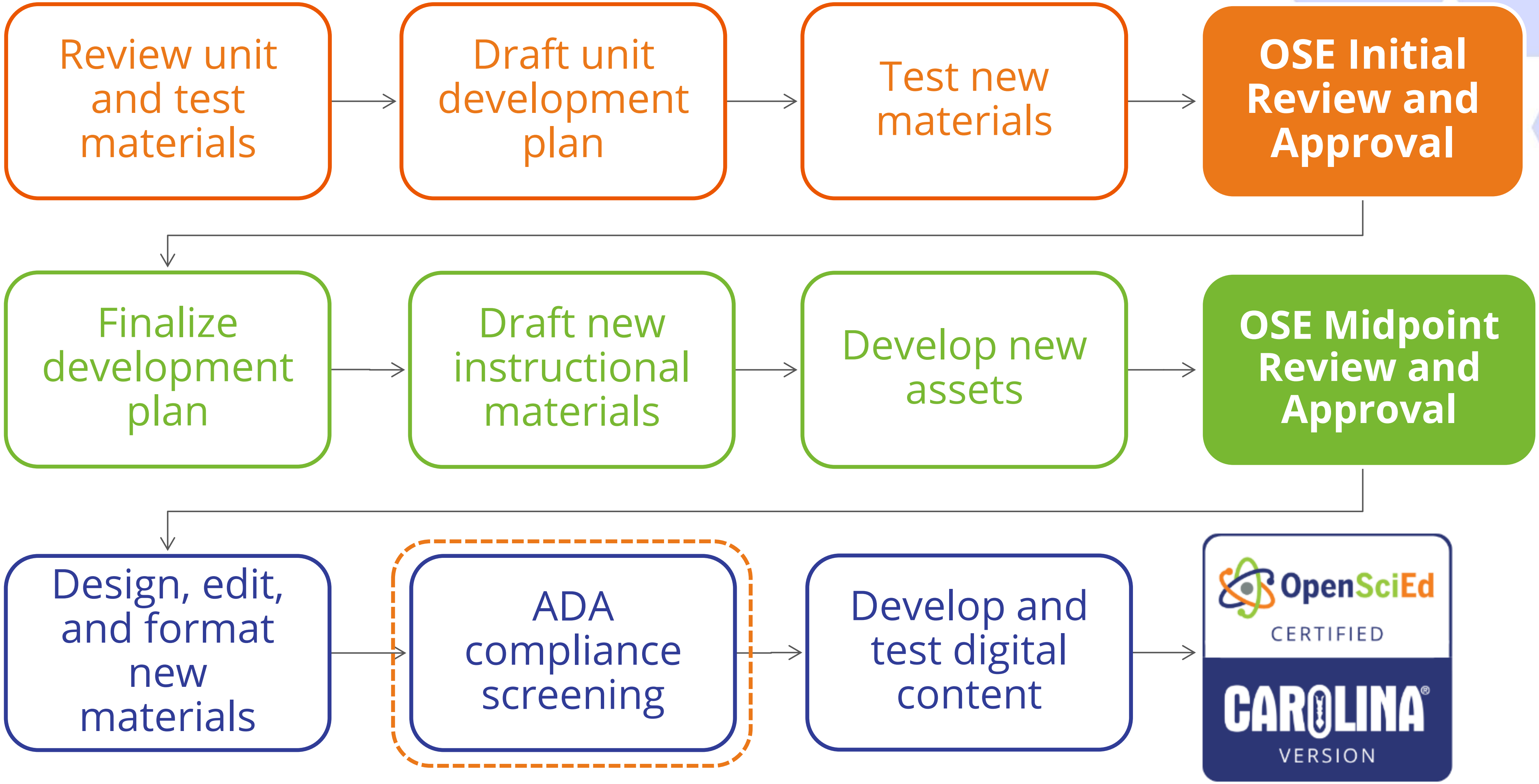
Materials and development expertise from Carolina

Dedicated service and support from Carolina

Carolina Development Focus

Ease of Use	Redesign the Teacher Guide Reengineer labs and materials Add digital resources and support
Less Prep and Instruction Time	Simplify procedures with new or improved materials Convert some labs to demo or video Add teacher prep videos
Reduce Cost of Kits	Fewer materials Less expensive materials Digital options
Add Safety Measures	Additional safety guidance Include PPE in kits Replace and/or reduce some chemicals
Enhance Accessibility	Enhanced ADA features Maintain UDL standards Materials meet adoption standards

Carolina Development Plan



OpenSciEd CERTIFIED CAROLINA VERSION

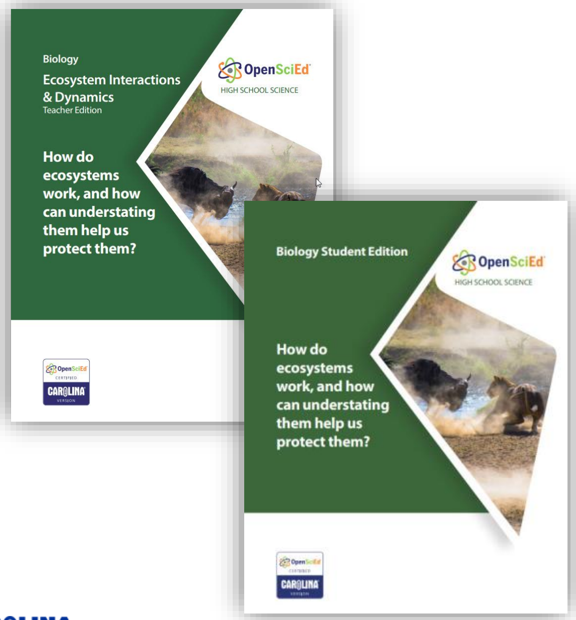
Carolina Certified Version

OpenSciEd Professional Learning CERTIFIED

Redesigned Print Materials

Simplified Investigations

Enhanced Digital Content



CAROLINA UNLEASH LEARNING®

OpenSciEd®

Redesigned Teacher Guide

BIOLOGY

3 · CO-CONSTRUCT COMMUNITY AGREEMENTS

10 min

MATERIALS: *Community Agreements*

Consider why we should establish Community Agreements. Before facilitating the first formal discussion of the unit, take some time to prioritize and establish the classroom community. Navigate to this work with community agreements by saying something like, *We have already been working as scientists today as we obtained, evaluated, and communicated information and asked questions. Over the course of the school year, we will engage in these and other science practices together. Those can be difficult tasks, and we will need to practice them together. Scientific work is rarely done alone, and my goal for this class is to have us build a community where we can figure things out together.*

Display **slide G**. Direct students to stop and jot their responses to these prompts in their notebooks:✱
- What are you hoping to get out of this class?
- How can working together help us get farther than we would on our own?
- What barriers may come up that would make it difficult for us to:
  - build a community?
  - accomplish our goals, both as individuals and as a class?
- How can we plan to address these barriers?

Develop community agreements. Distribute *Community Agreements* to each student and give them some individual time to fill in their ideas. Then discuss as a class and build a class set of agreements together.

ALTERNATE ACTIVITY

When setting up learning community agreements, students should understand how agreements help everyone in the community to know what is expected of them. Here are two approaches to setting up community agreements:
- Co-construct agreements with students (the default approach using *Community Agreements* or something similar). Explain what agreements are and why we need them for productive science talk and classroom culture. Have students co-construct agreements. As the teacher, you can add agreements that may be missing from the list. Be sure to explain to students how you think the agreement you added is helpful so that they are clear about why you are adding it to the list.
- Give students a set of agreements as a starting point (the alternate approach). Share a set of community agreements with students and provide space for students to edit or add to the agreements if they believe something is missing.

Consider the following questions, which can help you determine which approach is best for your situation:
- Do you want students to participate in co-constructing the agreements?
- Do you want the same set of agreements for every section of science you teach?
- Do you want to work with your team teachers to establish a shared set of agreements for students across all your classes?
- What kinds of consequences will you enforce if students do not follow the agreements?

✱ ATTENDING TO EQUITY

Building classroom culture: It is important to use this norm-building time to begin to cultivate an equitable learning community that promotes trusting and caring relationships. The community agreements should reinforce to students the value of (1) the diversity of thought among all classroom community members in pushing our learning forward and (2) providing a safe learning environment that ensures fair participation. In addition, classroom agreements should interrupt cultural norms or stereotypes that could make science experiences feel uncomfortable for some students (e.g., as being someone who is not intelligent enough to think like a scientist, who cannot do the relevant math, who cannot share their thinking). Example community agreements can be found in *Example Community Agreements*. Your version of the agreements should use wording and ideas co-constructed with your class.

4 · FACILITATE AN INITIAL IDEAS DISCUSSION ABOUT CONSERVATION CRITERIA

10 min

MATERIALS: science notebook, whiteboard or chart paper, chart paper markers

Facilitate an Initial Ideas Discussion. ✱ ✱ Display **slide H**. Call on one group to share their list of criteria and publicly record it on the whiteboard. Ask each additional group to indicate which criteria they have in common by adding a checkmark next to that criteria and add any new criteria to the list.

✱ STRATEGIES FOR THIS INITIAL IDEAS DISCUSSION

BIOLOGY

Lesson 1 LEARNING PLAN

3 Co-Construct Community Agreements 10 min.

Materials
- *Community Agreements*

Consider why we should establish Community Agreements. Before facilitating the first formal discussion of the unit, take some time to prioritize and establish the classroom community. Navigate to this work with community agreements. **Say,** *We have already been working as scientists today as we obtained, evaluated, and communicated information and asked questions. Over the course of the school year, we will engage in these and other science practices together. Those can be difficult tasks, and we will need to practice them together. Scientific work is rarely done alone, and my goal for this class is to have us build a community where we can figure things out together.*

G **Present slide G.**

Direct students to stop and jot their responses to these prompts in their notebooks:[2]
- What are you hoping to get out of this class?
- How can working together help us get farther than we would on our own?
- What barriers may come up that would make it difficult for us to:
  - build a community?
  - accomplish our goals, both as individuals and as a class?
- How can we plan to address these barriers?

