Exploring Synergy: Environmental Literacy and the Next Generation Science Standards

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August 2019

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North American Association for Environmental Education

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PART 1
Introduction and Overview

How environmental education is conceptualized and implemented in elementary and secondary schools is critical if we are to meet our goal of environmental literacy. Integrated across the curriculum, environmental education draws upon the natural and physical sciences, social sciences, and humanities. These disciplines are connected not only through the medium of the environment, but also through the development of environmental issue investigation and action skills needed for civic engagement. In the end, however, the ability of school systems to provide comprehensive environmental education will depend on its systematic and cohesive integration into the standards-based curriculum. Although we know that curriculum can be designed that supports both academic achievement *and* the development of environmental literacy, we also know that this type of curriculum planning takes work. It requires a thorough understanding of the standards and of the components of environmental literacy.

With the publication of the *Next Generation Science Standards* (NGSS Lead States 2013), a new vision of science education was articulated. As teachers and other educators begin the process of mapping their curriculum and developing the instructional strategies necessary to implement *NGSS* fully, it seemed useful to provide a resource that highlights some of the linkages between this vision of science education and environmental literacy.

K-12 Framework for Environmental Literacy

K-12 Environmental Education: Guidelines for Excellence (2019) offers a detailed curriculum and instructional framework and vision for environmental education that promotes progress toward sustaining a healthy environment and quality of life. By setting specific expectations for what young people should *know and be able to do* by the time they complete fourth, eighth, and twelfth grades, *K-12 EE Guidelines* translates general notions about environmental literacy into an age-appropriate framework for

DEFINING ENVIRONMENTAL EDUCATION AND ENVIRONMENTAL LITERACY

Environmental Education (1) … is a process that helps individuals, communities, and organizations learn more about the environment, develop skills to investigate their environment and to make intelligent, informed decisions about how they can help take care of it. It has the power to transform lives and society. It informs and inspires. It motivates action. EE is a key tool in creating healthier and more civically engaged communities.

An Environmentally Literate Person (2) …is someone who, both individually and together with others, makes informed decisions concerning the environment; is willing to act on these decisions to improve the well-being of other individuals, societies, and the global environment; and participates in civic life. Those who are environmentally literate possess, to varying degrees, the knowledge and understanding of a wide range of environmental concepts, problems, and issues; a set of cognitive and affective dispositions; a set of cognitive skills and abilities; and the appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts.

(1) NAAEE (nd) About EE and Why it Matters, https://naaee.org/about-us/about-ee-and-why-it-matters
(2) Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). Developing a framework for assessing environmental literacy. Washington, DC: North American Association for Environmental Education. https://naaee.org/our-work/programs/environmental-literacy-framework.

effective and comprehensive environmental education programming. The guidelines emphasize the development of conceptual knowledge as well as thinking, investigation, and action skills necessary for civic engagement. They rest on the idea that environmental literacy must be a goal of society and that environmental education must play an integral role throughout educational systems.

Essential Underpinnings

Environmental education builds from a core of key principles that inform its approach to education. Some of these important underpinnings are:

Systems and Systems Thinking: Systems thinking helps make sense of a large and complex world. A system is made up of parts. Each part can be understood separately. The whole, however, is understood only by understanding the relationships and interactions among the parts. Earth is a complex system of interacting physical, chemical, and biological processes. Organizations, individual cells, communities of animals and plants, and families can all be understood as systems. And systems can be nested within other systems.

Human Well-being: Human well-being is inextricably bound with environmental quality. Humans are a part of the natural order. Humans, and the systems they create—societies, political systems, economies, religions, cultures, technologies— impact the total environment and are impacted by the environment. Since humans are a part of nature rather than outside it, they are challenged to recognize the ramifications of their interdependence with Earth systems.

Equity and Inclusion: Environmental education instruction is inclusive, respectful, and equitable, and designed to employ the talents of people with different backgrounds, experiences, and perspectives.

The Importance of Where One Lives: Beginning close to home, learners connect with, explore, and understand their immediate surroundings. The sensitivity, knowledge, and skills needed for this local connection provides a base for moving into larger systems, broader issues, and an expanding understanding of causes, connections, and consequences.

