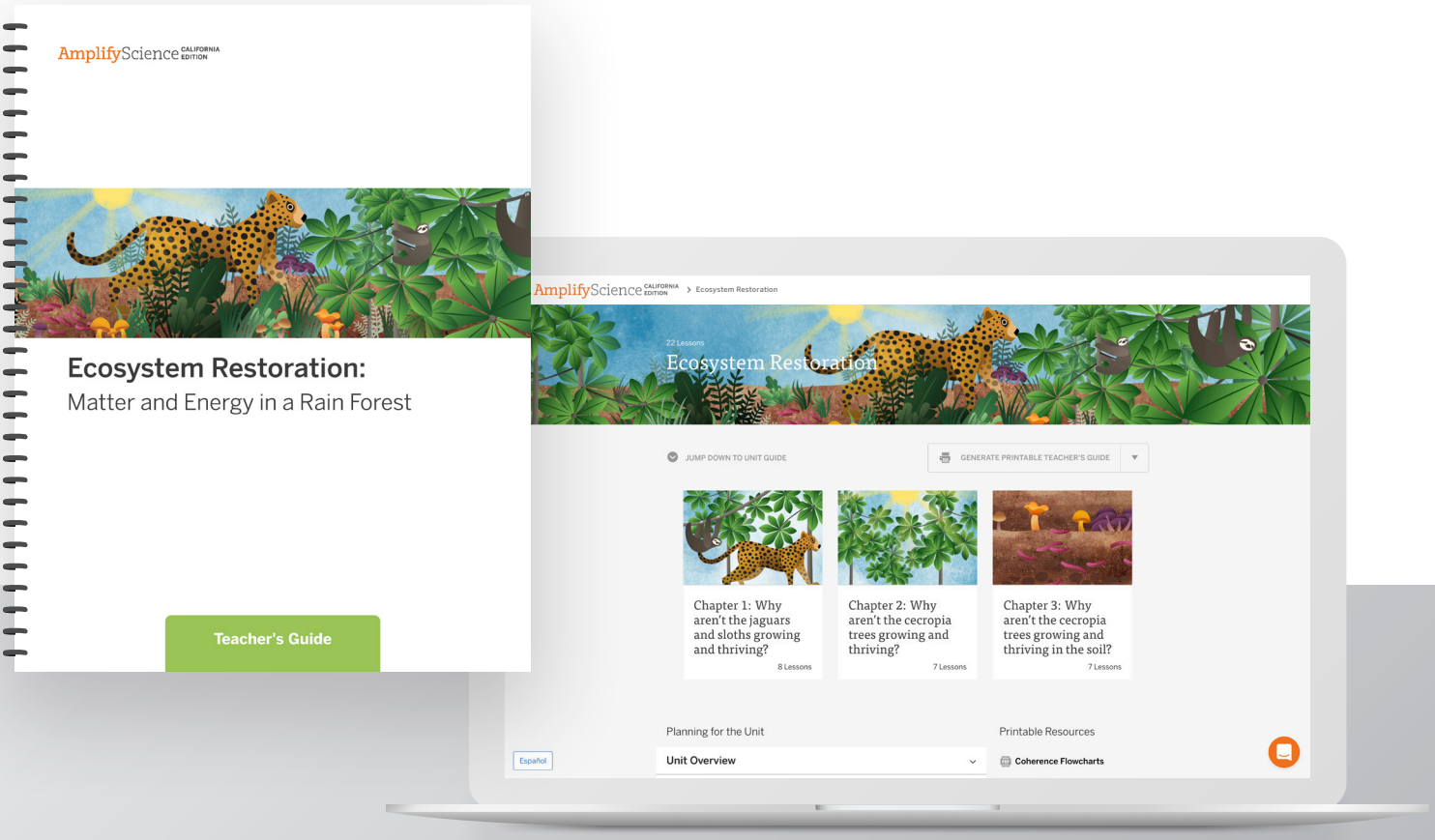
Amplify Science
CALIFORNIA

Grade 5

UNIT GUIDE

Ecosystem Restoration



Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Table of contents

Welcome to Ecosystem Restoration

In the past, students were expected to be able to categorize organisms in an ecosystem as producers (plants) and consumers (animals and decomposers) and to know the relationships among these groups by using food chains and food webs. Now, the expectations are much more rigorous. Students must also be able to describe the movement of matter and energy among plants, animals, decomposers, and the environment. Unlike other programs, Amplify Science California helps all students rise to this challenge. By focusing on the mechanism underlying food chains and food webs, students develop a richer understanding of the connections among organisms. In addition, they can more effectively visualize food matter that in one organism becomes body matter of another organism. This represents a marked shift in the way that students learn about ecosystems.

> Unlike a typical curriculum, Amplify Science California anchors learning by inviting students to take on the role of scientists and engineers.

