Pathways to Sustainability
Alignment to NGSS – Fifth Grade

The performance expectations in fifth grade help students formulate answers to questions such as: “When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?” Fifth grade performance expectations include PS1, PS2, PS3, LS1, LS2, ESS1, ESS2, and ESS3 Disciplinary Core Ideas from the NRC Framework.

Students are able to describe that matter is made of particles too small to be seen through the development of a model. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun. Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The crosscutting concepts of patterns; cause and effect; scale, proportion, and
quantity; energy and matter; and systems and systems models are called out as organizing concepts for these disciplinary core ideas.

In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and 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
MATTER AND ENERGY IN ORGANISMS AND ECOSYSTEMS

Students who demonstrate understanding can:

**5-PS3-1.** Use models to describe that energy in animals’ food (used for body repair, growth, motion and to maintain body warmth) was once energy from the sun.

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

**5-LS1-2.** Develop a model to describe the movement of matter among plants, animals, decomposers and the environment.

Each of the Performance Expectations is more easily accomplished by students who have spent significant time outdoors using their schoolyard as a learning laboratory. Students will be able to use models with greater precision and understanding to describe that energy in animals’ food was once energy from the sun because they have had several experiences, K-5 in the school’s NWF certified Schoolyard Habitat®, sustainable food gardens, and/or through investigations of biodiversity, forestry or watershed. Many of the students’ experiences with plants have been done in soil and a lot of emphasis has been placed on soil health. Utilize hydroponics and/or air gardens to allow students the opportunity to become familiar with this type of gardening and as it will give students the supporting details for an argument that plants get the materials they need for growth chiefly from air or water. For students who have been integral in the creation and care of a Schoolyard Habitat®, sustainable food garden, micro-forest, pond system, etc., developing a model based on those experiences will allow them to describe the movement of matter through ecosystems with greater depth and understanding. Models in texts are 2D and do not allow students to explore the complex processes of cycle components, whereas the outdoors allow for full-on, sensory-packed learning experiences.

Driving Questions – Examples

- How can our class teach other students that energy in animals food originates from the sun?
- How can our class develop a valid argument in support of the clean water and air act?
### MATTER AND ENERGY IN ORGANISMS AND ECOSYSTEMS - CONTINUED

<table>
<thead>
<tr>
<th>SCIENCE AND ENGINEERING PRACTICES</th>
<th>DISCIPLINARY CORE IDEAS</th>
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<tbody>
<tr>
<td>• Developing and Using Models</td>
<td>PS3.D</td>
<td>Energy in Chemical Processes and Everyday Life</td>
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<tr>
<td>• Engaging in Argument from Evidence</td>
<td>LS1.C</td>
<td>Organization for Matter and Energy Flow in Organisms</td>
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<td>CONNECTIONS TO NATURE OF SCIENCE</td>
<td>LS2.A</td>
<td>Interdependent Relationships in Ecosystems</td>
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<td>• Science Models, Laws, Mechanisms and Theories Explain Natural Phenomena</td>
<td>LS2.B</td>
<td>Cycles of Matter and Energy Transfer in Ecosystems</td>
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</table>

Connections to other DCIs in third grade: **5.ESS2.A** (5-LS2-1); **5.PS1.A** (5-LS1-1),(5-LS2-1)

Articulation of DCIs across grade-bands: **K.LS1.C** (5-LS1-1),(5-PS3-1); **2.PS1.A** (5-LS2-1); **2.LS2.A** (5-PS3-1) (5-LS1-1); **2.LS4.D** (5-LS2-1); **4.PS3.A** (5-PS3-1); **4.PS3.B** (5-PS3-1); **4.PS3.D** (5-PS3-1); **4.ESS2.E** (5-LS2-1); **MS.PS3.D** (5-PS3-1) (5-LS2-1); **MS.PS4.B** (5-PS3-1); **MS.LS1.C** (5-PS3-1) (5-LS1-1) (5-LS2-1); **MS.LS2.A** (5-LS2-1); **MS.LS2.B** (5-PS3-1), (5-LS2-1)