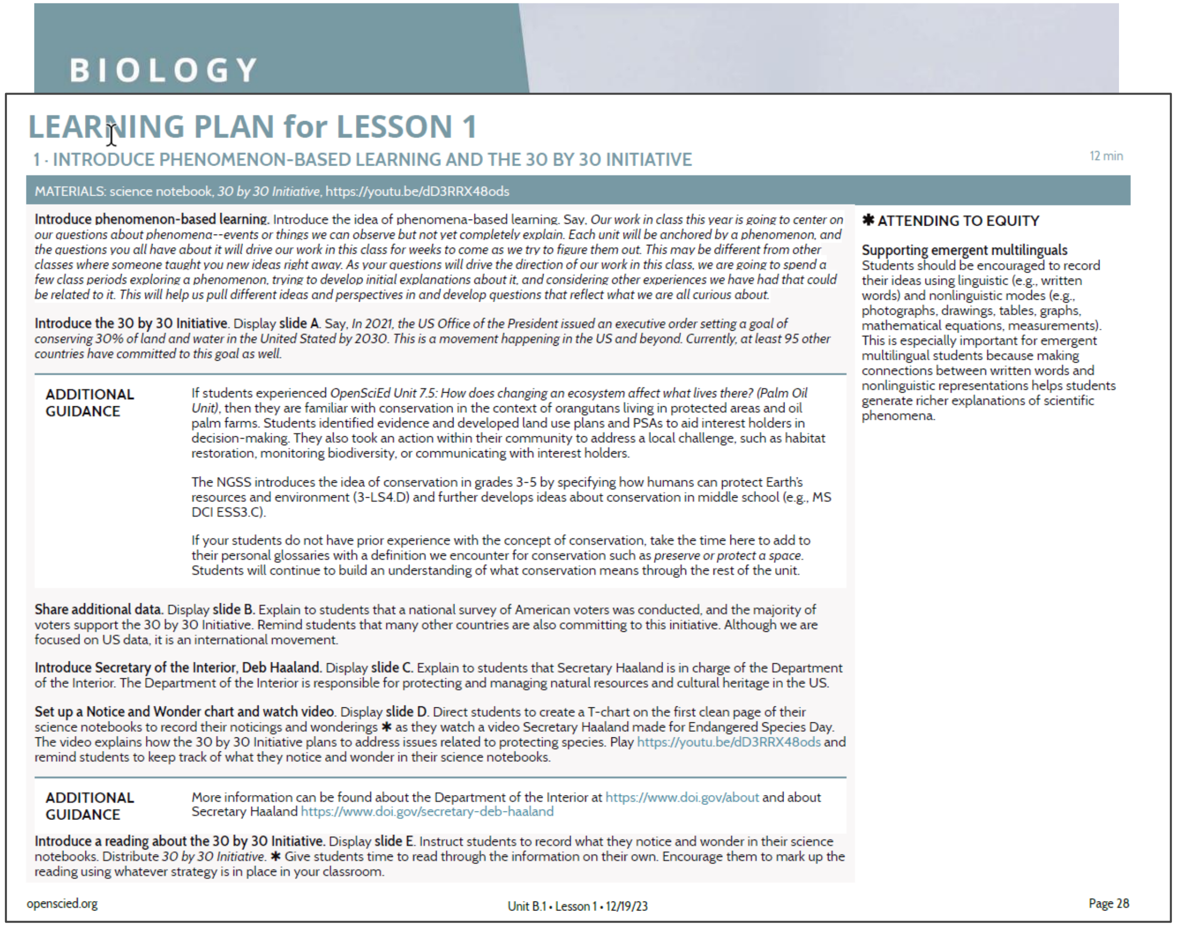
[2] ATTENDING TO EQUITY

Building classroom culture: It is important to use this norm-building time to begin to cultivate an equitable learning community that promotes trusting and caring relationships. The community agreements should reinforce to students the value of (1) the diversity of thought among all classroom community members in pushing our learning forward and (2) providing a safe learning environment that ensures fair participation. In addition, classroom agreements should interrupt cultural norms or stereotypes that could make science experiences feel uncomfortable for some students (e.g., as being someone who is not intelligent enough to think like a scientist, who cannot do the relevant math, who cannot share their thinking). Example community agreements can be found in *Example Community Agreements*. Your version of the agreements should use wording and ideas co-constructed with your class.

Develop community agreements. Distribute *Community Agreements* to each student and give them some individual time to fill in their ideas. Then discuss as a class and build a class set of agreements together.

Reorganized content

Redesigned Teacher Guide


BIOLOGY

LEARNING PLAN for LESSON 1

1 · INTRODUCE PHENOMENON-BASED LEARNING AND THE 30 BY 30 INITIATIVE 12 min

MATERIALS: science notebook, *30 by 30 Initiative*, https://youtu.be/dD3RRX48ods

Introduce phenomenon-based learning. Introduce the idea of phenomena-based learning. Say, *Our work in class this year is going to center on our questions about phenomena--events or things we can observe but not yet completely explain. Each unit will be anchored by a phenomenon, and the questions you all have about it will drive our work in this class for weeks to come as we try to figure them out. This may be different from other classes where someone taught you new ideas right away. As your questions will drive the direction of our work in this class, we are going to spend a few class periods exploring a phenomenon, trying to develop initial explanations about it, and considering other experiences we have had that could be related to it. This will help us pull different ideas and perspectives in and develop questions that reflect what we are all curious about.*

Introduce the 30 by 30 Initiative. Display **slide A**. Say, *In 2021, the US Office of the President issued an executive order setting a goal of conserving 30% of land and water in the United Stated by 2030. This is a movement happening in the US and beyond. Currently, at least 95 other countries have committed to this goal as well.*

ADDITIONAL GUIDANCE

If students experienced *OpenSciEd Unit 7.5: How does changing an ecosystem affect what lives there? (Palm Oil Unit)*, then they are familiar with conservation in the context of orangutans living in protected areas and oil palm farms. Students identified evidence and developed land use plans and PSAs to aid interest holders in decision-making. They also took an action within their community to address a local challenge, such as habitat restoration, monitoring biodiversity, or communicating with interest holders.

The NGSS introduces the idea of conservation in grades 3-5 by specifying how humans can protect Earth's resources and environment (3-LS4.D) and further develops ideas about conservation in middle school (e.g., MS DCI ESS3.C).

If your students do not have prior experience with the concept of conservation, take the time here to add to their personal glossaries with a definition we encounter for conservation such as *preserve or protect a space*. Students will continue to build an understanding of what conservation means through the rest of the unit.

Share additional data. Display **slide B**. Explain to students that a national survey of American voters was conducted, and the majority of voters support the 30 by 30 Initiative. Remind students that many other countries are also committing to this initiative. Although we are focused on US data, it is an international movement.

Introduce Secretary of the Interior, Deb Haaland. Display **slide C**. Explain to students that Secretary Haaland is in charge of the Department of the Interior. The Department of the Interior is responsible for protecting and managing natural resources and cultural heritage in the US.

Set up a Notice and Wonder chart and watch video. Display **slide D**. Direct students to create a T-chart on the first clean page of their science notebooks to record their noticings and wonderings ✱ as they watch a video Secretary Haaland made for Endangered Species Day. The video explains how the 30 by 30 Initiative plans to address issues related to protecting species. Play https://youtu.be/dD3RRX48ods and remind students to keep track of what they notice and wonder in their science notebooks.

ADDITIONAL GUIDANCE

More information can be found about the Department of the Interior at https://www.doi.gov/about and about Secretary Haaland https://www.doi.gov/secretary-deb-haaland

Introduce a reading about the 30 by 30 Initiative. Display **slide E**. Instruct students to record what they notice and wonder in their science notebooks. Distribute *30 by 30 Initiative*. ✱ Give students time to read through the information on their own. Encourage them to mark up the reading using whatever strategy is in place in your classroom.

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Students should be encouraged to record their ideas using linguistic (e.g., written words) and nonlinguistic modes (e.g., photographs, drawings, tables, graphs, mathematical equations, measurements). This is especially important for emergent multilingual students because making connections between written words and nonlinguistic representations helps students generate richer explanations of scientific phenomena.

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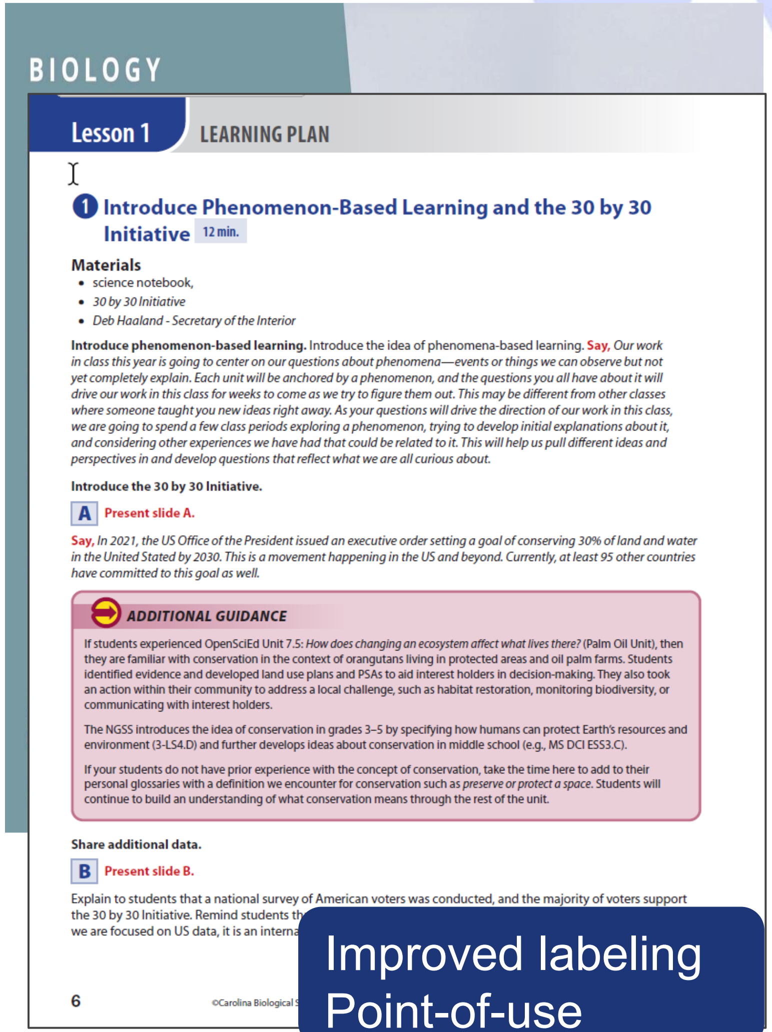
BIOLOGY

Lesson 1 LEARNING PLAN

1 Introduce Phenomenon-Based Learning and the 30 by 30 Initiative 12 min.

Materials
- science notebook,
- *30 by 30 Initiative*
- *Deb Haaland - Secretary of the Interior*

Introduce phenomenon-based learning. Introduce the idea of phenomena-based learning. **Say,** *Our work in class this year is going to center on our questions about phenomena—events or things we can observe but not yet completely explain. Each unit will be anchored by a phenomenon, and the questions you all have about it will drive our work in this class for weeks to come as we try to figure them out. This may be different from other classes where someone taught you new ideas right away. As your questions will drive the direction of our work in this class, we are going to spend a few class periods exploring a phenomenon, trying to develop initial explanations about it, and considering other experiences we have had that could be related to it. This will help us pull different ideas and perspectives in and develop questions that reflect what we are all curious about.*

Introduce the 30 by 30 Initiative.

A **Present slide A.**

Say, *In 2021, the US Office of the President issued an executive order setting a goal of conserving 30% of land and water in the United Stated by 2030. This is a movement happening in the US and beyond. Currently, at least 95 other countries have committed to this goal as well.*

ADDITIONAL GUIDANCE

If students experienced OpenSciEd Unit 7.5: *How does changing an ecosystem affect what lives there?* (Palm Oil Unit), then they are familiar with conservation in the context of orangutans living in protected areas and oil palm farms. Students identified evidence and developed land use plans and PSAs to aid interest holders in decision-making. They also took an action within their community to address a local challenge, such as habitat restoration, monitoring biodiversity, or communicating with interest holders.

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Share additional data.

B **Present slide B.**

Explain to students that a national survey of American voters was conducted, and the majority of voters support the 30 by 30 Initiative. Remind students th
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6 ©Carolina Biological S

Improved labeling
Point-of-use

Simplified Investigations and Materials

"How can we make this lesson easier, reduce cost, and enhance safety?"