In this unit, students take on the role of ecologists. Their job is to help the Natural Resource Rescue organization figure out why a reforested section of the Costa Rican rain forest ecosystem is failing. Working together, they figure out the source of the problem, and write and revise a Rain Forest Restoration Plan. By the end of the unit, students present their final recommendations for restoring the failing rain forest ecosystem to its original condition.

Unit Type: Argumentation

Student Role: Ecologists

Phenomenon: The jaguars, sloths, and cecropia trees in a reforested section of a Costa Rican rain forest are not growing and thriving.

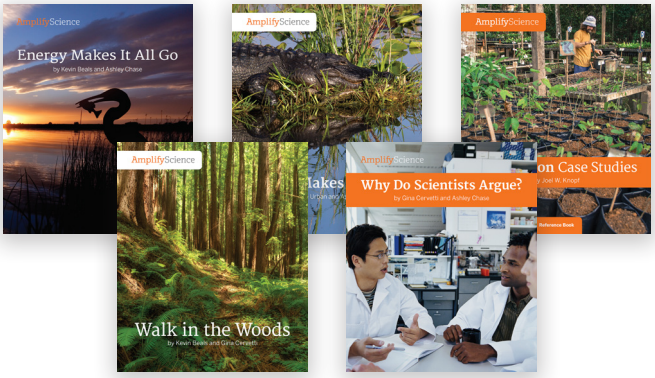
Core Concept: Understanding what it means to grow and how living things get the matter and energy they need to grow

Target Performance Expectations:

- 5-PS3-1: Use and Origin of Energy in Food
- 5-LS1-1: Plant Materials from Air and Water
- 5-LS2-1: Matter Flows
- 5-ESS3-1: Protecting Earth
- 5-PS1-1: Matter is Made of Particles
- 3-5-ETS1-1: Defining the Problem
- 3-5-ETS1-2: Developing Possible Solutions

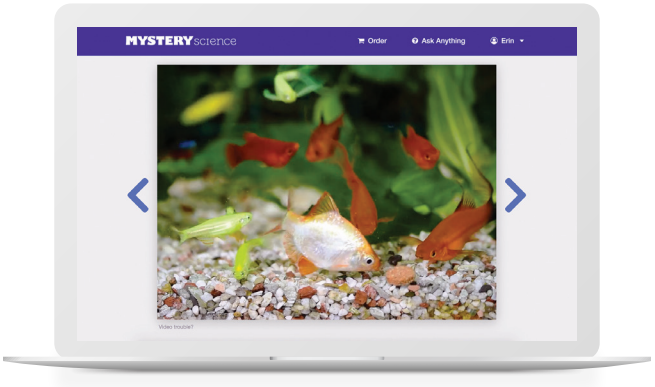
Students figure out the unit phenomenon through the use of a variety of resources.