### Common Core State Standards Connections

**ELA/Literacy**

<table>
<thead>
<tr>
<th>CCSS Code</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>RI.5.1</strong></td>
<td>Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)</td>
</tr>
<tr>
<td><strong>RI.5.7</strong></td>
<td>Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1),(5-LS2-1)</td>
</tr>
<tr>
<td><strong>RI.5.9</strong></td>
<td>Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)</td>
</tr>
<tr>
<td><strong>W.5.1</strong></td>
<td>Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)</td>
</tr>
<tr>
<td><strong>SL.5.5</strong></td>
<td>Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1),(5-LS2-1)</td>
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**Mathematics**

<table>
<thead>
<tr>
<th>CCSS Code</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>MP.2</strong></td>
<td>Reason abstractly and quantitatively. (5-LS2-1)</td>
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<tr>
<td><strong>MP.4</strong></td>
<td>Model with mathematics. (5-LS2-1)</td>
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<tr>
<td><strong>5.MD.A.1</strong></td>
<td>Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1-1)</td>
</tr>
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**Pathways to Sustainability**

**Alignment to NGSS**

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**EARTH’S SYSTEMS**

**Students who demonstrate understanding can:**

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

**5-ESS2-2.** Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

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

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Systems’ thinking is a valuable tool especially when we consider the interactions between the Earth’s various systems. The GLOBE Program is an excellent inquiry-driven citizen science program that demonstrates the intersections amongst Earth’s systems.

We all know to turn off the water while brushing our teeth, work to take shorter showers, and buy water wise appliances, but why? Students often think our water resources on Earth are infinite, they don’t understand how much of that water is usable for human consumption and daily needs. [https://water.usgs.gov/edu/earthwherewater.html](https://water.usgs.gov/edu/earthwherewater.html)

What are innovations that have had positive impacts on water resources and the environment? Do students have any ideas? Have students think about natural resource conservation, marine sanctuaries, and national parks with protected waterways.

What about rain barrels and water pump systems to recycle gray water? How do we feed a world with a growing population? What is Eco-agriculture and what innovations have been created and successfully used to protect our resources and the environment? What role do solar and wind energy companies play in protecting our resources and the environment? The possibilities for sustainability-driven innovation are endless.

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**Driving Questions – Examples**

- What does our class need to create a summer science activities guide for our school families to use?

- How can our class teach our others about the scarcity of water and the local implications it has or will have on the economy, recreational activities and wildlife?
### EARTH’S SYSTEMS - CONTINUED

#### SCIENCE AND ENGINEERING PRACTICES
- Developing and Using Models
- Using Mathematics and Computational Thinking
- Obtaining, Evaluating and Communicating Information

#### DISCIPLINARY CORE IDEAS
- **ESS2.A** Earth Materials and Systems
- **ESS2.C** The Role of Water in Earth’s Surface Processes
- **ESS3.C** Human Impacts on Earth Systems

#### CROSSCUTTING CONCEPTS
- Scale, Proportion and Quantity
- Systems and System Models

#### CONNECTIONS TO NATURE OF SCIENCE
- Science Addresses Questions About the Natural and Material World

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-bands: **2.ESS2.A** (5-ESS2-1); **2.ESS2.C** (5-ESS2-2); **3.ESS2.D** (5-ESS2-1); **4.ESS2.A** (5-ESS2-1); **ESS2.A** (5-ESS2-1); **ESS2.C** (5-ESS2-1), (5-ESS2-2); **ESS2.D** (5-ESS2-1); **ESS3.A** (5-ESS2-2), (5-ESS3-1); **ESS3.C** (5-ESS3-1); **ESS3.D** (5-ESS3-1)

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### Common Core State Standards

**ELA/Literacy**

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1), (5-ESS2-2), (5-ESS3-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2), (5-ESS3-1)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1), (5-ESS2-2)

**Mathematics**

MP.2 Reason abstractly and quantitatively. (5-ESS2-1) (5-ESS2-2) (5-ESS3-1)

MP.4 Model with mathematics. (5-ESS2-1) (5-ESS2-2) (5-ESS3-1)

5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1)
**STRUCTURE AND PROPERTIES OF MATTER**

**Students who demonstrate understanding can:**

- **5-PS1-3.** Make observations and measurements to identify materials based on their properties.
- **5-PS1-4.** Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

As students address consumption and waste, this would be a good time to reuse and repurpose some of those items found while auditing. Use the recyclables when conducting investigations on properties of matter. Use the creation or maintenance of the Schoolyard Habitat to investigate the properties of organic soils and soil amendments, such as lava sand, compost, peat moss, earth worm castings, etc.

