



CONNECTING PLT'S EXPLORE YOUR ENVIRONMENT: K-8 ACTIVITY GUIDE TO NGSS

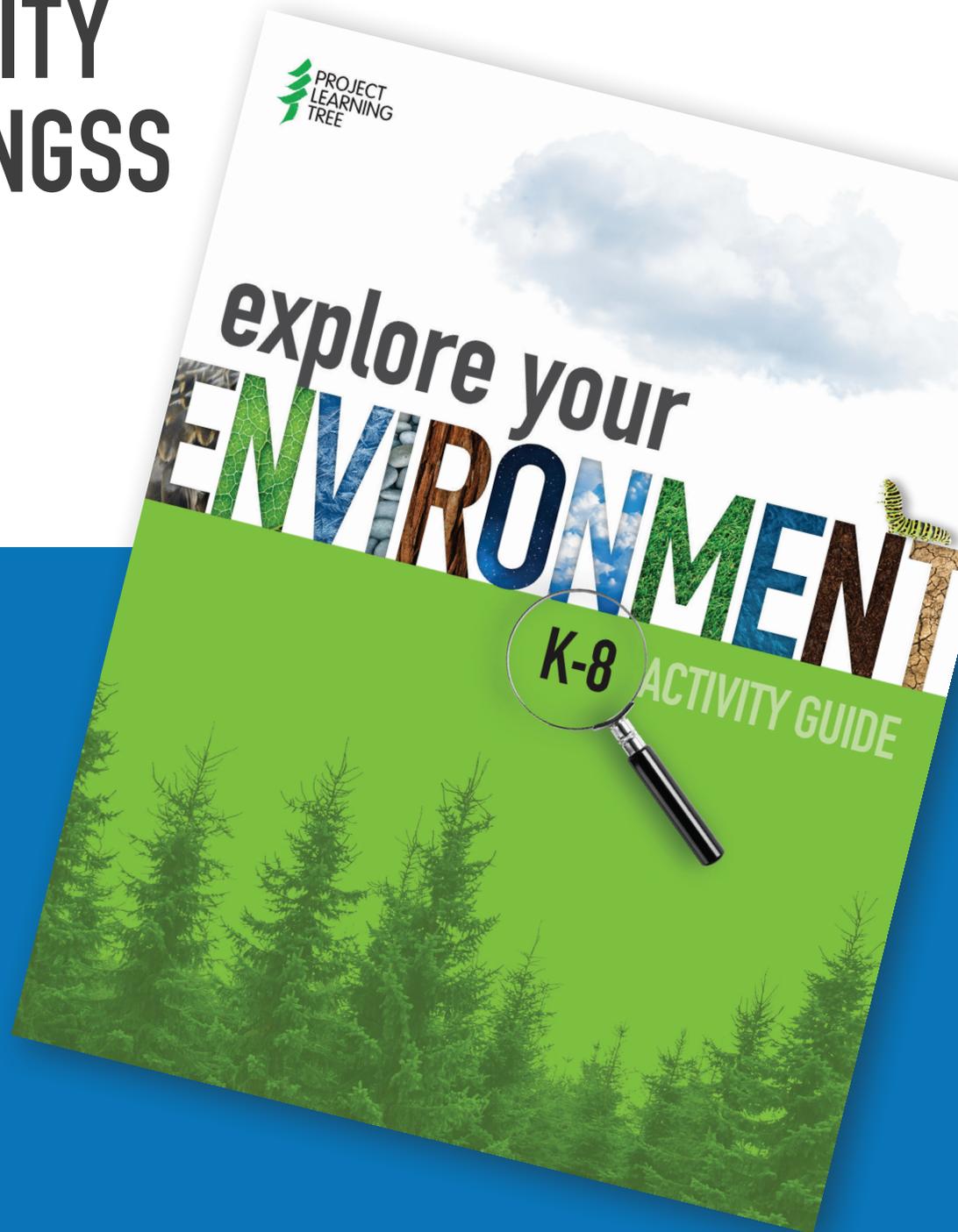


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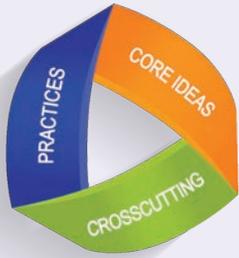
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? GUIDING QUESTION: GROUNDED IN PHENOMENA

Phenomenon-based instruction is directly connected to students' homes, communities, and cultures, thus making teaching and learning more diverse, inclusive, and relevant. PLT identifies Guiding Questions that drive phenomenon-based, three-dimensional learning for each of the 50 Explore Your Environment K-8 Activity Guide activities.

CONNECTING PLT'S EXPLORE YOUR ENVIRONMENT K-8 ACTIVITY GUIDE TO NGSS

IN THE ACTIVITY

The left hand column details where science connections can be found in the PLT activity.

PRACTICES

ENGAGING IN THE PRACTICES OF SCIENCE helps students understand how scientific knowledge develops. Students gain skill in the wide range of approaches that are used to investigate, model, and explain the world.

CONCEPTS

THESE CORE IDEAS HAVE BROAD IMPORTANCE across science disciplines, providing tools for understanding or investigating complex ideas and solving problems, and can be taught at progressive levels of depth and complexity.

Project Learning Tree is committed to supporting educators in providing instruction that helps students meet science education standards.

The Next Generation Science Standards (NGSS) define what students should know or be able to do at the end of instruction. To demonstrate learning, NGSS identifies Performance Expectations (PEs) that may be used to assess a student's knowledge and proficiency. To meet benchmarks, students engage in the three dimensions of science— Science & Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts—to explain a phenomenon or design a solution.

Activities in the *Explore Your Environment K-8 Activity Guide* provide students opportunities to explore the three dimensions of science to build knowledge and understanding. In addition, activities offer phenomenon-based learning, which involves exploring the real world through learner-centered, multidisciplinary investigations that promote inquiry and problem solving.

The NGSS Correlation pages for each activity include a guiding question, science connections found in the activity, and explicit NGSS correlations. Activities are organized around the three dimensions of science, making it useful for educators even if their state has not adopted NGSS.

FROM NGSS

The right hand column identifies correlations to specific NGSS standards, including references to the relevant PE for focus on the grade level band.

SCIENCE AND ENGINEERING PRACTICES

The practices are what students do to make sense of phenomena and reflect how scientists and engineers investigate the world and design solutions.

DISCIPLINARY CORE IDEAS

These foundational ideas of science are grouped into four domains: physical sciences; life sciences; Earth and space sciences; and engineering, technology and applications of science.

CROSSCUTTING CONCEPTS

These concepts hold true across the natural and engineered world. Students use them to make connections across disciplines, connect to prior experiences, and engage with material in other dimensions.



? GUIDING QUESTION

How do the trees around your school (or home) change over their lifetime?