- All materials are tested to ensure safety, quality, and accuracy of investigations
- Some materials have been changed to simplify lab setups
- High-quality videos or teacher demonstrations are available to save time or address safety concerns (e.g., open flame)

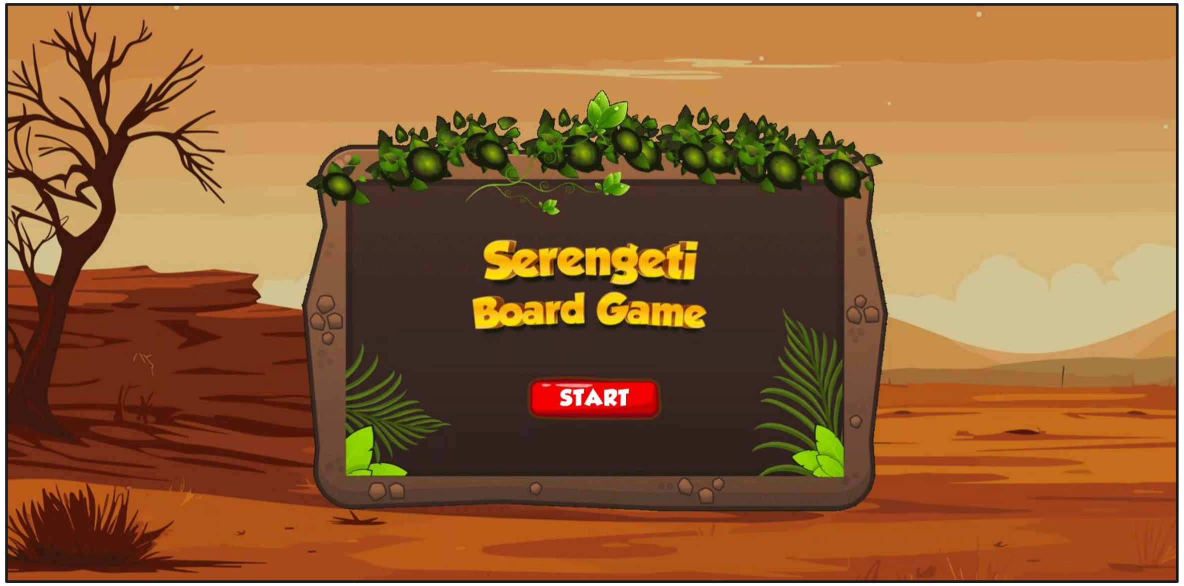
B.1 Ecosystem Interactions & Dynamics

OER Resources:

- Resize and print Gameboard
- Print and cut out Event Cards
- Print and cut out game tokens

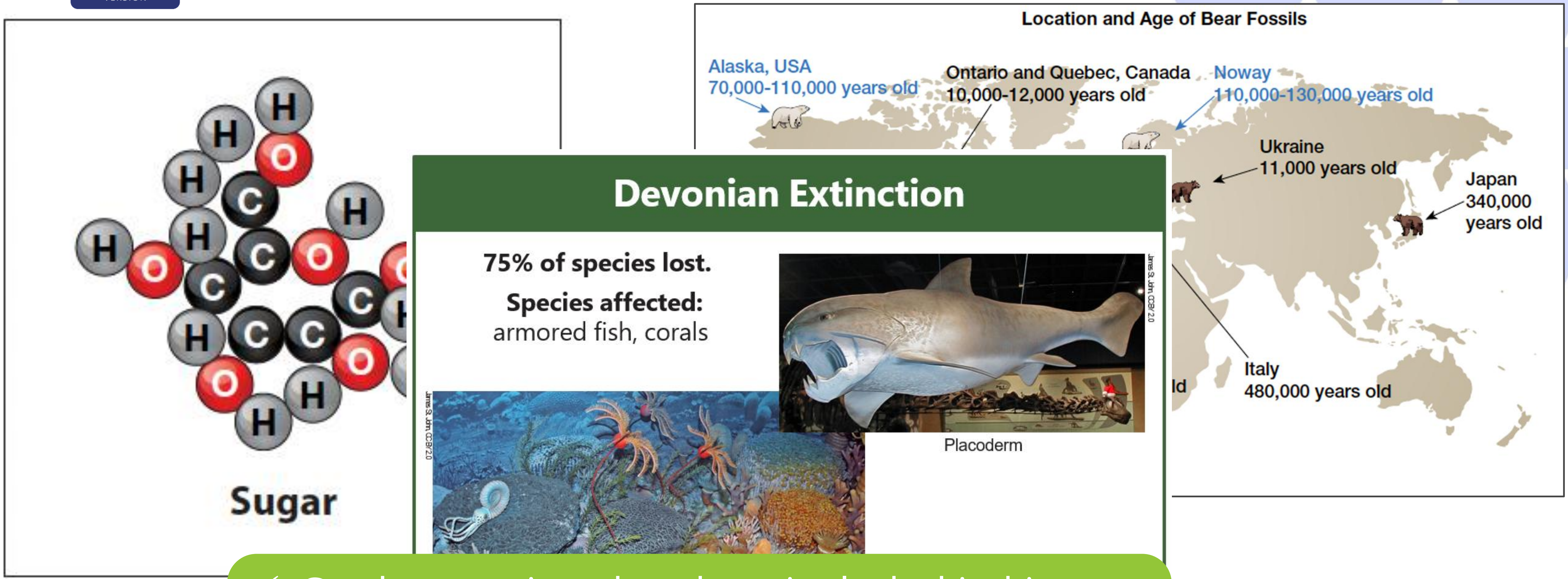
- ✓ Prepared materials
- ✓ Cut prep time
- ✓ Better storage option

B.1 Ecosystem Interactions & Dynamics



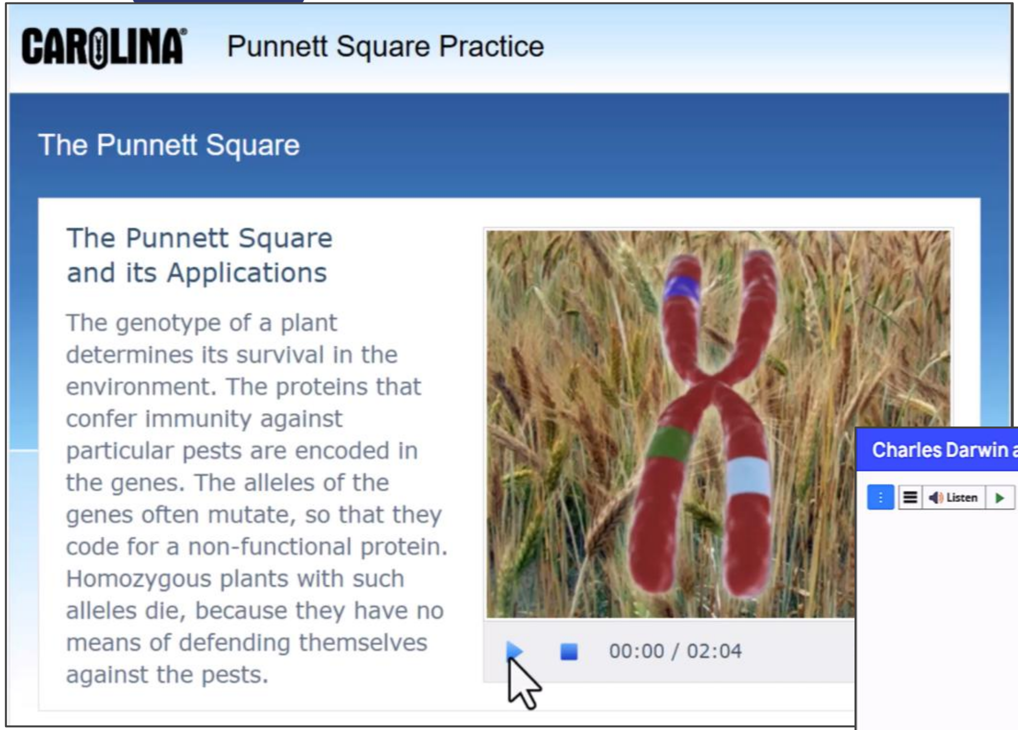
- ✓ Can be played in classroom or remotely
- ✓ Cut prep time
- ✓ Better storage option

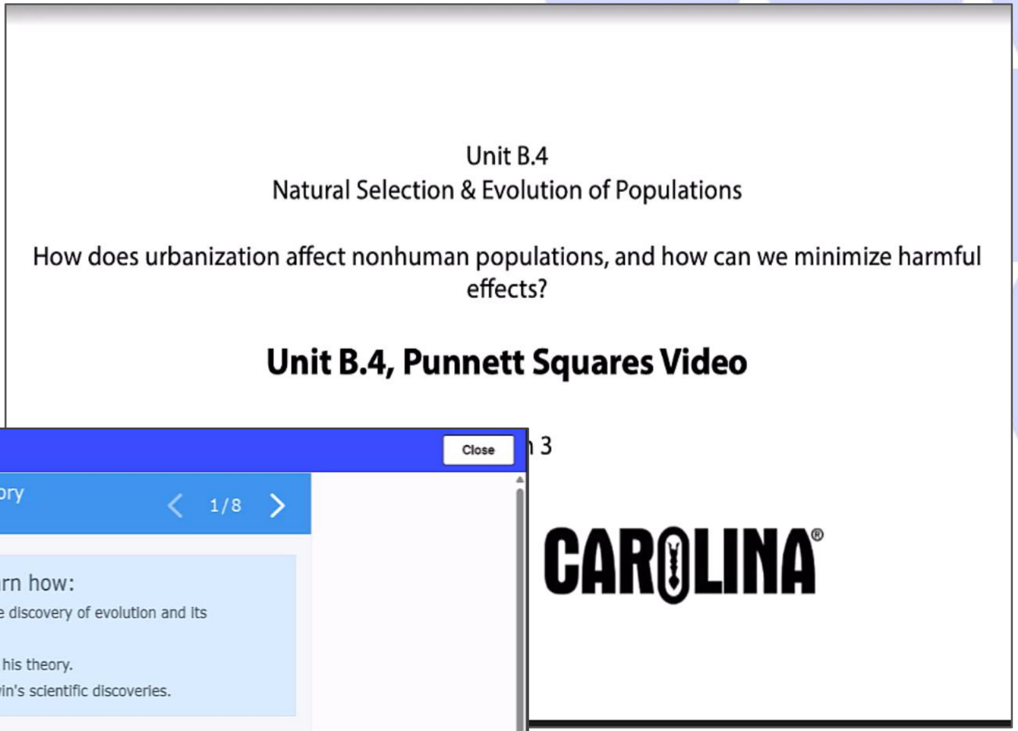
Biology Card Sets, Print and Digital

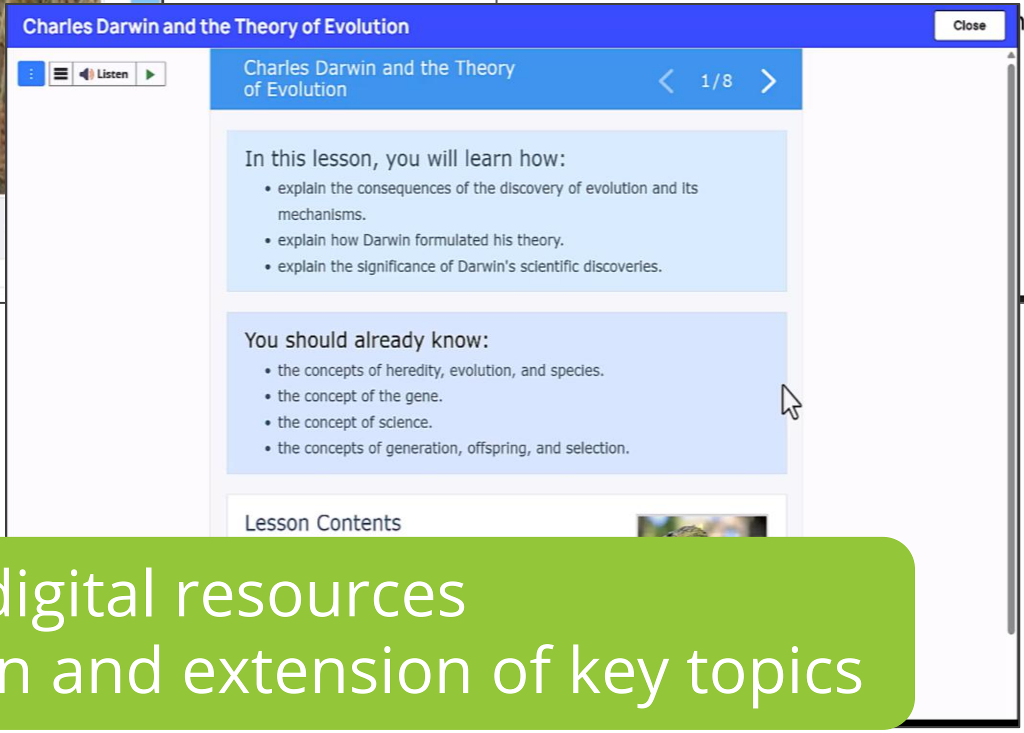


- ✓ Card sets printed and cut included in kit
- ✓ Available digitally as well
- ✓ Cuts prep time

B.4 Natural Selection & Evolution of Populations







- ✓ Additional digital resources
- ✓ Remediation and extension of key topics

C.2 Structures & Properties of Matter

OER Resources:

