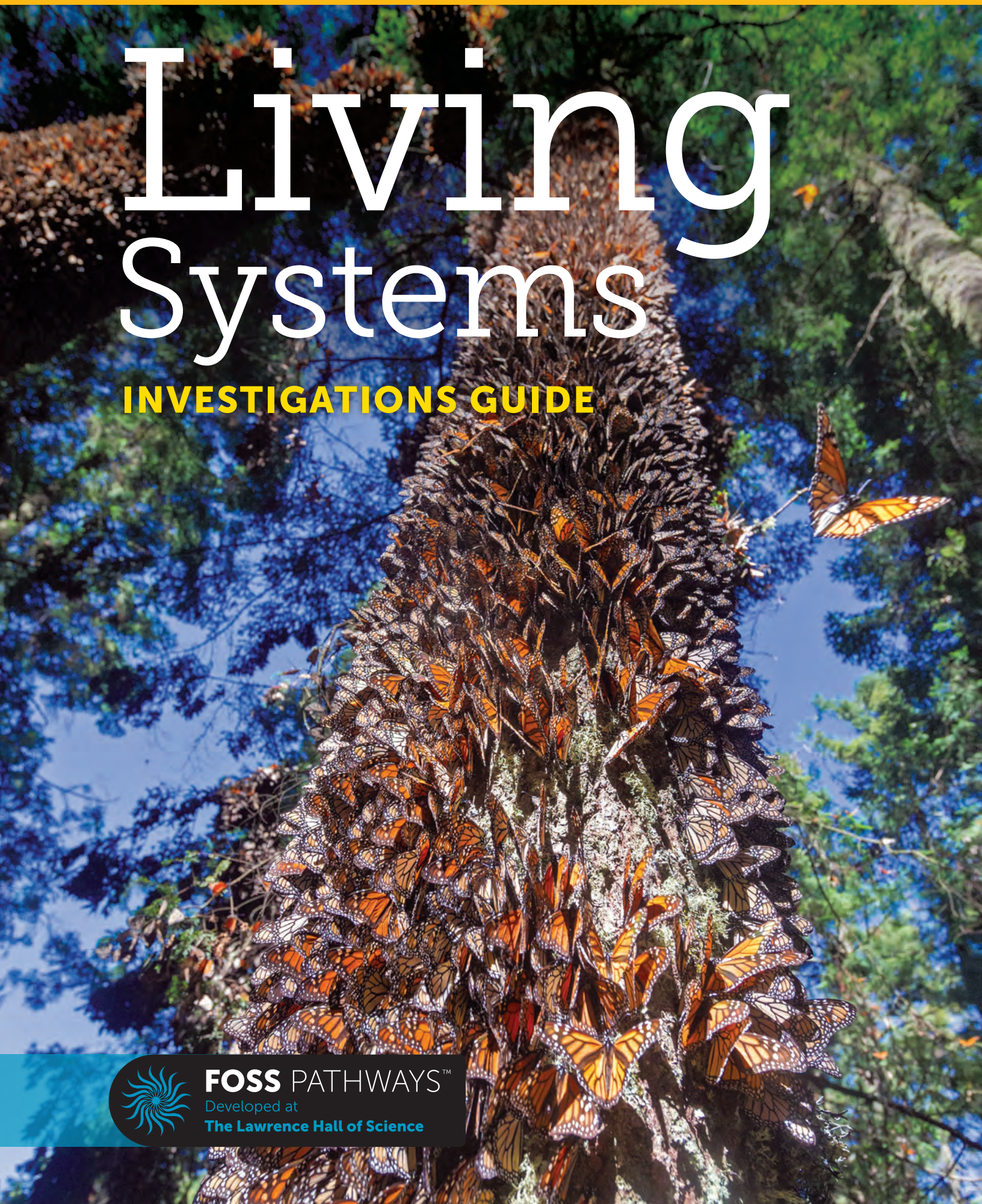
SAMPLER

Living Systems

INVESTIGATIONS GUIDE



FOSS PATHWAYS™
Developed at
The Lawrence Hall of Science

PreK–5 science that meets the challenge of our time

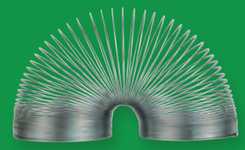
Welcome to new FOSS® Pathways™. Now as never before, the world needs scientific thinkers—to view the world thoughtfully, approach challenges analytically, and embrace opportunities enthusiastically. For educators to help unlock this potential in their students, they need powerful tools that work for the needs of today. A program that engages students of all backgrounds and experiences. Fully leverages modern digital technology. And does it all in the hours available.