Student Books

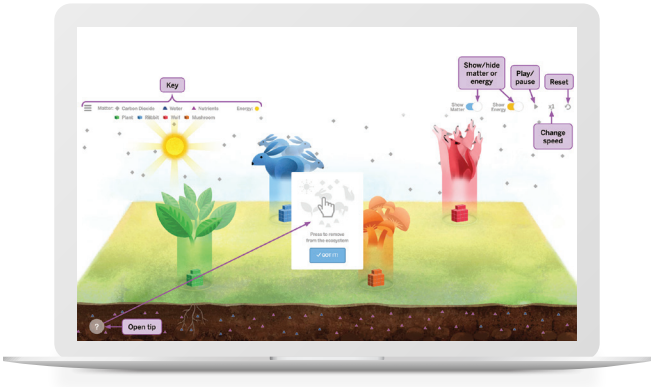


Hands-On Kit

Videos



Practice Tools



About technology in this unit:
Amplify Science California gives you the flexibility to use technology in the way that meets your needs best. In 3–5, teachers have the option of using:

- **Student digital licenses** that allow for online completion of work, teacher feedback and grading, and digital class management.
- **Traditional consumable resources** that allow for a more familiar paper and pencil experience.

Whether students use the student digital experience or print workbooks, there are some technology-based activities all students will experience from time to time.

In grade 5, technology-based activities include Practice Tools and digital Simulations. In this particular unit, 9 of the 22 lessons incorporate the use of devices with 13% of the unit's activities involving the use of a digital tool.

When the use of a digital tool is called for in a lesson, teachers have several implementation options:

- **If limited student devices are available,** students can do activities in pairs or small groups.
- **If no student devices are available,** teachers can project the digital tool to the class and create a whole class experience.

Chapter 1: The storyline begins

What students investigate:

Why aren't the jaguars and sloths growing and thriving?

What they figure out:

Jaguars eat the body matter of sloths as food so they can grow. They change the food molecules from the sloth into molecules that build their body matter or release energy for movement and growth. The sloths eat the body matter of cecropia trees as food so they can grow. They change the food molecules from the cecropia trees into molecules that build their body matter or release energy for movement and growth. Because there weren't enough cecropia trees in the failing rain forest ecosystem, the sloths and jaguars did not have enough food.

How they figure it out:

- Exploring the fundamental concept that everything in an ecosystem—both living and nonliving parts—is made of matter as they read the student book *Matter Makes It All Up*
- Showing how animals get the food molecules they need to grow their bodies using physical models and the Sim
- Analyzing data about the animals and plants in the project area
- Using data to write an argument about why the animals are not growing and thriving

KEY


HANDS-ON


MODELING


READING


SIM


STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WRITING

DAY 1 | LESSON 1.1

Pre-Unit Assessment

- Introducing the Unit (10 min)
- Writing Initial Arguments (25 min)
- Exploring the Simulation (20 min)
- Introducing the Investigation Notebook (5 min)

Pre-Unit Assessment

DAY 2 | LESSON 1.2

Introducing Ecosystems

- Introducing the Rain Forest Problem (15 min)
- Setting Up the Terrariums (25 min)
- Observing Ecosystems (20 min)

DAY 3 | LESSON 1.3

Matter Makes It All Up

- Thinking About Scale (15 min)
- Partner Reading (20 min)
- Discussing Matter and Molecules (10 min)
- Synthesizing Ideas About How Animals Grow (15 min)

On-the-Fly Assessment

DAY 4 | LESSON 1.4

Investigating How Animals Grow

- Introduction to Argumentation (20 min)
- Observing Animals in their Environment (10 min)
- Evidence About How Animals Grow (15 min)
- Modeling How Animals Grow (15 min)

On-the-Fly Assessment
Critical Juncture Assessment

DAY 5 | LESSON 1.5

Modeling How Animals Use Food Matter

- How Animals Use Food Molecules (25 min)
- Synthesizing Ideas Across Multiple Sources (15 min)
- Modeling Food Matter (20 min)

DAY 6 | LESSON 1.6

The Role of Food in an Ecosystem

- Making Arguments About the Investigation Question (5 min)
- Modeling the Flow of Matter (15 min)
- Writing About Rain Forest Animals (15 min)
- Partner Reading (25 min)

