

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 7-Step Framework, linking to the curriculum is a priority. **This alignment is designed to highlight the natural connections between the NGSS and NWF’s Eco-Schools USA program.**

Our program icons are used to denote pathway connections the NGSS Performance Expectations. **Not every topic, with its set of Performance Expectations are a fit with NWF’s Eco-Schools USA program and in that case an alignment will not be present.**



Also present within this alignment document are connections to the **Common Core State Standards, CCSS, English Language Arts, ELA and Mathematics, 21st Century Skills, Environmental Ladder of Responsibility, and Connections to Music, Physical Education, and Art.**

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:

- Problem-Based Learning
- Utilizing the school, both inside and outside, as a learning laboratory
- The incorporation of two or more STEM disciplines within a single lesson, whole curricula, a set of standards, etc.
- A Maker mentality – design/create/solve
- A commitment to service learning
- An inclusive culture, where all students can learn and all student can participate



HS-ESS3 Earth and Human Activity

Students who demonstrate understanding can:

- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]
- HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resource based on cost-benefit ratios.*** [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]
- HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]
- HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.** [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]
- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]



Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)
- New technologies advance scientific knowledge. (HS-ESS3-5)

Disciplinary Core Ideas

ESS2.D: Weather and Climate

- Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary to HS-ESS3-6)

ESS3.A: Natural Resources

- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)

ESS3.B: Natural Hazards

- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ESS3.D: Global Climate Change

- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)
- Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HS-ESS3-2), (secondary HS-ESS3-4)

Crosscutting Concepts

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)

Stability and Change

- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3), (HS-ESS3-5)
- Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)

Connections to Engineering, Technology and Applications of Science

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

- Modern civilization depends on major technological systems. (HS-ESS3-1), (HS-ESS3-3)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-2), (HS-ESS3-4)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2)

Connections to Nature of Science

Science is a Human Endeavor

- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2)
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)

The section entitled “Disciplinary Core Ideas” is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.



Science and Engineering Practices Continued	Disciplinary Core Ideas Continued	Crosscutting Concepts
--	--	------------------------------

<p>Connections to other DCIs in this grade-band: HS.PS1.B (HS-ESS3-3); HS.PS3.B (HS-ESS3-2), (HS-ESS3-5); HS.PS3.D (HS-ESS3-2), (HS-ESS3-5); HS.LS1.C (HS-ESS3-5); HS.LS2.A (HS-ESS3-2), (HS-ESS3-3); HS.LS2.B (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-6); HS.LS2.C (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); HS.LS4.D (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); HS.ESS2.A (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-6); HS.ESS2.D (HS-ESS3-5); HS.ESS2.E (HS-ESS3-3)</p>	
<p>Articulation across grade-bands: MS.PS1.B (HS-ESS3-3); MS.PS3.B (HS-ESS3-5); MS.PS3.D (HS-ESS3-2), (HS-ESS3-5); MS.LS2.A (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3); MS.LS2.B (HS-ESS3-2), (HS-ESS3-3); MS.LS2.C (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); MS.LS4.C (HS-ESS3-3); MS.LS4.D (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3); MS.ESS2.A (HS-ESS3-1), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6); MS.ESS2.C (HS-ESS3-6); MS.ESS2.D (HS-ESS3-5); MS.ESS3.A (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3); MS.ESS3.B (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5); MS.ESS3.C (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6); MS.ESS3.D (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)</p>	
<p>Common Core State Standards Connections:</p>	
<p>ELA/Literacy –</p> <p>RST.11-12.1</p> <p>RST.11-12.2</p> <p>RST.11-12.7</p> <p>RST.11-12.8</p> <p>WHST.9-12.2</p> <p>Mathematics –</p> <p>MP.2</p> <p>MP.4</p> <p>HSN-Q.A.1</p> <p>HSN-Q.A.2</p> <p>HSN-Q.A.3</p>	<p>Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-ESS3-5)</p> <p>Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)</p> <p>Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5)</p> <p>Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4)</p> <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)</p> <p>Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)</p> <p>Model with mathematics. (HS-ESS3-3), (HS-ESS3-6)</p> <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)</p> <p>Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)</p> <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)</p>

The section entitled “Disciplinary Core Ideas” is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.



ECO-SCHOOLS USA PATHWAYS ALIGNMENT

HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6

Each *Performance Expectation* is more successfully accomplished by students who have spent significant time outdoors in the natural world. Connecting to nature increases student engagement, focus, creativity and innovation. Each of the Pathways to Sustainability help students better understand the Earth system and the impact human activities has on these systems. By increasing content knowledge and providing tools and resources, student learning is place-based, real-world and experiential. Students take on leadership roles in helping to build a sustainable school community and neighborhood. The experiences students have as a part of the Eco-Schools USA program prepare them to take on similar roles and responsibilities as young adults; the leaders in sustainable partnerships, design and innovation, community problem solving and as overall engaged members of their community.



LADDER OF ENVIRONMENTAL RESPONSIBILITY

Looking at the responsibilities below determine which are applicable or could be modified to add rigor and more meaning to the sustainability work that is taking place on campus. The focus is on changing behavior no matter how small. Human activities brought us to this point in time, and it will be human activities that help us make positive change in the right direction.

Green Living Pledge

- Each grade level has a goal to meet (reducing the overall carbon footprint, reduction in kilowatt hours, amount of recycling, conservation hours, etc.)

Social Contract Theory

- Students explore different ethical dilemmas related to the environment and to global social, economic, and political discussions and quandaries
- Students explore ethical theories and relate to past and present case studies involving social contract theory and the environment

Connecting with the County – Student Liaison

- Dept. of Facilities and Transportation Services: Student Liaison to report back on district programs; re: Energy Management Program, Greenhouse Gas Inventory, Municipal Separate Storm Sewer System (MS4) Program, and Recycling Program

Connecting to Home, Work, and Community

- Fostering new and continued Business and Community Partnerships

Using Tools Outside

- What tools we use; using tools properly and safely; return tools; using more technology as a tool to record, analyze, and share data.

Caring for our Environment

- We have to care for our environment as we have a shared global interest in stewardship for the Earth and its resources.

The Three R's

- Try to reuse what you can; recycle what you can't. Conservation and reducing waste and water/energy use.

21st CENTURY SKILLS

Learning and Innovation

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media, and Technology

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

Life and Career

- Flexibility and Adaptability
- Initiative and Self-Direction
- Social and Cross Cultural Skills
- Productivity and Accountability
- Leadership and Responsibility

Music/PE/Art

Work with teachers on campus that have the ability and expertise to extend student learning beyond their core academic classes, ELA, science, math, and the social studies. Examples include:

- Have students research national anthems. What event(s) inspired the lyrics? Have students work together to compose and Earth anthem.
- Advocate for more unstructured natural physical education – free choice connections to nature – hiking, volunteering in botanic gardens, farming at local co-op, kayaking, etc.
- Artists around the world have used their talents to inspire change in their community and around the world. Ask the art teacher to provide students with an opportunity to do research on the topic and then use their artistic talents to inspire change in their community.

The section entitled “Disciplinary Core Ideas” is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.