A major advancement from a proven leader

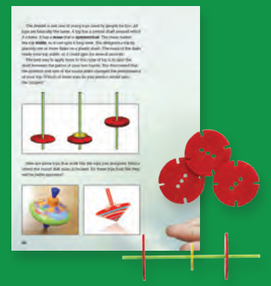
The Full Option Science System™ (FOSS) was conceived to enlist students not as passive recipients of information, but as active investigators of phenomena. That principle has proven its worth for 150,000 teachers and 4 million students across all 50 states, building a legacy of student engagement and test-score improvement. Now FOSS takes science education another significant step forward, with FOSS Pathways. This new PreK–5 core curriculum:

Aligns with today's national science standards and is adaptable to meet state and local requirements

Incorporates the digital tools for a flexible multimedia experience



Lends flexibility to teach in the class time allotted for science



Teaches through a multimodal approach to resonate with every student

Engages students through coherent phenomenon storylines that are local and relevant

Provides unmatched educative support to teach phenomena-based science

How Pathways develops the scientific thinkers of tomorrow

New FOSS Pathways supports today's demand to develop scientifically literate thinkers and problem solvers in a multitude of ways.

A logical progression

Students develop core ideas in a relevant and coherent learning progression that allows them to construct an explanation of the phenomena they have experienced.

Support for students

Comprehensive support and multimodal instructional experiences engage learners of all languages and cultures, taking advantage of prior experiences so all students can reason scientifically.

Evidence of learning

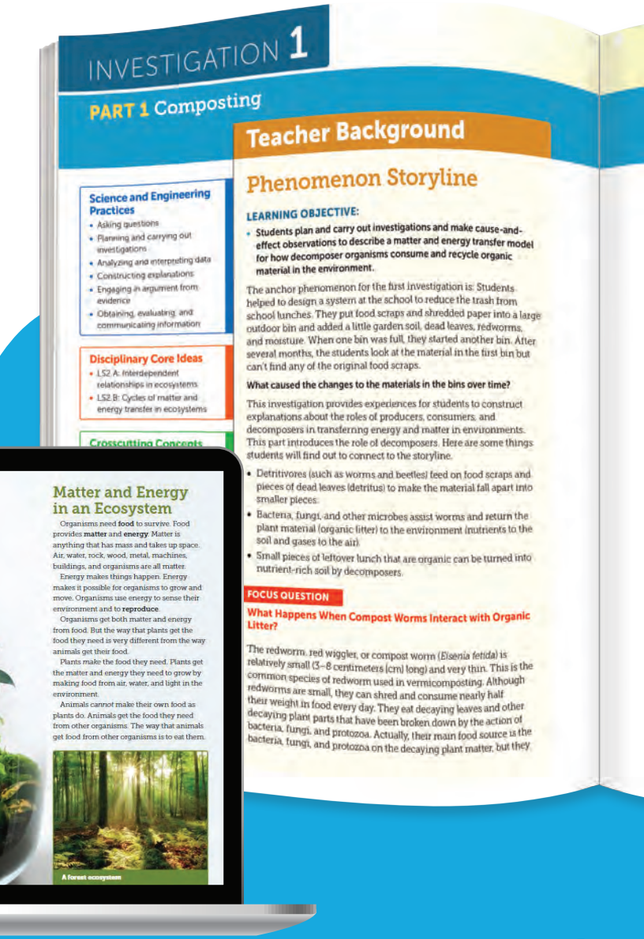
Research-based and field-tested assessments accurately measure student learning and progress. A variety of formative assessment tools provide evidence of students' use of the three dimensions and their knowledge of phenomena.