GRADES K-2

A TREE'S LIFE

PRACTICES

DEVELOPING AND USING MODELS

Students simulate a tree's life stages and create diagrams that can be used to explain or interpret the phenomena.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students obtain information about a tree's life cycle in order to draw the different stages and then communicate the information by sharing their diagrams.

CONCEPTS

GROWTH AND DEVELOPMENT OF ORGANISMS

By observing a tree's life stages, students deepen their understanding of the growth and development of organisms. By comparing the life stages, students can see that tree species have common features as well as differences in their life stages.

PATTERNS

When students simulate a tree's life stages and relate those stages to human life stages, they use patterns to make sense of the concept of growth and development of organisms.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use a model to represent patterns in the natural world.

Obtaining, Evaluating, and Communicating Information

Obtain information using various media that will be useful in answering a scientific question.

DISCIPLINARY CORE IDEAS

LS1.B: Growth and Development of Organisms

Adult plants and animals can have young. In many kinds of animals, parents, and the offspring themselves engage in behaviors that help the offspring to survive.

PERFORMANCE EXPECTATION

1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

How do the trees near your school (or home) look different throughout the year?

GRADES K-2

ADOPT A TREE

PRACTICES

PLANNING AND CARRYING OUT INVESTIGATIONS

Students investigate changes in a tree over time. They may also develop their own questions to investigate further.

ANALYZING AND INTERPRETING DATA

Students record information about their tree and use it to describe patterns and/or relationships with other organisms. They also use the information they recorded to compare events at different times throughout the observation period.

CONCEPTS

PATTERNS

Students record seasonal patterns of their tree's growth and other changes in their journals.

CAUSE AND EFFECT

As students record observations of seasonal changes or the interactions of other organisms with the tree, they can use this information to predict changes in the tree and their causes.

NATURAL RESOURCES

Students learn that trees are living things and provide resources that humans need.

INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS

Students learn that trees need water and light to grow.

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

Make observations (firsthand) to collect data that can be used to make comparisons.

Analyzing and Interpreting Data

Use observations to describe patterns and/or relationships in the natural and designed worlds in order to answer scientific questions and solve problems.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

PERFORMANCE EXPECTATION

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

LS2.A: Interdependent Relationships in Ecosystems

Plants depend on water and light to grow.

PERFORMANCE EXPECTATION

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Cause and Effect

Events have causes that generate observable patterns.



? GUIDING QUESTION

What animals live near your school (or home), and where can you find them?

GRADES K-2

BACKYARD SAFARI

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use their observations to explain that the wildlife they found at the site are able to live there because the habitat meets their needs.

CONCEPTS

BIODIVERSITY AND HUMANS

Students search for diverse populations of animals living in various habitats.

NATURAL RESOURCES

Students name the habitat components they found that support the animals they discovered.

SYSTEMS AND SYSTEM MODELS

Students discuss how the observed wildlife and the resources they use are part of an ecosystem.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

DISCIPLINARY CORE IDEAS

LS4.D: Biodiversity and Humans

There are many different kinds of living things in any area, and they exist in different places on land and in water.

PERFORMANCE EXPECTATION

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

PERFORMANCE EXPECTATION

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Systems and System Models

Systems in the natural and designed world have parts that work together.



? GUIDING QUESTION

How does the color of a bug affect its chance of getting eaten by another animal?

GRADES K-2

BIRDS AND BUGS

PRACTICES

ANALYZING AND INTERPRETING DATA

Students analyze and interpret data as they place “bugs” in the data chart and use the results to determine the effects of camouflage.

DEVELOPING AND USING MODELS

Students participate in a simulation that models birds feeding on different-colored bugs.

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use the simulation and data charts to discover which color bugs are easier or harder to find.

CONCEPTS

PATTERNS

Students look for a pattern to the order in which the different colors of bugs were found.

STRUCTURE AND FUNCTION

The simulation allows students to see that some of the bugs have different colors and that the external color of a bug influences the bug’s survival and a bird’s ability to catch it.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Record information (observations). Use observations (firsthand) to describe patterns and/or relationships in the natural world in order to answer scientific questions.

Developing and Using Models

Use a model to represent amounts and patterns in the natural world.

Constructing Explanations and Designing Solutions

Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

PERFORMANCE EXPECTATION

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Structure and Function

The shape and stability of structures of natural objects are related to their function.



? GUIDING QUESTION

Where do the new leaves on the trees in your schoolyard (or backyard) come from?

GRADES K-2

BURSTING BUDS

PRACTICES

PLANNING AND CARRYING OUT INVESTIGATIONS

Students observe tree buds over time and collect data that can be compared across seasons.

CONCEPTS

STRUCTURE AND FUNCTION

Students investigate the structure of tree buds and learn about their function as embryonic leaves and flowers.

PATTERNS

Students compare their drawings of buds in different seasons to recognize patterns of change over time.

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

Make observations (firsthand) to collect data that can be used to make comparisons.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

PERFORMANCE EXPECTATION

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

How have you changed since you were born?

GRADES K-2

DID YOU NOTICE?

PRACTICES

ANALYZING AND INTERPRETING DATA

Students analyze data from their past personal history.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students communicate information about their past through their timeline and the gallery walk.

CONCEPTS

STABILITY AND CHANGE

By completing the gallery walk, students observe that some things stay the same while others change, and that some things change slowly while others change quickly.

GROWTH AND DEVELOPMENT OF ORGANISMS

Students observe that organisms, including humans, have common features in their life cycles.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Use and share pictures, drawings, and/or writings of observations.

Obtaining, Evaluating, and Communicating Information

Communicate information with others in written forms using models, drawings, writing, or numbers that provide detail about scientific ideas.

DISCIPLINARY CORE IDEAS

LS1.B: Growth and Development of Organisms

Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

PERFORMANCE EXPECTATION

3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Note: The activity provides appropriate scaffolding to support this Grade 3 Performance Expectation. Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Stability and Change

Some things stay the same while others change. Things may change slowly or rapidly.



? GUIDING QUESTION

How do seeds from the plants around your school (or home) move to a new place where they can grow?

GRADES K-2

HAVE SEEDS, WILL TRAVEL

PRACTICES

ANALYZING AND INTERPRETING DATA

Students record information and use observations to identify patterns among seed appearance and dispersal.

USING MATHEMATICS AND COMPUTATIONAL THINKING

Students create visual representations (bar graphs, decision trees, etc.) to show how they sorted or categorized the seeds.

CONCEPTS

STRUCTURE AND FUNCTION

Students explore the idea that plants use different dispersal methods in order to help them survive.

ENGINEERING DESIGN

Students explore the design process as they design, test, and re-design their seed dispersal method.