- Difficult and time-consuming to set up
- Not very reliable results

- ✓ Easier setup
- ✓ Reliable results
- ✓ Video option for results

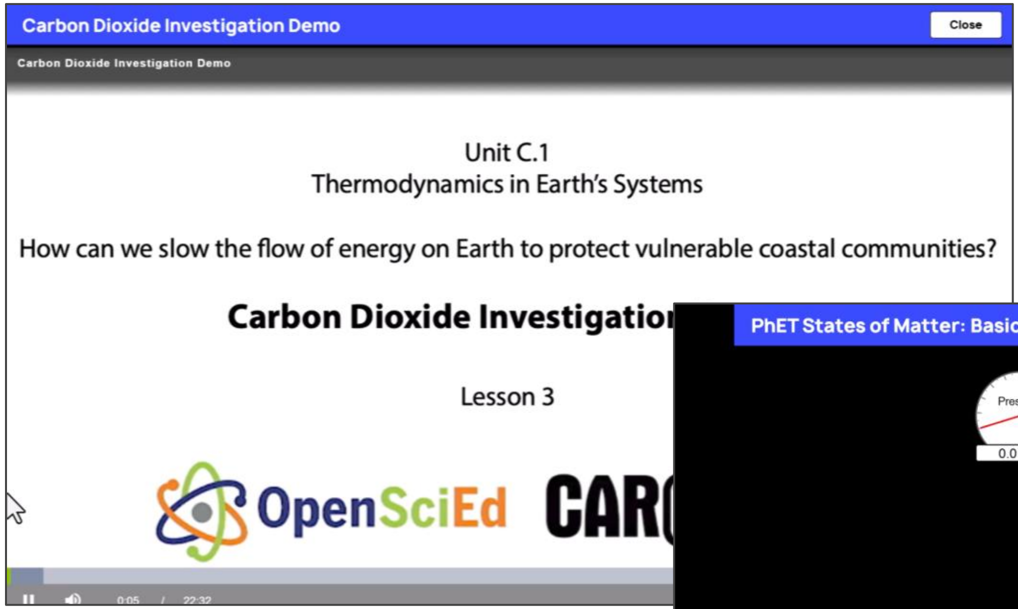
C.1 Thermodynamics in Earth's Systems

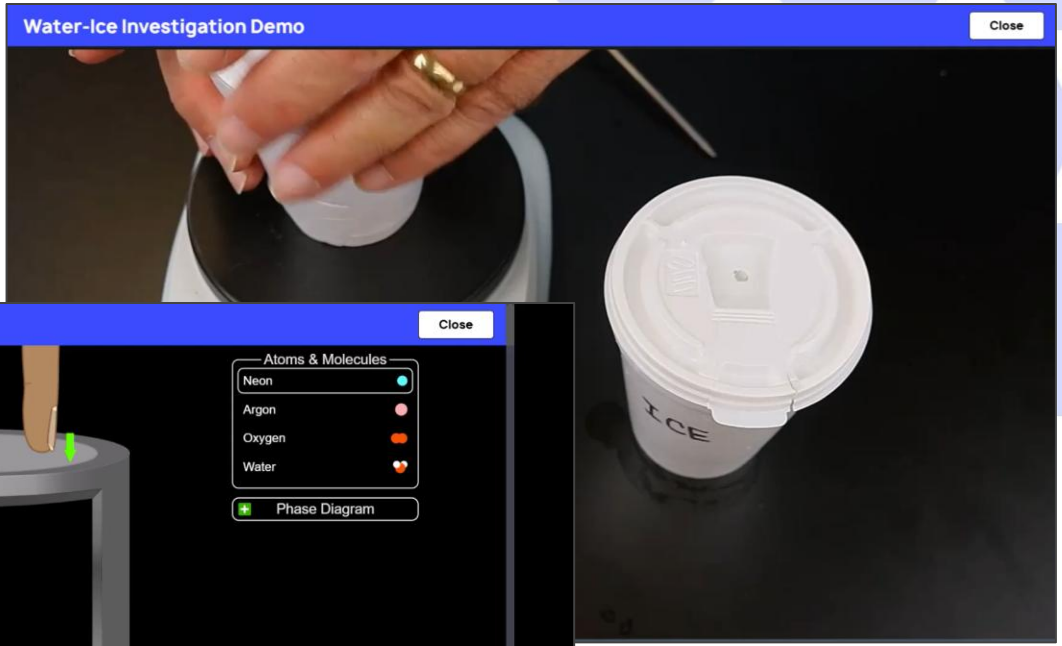
OER Resources:

- Water bottle melts
- More difficult and more time to set up
- Poor data

- ✓ Safer
- ✓ Easier setup
- ✓ Better data

Enhanced Additional Digital Resources



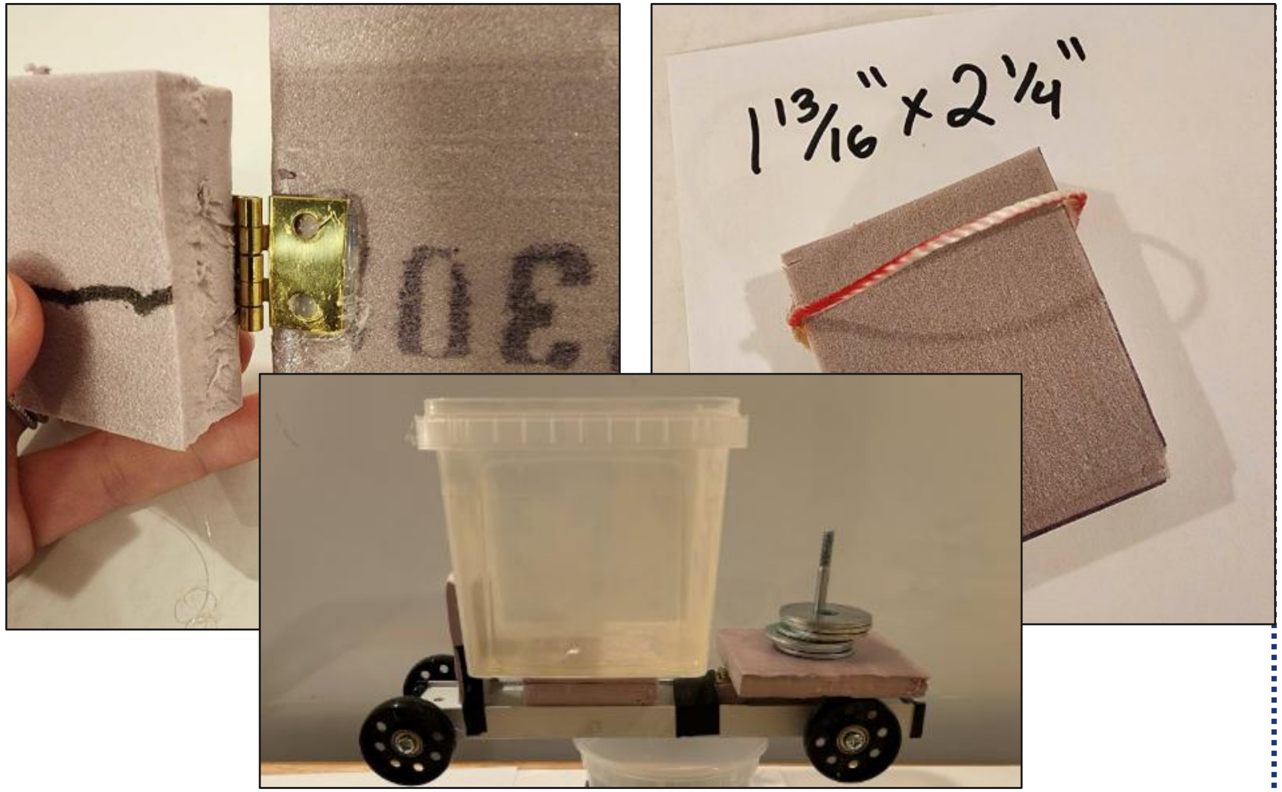


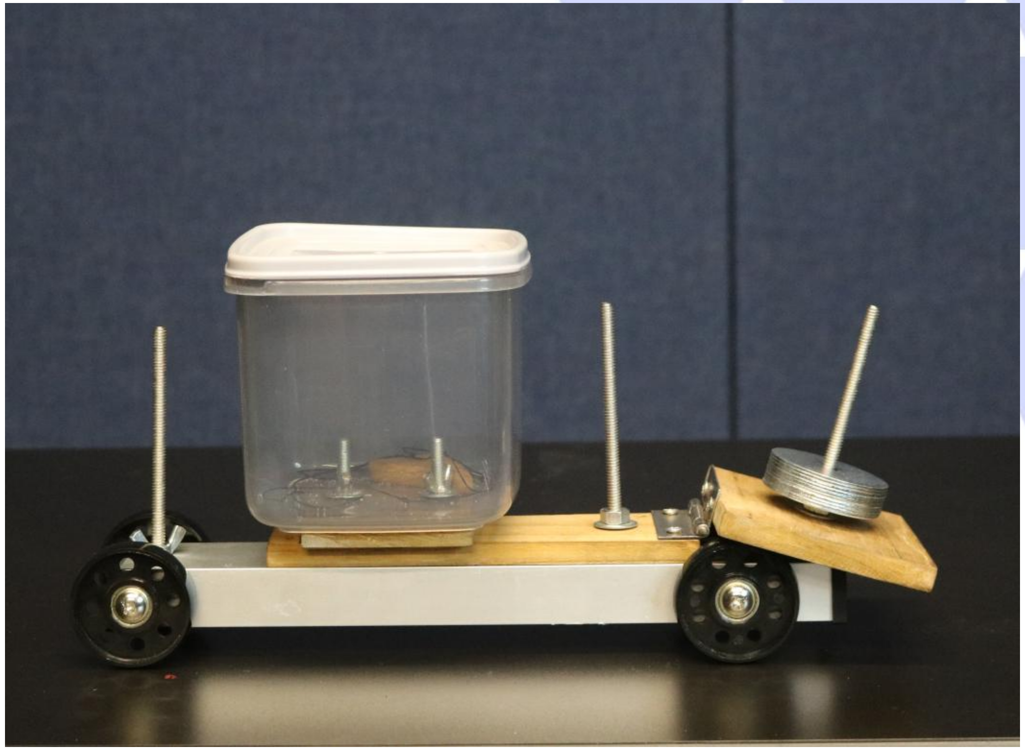
- ✓ Additional digital resources
- ✓ Remediation and extension of key topics

P.3 Collisions & Momentum

OER Resources:

