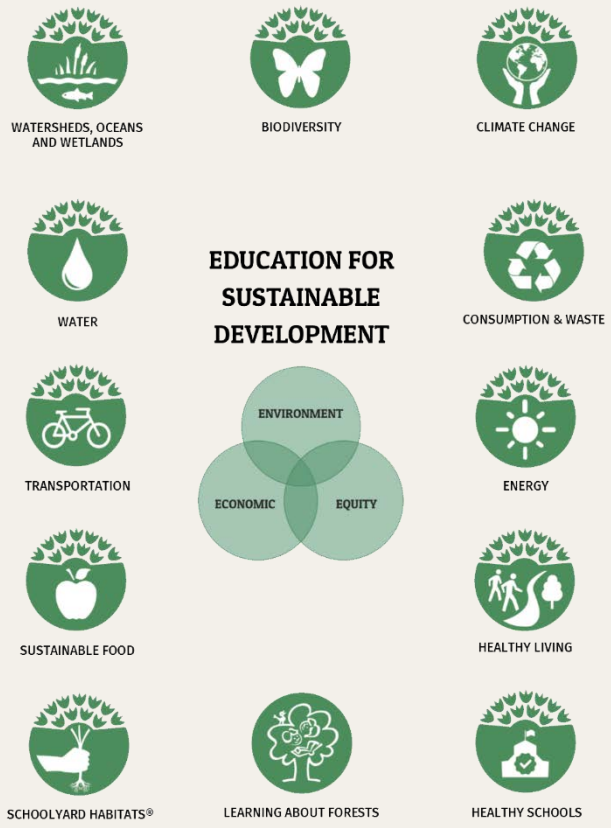
Pathways to Sustainability

Alignment to NGSS – Fourth Grade

The performance expectations in fourth grade help students formulate answers to questions such as: "What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth's features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?" Fourth grade performance expectations include PS3, PS4, LS1, ESS1, ESS2, ESS3, and ETS1 Disciplinary Core Ideas from the NRC Framework.

Students are able to use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric



currents or from object to object through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas.

In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

The National Wildlife Federation's Eco-Schools USA program has aligned their program Pathways of Sustainability to the Next Generation Science Standards, NGSS. As a part of the Eco-Schools Seven Step Framework, linking to the curriculum is a priority. This alignment is designed to highlight the natural connections between the NGSS and the Eco-Schools USA program.

Our program icons are used to denote pathway connections to the NGSS Performance Expectations and alignment to the Common Core State Standards, CCSS, English Language Arts, ELA and Mathematics.

Green STEM is an initiative of NWF's Eco-Schools USA program and is focused on identifying best practice in the STEM fields as it relates to environment-based learning. These elements include:

- Project, problem and place-based learning
- Utilizing the school, both inside and outside, as a learning laboratory
- Interdisciplinary approach
- Innovation space
- A commitment to stewardship
- An inclusive culture, where all students can learn, participate and take action

STRUCTURE, FUNCTION AND INFORMATION PROCESSING

Students who demonstrate understanding can:

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

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain and respond to the information in different ways.

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There is great power when an entire school or school district uses sustainability in which to address learning expectations and whose culture has shifted to the utilization of the school building and grounds as a laboratory for active authentic learning.

Taking the learning experience outside will create opportunities to increase students' engagement and understanding. By addressing any one of the pathways above, students will have first-hand experience in authentic learning environments, making the construction of arguments and use of models to describe, less complex and abstract. These thought processes will be more easily understood in schools who have utilized their NWF certified Schoolyard Habitat® or other natural environment on or near the school grounds in grades K-3.

Driving Questions – Examples

- How can our class develop a model that shows how wildlife in our nearby wetland use their body systems to adapt to changes in the seasons?
- How can our class share with our community about the ways trees protect themselves from fires and pests, but at the same time increase awareness for community action in support of the forested areas near our homes?

STRUCTURE, FUNCTION AND INFORMATION PROCESSING - CONTINUED

SCIENCE AND ENGINEERING PRACTICES	DISCIPLINARY CORE IDEAS	CROSSCUTTING CONCEPTS
• Developing and Using Models	**LS1.A** Structure and Function	• Systems and System Models
• Engaging in Argument from Evidence	**LS1.D** Information Processing	

Connections to other DCIs in third grade: N/A

Articulation of DCIs across grade-bands: **1.LS1.A** (4-LS1-1); **1.LS1.D** (4-LS1-2); **3.LS3.B** (4-LS1-1); **MS.LS1.A** (4-LS1-1) (4-LS1-2)

Common Core State Standards Connections

ELA/Literacy

W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)

SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-LS1-2)

Mathematics

MP.4 Model with mathematics. (4-PS4-1)

4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line- symmetric figures and draw lines of symmetry. (4-LS1-1)

EARTH'S SYSTEMS: PROCESSES THAT SHAPE THE EARTH

Students who demonstrate understanding can:

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.

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

BIODIVERSITY CLIMATE CHANGE HEALTHY LIVING LEAF WOW

Each of the Performance Expectations play a significant role in understanding the cause and effect relationship between Earth's natural processes, Earth's cyclical changes, and human induced climate change.

4-ESS2-1 The rate at which weathering and erosion occur vary and are impacted by many variables. This PE indicates several variables that can be tested in the lab and in the real world are affected by Earth's natural processes of weathering and erosion and how those natural processes are complicated by climate change. Look on the school grounds for evidence of weathering and erosion, a local creek, park or open green space. While climate change is not the focus of this PE it is another piece of the foundation that allows students to understand its complexities.

4-ESS2-2 Maps and other graphically represented data are integral in helping NASA, NOAA, and other agencies better understand climate change by taking the massive amounts of data they collect and turning them into a visual representation that is understandable. Reading maps and other graphics is an essential skill for students to have. This PE lays the groundwork for a lifetime of graphic interpretation.