PATTERNS

Students sort and classify items based on similarities and differences from patterns, which can be used as evidence to support their explanations of phenomena.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Record information (observations). Use observations (firsthand) to describe patterns in the natural world in order to answer scientific questions and solve problems.

Use Mathematics and Computational Thinking

Compare attributes of different objects and display the data using simple graphs.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

PERFORMANCE EXPECTATION

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

ETS1.C: Optimizing the Design Solution

Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

PERFORMANCE EXPECTATION

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

What do plants around your school (or home) need to live and grow?

GRADES K-2

HERE WE GROW AGAIN

PRACTICES

PLANNING AND CARRYING OUT INVESTIGATIONS

With adult help, students plan and conduct an investigation to help them discover what plants need to live and grow.

USING MATHEMATICS AND COMPUTATIONAL THINKING

Students use quantitative data to describe and measure plant growth.

CONCEPTS

MATTER AND ENERGY FLOW IN ORGANISMS

Through their investigation, students learn that plants need water, light, and soil to live and grow.

INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS

Students learn that plants depend on elements from their surroundings—water, light, and soil—to grow.

PATTERNS

Students look for patterns in their data to determine what factors affect plant growth.

CAUSE AND EFFECT

Students determine the effect of water, light, and soil on the growth of plants.

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Use Mathematics and Computational Thinking

Describe, measure, and compare quantitative attributes of different objects and display the data using simple graphs.

DISCIPLINARY CORE IDEAS

LS1.C: Organization for Matter and Energy Flow in Organisms

Plants need water and light to live and grow.

PERFORMANCE EXPECTATION

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

LS2.A: Interdependent Relationships in Ecosystems

Plants depend on water and light to grow.

PERFORMANCE EXPECTATION

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Cause and Effect

Simple tests can be designed to gather evidence to support or refute student ideas about causes.



? GUIDING QUESTION

Where does paper come from, and how is it made?

GRADES K-2

MAKE YOUR OWN PAPER

PRACTICES

ASKING QUESTIONS AND DEFINING PROBLEMS

Students pose questions about how paper is made and review these questions after the activity. Students define problems based on their observations of the designed world.

CONCEPTS

NATURAL RESOURCES

Students discuss and participate in the papermaking process and learn that paper comes from natural resources (trees and other plants).

ENGINEERING DESIGN

Students explore the design process as they make their own paper.

CAUSE AND EFFECT

Students learn about the inputs and outputs of the papermaking process by discussing and participating in this process.

SCIENCE AND ENGINEERING PRACTICES

Asking Questions and Defining Problems

Ask questions based on observations to find more information about the natural and designed world.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

PERFORMANCE EXPECTATION

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

ETS1.A: Defining and Delimiting Engineering

Problems: Asking questions, making observations, and gathering information are helpful in thinking about problems.

PERFORMANCE EXPECTATION

K-2-ETS-1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Cause and Effect

Events have causes that generate observable patterns.

? GUIDING QUESTION

What do beetles use their sense of smell for?

GRADES K-2

PEPPERMINT BEETLE

PRACTICES

DEVELOPING AND USING MODELS

Students participate in a simulation to model how beetles locate host trees using their sense of smell.

ANALYZING AND INTERPRETING DATA

Students use their own sense of smell in a simulation in which they search for trees that a “peppermint beetle” has visited.

CONCEPTS

STRUCTURE AND FUNCTION

Students learn that animals have different structures that detect odors.

INFORMATION PROCESSING

As students use their sense of smell to locate marked trees, they model how beetles obtain, process, and respond to odors.

PATTERNS

Students rely on patterns to tag just the trees that have a matching odor.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use a model to represent patterns in the natural world.

Analyzing and Interpreting Data

Use observations (firsthand) to describe patterns in the natural world in order to answer scientific questions.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air.

LS1.D: Information Processing

Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive.

PERFORMANCE EXPECTATION

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

What parts do trees have in common?

GRADES K-2

THE CLOSER YOU LOOK

PRACTICES

ANALYZING AND INTERPRETING DATA

Students use drawings to record their observations of trees and use those data to compare different trees.

CONCEPTS

STRUCTURE AND FUNCTION

Through their observations and drawings, students learn that all trees have similar structures.

PATTERNS

Students compare their tree drawings with others' drawings to look for patterns.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Record information (observations). Use observations (firsthand) to describe patterns in the natural world in order to answer scientific questions.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and to seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

PERFORMANCE EXPECTATION

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Structure and Function

The shape and stability of structures of natural and designed objects are related to their function.

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

What plants and animals can live on trees?

GRADES K-2

TREES AS HABITATS

PRACTICES

ANALYZING AND INTERPRETING DATA

Students collect data through observations, then analyze and interpret their data about the organisms they find living on trees.

CONCEPTS

BIODIVERSITY AND HUMANS

Through their observations, students determine that many different kinds of organisms live on and around trees.

NATURAL RESOURCES

Students consider what organisms living on and around trees get from the tree.

PATTERNS

Students look for patterns in their observations of the organisms found in different parts of a tree.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Record information (observations). Use observations (firsthand) to describe patterns in the natural world in order to answer scientific questions.

DISCIPLINARY CORE IDEAS

LS4.D: Biodiversity and Humans

There are many different kinds of living things in any area, and they exist in different places on land and in water.

PERFORMANCE EXPECTATION

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need.

PERFORMANCE EXPECTATION

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

What do people use trees for?

GRADES K-2

WE ALL NEED TREES

PRACTICES

ANALYZING AND INTERPRETING DATA

Students observe different products to determine whether they come from trees and to categorize them.

CONCEPTS

NATURAL RESOURCES

Students learn that many different things in our everyday lives are made from trees.

STRUCTURE AND PROPERTIES OF MATTER

Students learn that different tree products have different properties.

PATTERNS

Students identify patterns to determine whether different products came from a tree and, if so, to what category of tree product they belong.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Use observations (firsthand) to describe patterns and/or relationships in the natural world in order to answer scientific questions.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

PERFORMANCE EXPECTATION

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

PS1.A: Structure and Properties of Matter

Different properties are suited to different purposes.

PERFORMANCE EXPECTATION

2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.



? GUIDING QUESTION

Why are some organisms suited to live high up, down low, or somewhere in between?

GRADES 3–5

CHARTING BIODIVERSITY

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students research and share information about how animals are suited to live in various places.

CONCEPTS

STRUCTURE AND FUNCTION

Students research how organisms' unique structures enable them to survive in certain locations.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Obtain and combine information from books and/or other reliable media to explain phenomena.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

Organisms have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction.

PERFORMANCE EXPECTATION

4-LS1-1. Construct an argument with evidence that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Structure and Function

Substructures have shapes and parts that serve functions.



? GUIDING QUESTION

What kinds of organisms live nearby and how many of them are there?