Roots in the Real World: Learners develop knowledge and skills through direct experience with the environment, current environmental issues, and society. Investigation, analysis, and problem solving are essential activities and are most effective when relevant to the real world.

Integration and Infusion: Disciplines from the natural sciences, social sciences, and the humanities are connected through the environment and environmental issues. Environmental education offers opportunities for integration and works best when infused across the curriculum, rather than being treated as a separate discipline or subject area.

Lifelong Learning: Critical and creative thinking, decision making, and communication, as well as collaborative learning, are emphasized. These skills are essential for active and meaningful learning, both in school and over a lifetime.

Sustainability: Learning is future oriented, and focused on environmental, social, and economic responsibility as drivers of individual and institutional choices.

How are the K-12 EE Guidelines Organized?

Ultimately, environmentally literate individuals possess a sophisticated set of knowledge, skills, and dispositions that allow them to solve novel environmental problems and determine the best set of actions; they are engaged in civic decision-making and action. Four key elements of environmental literacy have been articulated and further delineated in guidelines:

Strand 1: Questioning, Analysis and Interpretation Skills

Environmental literacy depends on learners' ability to ask questions, speculate, and hypothesize about the world around them, seek information, and develop answers to their questions. Learners must be familiar with inquiry; master fundamental skills for gathering and organizing information; and interpret and synthesize information to develop and communicate explanations.

A. Questioning
B. Designing investigations
C. Collecting information
D. Evaluating accuracy and reliability
E. Organizing and analyzing information
F. Working with models and simulations
G. Drawing conclusions and developing explanations

Strand 2: Environmental Processes and Systems

Environmental literacy is dependent on an understanding of the processes and systems that comprise the environment, including human social systems and influences. Students develop an understanding of how changes in one system (hydrosphere, atmosphere, geosphere, and biosphere) results in changes in another. They develop an understanding of how human activities affect environmental quality and long-term sustainability at local, tribal, national, and global levels. These understandings are based on knowledge synthesized from across traditional disciplines. The guidelines in this section are grouped in three sub-categories:

2.1—Earth's physical and living systems

A. Earth's physical systems
B. Earth's living systems

2.2—Human systems

A. Individuals, groups, and societies
B. Culture
C. Political systems
D. Economic systems

2.3—Environment and society
A. Human-environment interactions
B. Resource distribution and consumption
C. Places
D. Change and conflict

Strand 3: Skills for Understanding and Addressing Environmental Issues
Skills and knowledge are refined and applied in the context of environmental issues at varying scales. Environmental literacy includes the abilities to define, learn about, evaluate, and act on environmental issues. Students investigate environmental issues; consider evidence and differing viewpoints; and evaluate proposed action plans, including likely effectiveness in specific environmental, cultural, social, and economic contexts. They analyze the intended and unintended consequences of their own actions and actions taken by other individuals and groups, including long-term environmental, social, and economic implications for sustainability. In this section, the guidelines are grouped in two sub-categories:

3.1—Skills for analyzing and investigating environmental issues
A. Identifying and investigating issues
B. Sorting out the consequences of issues
C. Identifying and critiquing alternative solutions and courses of action
D. Working with flexibility, creativity, and openness

3.2—Decision-making and action skills
A. Forming and evaluating personal views
B. Evaluating the need for action
C. Planning and taking action
D. Evaluating the results of actions

Strand 4: Personal and Civic Responsibility
Environmentally literate community members are willing and able to act on their own conclusions about what should be done to ensure environmental quality, social equity, and economic prosperity. As learners develop and apply concept-based learning and skills for inquiry, analysis, and action, they also understand that what they do individually and in groups can make a difference.
A. Recognizing rights and responsibilities
B. Recognizing efficacy and developing agency
C. Accepting personal responsibility

Taken together, this framework creates a vision of environmental literacy. The sequence of the strands—and the individual guidelines themselves— may suggest that some skills or knowledge serve as a foundation for others. But the process of becoming environmentally literate is not linear, and the sequence of the guidelines is more a function of bringing an order and logic to this document than establishing a hierarchy of skills and knowledge.

Next Generation Science Standards[1]

How are the Next Generation Science Standards organized?

Developed using *A Framework for K-12 Science Education* (NRC 2012) as its foundation, *NGSS* provides a developmentally appropriate vision for science education. The NRC *Framework* describes, in detail, three dimensions of science education: Practices, Crosscutting Concepts and Disciplinary Core Ideas. These dimensions, taken together, describe what it means to be scientifically literate. *NGSS* combines each of these three dimensions into performance expectations that reflect underlying learning progressions and describe specific assessment targets across benchmark grade levels. It is important to note that *NGSS* was conceived as a document that would guide assessment. Because *NGSS* was designed with assessment in mind, it was decided that writing performance expectations that cut evenly across the *Framework* would have set up unreasonable expectations. Consequently, *NGSS* concentrates only on a portion of the knowledge and skills presented in the *Framework*.

Dimension 1: Practices

Asking questions (for science) and defining problems (for engineering)
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematics and computational thinking
Constructing explanations (for science) and designing solutions (for engineering)
Engaging in argument from evidence
Obtaining, evaluating, and communicating information

[1] NGSS is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

Dimension 2: Crosscutting Concepts

Patterns
Cause and effect
Scale, proportion, and quantity
Systems and system models
Energy and matter
Structure and function
Stability and change
Interdependence of Science, Engineering, and Technology
Influence of Science, Engineering, and Technology on Society and the Natural World

Dimension 3: Disciplinary Core Ideas

Physical Sciences
- Matter and its Interactions
- Motion and Stability
- Energy
- Waves and Their Applications

Life Sciences
- From Molecules to Organisms
- Ecosystems
- Heredity
- Biological Evolution

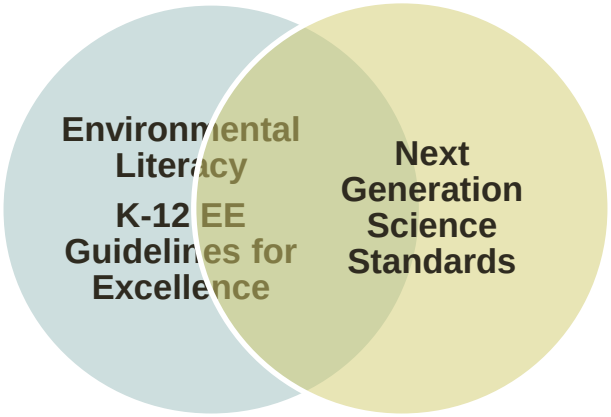
Earth and Space Sciences
- Earth's Place in the Universe
- Earth's Systems
- Earth and Human Activity

Engineering Design

Linking Environmental Education to Academic Standards

Intentionally, the *K-12 Environmental Education: Guidelines for Excellence* (2019) make clear the argument that environmental education is not separate from mandated education priorities but should be integral to them. The conceptual framework can be used to craft a comprehensive environmental education program that leads towards environmental literacy while also helping educators meet the requirements of the officially sanctioned and assessed standards-based curriculum. We envision a Win-Win solution. Building a standards-based curriculum is not a simple task, however. And, in the case of looking at the linkages between environmental literacy and *NGSS* it must be understood that environmental literacy depends on more than science skills and understandings. Environmental literacy also requires skills and understandings that are most often found within the social studies and humanities curriculum. Similarly, *NGSS* and its foundational

Framework (NRC 2012) are not limited to environmental science. There is, however, an important and necessary intersection between environmental literacy and *NGSS* that may be best visualized as a Venn diagram:



As with many Venn diagrams, the amount of overlap – the intersection between the two circles – is not proscribed or precise. This document was designed to provide insights into the connections that can be found between *NGSS* and the *K-12 Environmental Education: Guidelines for Excellence*. To illustrate these linkages, a series of detailed matrices, displayed in Parts 2-5, have been created that cross reference the intersections between key elements of *NGSS* and the *K-12 Environmental Education: Guidelines for Excellence.* These matrices were developed with two distinct purposes in mind: 1) to help educators identify natural opportunities to connect the curriculum through a comprehensive, cohesive vision of environmental literacy and 2) to help educators identify how environmental education can support science education and the implementation of *NGSS*. Ultimately, this document is meant to be used as a tool for curriculum development and instructional design.

Comparing the Environmental Literacy Framework and *NGSS*

When the cross-references between *NGSS*'s three dimensions and the environmental literacy framework are taken together, distinct patterns emerge. These patterns help us answer two questions important to curriculum development: 1) how can environmental literacy instruction best support the implementation of *NGSS* and 2) how can instruction designed to address *NGSS* performance expectations also support the development of environmental literacy. Table 1 displays an overview of the linkages between the *K-12 Environmental Education: Guidelines for Excellence* and *NGSS*. The linkages are drawn from the more detailed matrices found in Parts 2-5 of this document. For ease of interpretation, the level or degree of cross referencing is coded, with darker shading indicating a stronger connection and lighter or no shading indicating little or no connection.

How can environmental literacy instruction best support the implementation of NGSS?

Reading down the columns offers insight into specific places where instruction focusing on environmental literacy could also support *NGSS*. As might be expected, Strand 1 (Questioning, Analysis and Interpretation Skills) provides a strong link to all the Science and Engineering Practices (see Part 2).

Strand 2: Environmental Processes and Systems considers the development of understandings typically included in Earth system and ecological sciences (2.1). Strand 2 also includes understandings of human systems (2.2) and the relationships and interactions between human societies and the environment (2.3). Earth's physical system (2.1.A) which includes understandings related to the processes that shape Earth, changes in matter, and energy, cuts across Earth and Space Science, particularly Earth's Systems (ESS2) and Earth and Human Activity (ESS3), and to a somewhat lesser extent to Physical Science, Matter and its Interactions (PS1) and Energy (PS3). As one might expect, Strand 2.1.B – Living systems is most closely aligned with Life Science. Although Strand 2.3 – Environment and Society does align with Earth and Human Activity (ESS3), Ecosystems (LS 2), and Biological Evolution (LS 4). Strand 2, specifically 2.1 Earth's Physical and Living Systems and 2.3 Environment and Society, also supports the Crosscutting Concepts.

The final linkages of note relate to Strand 3.1 – Skills for Analyzing and Investigating Environmental Issues. Strand 3.1 focuses on the skills needed to identify and investigate environmental issues, explore the consequences of issues, evaluate alternative solutions and courses of action (including design solutions), and work with flexibility and openness. These skills align most closely with Engineering Design.

What is missing is also of interest. Environmental literacy and science literacy are different and *NGSS* articulates important understandings that are typically not included with environmental literacy instruction. The linkages with ESS1 Earth's Place in the Universe and From Molecules to Organisms (LS 1) are limited, and there are no linkages with Motion and Stability (PS2) and Waves and Their Applications (PS4).

How can science education (NGSS) support the development of environmental literacy?

By reading across the rows of Table 1 a vision is garnered of how *NGSS* instruction can support environmental literacy development. As was discussed above, there are strong connections between the *NGSS* Science and Engineering Practices and Strand 1: Questioning, Analysis and Interpretation Skills. *NGSS* supports the development of understandings related to Strand 2.1 – Earth's physical and living systems with cross references to Earth and Space Sciences (ESS1, ESS2, ESS3), Life Sciences (LS1, LS2, LS3, LS4) and to a somewhat lesser degree Physical Science (PS1, PS3).

The connections between *NGSS* and the more purely science-oriented sub strand, Earth's Physical and Living Systems (2.1), would be expected. What is perhaps most interesting is to look at where *NGSS* cuts across more than one Strand. Strong linkages are found between Earth and Human Activity (ESS3) and Strand 2.1, Strand 2.2, and Strand 2.3. Multiple linkages can also be found between the Crosscutting Concepts, LS2 Ecosystems, and LS4 Biological Evolution and Strand 2.1 and Strand 2.3.

It should not be surprising that *NGSS* does not fully support the environmental literacy framework. As has been stated before, environmental literacy depends on understandings and skills from the sciences, social sciences, and the humanities. There is only one linkage with Strand

2.2 – Human Systems (with ESS3 Earth and Human Activity). There are no linkages with Strand 3.2 – Decision-Making and Citizenship Skills and Strand 4: Personal and Civic Responsibilities. These skills and understandings are more typically part of a social science curriculum that focuses on civic engagement.