Support for teachers

Phenomena-based instruction is facilitated by appropriate educative support. This includes explicit background information needed for teachers to engage students in making the connection between the anchor phenomenon being investigated and the core ideas being exposed.

Rich digital resources

Digital resources for students and teachers are provided through FOSSweb on ThinkLink™. These multimedia materials are purposefully designed to enhance the learning experience and lend the flexibility to keep active science teaching viable if classroom circumstances change.



How FOSS Pathways aligns with today's standards

In this Sampler, pages 9-21 and 23-49 are provided from the teacher *Investigations Guide*. As you review, you will begin to witness the numerous ways that FOSS Pathways supports the development of tomorrow's scientists, engineers, and informed citizens. You'll see examples for:

Investigations driven by local, relevant phenomena and real-world problems

Instruction led by multimodal experiences that cognitively engage students to figure out phenomena

Identification of performances to meet targeted learning goals and elicit evidence of students' use of all three dimensions

Instructional support for teachers that provides an explicit connection between the phenomenon, three-dimensional learning, and multimodal learning experiences

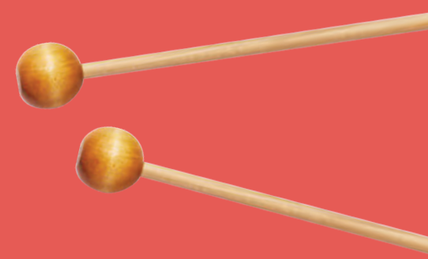
Clear integration of ELA/ELD skills and practices, with ties to standards and resources for engaging multilingual students

Cross-curricular activities that give students a choice and voice to differentiate instruction

▶ Images on this page include actual components, resources and/or materials provided in FOSS kits.

Alignment to NGSS Performance Expectations

Grade 5 NGSS Performance Expectations	FOSS Living Systems	
	Investigation(s)	Benchmark Assessment
5-PS3-1: Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the Sun.	**Investigation 2**	• Investigations 1–2 I-Check • Survey/Posttest
5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.	**Investigation 2** **Investigation 3**	• Investigations 1–2 I-Check • Investigation 3 I-Check • Survey/Posttest
5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	**Investigation 1** **Investigation 3** **Investigation 4**	• Investigation 1–2 I-Check • Investigation 3 I-Check • Survey/Posttest
5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	**Investigation 3** **Investigation 4**	• Investigation 3 I-Check • Survey/Posttest
5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect Earth's resources and environment.	**Investigation 3** **Investigation 4**	• Investigation 3 I-Check • Survey/Posttest



Living Systems Investigations

Investigation 1: Food Webs

Part 1: Composting
Part 2: Ecosystems

Investigation 2: Producers and Consumers

Part 1: Plants Make Food
Part 2: Animals Get Food

Investigation 3: Aquatic Ecosystems

Part 1: Freshwater Ecosystems
Part 2: Marine and Estuary Ecosystems
Part 3: Salt-Lake Ecosystems

Investigation 4: Understanding Systems

Part 1: Migration Systems

Living Systems

▶ Start here to begin your review of the Grade 5 Living Systems Investigations Guide

Introduction

The idea of a system is one of the grand integrating (crosscutting) concepts that pervades all of science. In grade 5, students look at Earth as the interaction of four Earth systems or subsystems—the geosphere, the atmosphere, the hydrosphere, and the biosphere. The focus of the **Living Systems Module** is the biosphere as students investigate ecosystems in terms of their interacting parts.

These anchor phenomena drive the investigations.

- Anchor phenomenon 1—Changed into compost
- Anchor phenomenon 2—Fruit from plants growing with and without soil
- Anchor phenomenon 3—Changes in a fishing pond

Students think about systems on different scales—systems within an organism that move matter and provide energy to the individual organism, and feeding relationships in ecosystems that move matter among plants, animals, decomposers, and the environment. Students come to understand through a variety of experiences that plants get the materials they need for growth primarily from water and air, and that energy in animals' food was once energy from the Sun. There are opportunities for students to explore how human activities in agriculture, industry, and everyday life can have major effects on these systems. Students gain experiences that will contribute to the understanding of the crosscutting concepts of patterns; scale, proportion, and quantity; systems and system models; and energy and matter.