GRADES 3–5

DISCOVER DIVERSITY

PRACTICES

ANALYZING AND INTERPRETING DATA

Students record and analyze the kinds and amounts of organisms found in different plots of a local habitat.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students communicate through a presentation the information they observe and collect in their study plot.

CONCEPTS

BIODIVERSITY AND HUMANS

Students observe and compare populations of organisms living in various locations within a habitat.

PATTERNS

Students compare the different study plots, looking for patterns, which can help them understand what features are the same, which are different, and why.

CAUSE AND EFFECT

Students observe abiotic factors that can affect the populations of organisms living in different locations of a habitat, including variables such as shade and sunlight.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Analyze and interpret data to make sense of phenomena using logical reasoning.

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information orally and/or in written formats, including various forms of media.

DISCIPLINARY CORE IDEAS

LS4.D: Biodiversity and Humans

Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

PERFORMANCE EXPECTATION

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals there may change.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns can be used as evidence to support an explanation.

Cause and Effect

Cause and effect relationships are routinely identified and used to explain change.



? GUIDING QUESTION

How can you reduce the amount of water you use in a day?

GRADES 3–5

EVERY DROP COUNTS

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students collect data about the amount of water they use daily and the ways they use that water. They communicate ways to conserve water.

USING MATHEMATICS AND COMPUTATIONAL THINKING

Students calculate the volume of water they use per day for various common tasks.

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use data they collected on how much water they use as criteria for their action plan to conserve water.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students research how, and how much, of Earth's fresh water they use—and waste—in a typical day.

CAUSE AND EFFECT

Students research and recommend ways to conserve water that will affect the volume of their daily water use.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

Using Mathematics and Computational Thinking

Describe, measure, estimate, and/or graph quantities such as volume to address scientific and engineering questions and problems.

Constructing Explanations and Designing Solutions

Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

PERFORMANCE EXPECTATION

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships are routinely identified and used to explain change.



🔍 GUIDING QUESTION

Why do some trees in our community grow bigger than others?

GRADES 3-5

EVERY TREE FOR ITSELF

PRACTICES

DEVELOPING AND USING MODELS

Students use a model to describe and predict a tree's growth.

ANALYZING AND INTERPRETING DATA

Students interpret the data they collected and recorded on the Student Page or from the simulation.

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use evidence to explain the results of the simulation.

CONCEPTS

ADAPTATION

By participating in a simulation, students see that trees have certain requirements that must be met in order for them to thrive.

ORGANIZATION FOR MATTER AND ENERGY FLOW IN ORGANISMS

Students model how trees, with energy provided by sunlight, convert air and water into glucose to survive.

ENERGY AND MATTER

Students participate in a simulation that models how energy is transferred between the surrounding resources and a tree.

SYSTEMS AND SYSTEM MODELS

Through the simulation model, students see that a tree is a system that is affected by the water, sunlight, air, and nutrients it receives.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use models to describe and/or predict phenomena.

Analyzing and Interpreting Data

Analyze and interpret data to make sense of phenomena.

Constructing Explanations and Designing Solutions

Use evidence to construct or support an explanation.

DISCIPLINARY CORE IDEAS

LS4.C: Adaptation

For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

PERFORMANCE EXPECTATION

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

LS1.C: Organization for Matter and Energy Flow in Organisms

Plants acquire their material for growth chiefly from air and water.

PERFORMANCE EXPECTATION

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Energy and Matter

Energy can be transferred in various ways and between objects.

Systems and System Models

A system can be described in terms of its components and their interactions.



? GUIDING QUESTION

Why are fallen logs an important part of the environment?

GRADES 3-5

FALLEN LOG

PRACTICES

ASKING QUESTIONS AND DEFINING PROBLEMS

After observing the fallen logs, students develop questions about them.

PLANNING AND CARRYING OUT INVESTIGATIONS

Students gather data about the plants and animals that live in and around the rotting wood to find answers to their questions.

CONCEPTS

CYCLE OF MATTER AND ENERGY TRANSFER IN ECOSYSTEMS

Students explore what kinds of plants and animals live in rotting wood and contribute to the decomposition of fallen logs.

PATTERNS

Students look for patterns in their data to provide evidence to answer their questions.

ENERGY AND MATTER: FLOWS, CYCLES, AND CONSERVATION

Class discussion focuses on the importance of decomposition in cycling of matter.

SCIENCE AND ENGINEERING PRACTICES

Asking Questions and Defining Problems

Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.

Planning and Carrying Out Investigations

Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

DISCIPLINARY CORE IDEAS

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

PERFORMANCE EXPECTATION

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns can be used to identify cause and effect relationships.

Energy and Matter: Flows, Cycles, and Conservation

Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.



? GUIDING QUESTION

Where do you feel healthier and happier: inside or outside?

GRADES 3-5

GET OUTSIDE!

PRACTICES

PLANNING AND CARRYING OUT INVESTIGATIONS

Students plan a test to determine whether being outdoors versus indoors improves a person's performance or feelings about a task.

ANALYZING AND INTERPRETING DATA

Students analyze data from their investigations to determine how being outdoors or indoors affects health and mood.

CONCEPTS

STRUCTURE AND FUNCTION

Students learn that their heart rate may be associated with how they feel.

CAUSE AND EFFECT

Students use evidence from their data to identify what may have caused changes in their heart rate, mood, or other factors.

PATTERNS

Students discuss patterns they noticed in their data comparing outdoor tasks with indoor tasks.

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Analyzing and Interpreting Data

Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

PERFORMANCE EXPECTATION

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships are routinely identified, tested, and used to explain change.

Patterns

Patterns can be used as evidence to support an explanation.



? GUIDING QUESTION

What kinds of jobs can people do that are linked to forests?

GRADES 3-5

MY GREEN FUTURE

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students obtain information about forestry-related careers through various sources and write about them.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students investigate careers that help to protect forests.

SYSTEMS AND SYSTEM MODELS

Students examine jobs that affect forest systems.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information in written formats.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

PERFORMANCE EXPECTATION

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Systems and System Models

A system can be described in terms of its components and their interactions.



? GUIDING QUESTION

How does packaging of consumer items impact our environment?

GRADES 3-5

PEEK AT PACKAGING

PRACTICES

DEVELOPING AND USING MODELS

Students develop a model or prototype of an ideal package for a product.

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students apply information they learned about environmental impacts to design an ideal package for a consumer item.

CONCEPTS

DEFINING AND DELIMITING ENGINEERING PROBLEMS

Teams of students design a package and explain why it meets the criteria for their product.

HUMAN IMPACTS ON EARTH SYSTEMS

Students learn how packaging impacts the natural world.

STRUCTURE AND FUNCTION

Students design a product's package to serve a specific function.

CAUSE AND EFFECT

Students consider how the different materials used in packaging influences how well it works.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Develop and/or use a model to predict and/or describe phenomena.