DAY 7 | LESSON 1.7

Modeling Food Webs

- Reflecting on the Language of Science (10 min)
- Food Web Model (35 min)
- The Importance of Plants (15 min)

On-the-Fly Assessment

DAY 8 | LESSON 1.8

Arguments About Animals in the Ecosystem

- More About Evidence (10 min)
- Evidence Circles (20 min)
- Writing a Scientific Argument (20 min)
- Action Steps for Restoring the Ecosystem (10 min)

On-the-Fly Assessment
Self-Assessment

Chapter 2:
The storyline builds

What students investigate:

Why aren't the cecropia trees growing and thriving?

What they figure out:

Cecropia trees in the rain forest ecosystem make their own food. Like all plants, they use energy from the sun to turn carbon dioxide and water into food molecules. They change these food molecules into molecules that build their bodies or release energy. The cecropia trees must not be getting the sunlight, water molecules, or air molecules that they need to grow and thrive.

How they figure it out:

- Creating and using models to investigate how plants get food and how energy enters and flows through the ecosystem
- Considering the idea that nearly all energy on Earth ultimately comes from the sun as they read the student book *Energy Makes It All Go*
- Making a model of the relationships between the sun, plants, and animals in an ecosystem
- Exploring various sources of energy in an ecosystem using the Sim
- Learning about the scientific practice of argumentation and how and why arguments are so important to scientists as they read the student book *Why Do Scientists Argue?*
- Writing a data-based argument about why the cecropia trees are not growing and thriving that includes a new recommendation for improving the health of this area of the rain forest

KEY


HANDS-ON


MODELING


READING


SIM


STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WRITING

DAY 9 | LESSON 2.1

Even Plants Need Food

- Restoration Project Update (10 min)
- Observing Terrariums (20 min)
- Exploring Plants in the Simulation (20 min)
- What Is Made of Matter? (10 min)

DAY 10 | LESSON 2.2

Energy Makes It All Go

- Preparing to Read (15 min)
- Partner Reading (30 min)
- Synthesizing Ideas (15 min)

On-the-Fly Assessment

DAY 11 | LESSON 2.3

How Plants Make Food

- Modeling How Plants Make Food (25 min)
- Debriefing the Model (5 min)
- Modeling Plants in an Ecosystem (20 min)
- Writing About Plants in the Rain Forest (10 min)

On-the-Fly Assessment

DAY 12 | LESSON 2.4

Claims and Evidence About Energy

- Revising a Key Concept About Food Molecules (15 min)
- Gathering Evidence About Energy (30 min)
- Making Arguments About Energy in Ecosystems (15 min)

DAY 13 | LESSON 2.5

Energy in Ecosystems

- Modeling Energy in an Ecosystem (25 min)
- Debriefing the Model (15 min)
- Reading a Restoration Case Study (20 min)

On-the-Fly Assessment

DAY 14 | LESSON 2.6

Why Do Scientists Argue?

- Introducing *Why Do Scientists Argue?* (10 min)
- Partner Reading (30 min)
- Synthesizing Ideas About How Scientists Argue (20 min)

On-the-Fly Assessment

DAY 15 | LESSON 2.7

Arguments About Plants in the Ecosystem

- Restoration Project Update (5 min)
- Evidence Circles (25 min)
- Writing a Scientific Argument (20 min)
- Action Steps for Restoring the Rain Forest (10 min)

Critical Juncture Assessment
Self-Assessment

Chapter 3: Application to a new context

What students investigate:

Why aren't the cecropia trees growing and thriving in the soil?

What they figure out:

Decomposers live in the soil in the rain forest ecosystem and use matter from dead organisms as food. Decomposers change the food molecules into molecules that build their own body matter or release energy for movement and growth, and decomposers also release nutrients into the soil. Nutrients in the soil are important for cecropia trees because they help the plants make food and body matter. Because there are not enough decomposers in the soil, there are not enough nutrients. This is the reason the cecropia trees are not growing and thriving, which affects the health of the whole ecosystem.