- Difficult and time-consuming to set up
- Not very durable material



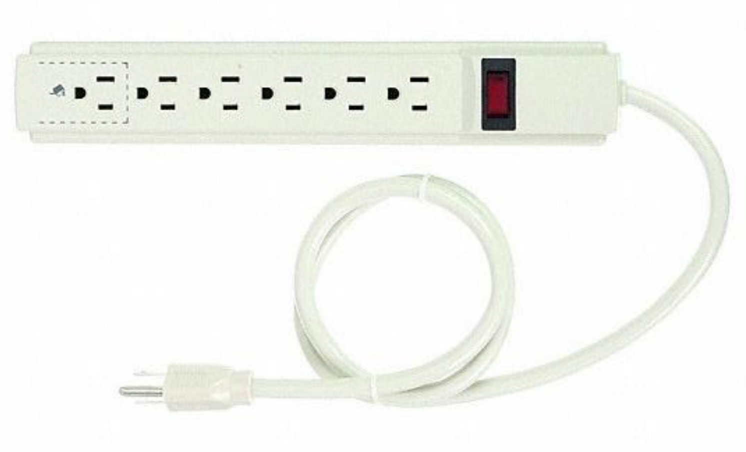


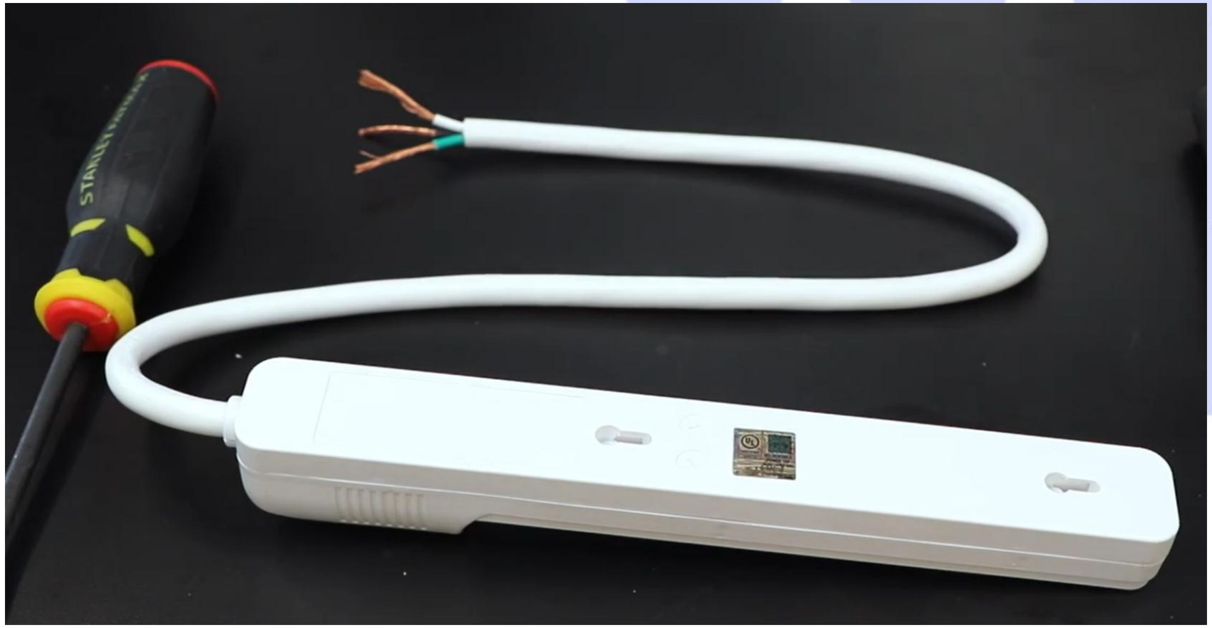
✓ Prepared materials
✓ Cut prep time to ~10 mins per group

P.1 Energy Flow from Earth's Systems

OER Resources:

- Supply your own power strip
- More difficult and more time-consuming to set up
- Safety concern for students and teachers





✓ Safer
✓ Easier setup
✓ Provided for the class

Carolina Development Plan

"It is a pleasure to partner with Carolina Biological Supply Company… to offer a Certified Version of our OpenSciEd science curriculum for middle school. ***I am impressed with how Carolina understood our vision, paired it with their expertise in designing investigations, and created a custom version with enhancements to the units.*** *We are excited that science teachers and students have a new option to transform their science education experience."*

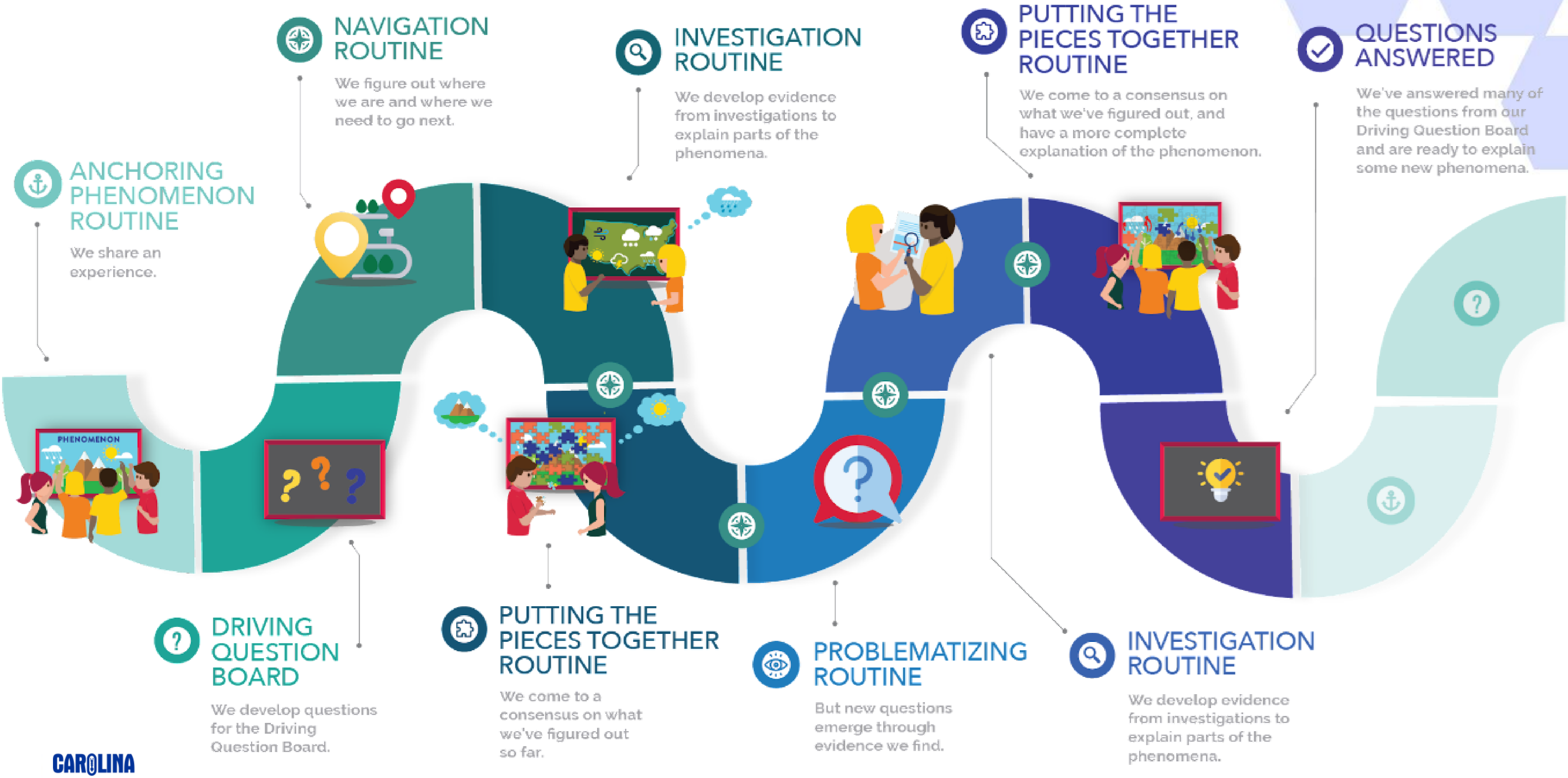
- Jim Ryan, Executive Director of OpenSciEd

Instructional Routines

Each step is driven by student questions about the phenomenon.

Anchoring Phenomenon Routine	How do we kick off investigations in a unit?
Navigation Routine	How do we work with students to motivate the next step in an investigation?
Investigation Routine	How do we help students use practices to figure out pieces of the science ideas?
Putting the Pieces Together Routine	How do we help students put together pieces of the disciplinary core ideas and crosscutting concepts?
Problematizing Routine	How do we push students to go deeper and revise their science ideas?

OpenSciEd Storyline Instructional Model



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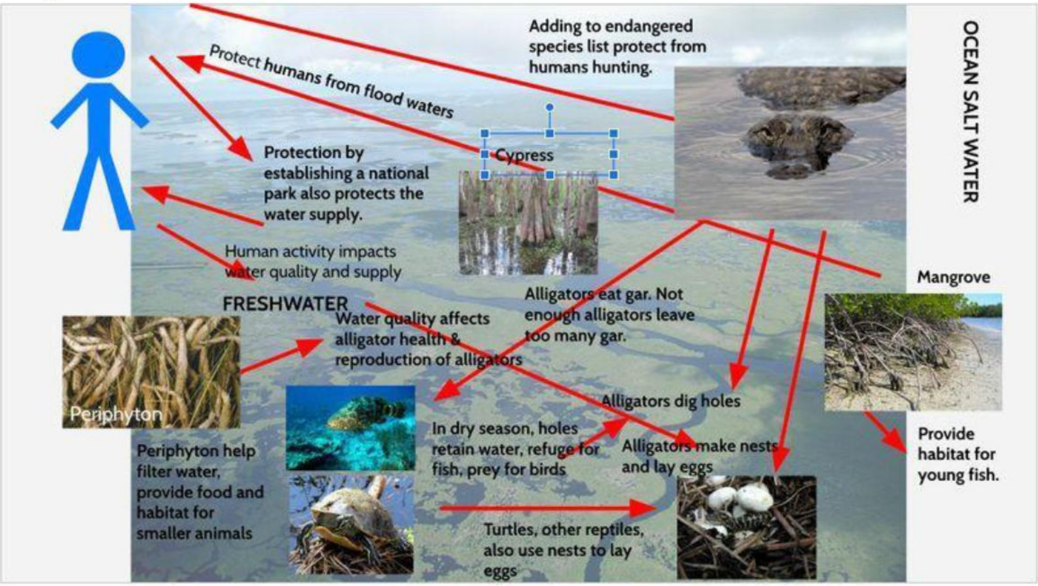
Initial Model and Driving Question Board