Healthy Schools is about the indoor air quality and use of chemical cleaners and pesticides inside and outside the school. While **NWF’s Eco-Schools USA DOES NOT** condone the mixing of chemicals, we do support students investigating natural alternatives to chemical cleaners and pesticides. Many natural products contain vinegar, water, essential oils, baking soda, and lemon juice to name a few. Students can conduct investigations to create their own natural alternatives, such as, window cleaner, all-purpose cleaner, pest deterrents, etc.

**Driving Questions – Examples**

- How can our class demonstrate the effectiveness of organic all-purpose cleaners to our custodial staff?
- How can our class classify soil amendments used in our NWF certified Schoolyard Habitat®?
### STRUCTURE AND PROPERTIES OF MATTER - CONTINUED

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#### CROSSCUTTING CONCEPTS
- Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Connections to other DCIs in this grade: N/A

Articulation of DCIs across grade-bands: **2.PS1.A** (5-PS1-3); **2.PS1.B** (5-PS1-4); **MS.PS1.A** (5-PS1-3),(5-PS1-4); **MS.PS1.B** (5-PS1-4)

#### Common Core State Standards

**ELA/Literacy**

**W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-3) (5-PS1-4)

**W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-3) (5-PS1-4)

**W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-3),(5-PS1-4)

**Mathematics**

**MP.2** Reason abstractly and quantitatively. (5-PS1-3)

**MP.4** Model with mathematics. (5-PS1-3)

**MP.5** Use appropriate tools strategically. (PS1-3)
ENGINEERING DESIGN

Students who demonstrate understanding can:

**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.

**3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**3-5-ETS1-3.** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

While all the Eco-Schools USA pathways lend themselves to engineering design, these pathways have been chosen because they are found in many of the other Performance Expectations for second grade. To strengthen the concepts that students have been learning, it is logical to allow them opportunities to design solutions to real world issues that affect the issues of sustainability they have been working to address.

Design solutions could include:

- Methods of water distribution that conserve water for the school gardens
- Using green, grey and brown infrastructure to build resilience to ongoing flooding issues
- The use of trees and gardens to conserve energy
- Creation and marketing of natural cleaning products

**Driving Questions – Examples**

- How can our class create a natural barrier to flooding that occurs in different places on the school grounds, in a way that is economically feasible, beautifies the campus and provides wildlife habitat?
- What are ways our class can capture rainwater water and reuse it in our gardens?
### Engineering Design - Continued

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<td>• Influence Of Science, Engineering And Technology On Society And The Natural World</td>
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<tr>
<td>• Constructing Explanations and Designing Solutions</td>
<td>ETS1.C Optimizing the Design Solution</td>
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Connections to other DCIs in this grade:
- Connections to 3-5-ETS1.A: Defining and Delimiting Engineering Problems include: 4th Grade: 4-PS3-4
- Connections to 3-5-ETS1.B: Designing Solutions to Engineering Problems include: 4th Grade: 4-ESS3-2
- Connections to 3-5-ETS1.C: Optimizing the Design Solution include: 4th Grade: 4-PS4-3

Articulation of DCIs across grade-bands: **K-2.ETS1.A** (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3); **K-2.ETS1.B** (3-5-ETS1-2); **K-2.ETS1.C** (3-5-ETS1-3) (3-5-ETS1-3); **MS.E.ETS1.A** (3-5-ETS1-1); **MS.E.ETS1.B** (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3); **MS.E.ETS1.C** (3-5-ETS1-2) (3-5-ETS1-3)

### Common Core State Standards

**ELA/Literacy**

**RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS-2)

**RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS-2)

**RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS-2)

**W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)

**W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)

**Mathematics**

**MP.2** Reason abstractly and quantitatively. (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3)

**MP.4** Model with mathematics. (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3)

**MP.5** Use appropriate tools strategically. (3-5-ETS1-1) (3-5-ETS1-2) (3-5-ETS1-3)

**3-5.OA** Operations and Algebraic Thinking (3-5-ETS1-1) (3-5-ETS1-2)