Constructing Explanations and Designing Solutions

Apply scientific ideas to solve design problems.

DISCIPLINARY CORE IDEAS

ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

PERFORMANCE EXPECTATION

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

ESS3.C: Human Impacts on Earth Systems

Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

PERFORMANCE EXPECTATION

5-ESS3-1. Obtain and combine information about ways that individual communities use science ideas to protect the Earth's resources and environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Structure and Function

Substructures have shapes and parts that serve functions.

Cause and Effect

Cause and effect relationships are routinely identified, tested, and used to explain change.



? GUIDING QUESTION

How can poems describe what is special about trees?

GRADES 3-5

POET-TREE

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use specific forms of poetry to describe the interactions of trees in natural systems and the relevance of trees to their own lives.

CONCEPTS

EARTH MATERIALS AND SYSTEMS

Students' poems may address trees' interactions with natural systems, such as how roots break through rocks and soil, hold soil in place, or transfer water through the hydrosphere.

Poems may address the role of trees as shelter for animals and other organisms.

SYSTEMS AND SYSTEM MODELS

Inspirations for students' poems may come from their observations of trees interacting with natural systems such as the biosphere, geosphere, hydrosphere, or atmosphere.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Construct an explanation of observed relationships.

DISCIPLINARY CORE IDEAS

ESS2.A: Earth Materials and Systems

Earth's major systems are the geosphere, the hydrosphere, the atmosphere, and the biosphere. These systems interact in multiple ways to affect Earth's surface materials and processes.

PERFORMANCE EXPECTATION

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and System Models

A system can be described in terms of its components and their interactions.



GUIDING QUESTION

What are some ways that trees prepare for winter?

GRADES 3-5

SIGNS OF FALL

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use evidence from their observations to explain how the similarities and/or differences between deciduous and evergreen leaves contribute to the survival of trees as seasons change.

CONCEPTS

VARIATION OF TRAITS

As students observe deciduous and evergreen trees, in nature and through chromatography, they discuss how leaf traits help trees respond to seasonal changes.

STRUCTURE AND FUNCTION

Students observe how internal and external leaf structures contribute to the survival of the leaf and tree from season to season.

PATTERNS

Students identify similar and different patterns among the structures of various leaves, including the outer coverings, shapes, and chromatography.

CAUSE AND EFFECT

Students discuss how seasonal changes affect the leaves of various trees.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Use evidence (e.g. measurements, observations, patterns) to construct or support an explanation.

DISCIPLINARY CORE IDEAS

LS3.B: Variation of Traits

Different organisms vary in how they look and function because they have different inherited information. The environment also affects the traits that an organism develops.

PERFORMANCE EXPECTATION

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

LS1.A: Structure and Function

Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

PERFORMANCE EXPECTATION

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns can be used as evidence to support an explanation.

Cause and Effect

Events that occur together with regularity might or might not be a cause and effect relationship.



GUIDING QUESTION

What organisms live in the soil below our feet?

GRADES 3-5

SOIL BUILDERS

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use evidence from observations to support a claim that not all soils are alike.

PLANNING AND CARRYING OUT INVESTIGATIONS

With adult help, students plan and conduct an investigation to determine what pill or sow bugs eat and how their presence might contribute to a forest ecosystem.

CONCEPTS

EARTH MATERIALS AND SYSTEMS

Students describe the ingredients of their soil, such as particles of clay and rock, minerals, water, and once-living organisms.

CYCLES OF MATTER AND ENERGY TRANSFER IN ECOSYSTEMS

Students observe how pill or sow bugs contribute to the cycling of matter within an ecosystem.

PATTERNS

Students use patterns to look at the layers in their soil shakes and to analyze the data from their investigation.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Support an argument with evidence, data, or a model.

Planning and Carrying Out Investigations

Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.

DISCIPLINARY CORE IDEAS

ESS2.A: Earth Materials and Systems

Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soil, and sediments into smaller particles and move them around.

PERFORMANCE EXPECTATION

4-ESS2.1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Matter cycles between the air and soil and among plants, animals, and microbes as the organisms live and die. Organisms obtain gases and water from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

PERFORMANCE EXPECTATION

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and designed products. Patterns can be used as evidence to support an evaluation.



❓ GUIDING QUESTION

What can a tree cross-section or “tree cookie” tell us about a tree’s life?

GRADES 3–5

TREE COOKIES

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students read a variety of texts and use different media to identify events that relate to a tree’s life.

Students communicate this information visually on a model cross-section of the tree.

CONCEPTS

STRUCTURE AND FUNCTION

Students identify growth rings and observe the different structures found in the cross-section of a tree.

STABILITY AND CHANGE

Students examine differences in widths of growth rings to see that trees grow at different rates each year.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

PERFORMANCE EXPECTATION

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Structure and Function

Natural systems and objects have different substructures, which can sometimes be observed.

Stability and Change

Change is measured in terms of differences over time and may occur at different rates.



❓ GUIDING QUESTION

How do a tree's different parts work together to help it live and grow?

GRADES 3-5

TREE FACTORY

PRACTICES

DEVELOPING AND USING MODELS

Students use a model to describe how each structure of a tree functions in the tree.

ENGAGING IN ARGUMENT FROM EVIDENCE

Students support an argument with evidence from the model that trees' structures enable them to grow and survive.

CONCEPTS

STRUCTURE AND FUNCTION

By modeling a tree, students see that each part of a tree has a special job or function.

SYSTEMS AND SYSTEM MODELS

Students learn that a tree is a system made of many parts, or substructures, that interact to maintain the health of the tree.

ENERGY AND MATTER

Students consider ways that water and air are transported into, out of, and within a tree.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use models to describe phenomena.

Engaging in Argument from Evidence

Support an argument with a model.

DISCIPLINARY CORE IDEAS

LS1.A: Structure and Function

Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

PERFORMANCE EXPECTATION

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases and water from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

PERFORMANCE EXPECTATION

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and System Models

A system can be described in terms of its components and their interactions.

Energy and Matter

Energy can be transferred in various ways and between objects.





? GUIDING QUESTION

What clues do leaf and trunk patterns give about the kinds of trees growing here?

GRADES 3–5

TREE ID

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use observed patterns to sort and classify leaves and use leaf and trunk patterns to identify trees.

CONCEPTS

VARIATION OF TRAITS

Students identify tree species as they sort them by their leaf characteristics and other traits.

PATTERNS

Students sort and classify trees by their similarities and differences.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Use evidence (patterns) to construct or support an explanation.

DISCIPLINARY CORE IDEAS

LS3.B: Variation of Traits

Different organisms vary in how they look and function because they have different inherited information.

PERFORMANCE EXPECTATION

3-LS3.1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in groups of similar organisms.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Similarities and differences in patterns can be used to sort and classify natural phenomena.