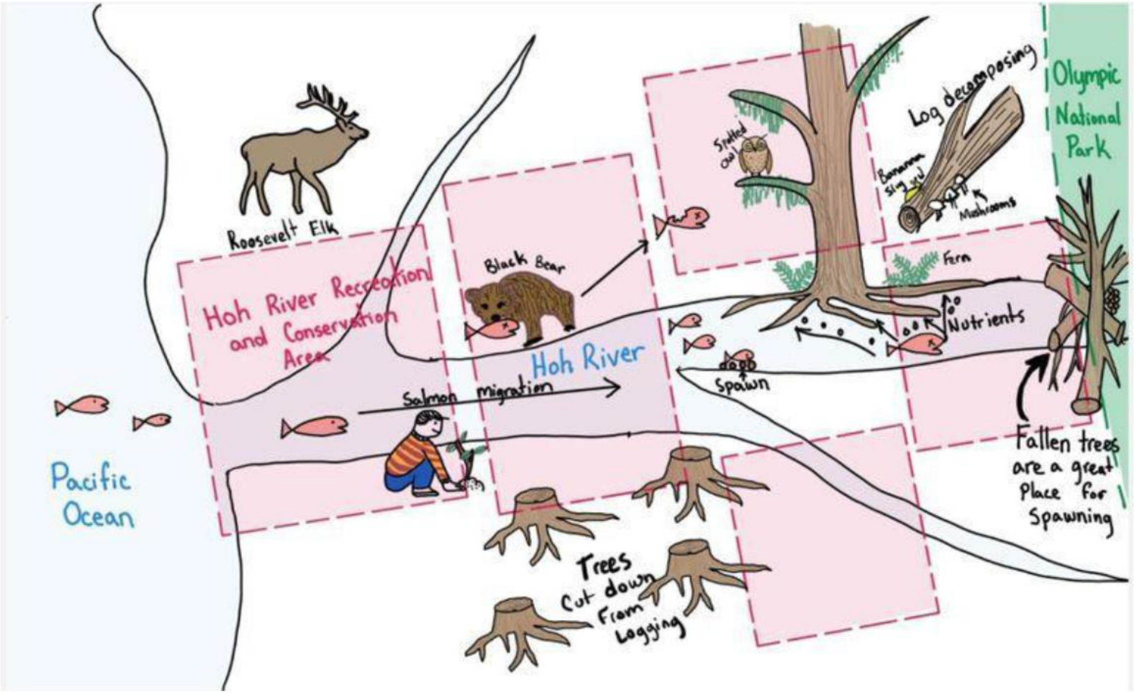
Conservation Profile Models

Everglades

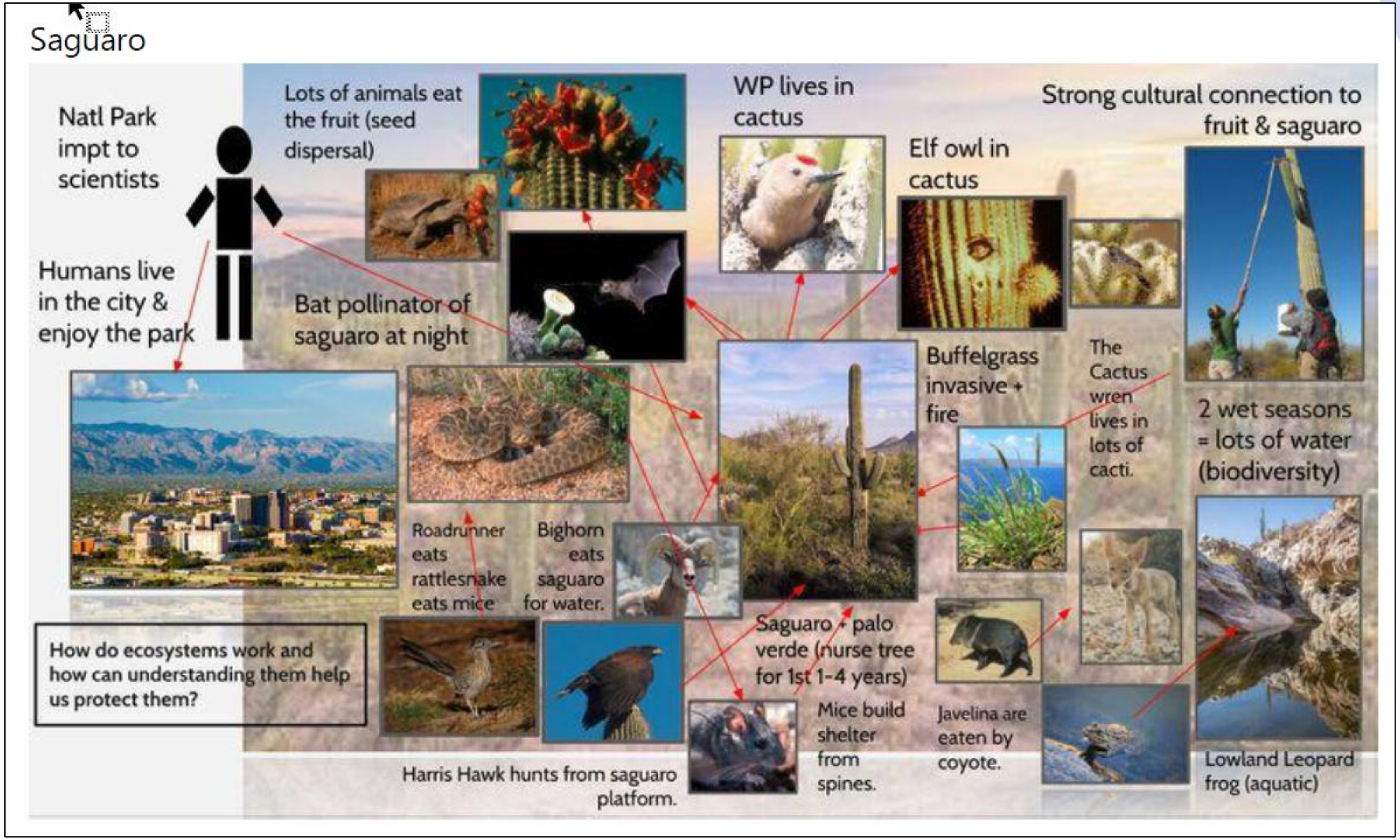


National Park Service

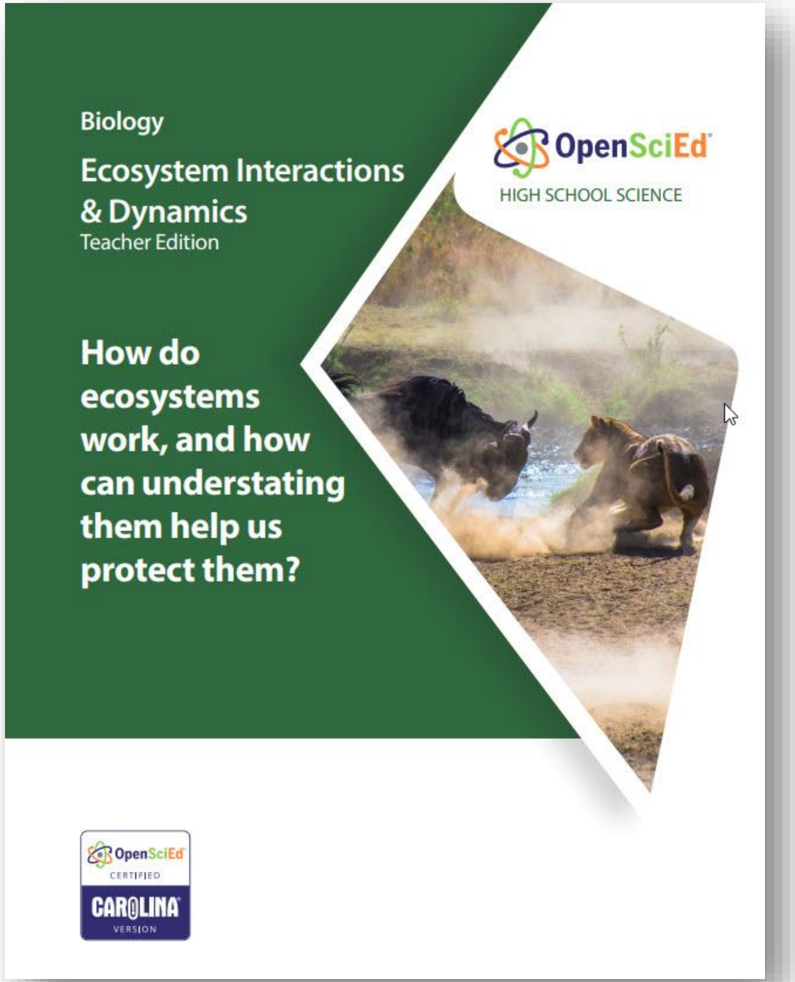
Hoh River



Use Models *for* Exploration and Explanation



Teacher Guide



OpenSciEd CERTIFIED
CAROLINA VERSION

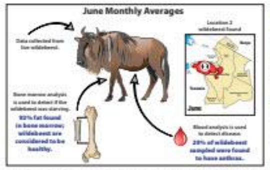
Teacher Edition

Lesson 3

Why do the animals in the Serengeti migrate?

Previous Lesson We were introduced to Serengeti National Park as a case study. We read about the creation of the park and the controversial decisions made over which areas the park should protect. We participated in an information scavenger hunt to learn about the many different species in the park, with emphasis on the migrating herds of wildebeest. We created a consensus model to explain why the park was created and who decided how humans could use the park.

This Lesson
Investigation
2 days



We revisit wildebeest migration and brainstorm reasons for why they are migrating. We watch a video of researcher Dr. Simon Mduma to hear what he observed and what data he collected. We look at wildebeest field data cards for patterns to use as evidence to connect our predictions about why wildebeest migrate. We create data displays to show our findings and share them. We notice a connection between nutritional health and wildebeest migration. We wonder how food could be causing wildebeest migration.

Next Lesson We will investigate the relationship between food and wildebeest location by looking for patterns in rainfall as well as other factors that affect the migration.

BUILDING TOWARD NGSS
HS-LS2-1, HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS2-8, HS-ESS3-3, HS-ETS1-3

What students will do

3.A Communicate information about patterns in factors that affect wildebeest migration. (SEP: 8.5; DCI: LS2.A.1; CCC: 1.5)

3.B Develop a model of wildebeest migration using patterns found in empirical evidence about factors such as predation and food availability. (SEP: 2.3; DCI: LS2.A.1; CCC: 1.5)

What students will figure out

- Some wildebeest are killed by predators, but starvation is the leading cause of death in wildebeest.
- Food is the main factor that motivates the wildebeest migration.

Lesson 3 LEARNING PLAN SNAPSHOT

Part	Duration	Summary	Slide	Materials
1	5 min	**NAVIGATE: BRAINSTORM REASONS WILDEBEEST MIGRATE** Look back at the map of the great migration and lead a discussion about why wildebeest are migrating.	A	*Wildebeest Migration Map*
2	8 min	**WATCH AND DISCUSS A VIDEO INTERVIEW OF A SCIENTIST WHO STUDIES WILDEBEEST** Watch a video and annotate a transcript to discuss what scientists wanted to know about wildebeest and how scientists studied them.	B–E	*Interview with Dr. Simon Mduma, Wildebeest Field Researcher; Transcript, Interview with Dr. Simon Mduma, Wildebeest Field Researcher*
3	10 min	**INTRODUCE WILDEBEEST FIELD RESEARCH DATA CARDS** Observe and discuss the data found on the wildebeest field research data cards.	F–G	*Analyzing Wildebeest Data Cards*
4	15 min	**EXAMINE WILDEBEEST FIELD RESEARCH DATA CARDS** Organize Wildebeest Data Cards as assigned to find patterns in the data that provide evidence to explain why wildebeest migrate.	H	*Analyzing Wildebeest Data Cards, Data and Sources for Wildebeest Data Cards, KEY: Data Cards Patterns,* Wildebeest Data Cards
5	7 min	**NAVIGATE**	I	*Analyzing Wildebeest Data Cards*

End of Day 1

Part	Duration	Summary	Slide	Materials
6	3 min	**NAVIGATE** Discuss different ways scientists communicate what they figure out from their research.	J	
7	10 min	**CREATE DATA DISPLAYS** Create a data display that communicates evidence for why wildebeest are migrating.	K	*Analyzing Wildebeest Data Cards,* Chart paper or small whiteboards
8	10 min	**COMPARE AND CONTRAST DATA DISPLAYS** Share, discuss, and compare the data displays with other groups.	L	Data displays, *KEY: Data Cards Patterns*

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Teacher Edition

2 Watch and Discuss a Video Interview of a Scientist Who Studies Wildebeest 8 min

Materials
- *Interview with Dr. Simon Mduma, Wildebeest Field Researcher* video
- *Transcript, Interview with Dr. Simon Mduma, Wildebeest Field Researcher*

Watch a clip from an interview with a scientist who studies wildebeest.

B Present slide B.

Say, *I was able to find an interview with a scientist who studied wildebeest populations in the Serengeti. Let's first take a look at a short biography that highlights some of the things he has accomplished and consider how hearing from this scientist and looking at his research could help us understand more about wildebeest migration.* Allow students a few minutes to read over the slide, then have a short discussion about how Dr. Mduma's research could be useful.

Suggested prompt	Sample student response
How do you think Dr. Mduma's research could help us answer our questions?	*His research might give us some data to help us figure out why the wildebeest migrate or answer other questions we have about wildebeest.*
What would you want to know about his research?	*We want to know what data he collected and what he figured out.*

Play *Interview with Dr. Simon Mduma, Wildebeest Field Researcher* once, allowing students to watch and listen to the video.

C Present slide C.

Distribute *Transcript, Interview with Dr. Simon Mduma, Wildebeest Field Researcher*. Then play the video again. For the second viewing, have students annotate the transcript by underlining ideas that could help us understand wildebeest migration, circling ideas about data Dr. Simon Mduma looked at, and drawing question marks where they have questions.

Turn and talk with a partner about the questions on the slide.

D Present slide D.

Give students a minute to discuss the questions on the slides using their annotated transcripts. Then facilitate a whole-class discussion, allowing student pairs to share with the whole class.

Suggested prompt	Sample student response
What interested Dr. Mduma and other scientists about studying wildebeest?	*They were interested in understanding if poaching was affecting the population.*
What did Dr. Mduma determine about poaching? How did he come to this conclusion??	*The scientists looked at population data.* *They say that while poaching was continuing the population was not decreasing.* *They looked at mortality factors.*
What did they decide to investigate next?	*They decided to investigate mortality factors.*
How could these mortality factors connect to our ideas about wildebeest migration?	*We think that the wildebeest are migrating because if they stay in an area then they might die. If we understand why some are dying, we might be able to explain why the rest are moving.*

Update personal glossaries. [1, 2]

E Present slide E.

