

Standards Integration: A Framework for Incorporating NGSS, Social Sciences and Environmental Literacy into Classroom Curriculum

The Oregon Environmental Literacy Program believes pre-K-12 education can empower students to mature into Oregonians who can discover and treasure the places that provide us countless recreation opportunities, drive our state's economy and shape our heritage. Preparing Oregon's children to protect and sustain our state's natural resources is challenged by the fact that many are disconnected from the environment. Students also often lack the knowledge, skills, perspectives and values needed to consider whole systems, develop a sense of place, or pursue responsibility to shared resources and each other.

Standards Integration: A Framework for Incorporating NGSS, Social Sciences and Environmental Literacy into Classroom Curriculum was designed by a team of Oregon educators to:

1. Support K-12 educators as they prepare the next generation of Oregonians to experience and protect our state's resources;
2. Define what an environmentally literate student looks like at each grade level (K-5) or band (middle and high school) (Table 1);
3. Integrate the Oregon Environmental Literacy Strands (Table 2) into the Next Generation Science Standards and Oregon Social Sciences Standards through the use of guiding questions; and
4. Provide a list of suggested activities K-12 educators can implement in their classroom to promote environmental literacy.

This framework uses the Next Generation Science Standards (NGSS) (adopted 2014), Oregon Social Sciences Standards (adopted 2010) and the Oregon Environmental Literacy Strands (adopted 2011) to develop suggested guiding questions for grades K-12. A guiding question is the "fundamental query that directs the search for understanding. Everything in the curriculum is studied for the purpose of answering it." Guiding questions help provide focus and coherence for units of study.¹

Table 1: Identifies what an environmentally literate student at each grade level or band should demonstrate

Grade Level Progression for Environmentally Literate K-12 Students							
<i>This table identifies what an environmentally literate student should know at each grade level.</i>							
Elementary	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Middle School	High School
Knows they have influence on their environment, & community by the way that they care for themselves, others and places.	Knows how to take care of themselves, others & places. Is beginning to identify how problems arise when environments change, & can work with their peers to solve problems & answer questions.	Understand, value, & promote diversity among plants, animals, humans, & their environment.	Understand there are relationships between plants, animals, humans & their environment within their region; is beginning to identify how these have changed over time.	Has knowledge of & is a responsible steward of their local environment & natural resources. They are competent at investigating their questions & formulating solutions to problems.	Has knowledge of their local environment, & understands the impacts of technology & how it can be used to solve problems.	Are gaining a sense of self in their natural & human community, including their impact on others in those systems. They are able to discuss issues, take in multiple perspectives, back up personal opinions with evidence, & distinguish between opinion & fact.	Are inspired to be a life-long learners, stewards & enthusiasts of the natural world. They are prepared to make informed decisions that consider the economic, social & environmental impacts of issues using credible evidence.

1 Travers, R. (March, 1998). What is a good guiding question? Education Leadership, p. 70-73.

The guiding questions at each grade level have an environmental literacy focus that allows for easy integration of NGSS and Oregon Social Sciences Standards. Questions are open-ended and non-judgmental; encourage a focused query of a locally appropriate topic; and require high-level cognitive work to be answered. While Common Core is not explicitly called out at each grade level, these standards can easily be integrated into any unit of study.

Guiding questions for grades K through 5 are listed individually for each and consider NGSS, Oregon Social Sciences Standards and Oregon Environmental Literacy Strands. Middle (6–8) and high school (9–12) are each considered as separate grade bands. For each grade band, there is one of four main topics: Geography, Social Science Analysis, Life Science and Earth Science. For each of these topics relevant standards from NGSS, Oregon Social Sciences Standards and Oregon Environmental Literacy Strands are listed. Each grade level or grade level band also includes a list of activities that support integrating of environmental literacy.

An exhaustive list of the opportunities to integrate environmental literacy into the classroom has not been provided in this document. Countless other examples exist depending on how the NGSS, Oregon Social Sciences Standards and Environmental Literacy Strands are grouped.

Additional resources:

A detailed description of each environmental literacy strand can be found in Appendix A. Teachers can learn more about environmental literacy in Oregon by visiting the Oregon Environmental Literacy Program website at <http://oelp.oregonstate.edu>

Table 2: Abbreviated Environmental Literacy Strands

Oregon Environmental Literacy Strands	
Strand 1: Systems thinking	Students study systems and issues holistically, striving to understand the relationships and interactions between each system’s parts. They use the knowledge gained to assess the effects of human choices on economic, ecological and social systems, and to optimize outcomes for all three systems.
Strand 2: Physical, living and human systems	Students understand the characteristics of Earth’s physical, living and human systems.
Strand 3: Interconnectedness of people and the environment	Students understand the interdependence of humans and the environment, and appreciate the interconnectedness of environmental quality and human well-being.
Strand 4: Personal and civic responsibility	Students understand the rights, roles, responsibilities and actions associated with leading or participating in the creation of healthy environments and sustainable communities.
Strand 5: Investigate, plan and create a sustainable future	Students apply civic action skills that are essential to healthy, sustainable environments and communities.

KINDERGARTEN

Description: Environmentally literate kindergarten students know they have influence on their environment and community by the way they choose to care for themselves, others and places.

Essential and Guiding Questions

How do we take care of the plants and animals in nature?

- What do plants and animals (including humans) need to live in their environment?
- What happens to the plants and animals (including humans) when we change the land, water, and air?
- What rules do we have that help us treat the plants and animals in the environment with care?