❓ GUIDING QUESTION

How can we balance our wants against the health of our ecosystems to avoid damaging them (as described in the fable *The Lorax*)?

GRADES 3-5

TREES FOR MANY REASONS

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students listen to and respond to questions about overuse and sustainable practices as depicted by the events in *The Lorax*.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students identify ways the Once-ler's actions in *The Lorax* affected the health of the ecosystem. They respond to questions about how the story characters might have made more sustainable choices.

CAUSE AND EFFECT

Students discuss the effects of the Thneeds factory on the forest ecosystem in *The Lorax*.

SYSTEMS AND SYSTEM MODELS

Students discuss the role of the truffula trees in the ecosystem in *The Lorax*.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

PERFORMANCE EXPECTATION

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships are routinely identified and used to explain change.

Systems and System Models

A system can be described in terms of its components and their interactions.



? GUIDING QUESTION

How can we assess whether the trees on our site are healthy or not?

GRADES 3-5

TREES IN TROUBLE

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students observe, describe, and explain how factors such as disease, insects, and inability to meet basic needs can affect plant life.

PLANNING AND CARRYING OUT INVESTIGATIONS

Students work collaboratively to investigate how variables such as crowding or fertilizing affect plant growth.

CONCEPTS

ECOSYSTEM DYNAMICS, FUNCTIONING, AND RESILIENCE

Students observe and investigate how factors such as disease, insects, water, and sunlight affect the health of trees and other plants.

CAUSE AND EFFECT

Students identify factors that could cause trees and plants to grow well or less well.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Use evidence (e.g., observations, patterns) to support or construct an explanation.

Planning and Carrying Out Investigations

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Make observations (firsthand or from media) to collect data which can be used to make comparisons.

DISCIPLINARY CORE IDEAS

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, others move into the transformed environment, and some die.

PERFORMANCE EXPECTATION

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships are routinely identified and used to explain change.



GUIDING QUESTION

What happens to the water when a puddle dries up?
Where does it go, and where will it go next?

GRADES 3-5

WATER WONDERS

PRACTICES

DEVELOPING AND USING MODELS

Students model how water moves from place to place as they play the Water Wonders game.

Students observe how plants slow the flow of rainwater over the ground by observing water flow in stream tables or on slopes.

CONCEPTS

EARTH MATERIALS AND SYSTEMS

Students model the movement of water through and between the hydrosphere, atmosphere, geosphere, and biosphere.

SYSTEMS AND SYSTEM MODELS

Students model interactions between the hydrosphere, atmosphere, geosphere, and biosphere.

CAUSE AND EFFECT

Students describe how the presence or absence of plants affects the amount of rainwater and runoff and the possible erosion of soil.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use a model to describe phenomena.

DISCIPLINARY CORE IDEAS

ESS2.A: Earth Materials and Systems

Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

PERFORMANCE EXPECTATION

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

ESS2.A: Earth Materials and Systems

Earth's major systems are the geosphere, the hydrosphere, the atmosphere, and the biosphere. These systems interact in multiple ways to affect Earth's surface materials and processes.

PERFORMANCE EXPECTATION

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and Systems Models

A system can be described in terms of its parts and interactions.

Cause and Effect

Cause and effect in relationships are routinely identified, tested, and used to explain change.



? GUIDING QUESTION

In what ways do forest organisms depend on each other to survive? How can we model the interconnectedness of organisms in an ecosystem?

GRADES 3-5

WEB OF LIFE

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students research various organisms that live in a forest ecosystem and share how those organisms depend on each other.

DEVELOPING AND USING MODELS

Students participate in a “web of life” model to describe the interconnectedness of the organisms they researched.

CONCEPTS

INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS

Students research and model how organisms in a forest ecosystem depend on each other for food, shelter, and other needs.

SYSTEMS AND SYSTEM MODELS

Students describe a forest ecosystem in terms of its components and interactions and predict what would happen if one or more organisms in the forest system were removed.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Obtain and combine information from books and/or other reliable media to explain phenomena.

Developing and Using Models

Use models to describe and/or predict phenomena.

DISCIPLINARY CORE IDEAS

LS2.A: Interdependent Relationships in Ecosystems

The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or their parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

PERFORMANCE EXPECTATION

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and Systems Models

A system can be described in terms of its components and their interactions.



🔍 GUIDING QUESTION

How does your community make decisions about how to use land?

GRADES 6–8

DECISIONS, DECISIONS

PRACTICES

ENGAGING IN ARGUMENT FROM EVIDENCE

Students on the Town Council compare and critique different ways of solving the land-use dilemma.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Student groups communicate information to the Town Council about their proposal.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

By developing proposals to address a land-use issue, students explore how human activities can alter natural habitats.

SYSTEMS AND SYSTEM MODELS

As students develop and defend their proposals, they determine how elements of human systems interact with natural systems.

SCIENCE AND ENGINEERING PRACTICES

Engaging in Argument from Evidence

Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and System Models

Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.



? GUIDING QUESTION

How is environmental justice relevant to our community?

GRADES 6–8

ENVIRONMENTAL JUSTICE FOR ALL

PRACTICES

ANALYZING AND INTERPRETING DATA

Students gather and analyze data using the EJSCREEN mapping tool to explore environmental justice in their community.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students obtain information about environmental justice through case studies and internet research and create a visual presentation.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students learn about changes that have damaged their community's environment and propose solutions.

PATTERNS

Students use the EJSCREEN tool to look for patterns in the data that indicate causes of possible environmental justice issues.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Analyze and interpret data to provide evidence for phenomena.

Obtaining, Evaluating, and Communicating Information

Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, or system) in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns can be used to identify cause and effect relationships.

Graphs, charts, and images can be used to identify patterns in data.



? GUIDING QUESTION

How can personal decisions about electricity use impact the environment?

GRADES 6–8

EXPLORATION ENERGY!

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students research renewable and nonrenewable sources of energy used to produce electricity.

USING MATHEMATICS AND COMPUTATIONAL THINKING

Students read electric meters before and after weekly energy use to calculate the amount of electricity that their families use.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

During their research and group discussion, students explore how the use of nonrenewable and renewable sources impact land, water, and the atmosphere.

ENERGY AND MATTER: FLOWS, CYCLES, AND CONSERVATION

Students research and report ways that electricity is generated from renewable and nonrenewable natural resources.

CAUSE AND EFFECT

Students report how conscious efforts to conserve energy in the home affects the amount of electricity their families used during the week.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Obtain and combine information from books and other reliable media to explain phenomena.

Using Mathematics and Computational Thinking

Use mathematical representations to describe and/or support scientific conclusions and design solutions.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered otherwise.

PERFORMANCE EXPECTATION

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Energy and Matter: Flows, Cycles, and Conservation

The transfer of energy can be tracked as energy flows through a designed or natural system.

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

How is the ecosystem at our schoolyard (or backyard) different from a forest?