CONTENTS

The NGSS Performance Expectations bundled in this module include:

Physical Sciences
5-PS3-1

Life Sciences
5-LS1-1
5-LS2-1

Earth Sciences
5-ESS2-1
5-ESS3-1

NOTE

The three modules for grade 5 in FOSS Pathways are:

- Mixtures and Solutions
- Earth and Sun
- Living Systems

Module Matrix
At a Glance

Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
INV. 1 Food Webs **Phenomenon 1—Changed into compost:** Students helped to design a system at the school to reduce the trash from school lunches. They put food scraps and shredded paper into a large outdoor bin and added a little garden soil, dead leaves, redworms, and moisture. When one bin was full, they started another bin. After several months, the students look at the material in the first bin but can't find any of the original food scraps. **Storyline:** Students engage with Earth as a system, focusing on the biosphere and describing ecosystems by looking at feeding relationships and energy transfer. Students model food chains and food webs in a woods ecosystem. Each group of students sets up a redworm habitat to monitor for 8 weeks to investigate detritivores and the phenomenon of decomposition in ecosystems. Their findings provide the information they need to set up a compost system for lunch food scraps.	***What caused the changes to the materials in the bins over time?*** **FOCUS QUESTIONS:** **What happens when compost worms interact with organic litter?** **What are the roles of organisms in a food web?**	**LS2.A:** Interdependent relationships in ecosystems **LS2.B:** Cycles of matter and energy transfer in ecosystems • The Sun is the major source of energy on Earth. • The interaction of organisms with one another and with the nonliving environment is an ecosystem. • Food webs are subsystems within ecosystems. They describe the transfer of matter and energy within the system. Food webs are made up of producers (organisms that make their own food), consumers (organisms that eat other organisms to obtain food), and decomposers (organisms that consume and recycle dead organisms and organic waste).	**Science and Engineering Practices** Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Cause and effect Systems and system models Energy and matter Stability and change	**5-LS2-1:** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
INV. 2 Producers and Consumers **Phenomenon 2—Fruit from plants growing with and without soil:** Students visit a greenhouse where plants are growing with and without soil. The students observe that the plants growing in both conditions produced big fruit (e.g., tomatoes). **Storyline:** Students integrate firsthand experiences with plants and animals to explore how they get the materials they need to survive. Students plant wheat seeds in containers of soil and place half of the planters in a lighted environment and the other half in a dark environment to observe the action of chlorophyll and its role in the manufacture of sugar. They use a digital simulation, "Plant Lab," to set up a closed terrarium to test the effects of soil, water, and carbon dioxide on the growth of a plant over 28 days. The data gathered firsthand combined with the simulation provide evidence to support an argument that plants get the materials they need for growth from the air and water. Students read about how animals (consumers) need to get food (sugar) from plants or other animals to survive.	***What materials do plants need to grow and produce fruit (tomatoes) for an animal to eat?*** **FOCUS QUESTIONS:** **How do plants get the materials they need for growth and development?** **How do animals get the materials they need for growth and development?**	**LS1.C:** Organization for matter and energy flow in organisms **PS3.D:** Energy in chemical processes and everyday life **ESS2.A:** Earth materials and systems • Plants make their own food by photosynthesis. This process is an example of the interaction of the hydrosphere (water), atmosphere (oxygen and carbon dioxide), and biosphere (plants). • Chlorophyll is the green pigment that absorbs sunlight in the cells of producer organisms. • Plants make sugar (food) from carbon dioxide and water in the presence of sunlight. They release oxygen. • Animals obtain nutrients by eating other organisms. • Digestion is the process used by animals to break down complex food items into simple nutrients. • Because plants use sunlight to produce sugars from water and carbon dioxide, the food that animals eat could be said to come from the Sun.	**Science and Engineering Practices** Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Engaging in argument with evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Patterns Cause and effect Systems and system models Energy and matter	**5-LS1-1:** Support an argument that plants get the materials they need for growth chiefly from air and water. **5-PS3-1:** Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the Sun. **5-ESS2-1:** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Module Matrix
At a Glance CONTINUED