How they figure it out:

- Gathering data about soil through hands-on investigations and using the Sim
- Learning about soil and decomposition in a forest ecosystem as they read the student book *Walk in the Woods*
- Learning about examples of ecosystem restoration projects taking place in the real world as they read the student book *Restoration Case Studies*
- Using and applying data about the decomposers and the soil in the project area to write their final Restoration Plan

KEY


HANDS-ON


MODELING


READING


SIM


STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WRITING

DAY 16 | LESSON 3.1

Investigating Soil

- Project Report Update (10 min)
- Analyzing Soil Samples (30 min)
- Observing Terrariums (20 min)

Optional Flextension: *Soil Profile Test*

DAY 17 | LESSON 3.2

Walk in the Woods

- Preparing to Read (10 min)
- Partner Reading (30 min)
- Discussing Decomposers (10 min)
- Synthesizing Ideas About What Makes Up Soil (10 min)

On-the-Fly Assessment

Optional Flextension: *Investigating How Things Decompose*

DAY 18 | LESSON 3.3

Differences in Soil

- Simulating Different Soils (25 min)
- Synthesizing Ideas About Differences in Soil (15 min)
- Writing About the Project Area (10 min)
- Investigating How Decomposers Get Food Molecules (10 min)

On-the-Fly Assessment

DAY 19 | LESSON 3.4

Nutrients and Soil

- New Data About Plant Growth (20 min)
- Investigating Plant Growth in the Simulation (30 min)
- Making Sense of Nutrients and Ecosystems (10 min)

On-the-Fly Assessment

DAY 20 | LESSON 3.5

Decomposers, Nutrients, and Ecosystems

- Using the Environments Model (20 min)
- More *Restoration Case Studies* (20 min)
- Critiquing an Argument About Soil (20 min)

On-the-Fly Assessment

Optional Flextension: *Making Changes to Terrariums*

DAY 21 | LESSON 3.6

Arguments About Soil in the Ecosystem

- Evidence Circles (25 min)
- Writing a Scientific Argument (25 min)
- Action Steps for Restoring the Rain Forest (10 min)

Critical Juncture Assessment

Self-Assessment

DAY 22 | LESSON 3.7

End-of-Unit Assessment

- Modeling an Ecosystem Without Decomposers (20 min)
- Writing Final Arguments (35 min)
- Concluding the Unit (5 min)

End-of-Unit Assessment

All students. All standards.

Rather than treating the standards simply as a list of topics to cover, we designed Amplify Science California to allow for truly in-depth and integrated coverage of the disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). Unlike other programs, however, ours makes the NGSS' vision of "all students, all standards" a reality by creating a unit-specific learning progression for every unit called a Progress Build.

Each Progress Build defines several levels of understanding of the unit's anchoring phenomenon, with each level integrating and building upon the knowledge and skills from lower levels. In this way, each Progress Build provides a clear roadmap for how students' understanding of the phenomenon is expected to deepen and develop with each successive chapter and lesson.

What's more, the program's system of assessments is also tied to these Progress Builds. This carefully crafted integration provides teachers with credible, actionable, and timely diagnostic information about student progress toward the unit's learning goals and grade-level performance expectations. Armed with this powerful data, teachers have the ultimate flexibility to decide when to move on and when to slow down and dive deeper.

Ecosystem Restoration Progress Build

The Progress Build in this unit consists of three levels of understanding. At each level, students add new ideas and integrate them into a progressively deeper understanding of how the flow of matter in an ecosystem can help ecologists understand why the organisms in a rain forest restoration project area are not growing and thriving.

Progress Build Level 1:

The food matter that animals need to grow and use for energy can always be traced back to plants.

Progress Build Level 2:

Energy from the sun is brought into an ecosystem when plants make food by using water molecules, carbon dioxide from the air, and energy from the sun.