GRADES 6–8

FIELD, FOREST, AND STREAM

PRACTICES

PLANNING AND CARRYING OUT INVESTIGATIONS

Students collect data to answer scientific questions.

ANALYZING AND INTERPRETING DATA

Students use charts or tables to analyze their data.

CONCEPTS

INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS

Students describe how biotic and abiotic factors are related in three different ecosystems.

PATTERNS

Students use patterns in the data they collected from three different ecosystems to identify differences in resource availability.

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

Collect data to produce data to serve as the basis for evidence to answer scientific questions.

Analyzing and Interpreting Data

Analyze and interpret data to provide evidence for phenomena.

DISCIPLINARY CORE IDEAS

LS2.A: Interdependent Relationships in Ecosystems

Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.

PERFORMANCE EXPECTATION

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Patterns in numerical relationships can provide information about natural systems.



? GUIDING QUESTION

What benefits do trees that live in our community provide?

GRADES 6–8

FOREST IN THE CITY

PRACTICES

PLANNING AND CARRYING OUT INVESTIGATIONS

Students either create their own survey or use the example provided to conduct an investigation to answer a question about the benefits of trees.

ANALYZING AND INTERPRETING DATA

Students collate their data and create graphs to analyze the data.

CONCEPTS

BIODIVERSITY AND HUMANS

Students collect information from a survey and analyze data to learn how the presence or absence of trees can affect the ecosystem services on which humans rely.

PATTERNS

Students interpret graphical data to identify patterns in the data.

SCIENCE AND ENGINEERING PRACTICES

Planning and Carrying Out Investigations

Conduct an investigation to produce data to serve as the basis for evidence to answer scientific questions.

Analyzing and Interpreting Data

Analyze and interpret data to provide evidence for phenomena.

DISCIPLINARY CORE IDEAS

LS4.D: Biodiversity and Humans

Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.

PERFORMANCE EXPECTATION

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns can be used to identify cause and effect relationships. Graphs, charts, and images can be used to identify patterns in data.



❓ GUIDING QUESTION

What natural resources do we use to make the objects around us?

GRADES 6–8

GLOBAL GOODS

PRACTICES

DEVELOPING AND USING MODELS

Students develop a model drawing of a product's life cycle.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students research the natural resources that go into making their product and share their findings with their peers.

CONCEPTS

NATURAL RESOURCES

Students examine the natural resources that make up a pencil and another product.

HUMAN IMPACTS ON EARTH SYSTEMS

Students discuss how the use of renewable and nonrenewable resources impact natural resources.

SYSTEMS AND SYSTEM MODELS

Students examine a product life cycle as a system.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Develop a model to describe phenomena.

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

PERFORMANCE EXPECTATION

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and System Models

Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems.



? GUIDING QUESTION

How should forested land that belongs to the community be used?

GRADES 6–8

IF YOU WERE THE BOSS

PRACTICES

USING MATHEMATICS AND COMPUTATIONAL THINKING

Students use mathematics to complete a cost-and-revenue analysis to support their forest management plan.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students obtain information about different potential uses for a piece of land and evaluate competing uses to create their forest management plan.

CONCEPTS

ECOSYSTEM DYNAMICS, FUNCTIONING, AND RESILIENCE

Students consider how different uses may change the forest ecosystem while creating their forest management plan.

DEVELOPING POSSIBLE SOLUTIONS

Students create a forest management plan and evaluate it using specific criteria.

SYSTEMS AND SYSTEM MODELS

The forest management plan that students develop outlines a system with several subsystems.

SCIENCE AND ENGINEERING PRACTICES

Using Mathematics and Computational Thinking

Apply mathematical concepts and/or processes to scientific and engineering questions or problems.

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, system) in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

PERFORMANCE EXPECTATION

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

ETS1.B: Developing Possible Solutions

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.

PERFORMANCE EXPECTATION

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and System Models

Systems may interact with other systems; they may have sub-systems and be part of a larger complex system.



? GUIDING QUESTION

How can we improve our community?

GRADES 6–8

IMPROVE YOUR PLACE

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students use a map to explain the strengths and problems they found at their site.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students gather information from a variety of sources to complete an action plan for a project.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students develop and implement a plan to make a positive change in a small part of the biosphere.

CAUSE AND EFFECT

Students investigate the causes of problems at their site, the effects that these problems have, and the effects of possible solutions.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Construct an explanation using models or representations.

Obtaining, Evaluating, and Communicating Information

Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

What impact do invasive species have on the environment?

GRADES 6–8

INVASIVE SPECIES

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students use information provided in the activity to compare invasive species and then use a variety of sources to research and present information on a local invasive species.

CONCEPTS

ECOSYSTEM DYNAMICS, FUNCTIONING, AND RESILIENCE

Students research invasive species, which often have a disrupting influence on the biodiversity and, therefore, the functioning of local ecosystems.

HUMAN IMPACTS ON EARTH SYSTEMS

Students explore how the introduction of invasive species impacts their local ecosystems.

CAUSE AND EFFECT

Students research the effects of invasive species on the environment and the effects of possible solutions.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

PERFORMANCE EXPECTATION

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



🔍 GUIDING QUESTION

What causes some species in your state to be considered rare, threatened, or endangered?

GRADES 6–8

LIFE ON THE EDGE

PRACTICES

DEVELOPING AND USING MODELS

Students use a model to investigate the phenomenon of habitat loss.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students gather, read, and synthesize information from various sources to research one particular rare, threatened, or endangered species.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students create a profile on a species and identify the impact that humans have had on that species.

CAUSE AND EFFECT

Students explore the effect of habitat loss and other human impacts on different species.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use a model to predict and/or describe phenomena.

Obtaining, Evaluating, and Communicating Information

Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

What are the dangers and benefits of fire in the environment?

GRADES 6–8

LIVING WITH FIRE

PRACTICES

ANALYZING AND INTERPRETING DATA

Students use data from both their candle investigation and the demonstration to determine what fires need in order to burn and how different fuels affect fires.

CONCEPTS

NATURAL HAZARDS

Students learn about fire as a natural hazard and how different fuels affect wildfires. They also evaluate the risk of wildfire to their home and community.

CAUSE AND EFFECT

Students determine the elements that are needed for a fire to start.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Analyze and interpret data to provide evidence for phenomena.

DISCIPLINARY CORE IDEAS

ESS3.B: Natural Hazards

Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events.

PERFORMANCE EXPECTATION

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

How do the trees in the neighborhood compare with the world's largest tree?

GRADES 6–8

NATURE'S SKYSCRAPERS

PRACTICES

USING MATHEMATICS AND COMPUTATIONAL THINKING

Students use several mathematical concepts to determine the size of a local tree.

CONCEPTS

SCALE, PROPORTION, AND QUANTITY

Students use proportions to understand and compare different tree species.