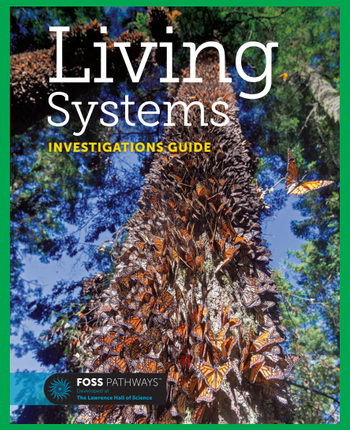
Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
INV. 3 Aquatic Ecosystems **Phenomenon 3—Changes in a fishing pond:** A group of friends went fishing at a local pond in early June where there were lots of fish. The friends return to the pond in August after a hot summer to find dead fish in the pond. **Storyline:** Students investigate different aquatic ecosystems firsthand and through media to develop models of movement of matter through ecosystems and further develop a general model. Using information from organism cards about producers and consumers, students design food webs for a selection of organisms in one or two marine ecosystems. Students are presented with an ecological problem related to water level fluctuations in an important migratory bird environment—a salt lake—and collect data to make a recommendation. Students read about the effects of human actions on an aquatic system and use the information gathered to explain the anchor phenomenon. **NOTE:** At the end of Investigation 3, students return to the redworm compost jar they set up 6–8 weeks earlier and finalize their observations to construct explanations as described in Inv. 1, Part 1, Session 3.	***What ecosystem interactions might have caused the death of the fish in the pond over the summer?*** **FOCUS QUESTIONS:** **How does the biosphere, hydrosphere, atmosphere, and/or geosphere interact in a freshwater ecosystem?** **How does energy and matter move through marine ecosystems?** **How does salinity affect the hatching of brine shrimp eggs and the food web in a salt lake?**	**LS2.A:** Interdependent relationships in ecosystems **LS2.B:** Cycles of matter and energy transfer in ecosystems **ESS2.A:** Earth materials and systems **ESS3.C:** Human impacts on Earth systems • Aquatic environments include living and nonliving factors (light and temperature). The nonliving factors in an ecosystem can cause changes to the biosphere. • Producers make their own food, which is also used by animals (consumers). Phytoplankton and algae are the major producers in most aquatic systems. • Food webs are made up of producers, consumers, and decomposers. • Freshwater environments depend on the hydrosphere for water. Moving water carries oxygen and nutrients to other parts of a lake and pond. • The bottom of lakes and ponds has sediments of the geosphere. • When the environment changes, food webs are affected, and some organisms may die. • Humans impact natural environments and communities have solved some environmental problems.	**Science and Engineering Practices** Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Obtaining, evaluating, and communicating information **Crosscutting Concepts** Cause and effect Systems and system models Energy and matter	**5-LS2-1:** Develop a model to describe that the movement of matter among plants, animals, decomposers, and the environment. **5-ESS2-1:** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **5-ESS3-1:** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
INV. 4 Understanding Systems **Problem to solve —Migrating monarch butterfly problem:** Students learn from a report that the number of endangered monarch butterflies that reached their winter habitat in the mountains of western Mexico dropped by 22% in Spring 2023. This butterfly population is in trouble. **Storyline:** Students obtain information about the life cycle of the monarch butterfly, the ecosystems that support the population, and the threats to its existence. This provides an opportunity to see the impact of climate change and human actions on an organism and what citizen scientists can do to protect the monarch populations. The final reading is a review of the ways that the geosphere, hydrosphere, atmosphere, and biosphere are interacting components of the larger Earth system.	***What can we do to protect the populations of migrating monarch butterflies?*** **FOCUS QUESTION:** **What is the monarch butterfly migration system?**	**LS2.A:** Interdependent relationships in ecosystems **ESS2.A:** Earth materials and systems **ESS3.C:** Human impacts on Earth system • The nonliving factors in an ecosystem can cause changes to the biosphere. • When the environment changes, food webs are affected, and some organisms may die. • Humans impact natural environments. • Monitoring of ecosystems provides data to use in making decisions about how to protect the environment.	**Science and Engineering Practices** Developing and using models Constructing explanations Obtaining, evaluating, and communicating information **Crosscutting Concepts** Cause and effect Systems and system models	**5-LS2-1:** Develop a model to describe the movement of matter among plants, animals decomposers, and the environment. **5-ESS2-1:** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **5-ESS3-1:** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