Say, *What I heard you saying was that Dr. Mduma had evidence from population data that poaching was not a factor. Scientists call this kind of data, from observation and experimentation, "empirical evidence."* Pause and give students a moment to update their personal glossaries by adding an entry for empirical evidence as a definition they encountered. Additionally, if your students do not have prior experience with the concept of mortality factors, take the time here to add to their personal glossaries as a definition we encounter such as *factors that affect survival or cause death.*

[1] **ATTENDING TO EQUITY**
Supporting Emergent Multilinguals: When developing new vocabulary, strategies that may benefit emergent multilingual learners are to use student-friendly definitions, make connections to cognate words when possible, and encourage students to include a visual representation of the word. Use these strategies throughout the unit for both "definitions we co-construct" and "definitions we encounter."

[2] **SUPPORTING STUDENTS IN DEVELOPING AND USING PATTERNS**
In this lesson, students analyze data to identify patterns. These patterns will serve as evidence to support explanations. At the high-school level, it is important that students build an understanding of and use empirical data as evidence. Empirical data will serve as evidence not only as they identify patterns, but also as they support arguments and make claims about cause and effect in biology and across disciplines.

Teacher Edition

4 Examine Wildebeest Field Research Data Cards 15 min

Materials

- *Analyzing Wildebeest Data Cards*
- *Data and Sources for Wildebeest Data Cards*
- KEY: *Data Cards Patterns*
- Wildebeest Data Cards

Support students in identifying patterns. **Say,** *However your group is organizing your cards, you will be looking for patterns in the data. What are we looking for when we look for patterns?* Listen for students to say they are looking for things to repeat.

Analyze wildebeest field data in groups. Organize students into small groups of 3–5.[3] As a class, assign one way each group will organize their cards to look for patterns. Make sure that all the ways to organize the cards that you listed have been assigned and are covered by at least one group. Then, distribute Wildebeest Data Cards for each pair or small group of students. **Say,** *Let's take a moment to organize the Wildebeest Data Cards, then look for patterns. Remember, a lot of our potential ideas related to the survival of the wildebeest, so once you organize them as you were assigned, compare the living and dead wildebeest to see if there are similarities or differences between them. Record all your findings in Part 3 on* Analyzing Wildebeest Data Cards. Make sure each student records their findings on their handout.

[3] SUPPORTING STUDENTS IN DEVELOPING AND USING PATTERNS

In this lesson, students focus on identifying patterns of empirical evidence to help answer questions about why the wildebeest migrate. For example, live wildebeest have a higher percentage of fat in their bone marrow than dead wildebeest. This evidence becomes a pattern when we see it repeat in multiple months. Both finding patterns and the absence of a pattern provide the class with meaningful evidence to help explain why wildebeest are migrating. Encourage groups that do not find patterns to think about what that tells them about wildebeest migration.

ASSESSMENT OPPORTUNITY

What to look for/listen for in the moment: Evidence communicated in Part 3 of *Analyzing Wildebeest Data Cards* (SEP 8.5) about the following patterns (CCC 1.5) that affect wildebeest migration (DCI: LS2.A.1):

- Bone marrow health showing that wildebeest killed by predators have slightly better bone marrow health than wildebeest that did not die from predators. (DCI: LS2.A.1)
- Live wildebeest have a higher percentage of fat in their bone marrow than dead wildebeest. (DCI: LS2.A.1)
- June and July were the only months where anthrax was found in the population. (DCI: LS2.A.1)
- There was no difference of anthrax infection percentages between living and dead wildebeest. (DCI: LS2.A.1)
- In some months/locations there were bigger differences between living and dead wildebeest's bone marrow fat (June–October) than other months (May). (DCI: LS2.A.1)

What to do:
Collect *Analyzing Wildebeest Data Cards* from each student. Use KEY: *Data Cards Patterns* as a guide to help you identify the appropriate evidence. Use the suggested feedback in the key to provide written feedback to individual students.

Building toward: 3.A.1 Communicate information about patterns in factors that affect wildebeest migration. (SEP 8.5; CCC 1.5; DCI: LS2.A.1)

M Present slide M.

Use prompts such as those that follow to facilitate this discussion.

KEY IDEAS

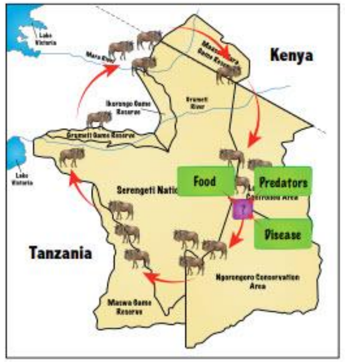
Purpose of this discussion: Come to consensus about the patterns we saw in grouping the Wildebeest Data Cards and use these patterns as evidence for an explanatory classroom consensus model about wildebeest migration.

Listen for these ideas:

- Living wildebeest have better nutritional health than both wildebeest killed by predation and those not killed by predation.
- There are no differences between living and dead wildebeest when it comes to anthrax.
- Later months, like September and October, seem to have bigger nutritional health differences than months like May.
- We have evidence that nutritional health seems to be an important factor in wildebeest survival.
- We think that food might be the driver for wildebeest migration.

Suggested prompt	Sample student response
At the beginning of this lesson, we returned to a map showing the wildebeest migration. What did we want to figure out?	*We wanted to understand why wildebeest were migrating.*
What possible ideas did we come up with that could explain the wildebeest migration?	*It could be because of predators.* *It could be for food.* *It could be related to diseases.*

Update class consensus model. At this point, add sticky notes to the Serengeti class poster to indicate the class's ideas about what is causing the migration. Use 6- × 8-in sticky notes to add all the different class ideas that students think could be causing the migration. Use 3- × 3-in sticky notes to draw question marks where the class has questions. Your classroom consensus model may look like the example shown here.



Continue the discussion to identify the data patterns about the disease anthrax. Discuss whether patterns of disease can be used as evidence to help support ideas about wildebeest migration. **Say,** *A lot of our ideas about wildebeest migration connect to survival. Let's first discuss what disease patterns we observed between living and nonliving wildebeest when we organized Wildebeest Data Cards.*

CAROLINA UNLEASH LEARNING

OpenSciEd

Assessment

Assessment System Overview

Each OpenSciEd unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons, including pre-assessment, formative assessment, summative assessment, and student self-assessment. Formative assessments are embedded and called out directly in the lesson plans. Please look for the "Assessment Opportunity" teacher support boxes to identify places for assessments. In addition, the table below outlines where each type of assessment can be found in the unit.

Overall Unit Assessment

Lesson 1	
Assessment and Scoring Guidance	**Purpose of Assessment**
Initial Models Driving Question Board	**Pre-Assessment** The student work in Lesson 1 should be considered a pre-assessment. It is an opportunity to learn more about the ideas your students bring to this unit. Hearing these ideas early on can help you be more strategic in how to build from and leverage student ideas across the unit. The initial model developed on Day 2 of Lesson 1 is a good opportunity to pre-assess student understanding of how students define and identify the important components and interactions of the system they investigate in their Conservation Profiles. The Driving Question Board is another opportunity for pre-assessment. Reinforce that students should generate open-ended questions, such as how and why questions, and post them to the board. However, any questions students share, even if they are closed-ended questions, can be valuable. Make note of any closed-ended questions and use navigation time throughout the unit to have your students practice turning these questions into open-ended questions when they relate to the investigations underway.
Lesson 2	
Assessment and Scoring Guidance	**Purpose of Assessment**
Scavenger Hunt Notes *Obtaining and Communicating Information Self-Assessment* *Graphic Organizer for Scavenger Hunt* KEY: *Graphic Organizer for Scavenger Hunt* Driving Question Board	**Formative** At the end of Day 1 students complete an exit ticket that summarizes what they learned about the formation of Serengeti National Park from the scavenger hunt on *Scavenger Hunt Notes*. This allows the teacher to assess individual students' ability to summarize information concisely and accurately. It also allows the teacher to group students who will work together using complementary information on Day 2. **Formative + Student Self-Assessment** Students complete *Obtaining and Communicating Information Self-Assessment* on Day 2 to reflect on their ability to record what they learned from the scavenger hunt and share that information with their peers when they worked together to complete *Graphic Organizer for Scavenger Hunt*. This allows students to reflect on their progress in SEP 8: *obtaining, evaluating, and communicating information*. **Formative** This Driving Question Board check-in allows students to see if they have answered any of their initial questions and then add questions about the Serengeti ecosystem function, in particular the migrating wildebeest that were introduced in this lesson. These serve as motivation for further investigations in the unit.

Lesson 8	
Assessment and Scoring Guidance	**Purpose of Assessment**
Serengeti Component Interactions KEY: *Serengeti Component Interactions* Driving Question Board *Unit B.1, Lesson 8 - Exit Ticket, Electronic* KEY: *Lesson 8 - Exit Ticket*	**Formative** This assessment opportunity aids students in applying the ideas they developed earlier in the unit to develop a more complex ecosystem model showing how components, interactions, and mechanisms in the Serengeti could be affected by disturbance. **Formative** This Driving Question Board check-in provides students a chance to answer questions related to complex interactions in ecosystems, while also aiding navigation into Lesson Set 3 by reminding them that many of our unanswered questions related to Serengeti National Park and students' conservation profiles. **Formative + Summative + Community Building** This second and final electronic exit ticket focuses on how ecosystems are resilient in response to a disturbance, which students will use again in Lessons 9, 10, and 11. It also provides an opportunity for students to share their thinking about various models developed from data and predictions; tie the concepts of biodiversity, disturbance, and resilience to their conservation profiles; and reflect on the role of stability and change in their sensemaking. Finally, students again celebrate how they have helped the class make progress.
Lesson 9	
Assessment and Scoring Guidance	**Purpose of Assessment**
Conservation Plan Evaluation KEY: *Conservation Plan Evaluation* *Road Proposal Evaluation* KEY: *Road Proposal Organizer Answer Key* *Unit B.1, Lesson 9 - Individual Assessment* KEY: *Unit B.1, Lesson 9 - Individual Assessment*	**Formative** Students use a model (Conservation Evaluation Tool) to evaluate the conservation plan in the Serengeti and identify the impacts for the system, including the human interest holders. **Formative** This assessment opportunity asks students to evaluate three different road proposals using the resources from the Learning in Places Ethical Decision-Making Tool. **Formative** This individual assessment opportunity asks students to construct a three-dimensional explanation of their road proposal evaluation.
Lesson 10	
Assessment and Scoring Guidance	**Purpose of Assessment**
Evaluating Conservation Plans KEY: *Evaluating Conservation Plans* Driving Question Board *Reviewing Our DQB*	**Formative** This assessment opportunity asks students to evaluate a conservation plan by using the data from their conservation profile as evidence to determine the impact the plan would have on organisms, the overall ecosystem, and other interest holders. **Formative + Summative** The final Driving Question Board check-in allows students to celebrate everything they have figured out in the unit. Students can also identify questions that were not answered in this unit, which might be addressed in later units or courses, or can serve as areas of independent research. Finally, this Driving Question Board check-in acts as a review of the units' ideas before students engage with the final transfer task.

Assessment

ASSESSMENT Unit B.1

Lesson-by-Lesson Assessment Opportunities

Every OpenSciEd lesson includes one or more lesson-level performance expectations (LLPEs). The structure of every LLPE is designed to be a three-dimensional learning, combining elements of science and engineering practices, disciplinary core ideas, and crosscutting concepts. The font used in the LLPE indicates the source/alignment of each piece of the text used in the statement as it relates to the NGSS dimensions: alignment to **Science and Engineering Practice(s)**, alignment to **Crosscutting Concept(s)**, and alignment to the **Disciplinary Core Ideas.**

The table below summarizes opportunities in each lesson for assessing every lesson-level performance expectation (LLPE). Examples of these opportunities include student handouts, home learning assignments, progress trackers, and student discussions. Most LLPEs are recommended as potential formative assessments. Assessing every LLPE listed can be logistically difficult. Strategically picking which LLPEs to assess and how to provide timely and informative feedback to students on their progress toward meeting these is left to the teacher's discretion.