Progress Build Level 3:

Decomposers consume dead matter and release nutrients that plants use to help them make food molecules.

Examples of differentiation in this unit

In addition to providing unit-specific Progress Builds that break learning goals into smaller, more achievable levels of understanding, Amplify Science California makes learning accessible for all students through a variety of scaffolds, supports, and differentiation strategies for every lesson. **For a complete list of strategies, see the Differentiation section of every Lesson Brief**.

Below are a few examples of strategies embedded in this unit.

For English learners:

Vocabulary support (Example from Lesson 1.3)
Matter Makes It All Up may be especially challenging for English learners because of the number of science vocabulary words introduced in the text. You may want to preview the text with students, pointing out strategies to use when they encounter unknown words. On page 5, point out that the definition for ecologist is listed in parentheses. You can also turn students' attention to the Glossary in the book and invite them to use this when they encounter words in bold print. Students will continue to be exposed to and have an opportunity to practice these words throughout the unit, which will help them develop flexible word knowledge.

For students needing more support:

Writing support (Example from Lesson 3.6)
Included with this lesson is an additional version of page 78, Rain Forest Restoration Plan 3, in the Investigation Notebook. The additional version is provided as a copymaster (in Digital Resources). The question and claim included are identical to the ones in the notebook, and all students are expected to write about the same science ideas. However, each version of Rain Forest Restoration Plan 3 represents a different level of guidance for students in organizing and writing about the content.

For students ready for a challenge:

Read for a new purpose (Example from Lesson 2.6)
Invite students to read page 10 of *Why Do Scientists Argue?* and consider the kind of data that Rachel Carson and other scientists may have collected as evidence of the effect of pesticides on an ecosystem. Students can draw pictures that illustrate how scientists might have measured a change in the number of organisms in an ecosystem.

3-D Statements

In order to help teachers recognize the three-dimensional structure of every unit, chapter, and lesson, each unit contains a 3-D Statement document that makes the integration clear.

Making the 3-D statement document all the more effective, the three dimensions are color-coded for easy recognition.

Ecosystem Restoration 3-D Coverage

SEPs
Science and Engineering Practices

DCIs
Disciplinary Core Ideas

CCCs
Cross-Cutting Concepts

Unit Level

Students use models to investigate why a reforested area of a Costa Rican rain forest is not thriving (energy and matter, systems and system models, cause and effect). Students use evidence to construct oral and written arguments about why the living things in this rain forest ecosystem are not growing and thriving (energy and matter, systems and system models, cause and effect).

Chapter Level

Chapter 1: Why aren't the jaguars and sloths growing and thriving?

Students use models to investigate what animals need to grow and thrive (energy and matter). Students use evidence to construct an argument about why jaguars and sloths in an area of a rain forest ecosystem are not growing and thriving (energy and matter, systems and system models).

