

Introduction

Science, Technology & Engineering, and Environmental Literacy & Sustainability (STEELS) Standards guide the study of the natural and human-made world through inquiry, problem-solving, critical thinking, and authentic exploration. This document displays a curriculum framework for Environmental Literacy & Sustainability. It is designed to focus curriculum and teaching, provide guidance for multiple approaches to curriculum development, encourage less reliance on textbooks as curriculum, and avoid activity-oriented teaching without focus/purpose

Environmental Literacy And Sustainability Long Term Transfer Goals

Long Term Transfer Goals (LTTG) provide the overarching practices that serve as a foundation for a robust curriculum. All curricula should relate to one or more of the LTTGs detailed below – as they highlight the effective uses of understanding, knowledge, and skill that we seek in the long run (i.e., what we want students to be able to do when they confront new challenges – both in and outside of school.)

Students will be able to independently use their learning to:

- Engage in informed consumer practices and choices that take into account the impact on agricultural and environmental systems.
- Categorize, analyze, and interpret how humans and environmental systems relate and affect one another.
- Evaluate and engage in discussion surrounding local and global issues that relate to resource use and management.
- Examine, analyze, interpret, and apply how an individual and community impacts the use and management of natural resources.
- Examine, develop, analyze, and interpret how watersheds function as a system and are impacted by external factors.
- Engage in informed use of land and water to contribute to a positive impact on local watersheds and wetlands.
- Understand how complex human and natural systems interact with each other and use empathy and data-informed evidence to make choices for the well-being of other species, including humans and the environment.
- Integrate scientific practices to research and investigate complex issues, problems, and phenomena.
- Understand, describe, and communicate the interconnected nature of local, regional, national, and global scales of environmental issues.
- Evaluate cost-benefit analysis in addressing solutions to environmental impacts.
- Carry out an investigation and collect data in an authentic environmental setting.
- Explain how the natural and designed worlds are interrelated and the application of scientific knowledge, technology, and engineering can have beneficial or harmful consequences, some of which may be unintended.
- Make informed decisions and identify solutions to environmental challenges.
- Recognize environmental injustices and take actions to mitigate them at various scales.

3.4 Environmental Literacy and Sustainability

Sub-domain: Environmental Literacy Skills

Strand: Investigating Environmental Issues

Long Term Transfer Goals *across all grades*

Students will be able to independently use their learning to:

Integrate scientific practices to research and investigate complex issues, problems, and phenomena.
Understand, describe, and communicate the interconnected nature of local, regional, national, and global scales of environmental issues.

Big Idea

The environment provides multi-faceted opportunities to develop and apply interdisciplinary literacy skills to investigate complex issues at various scales.

Essential Questions

may be used or modified across grade bands

How do investigations of local environmental issues expand understanding and facilitate potential solutions to other local, regional, and/or global environmental issues?

Component	K-2	3-5	6-8	9-12
Performance Expectation (Standard)	Intentionally Blank	3.4.3-5.D Develop a model to demonstrate how local environmental issues are connected to larger local environment and human systems.	3.4.6-8.D Gather, read, and synthesize information from multiple sources to investigate how Pennsylvania environmental issues affect Pennsylvania's human and natural systems.	3.4.9-12.D Apply research and analytical skills to systematically investigate environmental issues ranging from local issues to those that are regional or global in scope.
Clarifying Statement	Intentionally Blank	Examples include watersheds, food webs, human food systems, and life cycles. Emphasis is on investigating local environments and understanding how it	Examples could include sediment and nutrient loads in Pennsylvania waterways, indoor and outdoor air quality, urban heat islands, etc.	Emphasis is on students' ability to articulate assumptions, goals, priorities, and values that underlie perspectives on environmental issues.

		<p>connects to larger regional, national, or global systems.</p>		
<p>Disciplinary Core Ideas</p>	<p>Intentionally Blank</p>	<p>Human Impacts on Earth Systems Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments.</p> <p>Biodiversity and Humans Populations live in a variety of habitats and change in those habitats affects the organisms living there.</p>	<p>Human Impacts on Earth Systems Human activities have significantly altered the biosphere, sometimes damaging, or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things.</p> <p>Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.</p>	<p>Ecosystem Dynamics, Functioning, and Resilience A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.</p> <p>Biodiversity and Humans Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).</p> <p>Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus, sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving</p>

				landscapes of recreational or inspirational value. Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
Crosscutting Concepts	Intentionally Blank	Systems and System Models Cause and Effect	Cause and Effect Stability and Change	Cause and Effect
Scientific & Engineering Practices	Intentionally Blank	Developing and Using Models	Obtaining, Evaluating, and Communicating Information	Obtaining, evaluating, and communicating information
Vocabulary	food systems, life cycles, issue, problem, phenomena, local, regional, global, remediation, community, neighborhood, niche, viewpoints	urban heat island, indicator index, food access, insecurity, acid mine drainage, remediation, mitigation	non-governmental organization, advocacy, perspectives	food systems, life cycles, issue, problem, phenomena, local, regional, global, remediation, community, neighborhood, niche, viewpoints

3.4 Environmental Literacy and Sustainability

Sub-domain: Environmental Literacy Skills

Strand: Environmental Experiences

Long Term Transfer Goals *across all grades*

Students will be able to independently use their learning to:

Evaluate and engage in discussion surrounding local and global issues that relate to resource use and management.
Examine, analyze, interpret, and apply how an individual and community impacts the use and management of natural resources.