NATURAL RESOURCES

As students suggest and use different techniques for measuring a tree, they identify potential methods for monitoring this valuable natural resource.

SCIENCE AND ENGINEERING PRACTICES

Use Mathematics and Computational Thinking

Apply mathematical concepts and/or processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Scale, Proportion, and Quantity

Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.



? GUIDING QUESTION

How would the plants and animals in our schoolyard (or backyard) change over time if humans didn't interfere?

GRADES 6–8

NOTHING SUCCEEDS LIKE SUCCESSION

PRACTICES

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students read scientific texts and develop presentations about succession.

PLANNING AND CARRYING OUT INVESTIGATIONS

Students collect data from three study sites to show how the assemblage and numbers of plants and animals in an area can change over time.

CONCEPTS

ECOSYSTEM DYNAMICS, FUNCTIONING, AND RESILIENCE

Students learn that ecosystems are dynamic and that disruptions in an ecosystem can cause changes in populations.

PATTERNS

Students look for patterns in their observations to determine changes in ecosystems over time.

STABILITY AND CHANGE

Students investigate how the process of succession demonstrates stability and change in a natural system.

SCIENCE AND ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

Critically read scientific texts adapted for classroom use to determine the central ideas or conclusions or to obtain scientific information.

Planning and Carrying Out Investigations

Conduct an investigation to produce data to serve as the basis for evidence to answer scientific questions.

DISCIPLINARY CORE IDEAS

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

PERFORMANCE EXPECTATION

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Patterns

Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems.

Stability and Change

Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale.



? GUIDING QUESTION

How should the publicly owned forests near our community be used?

GRADES 6–8

OUR FEDERAL FORESTS

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students construct solutions to address multiple-use challenges for a specific area of federal forestland.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students gather and read information to determine different uses of forestland and then suggest how one specific forest area could be used.

CONCEPTS

NATURAL RESOURCES

Students explore how different uses of forest resources may conflict within federal forestlands.

CAUSE AND EFFECT

Students research the effect of different forest uses and how they may conflict in federal forestlands.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Apply scientific ideas or principles to design a process or system.

Obtaining, Evaluating, and Communicating Information

Gather, read, and synthesize information from multiple appropriate sources.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

PERFORMANCE EXPECTATION

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

What do we need to consider when planting trees?

GRADES 6–8

PLANT A TREE

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Students apply information about the benefits of trees to design a plan for planting trees in their community.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students collect information about potential local sites for tree planting and work with community members to develop and carry out a tree-planting plan.

CONCEPTS

NATURAL RESOURCES

Students investigate how trees are distributed throughout their community.

DEVELOPING POSSIBLE SOLUTIONS

Students devise a plan to enhance their community through tree planting.

CAUSE AND EFFECT

Students investigate the effects that trees have on the local environment and how their tree planting plan will positively impact the community.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

ETS1.B: Developing Possible Solutions

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.

PERFORMANCE EXPECTATION

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

What happens to the trash we generate, and how can we reduce the amount of trash we create each day?

GRADES 6–8

REDUCE, REUSE, RECYCLE

PRACTICES

ANALYZING AND INTERPRETING DATA

Students collect data about the amount of trash they produce. Then they construct, analyze, and interpret graphs using the data.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students examine the impact of their contributions to the waste stream and develop ways to decrease that impact.

PATTERNS

Students look for patterns in their graphs to determine categories of trash and to understand the waste stream.

CAUSE AND EFFECT

Through their service project, students examine the causes of solid waste and use that information to develop a plan to decrease the amount of waste they produce.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.

Analyze and interpret data to provide evidence for phenomena.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Graphs, charts, and images can be used to identify patterns in data.

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



? GUIDING QUESTION

What renewable and nonrenewable resources do you use in your daily activities?

GRADES 6–8

RENEWABLE OR NOT?

PRACTICES

DEVELOPING AND USING MODELS

Students use models to explore the concept of sustainability.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students obtain clues from scientific texts to determine the definitions of renewable and nonrenewable.

CONCEPTS

NATURAL RESOURCES

Students classify natural resources as renewable or nonrenewable and then investigate how resources might be used more sustainably.

SYSTEMS AND SYSTEM MODELS

Students model a community system to understand the sustainable use of resources.

STABILITY AND CHANGE

Students discuss how changes in their models would affect the need for resources and their use.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

Use a model to predict and/or describe phenomena.

Obtaining, Evaluating, and Communicating Information

Critically read scientific texts adapted for classroom use to determine the central ideas to describe patterns in the natural world.

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

PERFORMANCE EXPECTATION

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSCUTTING CONCEPTS

Systems and System Models

Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.

Stability and Change

Stability might be disturbed either by sudden events or gradual changes that accumulate over time.



? GUIDING QUESTION

How could climate change affect the ecosystems in our region?

GRADES 6–8

THE GLOBAL CLIMATE

PRACTICES

ANALYZING AND INTERPRETING DATA

Students construct and analyze data on climate change.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students use a variety of media to gather and present information about the effects of climate change on ecosystems.

CONCEPTS

GLOBAL CLIMATE CHANGE

Students explore how the changes in CO₂ levels in the atmosphere affect temperature and ecosystems.

PATTERNS

Students look for patterns in their graphical data to answer questions about climate change.

STABILITY AND CHANGE

Students discuss how changes in CO₂ levels influence changes in ecosystems.

SCIENCE AND ENGINEERING PRACTICES

Analyzing and Interpreting Data

Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.

Obtaining, Evaluating, and Communicating Information

Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).

DISCIPLINARY CORE IDEAS

ESS3.D: Global Climate Change

Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.

PERFORMANCE EXPECTATION

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Patterns

Graphs, charts, and images can be used to identify patterns in data.

Stability and Change

Small changes in one part of a system might cause large changes in another part.



? GUIDING QUESTION

Do the forest products that you use come from sustainably managed forests?

GRADES 6–8

WHAT'S IN A LABEL?

PRACTICES

CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

By identifying criteria for a forest certification system, students use scientific ideas and principles to design solutions to a problem.

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Students communicate information about their grocery bag chain of custody diagram.

CONCEPTS

HUMAN IMPACTS ON EARTH SYSTEMS

Students learn how forest certification can affect their impact on forest ecosystems.

SYSTEMS AND SYSTEM MODELS

Students consider both forest ecosystems and human systems as they suggest requirements for forest certification.

SCIENCE AND ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions

Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process, or system.

Obtaining, Evaluating, and Communicating Information

Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

DISCIPLINARY CORE IDEAS

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

PERFORMANCE EXPECTATION

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Note: Keep in mind that no single activity can fully meet a Performance Expectation.

CROSSCUTTING CONCEPTS

Systems and System Models

Systems may interact with other systems; they may have subsystems and be a part of larger complex systems.