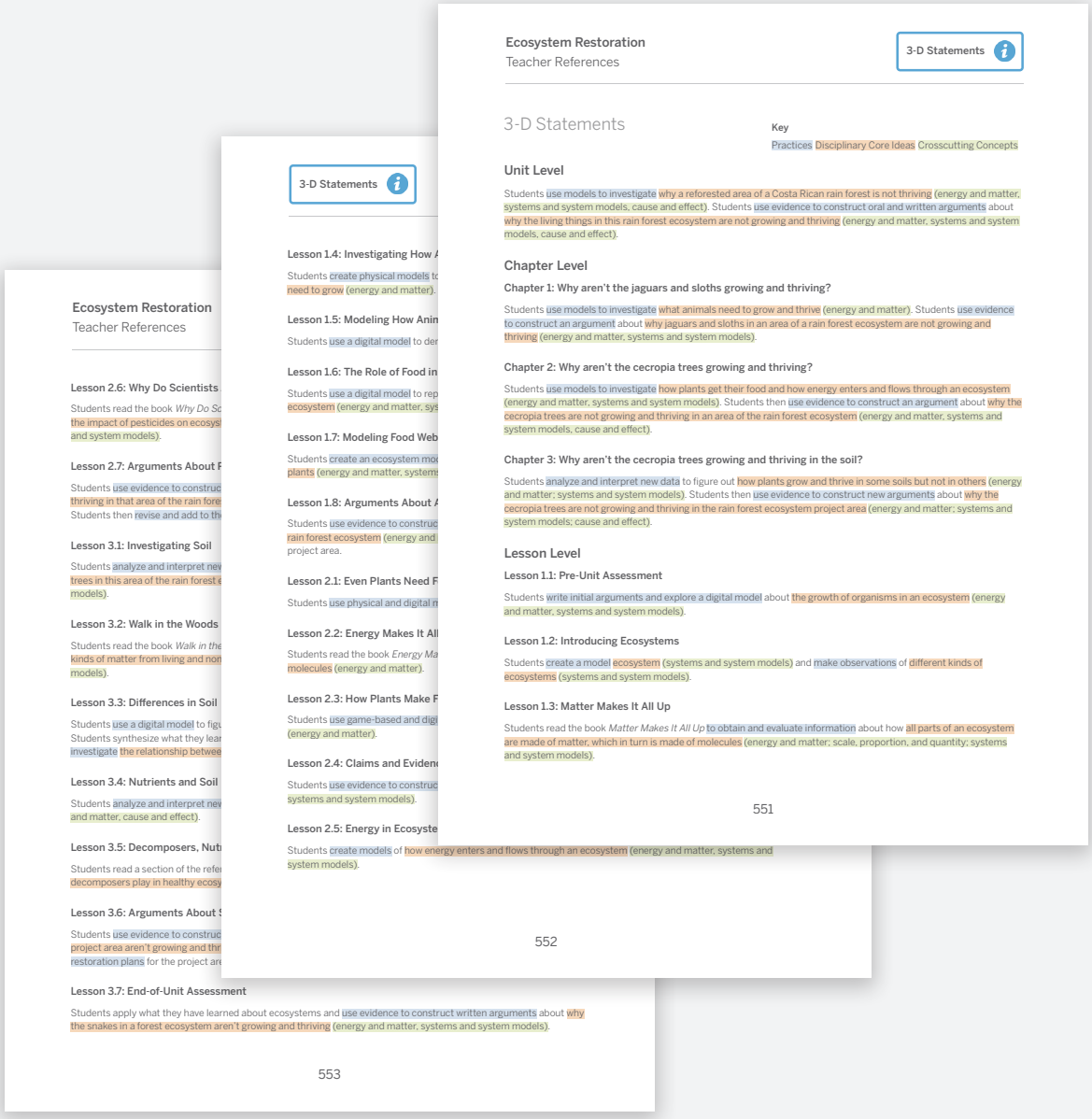
Chapter 2: Why aren't the cecropia trees growing and thriving?

Students use models to investigate how plants get their food and how energy enters and flows through an ecosystem (energy and matter, systems and system models). Students then use evidence to construct an argument about why the cecropia trees are not growing and thriving in an area of the rain forest ecosystem (energy and matter, systems and system models, cause and effect).

Chapter 3: Why aren't the cecropia trees growing and thriving in the soil?

Students analyze and interpret new data to figure out how plants grow and thrive in some soils but not in others (energy and matter; systems and system models). Students then use evidence to construct new arguments about why the cecropia trees are not growing and thriving in the rain forest ecosystem project area (energy and matter; systems and system models; cause and effect).

To review the 3-D Statements at the lesson level, see the Lesson Brief section of every lesson.



Ecosystem Restoration
Teacher References

3-D Statements

Key
Practices Disciplinary Core Ideas Crosscutting Concepts

Unit Level

Students use models to investigate why a reforested area of a Costa Rican rain forest is not thriving (energy and matter, systems and system models, cause and effect). Students use evidence to construct oral and written arguments about why the living things in this rain forest ecosystem are not growing and thriving (energy and matter, systems and system models, cause and effect).