Big Idea

Conducting scientific investigations using place-based inquiry and authentic, outdoor field experience(s) is essential to understanding local environmental issues.

Essential Questions

may be used or modified across grade bands

How can conducting local field investigations lead to identifying, understanding, and addressing environmental issues in my community?

Component	K-2	3-5	6-8	9-12
Performance Expectation (Standard)	3.4.K-2.D Plan and carry out an investigation to address an issue in the local environment and community.	Intentionally Blank	3.4.6-8.E Collect, analyze, and interpret environmental data to describe a local environment.	3.4.9-12.E Plan and conduct an investigation utilizing environmental data about a local environmental issue.
Clarifying Statement	Examples of planning could include developing questions ("wonder statements") about a local environment issue (e.g., litter, discolored streams, erosion) and then letting students decide how to answer them.	Intentionally Blank	Emphasis is on collecting information from a local outdoor area in order to accurately describe that environment. Examples could include weather data, stream studies, data on air quality, biodiversity assessments, etc.	Emphasis is on student-collected data from sources such as outdoor field experiences, media coverage, data mining, and so on.

<p>Disciplinary Core Ideas</p>	<p>Human Impacts on Earth Systems Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.</p>	<p>Intentionally Blank</p>	<p>Interdependent Relationships in Ecosystems Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.</p> <p>Weather and Climate Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.</p>	<p>Ecosystem Dynamics, Functioning, and Resilience Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.</p> <p>Biodiversity and Humans Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).</p> <p>Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus, sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.</p> <p>Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.</p>
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Crosscutting Concepts	Stability and Change Patterns	Intentionally Blank	Patterns	<i>Connections to Nature of Science</i> Science is a way of Knowing
Scientific & Engineering Practices	Planning and Carrying Out Investigations	Intentionally Blank	Analyzing and Interpreting Data	Planning and Carrying Out Investigations
Vocabulary	observe, measure, difference, similar, changes, balance	Intentionally Blank	variable, factors, sequence, variability, average, data analysis, varve, rates, parameter, indicators, correlations	scalability, common factors, denominator, local context, magnification, accumulation, recovery, place-based, community impacts, implication

3.4 Environmental Literacy and Sustainability

Sub-domain: Environmental Literacy Skills

Strand: Evaluating Experiences

Long Term Transfer Goals *across all grades*

Students will be able to independently use their learning to:

Make informed decisions and identify solutions to environmental challenges.
Evaluate cost-benefit analysis in addressing solutions to environmental impacts.

Big Idea

Conducting scientific investigations using place-based inquiry and authentic, outdoor field experience(s) are essential to understanding local environmental issues.

Essential Questions

may be used or modified across grade bands

How do we balance societal values, practices, and cost-benefit analysis (long-term and short-term) in addressing environmental issues?

Component	K-2	3-5	6-8	9-12
Performance Expectation (Standard)	Intentionally Blank	3.4.3-5.E Construct an argument to support whether action is needed on a selected environmental issue and propose possible solutions.	3.4.6-8.F Obtain and communicate information on how integrated pest management could improve indoor and outdoor environments.	3.4.9-12.F Evaluate and communicate the effect of integrated pest management practices on indoor and outdoor environments.
Clarifying Statement	Intentionally Blank	Using the claim-evidence-reasoning model or other critical thinking processes, students analyze and synthesize data they personally collected or compiled from provided sources to support their claims and proposed stewardship actions.	Examples of methods of integrated pest management may include biological (e.g., managing indoor air quality), cultural (e.g., planting locally pest-resistant crops or crop rotation), mechanical (e.g., trapping pests), and chemical (e.g., cleaning surfaces in schools) treatments of invasives; materials and	Emphasis is on assessing and communicating the effectiveness and impact of approaches to integrated pest management. Examples may include biological (e.g., managing indoor air quality), cultural (e.g., planting locally pest resistant crops or crop rotation), mechanical (e.g. trapping pests) and chemical

			procedures for cleaning surfaces and air in schools; and maintaining or promoting biodiversity.	(e.g., cleaning surfaces in schools) treatments of invasive, materials and procedures for cleaning surfaces and air in schools, and maintaining or promoting biodiversity.
Disciplinary Core Ideas	Intentionally Blank	<p>Biodiversity and Humans Populations live in a variety of habitats and change in those habitats affects the organisms living there.</p> <p>Human Impacts on Earth Systems Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.</p>	<p>Human Impacts on Earth Systems Human activities have significantly altered the biosphere, sometimes damaging, or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.</p>	<p>Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.</p> <p>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.</p>
Crosscutting Concepts	Intentionally Blank	Cause and Effect Patterns	Stability and Change Cause and Effect	Cause and Effect
Scientific & Engineering Practices	Intentionally Blank	Engaging in Argument From Evidence Obtaining, Evaluating, and Communicating Information	Obtaining, Evaluating, and Communicating Information	Obtaining, Evaluating, and Communicating Information
Vocabulary	Intentionally Blank	pest, pesticide, insecticide, herbicide, food chain, food web, native species, non-native species, values	invasive species, introduced species, sustainability, Integrated Pest Management (IPM), biodiversity, cost-benefit analysis, trophic level	biomagnification, synergistic effect, rebound, target species, toxicity