Driving Questions – Examples

- How can our class support the resilience of our community by providing our local leaders with design solutions to natural hazards that are occurring more frequently, with more intensity and/or causing more damage?
- How can our class use technology to better understand how water moves over our watershed and use this technology to show our school how pollutants make their way on to our beaches and into our ocean?

EARTH'S SYSTEMS: PROCESSES THAT SHAPE THE EARTH - CONTINUED

SCIENCE AND ENGINEERING PRACTICES

- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions

DISCIPLINARY CORE IDEAS

ESS2.A Earth Materials and Systems

ESS2.B Plate Tectonics and Large-Scale Interactions

ESS2.E Biogeology

ESS3.B Natural Hazards

ETS1.B Designing Solutions to Engineering Problems

CROSSCUTTING CONCEPTS

- Patterns
- Cause and Effect

CONNECTIONS TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

- Influence of Engineering, Technology and Science on Society and the Natural World

CONNECTIONS TO NATURE OF SCIENCE

- Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Connections to other DCIs in this grade: **4.ETS1.C** (4-ESS3-2)

Articulation of DCIs across grade-bands: **K.ETS1.A** (4-ESS3-2)**; 2.ESS1.C** (4-ESS2-1); **2.ESS2.A** (4-ESS2-1); **2.ESS2.B** (4-ESS2-2); **2.ESS2.C** (4-ESS2-2); **2.ETS1.B** (4-ESS3-2); **2.ETS1.C** (4-ESS3-2); **3.LS4.A** (4-ESS1-1); **5.ESS2.A** (4-ESS2-1); **5.ESS2.C** (4-ESS2-2); **MS.ESS1.C** (4-ESS2-2); **MS.ESS2.A** (4-ESS1- 1) (4-ESS2-2) (4-ESS3-2); **MS.ESS2.B** (4-ESS2-2); **MS.ESS3.B** (4-ESS3-2); **MS.ETS1.B** (4-ESS3-2)

EARTH'S SYSTEMS: PROCESSES THAT SHAPE THE EARTH - CONTINUED

Common Core State Standards

ELA/Literacy

RI.4.1	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2)
RI.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (4-ESS2-2)
RI.4.9	Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2)
W.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS2-1)
W.4.8	Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS2-1)

Mathematics

MP.2	Reason abstractly and quantitatively. (4-ESS2-1) (4-ESS3-2)
MP.4	Model with mathematics. (4-ESS2-1) (4-ESS3-2)
MP.5	Use appropriate tools strategically. (4-ESS2-1)
4.MD.A.1	Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb., oz.; l, ml; hr., min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. For example, know that 1 ft. is 12 times as long as 1 in. Express the length of a 4 ft. snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36). (4-ESS2-1)
4.MD.A.2	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. (4-ESS2-1),(4-ESS2-2)
4.OA.A.1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-2)

ENERGY

Students who demonstrate understanding can:

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-4. Apply scientific ideas to design, test and refine a device that converts energy from one form to another.

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

CLIMATE CHANGE ENERGY

As students learn energy saving behaviors to implement at school and in the classroom begin to learn that energy is more than just electricity, this is the opportune time to allow students to investigate not only environmental solutions to energy problems, but at the same time students will learn how energy transfers from one type to another through their design concept.

Teachers in grades K-3 have laid the framework that now allows you to broach the concept of climate change. As students learn about Earth's natural resources, renewable and nonrenewable, they also begin to grasp the cause and effect relationships related to the resources we rely on thus starting the innate problem solving process in students to design solutions that could have a positive impact.

Driving Questions – Examples

- To better inform our community, what is our states fuel mix and what are the environmental impacts associated with each natural resource?
- How can our class demonstrate to our school administration the most economical and most sustainable light bulb for classrooms?

ENERGY - CONTINUED

SCIENCE AND ENGINEERING PRACTICES

- Planning and Carrying Out Investigations
- Constructing Explanations and Designing Solutions

DISCIPLINARY CORE IDEAS

PS3.A Definitions of Energy

PS3.B Conservation of Energy and Energy Transfer

PS3.D Energy in Chemical Processes and Everyday Life

ESS3.A Natural Resources

ETS1.A Defining Engineering Problems

CROSSCUTTING CONCEPTS

- Cause and Effect
- Energy and Matter

CONNECTIONS TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

- Influence of Engineering, Technology and Science on Society and the Natural World

CONNECTIONS TO NATURE OF SCIENCE

- Science is a Human Endeavor

Connections to other DCIs in this grade: N/A

Articulation of DCIs across grade-bands: **K.ETS1.A** (4-PS3-4); **2.ETS1.B** (4-PS3-4); **5.PS3.D** (4-PS3-4); **5.LS1.C** (4-PS3-4); **MS.PS2.B** (4-PS3-2); **MS.PS3.A** (4-PS3-2) (4-PS3-4); **MS.PS3.B** (4-PS3-2) (4-PS3-4); **MS.PS3.C** (4-PS3-3); **MS.PS4.B** (4-PS3-2); **MS.ESS2.A** (4-ESS3-1); **MS.ESS3.A** (4-ESS3-1); **MS.ESS3.C** (4-ESS3-1); **MS.ESS3.D** (4-ESS3-1); **MS.ETS1.B** (4-PS3-4); **MS.ETS1.C** (4-PS3-4)

Common Core State Standards

ELA/Literacy

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2) (4-PS3-4) (4-ESS3-1)

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-PS3-2) (4-PS3-4),(4-ESS3-1)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1)

Mathematics

MP.2 Reason abstractly and quantitatively. (4-ESS3-1)

MP.4 Model with mathematics. (4-ESS3-1)

4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (4-PS3-4)

4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)