Chapter Level

Chapter 1: Why aren't the jaguars and sloths growing and thriving?

Students use models to investigate what animals need to grow and thrive (energy and matter). Students use evidence to construct an argument about why jaguars and sloths in an area of a rain forest ecosystem are not growing and thriving (energy and matter, systems and system models).

Chapter 2: Why aren't the cecropia trees growing and thriving?

Students use models to investigate how plants get their food and how energy enters and flows through an ecosystem (energy and matter, systems and system models). Students then use evidence to construct an argument about why the cecropia trees are not growing and thriving in an area of the rain forest ecosystem (energy and matter, systems and system models, cause and effect).

Chapter 3: Why aren't the cecropia trees growing and thriving in the soil?

Students analyze and interpret new data to figure out how plants grow and thrive in some soils but not in others (energy and matter; systems and system models). Students then use evidence to construct new arguments about why the cecropia trees are not growing and thriving in the rain forest ecosystem project area (energy and matter; systems and system models; cause and effect).

Lesson Level

Lesson 1.1: Pre-Unit Assessment

Students write initial arguments and explore a digital model about the growth of organisms in an ecosystem (energy and matter, systems and system models).

Lesson 1.2: Introducing Ecosystems

Students create a model ecosystem (systems and system models) and make observations of different kinds of ecosystems (systems and system models).

Lesson 1.3: Matter Makes It All Up

Students read the book *Matter Makes It All Up* to obtain and evaluate information about how all parts of an ecosystem are made of matter, which in turn is made of molecules (energy and matter; scale, proportion, and quantity; systems and system models).

551

3-D Statements

Lesson 1.4: Investigating How A

Students create physical models to
need to grow (energy and matter).

Lesson 1.5: Modeling How Anim

Students use a digital model to der

Lesson 1.6: The Role of Food in

Students use a digital model to rep
ecosystem (energy and matter, sy

Lesson 1.7: Modeling Food Web

Students create an ecosystem mo
plants (energy and matter, system

Lesson 1.8: Arguments About A

Students use evidence to construc
rain forest ecosystem (energy and
project area.

Lesson 2.1: Even Plants Need F

Students use physical and digital m

Lesson 2.2: Energy Makes It All

Students read the book *Energy Ma*
molecules (energy and matter).

Lesson 2.3: How Plants Make F

Students use game-based and digi
(energy and matter).

Lesson 2.4: Claims and Evidenc

Students use evidence to construc
systems and system models).

Lesson 2.5: Energy in Ecosyste

Students create models of how energy enters and flows through an ecosystem (energy and matter, systems and system models).

552

Ecosystem Restoration
Teacher References

Lesson 2.6: Why Do Scientists

Students read the book *Why Do Sc*
the impact of pesticides on ecosys
and system models).

Lesson 2.7: Arguments About F

Students use evidence to construc
thriving in that area of the rain fore
Students then revise and add to th

Lesson 3.1: Investigating Soil

Students analyze and interpret new
trees in this area of the rain forest e
models).

Lesson 3.2: Walk in the Woods

Students read the book *Walk in the*
kinds of matter from living and non
models).

Lesson 3.3: Differences in Soil

Students use a digital model to figu
Students synthesize what they lear
investigate the relationship betwee

Lesson 3.4: Nutrients and Soil

Students analyze and interpret new
and matter, cause and effect).

Lesson 3.5: Decomposers, Nutr

Students read a section of the refer
decomposers play in healthy ecosy

Lesson 3.6: Arguments About S

Students use evidence to construc
project area aren't growing and thr
restoration plans for the project are

Lesson 3.7: End-of-Unit Assessment

Students apply what they have learned about ecosystems and use evidence to construct written arguments about why the snakes in a forest ecosystem aren't growing and thriving (energy and matter, systems and system models).

553

For more information on Amplify Science, visit **amplify.com/science/california**.

Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY