

# ENVIRONMENTAL LITERACY CURRICULUM CONNECTIONS



## Ocean Sciences Curriculum Sequence for Grades 6-8: The Ocean-Atmosphere Connection and Climate Change

The Next Generation Science Standards (NGSS) are based on the premise that the purpose of learning science is to help students understand the natural world, solve problems, improve their lives and communities, and make the world a better place. Environmental literacy is an essential part of science and is deeply embedded throughout NGSS. We think environmental literacy should be deeply embedded throughout your science curriculum, too! This resource will help you identify the units in your curriculum that emphasize environmental concepts and that provide opportunities where outdoor learning experiences are part of regular classroom routines.

### What is environmental literacy and how is it connected to science teaching and learning?

In this document, environmental literacy is represented by three interconnected categories:

- 1) **Connection to nature:** having a sense of wonder and curiosity, enjoying the physical, social and emotional benefits of being outdoors, making observations and asking questions, building our relationship with the natural world;
- 2) **Understanding natural systems:** figuring out how nature works by carrying out investigations, collecting and analyzing data, constructing explanations, arguing based on evidence; and
- 3) **Community engagement:** communicating ideas, applying knowledge to positive community actions, understanding the socio-political and historical context for longstanding environmental inequities.

Within NGSS, Performance Expectations (PE) at every grade level ask students to **connect to nature**, **understand natural systems** and **apply** that knowledge. For example:

**Kindergarten** (K-ESS3-3) Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

**5th Grade** (5-ESS3-1) Obtain and combine information about ways individual communities use science ideas to protect Earth's resources and environment.

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

Emphasizing environmental literacy supports students to develop skills that make them well-rounded, effective leaders in their human and ecological communities.

### WHY DOES IT MATTER?

Environmental literacy leads to more equitable, inclusive, and culturally relevant learning experiences.

- Experiences in the local community with local partners are authentic, place-based and relevant to the lives of learners.
- Community leaders, community-based organizations, and environmental educators can help us understand environmental injustices and ensure that local issues and assets are part of student learning.
- Learning outdoors can be safer, healthier, more engaging than learning indoors.

## How to use this tool

This teaching tool allows teachers, site leaders and instructional leaders, to complement their classroom instructional materials with local and easily accessible, real-world opportunities for their students to more fully understand the world around them.

### Schoolyard Connections

### Field Trip Connections

### EP&C/Environmental Literacy Connections

- Select the appropriate curriculum document(s): FOSS Grades K-8; Amplify Science Grades K-8; SEPUP Grades 6-8; and, Ocean Sciences Sequence, Grades 6-8.
  - Read the environmental literacy curriculum connections (of select modules) organized by grade level and unit, describing meaningful outdoor learning activities for a schoolyard or local field trip destination
    - District office / school sites / or team of teachers may customize this tool, adding location ideas for outdoor learning when teaching the different units and lessons for each school, TK-8, in their district.

## CONNECTING ENVIRONMENTAL LITERACY TO SCIENCE CURRICULUM

Districts don't always have the expertise to effectively, systematically use the outdoors as a classroom from Grades TK-12. We need partners who know the landscape, the natural and human history of the community, and know how to engage students in the world around them.

***Environmental literacy curriculum*** connections in this document:

- support students to better understand natural systems,
- connect students to place, their schoolyard, their community, state and federal national parks; and
- encourage students to understand and create solutions to improve their communities.

## Environmental Literacy Curriculum Connections funded by



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Connecting Education, Environment, and Community

## Schoolyard Connections

## Field Trip Connections

Why does this support environmental literacy and NGSS?

## Unit 1: How do the Ocean and Atmosphere Interact?

Students learn ways Earth’s ocean and atmosphere interact to form currents, distribute heat energy, and keep the water cycle in motion, and they learn how these interactions drive weather and climate. Physical investigations, computer molecular models, and climate data help students discover that water acts as a heat reservoir and expands when heated. Students solve a mystery of floating and sinking balloons to learn about density. They investigate model ocean currents in tanks holding water of different temperatures and salinities. With what they have learned about density differences and ocean currents, students make sense of air currents (wind). A mystery of a recurring weather pattern helps students review their learning so far, and connect it to the water cycle. Then students use another physical model to explore how wind causes surface ocean currents. They read an article about El Niño that emphasizes the complexity of the ocean-atmosphere system. Throughout the unit, students learn about the practices of science, with a focus on scientific explanations and the role of evidence.

## SESSION 1.1: HEAT ENERGY AND MOVING MOLECULES

*This activity provides students with opportunities to observe and verbalize evaporation, condensation, and precipitation.*

**Best time to do this:** with clouds in the sky, after rain, and/or when there is dew on the ground, and when there is a breeze.

**Materials:** notepad and pencil

**Task:** Introduce a “Walk and Talk” routine—They will pair up and discuss and respond to a prompt, then when given another prompt, they will find another partner and discuss and respond to the new prompt. The prompts are:

1. How do you think water gets into and out of the air”  
(Think about all the places where we find water, even in the smallest amounts, and where that water goes)
2. What do you think causes wind?

Students discuss the prompts as they walk, then pause to make observations that support their ideas about the prompt.

See BEETLES Activity, Walk & Talk, for more information on facilitating the routine: <http://beetlesproject.org/resources/for-field-instructors/walk-and-talk/>

**Location:** Find a place on the school grounds that has as many examples of living organisms as possible (trees, bushes, grass), if there is a body of water, head there.

**LOCATION IDEA:**

*This activity provides students with opportunities to observe and verbalize evaporation, condensation, and precipitation.*

**Best time to do this:** with clouds in the sky, after rain, and/or when there is dew on the ground, and when there is a breeze.

**Materials:** notepad and pencil

**Task:** Introduce a “Walk and Talk” routine—They will pair up and discuss and respond to a prompt, then when given another prompt, they will find another partner and discuss and respond to the new prompt. The prompts are:

1. How do you think water gets into and out of the air”
2. What do you think causes wind?

If appropriate:

3. What do you think causes ocean water to move?

Students discuss the prompts as they walk, then pause to make observations that support their ideas about the prompt.

See BEETLES Activity, Walk & Talk, for more information on running the routine: <http://beetlesproject.org/resources/for-field-instructors/walk-and-talk/>

**Location:** Find a local body of water surrounded by living organisms.

**LOCATION IDEA:**

Builds a conceptual understanding of how where we live is part of a global water cycle.

Students are asked to develop a model explaining the cycling of water through Earth’s Systems. **MS-ESS2-4.**

**ESS2.C** The role of water in Earth’s Surface processes

**EP & C**

Principal 3: Concepts A and B

Principal 4: Concept B

**Schoolyard Connections**

**Field Trip Connections**

**Why does this support environmental literacy and NGSS?**

**TO CLOSE SESSION 1.4: TEMPERATURES AROUND THE WORLD**

**Extension: Are there microclimates in our schoolyard?** *Students explore microclimates, a concept that is revisited in Unit 3 when students consider the effects of climate change on living organisms and their habitats.*

**Materials:** Class set of thermometers and notebooks

**Task:** Students make predictions about where they might find the coolest and warmest temperatures. They visit the site and record temperature and all the factors that help them explain their findings.

**LOCATION IDEA:**

**Materials:** Class set of thermometers and notebooks

**Task:** Students make predictions about where they might find the coolest and warmest temperatures. Based on classroom observations they expect to find different temperatures closer to the water body. The classroom data is average climate data so there may be discrepancies to discuss. Students record the temperature at various distances from the water and note other factors that might help them explain their findings.

**Location:** A local body of water (pond, lake, river, ocean). Best if this site also has a weather station.

**LOCATION IDEA:**

Support student understanding of differences between weather and climate. Students also see that the school yard has microclimates created by human activities that affect the conditions for other living organisms. **MS ESS2D**

**EP & C**

Principal 1: Concept B  
Principal 2: Concept A

**Schoolyard Connections****Field Trip Connections****Why does this support environmental literacy and NGSS?****Unit 2: How Does Carbon Flow through the Ocean, Land, and Atmosphere?**

Students learn that carbon flows among reservoirs on Earth through processes such as respiration, photosynthesis, combustion, and decomposition, and that combustion of fossil fuels is causing an imbalance in this carbon cycle. Students explore a set of Carbon Cards to discover that carbon is found in all living things and many other parts of the Earth system. They conduct an experiment with yeast and learn that organisms consume carbon, and then release it as CO<sub>2</sub>. They read and analyze evidence about photosynthesis and observe a video animation showing plants' absorption of CO<sub>2</sub> at different times of the year. They read and discuss short articles to discover what can happen to the carbon in an organism after it dies. Students explore a computer model and manipulate a desktop model of the carbon cycle. They use math to investigate industry's impact on the carbon cycle, and they read about ocean acidification. Throughout the unit, students learn about the practices of science, with a focus on scientific explanations and the role of evidence.

**SESSION 2.1: FINDING OUT ABOUT CARBON**

**Carbon Cycle at School.** *After students have discussed and sorted carbon cards they have a sense of where they will find carbon, carbon reservoirs. Students see that they and their local environment are part of the carbon cycle.*

**Materials:** notepad and pencils

**Task:** Students individually sketch their view, labeling all the carbon reservoirs they can identify. They form a group of 3 to compare diagrams. Each small group then discusses how the carbon might flow from one reservoir to another (e.g. grass takes in CO<sub>2</sub> from the atmosphere, human releases CO<sub>2</sub> into the atmosphere), they add arrows and the questions they have to their diagrams.

**Location:** Take students to a place on the school grounds that has as many living organisms as possible (trees, bushes, grass, compost), if there is a body of water, head there. It is also helpful to have buildings, cars, roads etc in their field of view.

**LOCATION IDEA:****Carbon Cycle Comparisons**

*After students have discussed and sorted carbon cards they have a sense of where they will find carbon, carbon reservoirs. Students see that carbon is cycling everywhere, sometimes there is more evidence of carbon flows than others.*

**Location:** Various habitats  
Create carbon cycles in a variety of locations.

**LOCATION IDEA:**

Students need to understand the carbon cycle to better understand how humans are map carbon reservoirs and flows

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

**EP & C**

Principal 3: Concepts A and B

Principal 4: Concept B

<p style="text-align: center;"><b>Schoolyard Connections</b></p>	<p style="text-align: center;"><b>Field Trip Connections</b></p>	<p style="text-align: center;"><b>Why does this support environmental literacy and NGSS?</b></p>
<p><b>SESSION 2.6: DEATH AND DECAY</b></p>		
<p><b>Death and Decay in our Schoolyard.</b></p> <p><b>Location:</b> Take students to a place on the school grounds that has as many living organisms as possible (trees, bushes, grass), if there is a body of water, head there.</p> <p><b>Materials:</b> Hand Lenses</p> <p><b>Task:</b> <u>BEETLES Decomposition Mission</u>. activity. Students discover key characteristics of decomposition as they struggle with creating a sequence for decomposing wood and leaves. They learn the difference between physical decomposition and chemical decomposition and that many things contribute to decomposition, but certain organisms are classified as decomposers.</p>	<p><b>Death and Decay all around us.</b></p> <p><b>Location:</b> Habitat with plentiful examples of plants in various stages of decomposition—forest, community garden,</p> <p><b>Materials:</b> Hand Lenses</p> <p><b>Task:</b> <u>BEETLES Decomposition Mission activity</u>. Students discover key characteristics of decomposition as they struggle with creating a sequence for decomposing wood and leaves. They learn the difference between physical decomposition and chemical decomposition and that many things contribute to decomposition, but certain organisms are classified as decomposers.</p>	<p>Students are tracking carbon through decomposition, in these field experiences they consider decomposition not only as part of the carbon cycle but the role this process plays in other systems.</p> <p><b>LS2.B</b> As matter cycles and energy flows through living systems and between living systems and the physical environment, matter and energy are conserved in each change.</p> <p><b>EP &amp; C</b> Principal 3: Concepts A and B</p>

**Schoolyard Connections**

**Field Trip Connections**

**Why does this support environmental literacy and NGSS?**

**Unit 3: What Are the Causes and Effects of Climate Change?**

Students learn about the causes of climate change and the effects on sea level, currents, and organisms, and then they investigate possible solutions. Through information cards, graphs, and readings, students learn about changes to the atmosphere and ocean over the course of Earth’s history. They discover how carbon dioxide affects temperature, using a computer simulation and graphs. They explore evidence of the effects of climate change from photographs, short readings, and a physical model. Through a video, a desktop model, a computer simulation, and a reading, students explore how climate change affects currents. They read about effects on organisms and about possible solutions. At various points in the unit, they create cause and effect chains to synthesize their learning. Students learn that the climate change occurring now is caused by CO2 added to the atmosphere by human industry. Throughout the unit, students learn about the practices of science, with a focus on scientific explanations and the role of evidence.

**3.9 INVESTIGATING CLIMATE CHANGE: ORGANISMS**

**Local Effects of climate change**

**Location:**

**Materials:**

**Task:**

**Local Effects of climate change**

**Location:** A local Zoo or botanical garden, nature center, wildlife refuge

**Materials:**

**Task:** Contact a local organization and ask them how they share local effects of climate change with their visitors. Observing a local effect of climate change is a powerful and emotional experience. There are many cases of local effects of climate change—drought, fire, changing species populations, sea level rise.

**LS2.A:** Interdependent Relationships in Ecosystems

**ESS3.C:** Human Impacts on Earth Systems

**ESS3.D:** Global Climate Change

**EP & C**  
Principal 3: Concept C

Schoolyard Connections	Field Trip Connections	Why does this support environmental literacy and NGSS?
<b>3.11 SOLUTIONS TO CLIMATE CHANGE, PART 2</b>		
<p><b>Looking for Solutions</b></p> <p><b>Location:</b> Walk through the school and schoolyard</p> <p><b>Materials:</b> School site map, notebook and pencils</p> <p><b>Task:</b> Students make a map that identifies examples and locations of the 24 solutions to climate change introduced in the curriculum. Students estimate % ground cover of blacktop vs. plants and trees, and examine shade provided especially in relation to buildings;</p> <hr/> <p><b>Location:</b> Walk through the school neighborhood.</p> <p><b>Materials:</b> Street Map, notebook and pencils</p> <p><b>Task:</b> Students make a map that identifies examples and locations of the 24 solutions to climate change introduced in the curriculum. Students locate—bicycle paths, public transport, calculate shade provided by trees—using simple measurements of amount of shade along the sidewalk.</p> <p><a href="https://www.npr.org/2019/09/04/755349748/trees-are-key-to-fighting-urban-heat-but-cities-keep-losing-them">https://www.npr.org/2019/09/04/755349748/trees-are-key-to-fighting-urban-heat-but-cities-keep-losing-them</a> with a possible extension: <a href="http://www.treesforoaklandflatlands.org/plant-a-tree.html">http://www.treesforoaklandflatlands.org/plant-a-tree.html</a></p>	<p><b>Looking for Solutions</b></p> <p><i>Many areas have local groups addressing regional climate issues, some offer the opportunity for students to also participate in a service learning project, such as planting a tree, contributing species observations to citizen science projects.</i></p> <p><b>Location:</b> Visit a local organic farm, Ecology Center, solar plant, Green building contractor,</p> <p><b>Materials:</b></p> <p><b>Task:</b> Students create a cause and effect chart</p>	<p>Students reflect on the process of designing solutions to climate change—recognizing adaptation and mitigation actions.</p> <p><b>ESS3.D:</b> Global Climate Change</p> <p><b>ETS1.B:</b> Developing Possible Solutions</p> <p><b>EP &amp; C</b> Principal 4: Concept C Principal 5: Concept A</p>