FOSS Pathways includes:

Investigations Guide

The Investigations Guide is a spiral-bound guide containing everything you need to teach the module. FOSS active investigation lesson plans include:

- Three-dimensional learning objectives
- Relevant and local phenomena storylines with driving questions
- Sense-making discussions
- Embedded assessment and “What to Look For” guidance
- Vocabulary reviews
- English language support strategies
- ELA strategies and connections



Science Resources Student Book

The *FOSS Science Resources* student book contains readings developed to reinforce, extend, or apply core ideas covered during FOSS active investigations. Readings give students opportunities to:

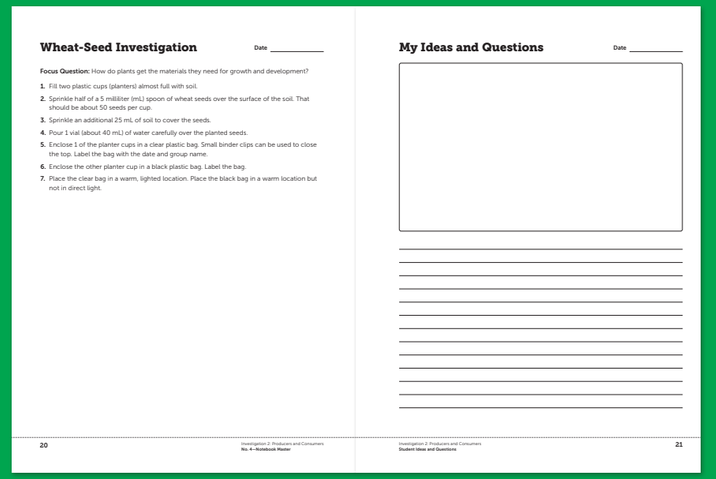
- Use text to obtain, evaluate, and communicate information
- Use evidence to support their ideas during sense-making discussions and focus question responses
- Integrate information from multiple sources
- Interpret graphs, diagrams, and photographs to build understanding

Available in print and as an interactive eBook in English and Spanish.

▶ Images on this page include actual components, resources and/or materials provided in FOSS kits.

Consumable Booklets

FOSS Booklets contain the Science Notebook Masters in a convenient booklet along with additional pages for writing and/or drawing opportunities and anchor phenomena explanations. There is one copy included in the kit. Additional copies are sold separately.



Equipment Kit

FOSS provides the equipment needed for all the investigations, including metric measuring tools. Our high-quality, classroom tested materials are long-lasting and packaged by investigation to facilitate preparation and clean up. There is enough permanent equipment in each kit for 32 students. Consumable materials are supplied for three uses. Convenient grade-level and refill kits are available.

Technology

Online resources include duplication masters, eInvestigations Guide, teaching slides, FOSSmap online assessment, streaming videos, virtual investigations, and tutorials, as well as a library of teacher resources, including access and equity, three-dimensional teaching and learning, and environmental literacy.

SCAN HERE FOR A TOUR OF FOSSWEB!

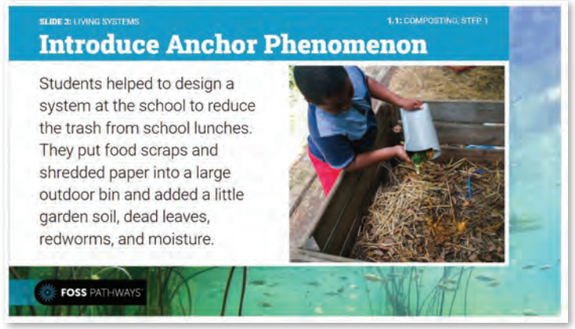
FOSSweb on ThinkLink

FOSSweb digital resources are delivered on School Specialty's curriculum platform called ThinkLink.

- Supports single sign-on and class management with Google classroom and learning management systems.
- Provides access to both teacher and student digital resources, including duplication masters, teaching slides, FOSSmap online assessment, streaming videos, and online activities.

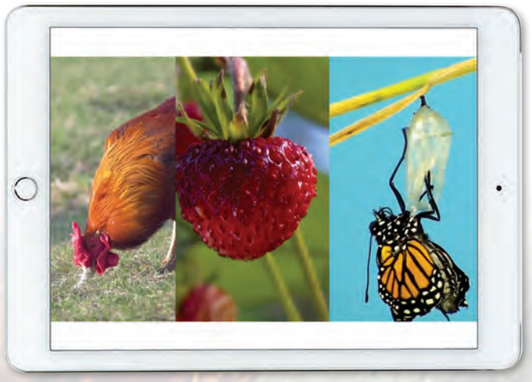
Teaching Slides

Downloadable and editable slides from FOSSweb can be used to facilitate each part of each investigation. Teaching slides are available as Google slides in English and Spanish.



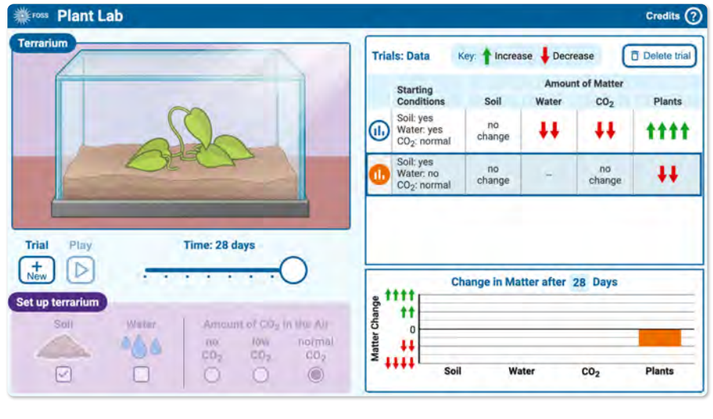
Streaming Videos

New engaging content videos in English and Spanish were developed to specifically support FOSS investigations.



Online Activities

New engaging simulations developed to address core ideas in FOSS, and interactive virtual investigations and tutorials offer additional content support for students.



Interactive eBooks

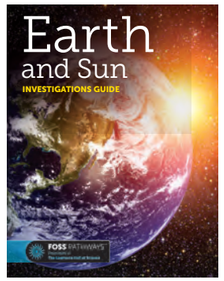
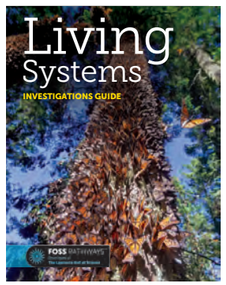
Keep your students engaged while teaching literacy skills with interactive *FOSS Science Resources* eBooks. The eBooks include integrated audio with text syncing and links to online activities and videos that bring the photos to life.

FOSSmap Online Assessment

Students in grades 3–5 can take summative assessments online with automatic coding of most responses. Student- and class-level reports help you identify the need for instructional next steps.