Table 1: Overview of Linkages between *K-12 Environmental Education*: *Guidelines for Excellence* and *NGSS*

Key: Level or degree of linkage	None	Limited	Moderate	Strong
		**********		

***NGSS* Framework**	**Strand 1: Questioning, Analysis, and Interpretation Skills**	**Strand 2: Environmental Processes & Systems**			**Strand 3: Skills for Understanding & Addressing Environmental Issues**		**Strand 4: Personal & Civic Responsibility**
		2.1: Earth's Physical & Living Systems	2.2: Human Systems	2.3: Environment & Society	3.1: Analyzing & Investigating Environmental Issues	3.2: Decision-making and action skills	
Science and Engineering Practices					**********		
Crosscutting Concepts							
Engineering Design							
Earth & Space Science							
ESS1 Earth's Place in the Universe		**********					
ESS2 Earth's Systems							
ESS3 Earth and Human Activity			********				

***NGSS* Framework**	**Strand 1: Questioning, Analysis, and Interpretation Skills**	**Strand 2: Environmental Processes & Systems**			**Strand 3: Skills for Understanding & Addressing Environmental Issues**		**Strand 4: Personal & Civic Responsibility**
		2.1: Earth's Physical & Living Systems	2.2: Human Systems	2.3: Environment & Society	3.1: Analyzing & Investigating Environmental Issues	3.2: Decision-making and action skills	
Life Science							
LS1 From Molecules to Organisms		*********					
LS2 Ecosystems							
LS3 Heredity							
LS 4 Biological Evolution				********			
Physical Science							
PS1 Matter & its Interactions							
PS2 Motion & Stability							
PS 3 Energy							
PS4 Waves & Their Applications							

It should be noted, as something of a disclaimer, that any attempt to identify linkages between environmental literacy and *NGSS* is based on perspective, interpretation, and ultimate use. Some may well "see" linkages that are not identified in this document. Others may well feel that weak or non-existing linkages were identified. Our task was to try to find a middle ground – one where we provide reasonable guidance to the natural overlaps and gaps between *NGSS* and environmental literacy. A great deal of the final interpretation will rest in our own practices and how we build curriculum and instruction to address both environmental literacy and *NGSS*.

PART 2

Linking Science and Engineering Practices and NAAEE *K-12 Environmental Education: Guidelines for Excellence*

Eight science and engineer practices are articulated in the NRC *Framework* (NRC 2012) and further developed as learning progressions in Appendix F of *NGSS*. The following provides a cross-referencing of these practices to Strand 1: Questioning, Analysis, and Interpretation Skills. Depending on the investigation, skills outlined in Strand 3 may also be appropriate.

***NGSS* – Science and Engineering Practices**	***K-12 Environmental Education* – Strand 1: Questioning, Analysis and Interpretation Skills and Strand 3: Skills for Understanding and Addressing environmental Issues**
1. Asking questions (for science) and defining problems (for engineering)	1. A. Questioning 3.1.A. Identifying and investigating issues
2. Developing and using models	1.F. Working with models and simulations.
3. Planning and carrying out investigations	1.B. Designing investigations
4. Analyzing and interpreting data	1.C. Collecting information
5. Using mathematics and computational thinking	1G Drawing conclusions and developing explanations
6. Constructing explanations (for science) and designing solutions (for engineering)	1G Drawing conclusions and developing explanations
7. Engaging in argument from evidence	1.D. Evaluating accuracy and reliability 1G Drawing conclusions and developing explanations 3.1.D. Working with flexibility, creativity, and openness
8. Obtaining, evaluating, and communicating information	1.E. Organizing information 1G Drawing conclusions and developing explanations

PART 3

Linking Crosscutting Concepts and NAAEE *K-12 Environmental Education: Guidelines for Excellence*

Seven crosscutting concepts are articulated in the NRC *Framework* (NRC 2012) and further developed as learning progressions in Appendix G of *NGSS*. Two additional crosscutting concepts that link to science, engineering and technology were included in the final publication of *NGSS*. Crosscutting concepts are designed to bridge all the disciplines. As one of the three dimensions, along with the science and engineering practices and the disciplinary core ideas, the crosscutting concepts are integrated throughout the *NGSS* performance expectations. The following provides sample linkages between the *NGSS* crosscutting concepts and the environmental literacy strands. Although there are numerous linkages to the environmental literacy strands, there are also linkages between the environmental education Essential Underpinnings and the *NGSS* crosscutting concepts.

***NGSS* – Crosscutting Concepts**	**NAAEE: *K-12 Environmental Education: Guidelines for Excellence***
1. Patterns.	**Essential Underpinning: Systems and Systems Thinking**: Systems thinking helps make sense of a large and complex world. A system is made up of parts. Each part can be understood separately. The whole, however, is understood only by understanding the relationships and interactions among the parts. Earth is a complex system of interacting physical, chemical, and biological processes. Organizations, individual cells, communities of animals and plants, and families can all be understood as systems. And systems can be nested within other systems. 2.1.A Earth's physical systems 2.1.B. Earth's living systems
2. Cause and effect - Mechanism and explanation.	**Essential Underpinning: Systems and Systems Thinking**: Systems thinking helps make sense of a large and complex world. A system is made up of parts. Each part can be understood separately. The whole, however, is understood only by understanding the relationships and interactions among the parts. Earth is a complex system of interacting physical, chemical, and biological processes. Organizations, individual cells, communities of animals and plants, and families can all be understood as systems. And systems can be nested within other systems.

***NGSS* – Crosscutting Concepts**	**NAAEE: *K-12 Environmental Education: Guidelines for Excellence***
	2.1.A Earth's physical systems 2.1.B. Earth's living systems 2.3.A. Human-environment interactions
3. Scale, proportion and quantity.	2.1.A Earth's physical systems 2.1.B. Earth's living systems
4. Systems and system models.	**Essential Underpinning: Systems and Systems Thinking**: Systems thinking helps make sense of a large and complex world. A system is made up of parts. Each part can be understood separately. The whole, however, is understood only by understanding the relationships and interactions among the parts. Earth is a complex system of interacting physical, chemical, and biological processes. Organizations, individual cells, communities of animals and plants, and families can all be understood as systems. And systems can be nested within other systems. 2.3.A. Human-environment interactions
5. Energy and matter – Flows, cycles, and conservation.	2.1.A Earth's physical systems 2.1.B. Earth's living systems
6. Structure and function.	2.1.B. Earth's living systems
7. Stability and change.	2.1.A Earth's physical systems 2.1.B. Earth's living systems 2.3.A. Human-environment interactions
8. Interdependence of Science, Engineering, and Technology	2.3.A. Human-environment interactions
9. Influence of Science, Engineering, and Technology on Society and the Natural World	2.3.A. Human-environment interactions

PART 4

Linking Engineering Design (ETS) and NAAEE *K-12 Environmental Education: Guidelines for Excellence*

NGSS identifies performance expectations related to Engineering Design for each of four grade bands. There are three overarching ideas for engineering design: 1) Defining and delimiting engineering problems; 2) Designing solutions to engineering problems; and 3) Optimizing the design solutions. A thorough explanation of Engineering Design and its learning progressions across the grade bands can be found in Appendix I of *NGSS*. As might be expected, depending on the engineering question, linkages draw primarily from Strand 3.1: Skills for Analyzing and Investigating Environmental Issues. It should be remembered that not all environmental issues lend themselves to engineering design solutions.

***NGSS* – Engineering Design (ETS)**	***K-12 Environmental Education* – Strand 3: Skills for Understanding and Addressing Environmental Issues**
Define Attend to a broad range of considerations in criteria and constraints for problems of social and global significance	3.1.A Identifying and investigating issues
Develop solutions Break a major problem into smaller problems that can be solved separately	3.1.B. Sorting out the consequences of issues
Optimize Prioritize criteria, consider tradeoffs, and assess social and environmental impacts as a complex solution is tested and refined	3.1.C. Identifying and critiquing alternative solutions and courses of action

PART 5

Linking *NGSS* Disciplinary Core Ideas and NAAEE *K-12 Environmental Education: Guidelines for Excellence*

NGSS disciplinary core ideas are delineated for Earth Space Science, Life Science, and Physical Science. *NGSS* disciplinary core ideas learning progressions (Appendix E) are articulated for four grade bands: K-2, 3-5, 6-8, and 9-12.

***NGSS* – Disciplinary Core Ideas**	**NAAEE: *K-12 Environmental Education: Guidelines for Excellence***
Earth Space Science	
ESS1.A The universe and its stars	
ESS1.B Earth and the solar system	2.1.A Earth's physical systems
ESS1.C The history of planet Earth	2.1.A Earth's physical systems
ESS2.A Earth materials and systems	2.1.A Earth's physical systems 2.1B. Earth's living systems
ESS2.B Plate tectonics and large-scale system interactions	2.1.A Earth's physical systems
ESS2.C The roles of water in Earth's surface processes	2.1.A Earth's physical systems
ESS2.D Weather and climate	2.1.A Earth's physical systems
ESS2.E Biogeology	2.1.A Earth's physical systems 2.1.B Earth's living systems
ESS3.A Natural resources	2.1.A Earth's physical systems 2.1.B Earth's living systems 2.3.A Human-environment interactions 2.3.B Resource distribution and consumption
ESS3.B Natural hazards	2.1.A Earth's physical systems 2.3.A Human-environment interactions
ESS3.C Human impacts on Earth systems	2.1.A Earth's physical systems 2.1.B. Earth's living systems

***NGSS* – Disciplinary Core Ideas**	**NAAEE: *K-12 Environmental Education: Guidelines for Excellence***
	2.2.A. Individuals, groups, and societies 2.3.A. Human-environment interactions 2.3.B. Resource distribution and consumption 2.3.D Change and conflict
ESS3.D Global climate change	2.1.A Earth's physical systems 2.1.B. Earth's living systems 2.2.A. Individuals, groups, and societies 2.3.A. Human-environment interactions 2.3.B. Resource distribution and consumption 2.3.D Change and conflict
Life Science	
LS1.A Structure and function	
LS1.B Growth and development of organisms	2.1.B. Earth's living systems
LS1.C Organization for matter and energy flow in organisms	2.1.B. Earth's living systems
LS1.D Information Processing	
LS2.A Interdependent relationships in ecosystems	2.1.A Earth's physical systems 2.1.B. Earth's living systems
LS2.B Cycles of matter and energy transfer in ecosystems	2.1.A Earth's physical systems 2.1.B. Earth's living systems
LS2.C Ecosystem dynamics, functioning, and resilience	2.1.A Earth's physical systems 2.1.B. Earth's living systems 2.3.A. Human-environment interactions
LS2.D Social interactions and group behavior	2.1.B. Earth's living systems 2.3.A. Human-environment interactions 2.3.B. Resource distribution and consumption

***NGSS* – Disciplinary Core Ideas**	**NAAEE: *K-12 Environmental Education: Guidelines for Excellence***
LS3.A Inheritance of traits	2.1.B. Earth's living systems
LS3.B Variation of traits	2.1.B. Earth's living systems
LS4.A Evidence of common ancestry and diversity	2.1.B. Earth's living systems
LS4.B Natural selection	2.1.B. Earth's living systems
LS4.C Adaptation	2.1.B. Earth's living systems
LS4.D Biodiversity and humans	2.1.B. Earth's living systems 2.3.A. Human-environment interactions 2.3.B. Resource distribution and consumption
Physical Science	
PS1.A Structure of matter (includes PS1.C Nuclear processes)	
PS1.B Chemical reactions	2.1.A Earth's physical systems
PS2.A Forces and motion	
PS2.B Types of interactions	
PS3.A Definitions of energy	2.1.A Earth's physical systems
PS3.B Conservation of energy and energy transfer	2.1.A Earth's physical systems
PS3.C Relationship between energy and forces	
PS3.D Energy in chemical processes and everyday life	2.1.A Earth's physical systems
PS4.A Wave properties	
PS4.B Electromagnetic radiation	
PS4.C Information technologies and instrumentation	

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