Lesson 1

Lesson-Level Performance Expectation(s)	Assessment Guidance
1.A Obtain information about how and why humans manage natural resources and communicate it as conservation criteria established to stabilize parts of the system. (SEP: 8.1; DCI: ESS 3.C.1; CCC: 7.1)	**1.A When to check for understanding:** On Day 1, when students brainstorm criteria for conservation based on information found in the reading, *30 by 30 Initiative*. **What to look for/listen for in the moment:** Varied motivations for humans to protect places, lands, and waters to stabilize the system, such as (DCI: ESS 3.C.1; CCC: 7.1): • natural beauty • recreation • ecosystem services • biodiversity • endangered/threatened species • cultural significance
1.B Develop a model based on evidence of an ecosystem that illustrates relationships between living and nonliving components and how they have changed over time as a result of human interactions. (SEP: 2.3; DCI: ESS 3.C.1; CCC: 7.1)	**1.B When to check for understanding:** When students develop their initial models on Day 2. **What to look for/listen for in the moment:** • Models include evidence of components and interactions from conservation profiles (SEP: 2.3; DCI: ESS 3.C.1). • Models include interactions between human and non-human components that illustrate changes over time (SEP: 2.3; DCI: ESS 3.C.1; CCC: 7.1).

1.C Ask questions to clarify or seek information about what causes humans to protect ecosystem functioning and productivity and what the effects of the protection are. (SEP: 1.1; DCI: LS 4.D.2; CCC: 2.2)	**1.C When to check for understanding:** When students develop the Driving Question Board on Day 3.
	What to look for/listen for in the moment: Questions to clarify and seek information about (SEP: 1.1):
	• causes or motivations of conservation (DCI: 4.D.2)
	• targets of conservation
	• effects of the conservation on stability and change (CCC: 2.2) of:
	  ▶ living and nonliving components of the ecosystem (DCI: 4.D.2)
	  ▶ interactions (DCI: 4.D.2)

Unit B.1 ASSESSMENT

Lesson 4

Assessment and Scoring Guidance	Assessment Guidance
4.A Analyze data using CODAP to determine how seasonal changes in rainfall limit food availability in the Serengeti. (SEP: 4.1; DCI: LS2.A.1; CCC: 7.1)	**4.A When to check for understanding:** When students complete an exit ticket at the end of Day 1. **What to look for/listen for in the moment:** Evidence to support the following claims (SEP: 4.1): • There is a wet season and a dry season that repeat each year with the most rain around April and the least around July. More rain means more grass and less rain means less grass. (DCI: LS2.A.1; CCC: 7.1) • There is no evidence to support this claim. • The pattern was similar for all three regions, but the rainfall amounts were always slightly higher for the north in each month, so there should be more grass there all year long. (DCI: LS2.A.1; CCC: 7.1)
4.B Use mathematical representations of empirical evidence related to rainfall and wildebeest location to support claims about the cause of the migration. (SEP: 5.2; DCI: LS2.A.1; CCC: 2.1)	**4.B When to check for understanding:** When students complete an exit ticket at the end of Day 2. **What to look for/listen for in the moment:** Evidence to support or contradict the following claims, drawing on patterns identified from mathematical representations. (SEP: 5.2; CCC: 2.1): • The scatter plot for the south region shows a positive relationship between annual rainfall and wildebeest occupancy, so this claim is supported by the data. Students do NOT need to use the word "positive," but look for the conceptual recognition of the upward trend in the data. (SEP: 5.2; DCI: LS2.A.1; CCC: 2.1) • The scatter plot for the west and north regions shows a negative relationship between annual rainfall and wildebeest occupancy, so this claim is not supported by the data. Students do NOT need to use the word "negative," but look for the conceptual recognition of the downward trend in the data. (SEP: 5.2; DCI: LS2.A.1; CCC: 2.1) • When comparing the scatter plots for all three regions, we can see that the wildebeest are spending more time in the west and in the south based on the higher values for wildebeest percentage occupancy. (SEP: 5.2; DCI: LS2.A.1; CCC: 2.1)
4.C Revise a model to include new evidence about factors that affect wildebeest survival to illustrate the patterns and relationships and limits of resources that the wildebeest migration depends on. (SEP: 2.3; DCI: LS2.A.1; CCC: 3.1)	**4.C When to check for understanding:** When the class revises the consensus model at the end of Day 3. **What to look for/listen for in the moment:** Model revisions that include the following evidence (SEP: 2.3): • Wildebeest are in the south during the wet season, even though that is not where the most rain is. (DCI: LS2.A.1; CCC: 3.1) • Wildebeest give birth in the south during the wet season, and that is where the best, most nutritious food is due to the richest soil and also where they can most easily see their predators. (DCI: LS2.A.1; CCC: 3.1) • The wildebeest move on to the west when the wet season is ending, in search of other grass. (DCI: LS2.A.1; CCC: 3.1) • During the dry season, the soil in the west is drier, making it easier for the wildebeest to walk through and making the grass more nutritious during that time. (DCI: LS2.A.1; CCC: 3.1) • The north has the most rain, but it has less nutritious grass, so the wildebeest only go there in the dry season, when there is no food in the south. (DCI: LS2.A.1; CCC: 3.1) • The Mara River is in the north, which provides water year round. (DCI: LS2.A.1; CCC: 3.1) • Looking at small-scale relationships can help us understand the pattern of migration at the scale of the Serengeti ecosystem. (CCC: 3.1)

CAROLINA UNLEASH LEARNING

OpenSciEd

Enhanced Assessment

Question types include:

- **Multiple choice**
- **Evidence-supported response**—A scenario or question that provides 3 correct or partially correct responses. Students choose the best response, then support their choice with evidence.
- **Scenario-based free response**

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Enhanced Assessment

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OSE B.1 Lesson 3: Your class is comparing and contrasting different data displays related to wildebeest migration. Some groups have organized their data into charts focusing on nutritional health, while others have emphasized predator data or environmental conditions.

1. What similarities and differences can you find between data displays focusing on nutritional health versus those focusing on predator data?
2. How can contrasting data displays help you draw more comprehensive conclusions about wildebeest migration?
3. What criteria should be used to determine what information is included in the final class data display?

OSE B.1 Lesson 3: What do the differences in bone marrow health between live and dead wildebeest indicate?

A. Nutritional differences impact survival against predation. (Correct)
B. Environmental temperature changes are the main cause of death.
C. Age differences solely determine wildebeest's survival chances.
D. Anthrax is the only factor influencing bone marrow health.

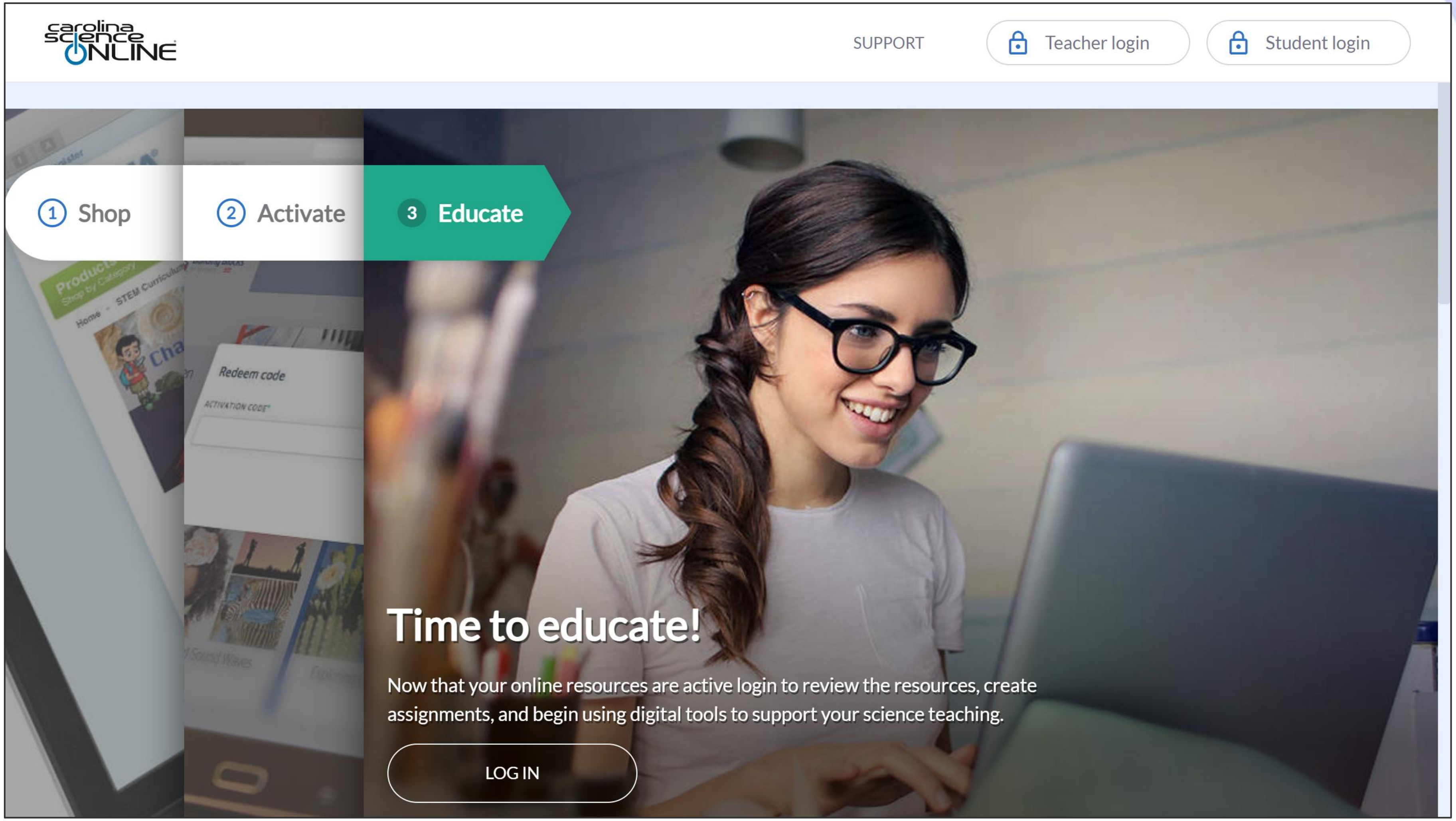
OSE B.1 Lesson 3: What is the significance of bone marrow data in understanding wildebeest migration? Explain your answer with examples.

1. Bone marrow data provides the strongest evidence for what causes wildebeest migration, showing a clear difference between the health of living and dead wildebeest.
2. Bone marrow data is slightly helpful, but it mainly highlights the differences in age among the wildebeest population.
3. Bone marrow data shows no notable differences and is therefore insignificant in understanding wildebeest migration.

CAROLINA UNLEASH LEARNING

OpenSciEd

Enhanced Digital Content



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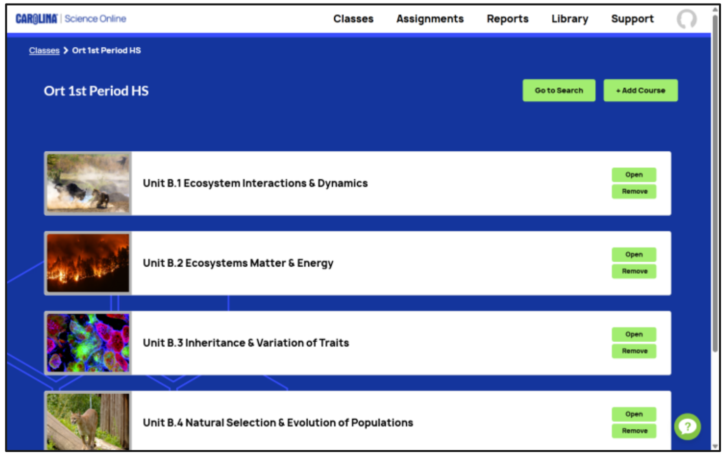

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