Grade Level Planning Guide

FOSS Pathways Modules Grade 5

FOSS Module	Module Overview/Bundled Performance Expectations	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts
 Earth Science	In the Earth and Sun Module, students explore the properties of the atmosphere, the energy transfer from the Sun to Earth, and the dynamics of weather and water cycling in Earth's atmosphere. The constant renewal of water on Earth's land surfaces by the activities in the atmosphere is one of the defining characteristics of Earth, the water planet. Other experiences help students to develop and use models to understand Earth's place in the solar system, and the interactions of Earth, the Sun, and the Moon to reveal predictable patterns—daily length and direction of shadows, day and night, and the seasonal appearance of stars in the night sky. Students gain experiences that will contribute to the understanding of crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; and energy and matter. **NGSS PEs:** **Earth Sciences:** **5-ESS1-1** **5-ESS1-2** **5-ESS2-1** **5-ESS2-2** **5-ESS3-1** **Physical Sciences:** **5-PS1-1** **5-PS2-1**	**ESS1.A:** The universe and its stars **ESS1.B:** Earth and the solar system **ESS2.A:** Earth materials and systems **ESS2.C:** The roles of water in Earth's surface processes **ESS3.C:** Human impacts on Earth systems **PS1.A:** Structure and properties of matter **PS2.B:** Types of interactions	• Asking questions • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Scale, proportion, and quantity • Systems and system models • Energy and matter • Stability and change
 Physical Science	In the Mixtures and Solutions Module, students construct models about matter made of particles too small to be seen and develop the understanding that matter is conserved when it changes state (from solid to liquid), when it dissolves in another substance, and when it is part of a chemical reaction. Students have experiences with mixtures, solutions of different concentrations, and reactions forming new substances. They also engage in engineering experiences using the properties of materials to design useful products. Learning about the properties and behaviors of substances and systems of substances develops their understanding about how things go together and how they can be taken apart. This gives them the opportunity to use and develop models that explain phenomena too small to see directly. Students gain experiences that will contribute to the understanding of the crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; and energy and matter. **NGSS PEs:** **Physical Sciences:** **5-PS1-1** **5-PS1-2** **5-PS1-3** **5-PS1-4** **ETAS:** **3-5 ETS1-2** **Earth and Space Sciences:** **5-ESS3-1**	**PS1.A:** Structure and properties of matter **PS1.B:** Chemical reactions **ETS1.B:** Designing solutions to engineering problems **ESS3.C:** Human impacts on Earth systems	• Asking questions • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Scale, proportion, and quantity • Systems and system models • Energy and matter • Structure and function
 Life Science	In the Living Systems Module, students think about systems on different scales—systems within an organism that move matter and provide energy to the individual organism, and feeding relationships in ecosystems that move matter among plants, animals, decomposers, and the environment. Students come to understand through a variety of experiences that plants get the materials they need for growth primarily from water and air, and that energy in animals' food was once energy from the Sun. There are opportunities for students to explore how human activities in agriculture, industry, and everyday life can have major effects on these systems. Students gain experiences that will contribute to the understanding of the crosscutting concepts of patterns;scale, proportion, and quantity; systems and system models; and energy and matter. **NGSS PEs:** **Life Sciences:** **5-LS1-1** **5-LS2-1** **Physical Sciences:** **5-PS3-1** **Earth Sciences:** **5-ESS2-1** **5-ESS3-1**	**LS1.C:** Organization for matter and energy flow in organisms **LS2.A:** Interdependent relationships in ecosystems **LS2.B:** Cycles of matter and energy transfer in ecosystems **PS3.D:** Energy in chemical processes and everyday life **ESS2.A:** Earth materials and systems **ESS3.C:** Human impacts on Earth systems	• Asking questions • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Systems and system models • Energy and matter

FOSS® Pathways™ is an engaging PreK–5 science program developed at the Lawrence Hall of Science for the Next Generation Science Standards (NGSS). This sampler will introduce you to the major components of the program and show examples from FOSS Pathways Living Systems Investigations Guide.

Recommended Scope and Sequence

FOSS Pathways

GRADE	PHYSICAL SCIENCE	EARTH SCIENCE	LIFE SCIENCE
PK		Observing Nature	
K	Materials and Forces	Trees and Weather	Animals Two by Two
1	Sound and Light	Changes in the Sky	Plants and Animals
2	Solids and Liquids	Water and Landforms	Insects and Plants
3	Motion	Water and Climate	Structures of Life
4	Energy	Soils, Rocks, and Landforms	Senses and Survival
5	Mixtures and Solutions	Earth and Sun	Living Systems

Learn more at **FOSSPathways.com**

Scan the QR code and explore additional FOSS Pathways Samplers today.

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