Next Generation Science Standards Performance Expectations

Life Science

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

Earth and Space Science

K-ESS3-1. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

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.

Oregon Social Sciences Standards

Historical Thinking

K.4. Compare and contrast the student's own environment with the past.

Geography

K.10. Explain how people can care for the environment.

K.12 Explain why rules are needed and how rules reduce conflict and promote fairness.

Example Activities

- Draw a picture that diagrams relationships between the plants and animals (humans) in the school environment. **EL Strand 1.**
- Make observations of plants and animals in the schoolyard (or of living organisms in the classroom) and use observations to discuss the needs of plants and animals. **EL Strand 2.**
- Visit a natural setting and list the various ways humans have changed the environment. Compare and contrast the school yard to the natural setting visited during the year. **EL Strand 3.**
- Make rules about how humans interact with the environment and draw pictures to represent these rules. Create a class rule book. **EL Strand 4.**
- Recycle, compost, and/or re-purpose materials within the classroom and discuss or diagram how these actions can reduce the impact on the environment. **EL Strand 5.**

FIRST GRADE

Description: Environmentally literate first grade students know how to care for themselves, others and places, and are beginning to identify how problems arise when environments change. They can work with their peers to solve problems and answer questions.

Essential and Guiding Questions

When the environment changes, what happens to the plants and animals (including humans)?

- What parts of plants and animals allow them to live in different environments?
- How do we use the plants and animals in our environment?
- What happens to the plants and animals when we change our environment?
- How do people use the environment today compared with people in the past?

Next Generation Science Standards Performance Expectations

Life Science

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Earth and Space Science

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Oregon Social Sciences Standards

Historical Knowledge

1.2. Compare the ways people lived in the community in the past with the way they live in the present.

Geography

1.12. Give examples of local natural resources and describe how people use them.

Social Science Analysis

1.20. Identify cause-and-effect relationships.

1.21. Identify an issue or problem that can be studied.

Example Activities

- Construct a map of the schoolyard including the plants and animals that live there. Discuss how these organisms affect their environment and vice versa. **EL Strand 1.**
- Observe and draw a species (bird, mammal or plant) and compare it to similar organism with different parts (beaks, size, legs, tail, etc.). Discuss how these differences allow these organisms to live. **EL Strand 2.**
- Identify common items in the classroom and determine which natural resource they were derived from and how these items are used in everyday life. Explore what would happen if these items were removed from the environment. **EL Strand 3.**
- Pick up litter on the playground and come up with a solution for reducing waste at school. Count the amount of waste and graph the numbers over the time of the activity. **EL Strand 5.**

SECOND GRADE

Description: Environmentally literate second grade students understand, value, and promote diversity among plants, animals, humans, and their environment.

Essential and Guiding Questions

What is diversity?

- Why is diversity important in an environment?
- How can we protect diversity in our environment?

Next Generation Science Standards Performance Expectations

Life Science

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

Oregon Social Sciences Standards

Geography

2.9. Describe physical and human characteristics of the community.

Civics and Government

2.16. Identify ways that students can have an impact in their community.

Social Science Analysis

2.21. Evaluate information relating to an issue or a problem.

Example Activities

- Investigate invasive species through identification, study the impact on native species and host a "weed out" day. **EL Strands 2, 3 & 4.**
- Participate in a schoolyard or local river study to compare the diversity of plant and animal life in different parts of the environment. **EL Strand 2.**
- Complete a photo study of how the built community and surrounding environment has changed over time. **EL Strands 3 & 4.**

THIRD GRADE

Description: Environmentally literate third grade students understand there are relationships between plants, animals, humans and their environment within their region, and are beginning to identify how these have changed over time.

Essential and Guiding Questions

How has Oregon's environment changed over time?

- In what ways have people changed the environment in Oregon?
- How do changes impact a plant's or animal's ability to survive?
- What can we do to reduce the effect of environmental changes on people, plants and animals?

Next Generation Science Standards Performance Expectations

Life Science

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there might change.

Earth and Space Science

3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of weather-related hazards.

Oregon Social Studies Standards

Social Science Analysis

3.4. Describe local communities and regions past and present.

3.11. Explain the influence of humans (traders, immigrants, indigenous, current residents) on Oregon's and the Northwest's physical systems.

3.12. Identify and analyze Oregon's natural resources and describe how people in Oregon and other parts of the world use them.

3.13. Identify how people have adapted to and have changed the physical geography of the community.

3.20. Identify how people or other living things might be affected by an event, issue or problem.

Example Activities

- Complete a study of a landscape following a fire, flood, development, etc. to see how the land, plant and animal communities have changed.

EL Strands 2, 3 & 5.

- Engineer extreme weather or seismic-resistant structures related to local natural hazards. **EL Strand 3.**
- Follow one of Oregon's natural resources (timber, water, seafood, etc.) from its natural system to harvest, sale and transport, historically and in the present. **EL Strands 2, 3 & 4.**

Oregon Environmental Literacy Program

FOURTH GRADE

Description: Environmentally literate fourth grade students have knowledge of and are responsible stewards of their local environment and natural resources. They are competent at investigating their questions and formulating solutions to problems.

Essential and Guiding Questions

How does the use of natural resources affect people and the environment?

- How and why do people use natural resources?
- What factors influence how we use our natural resources?
- In what ways can people use resources sustainably?

Next Generation Science Standards Performance Expectations

Earth and Space Science

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Engineering

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.

Oregon Social Sciences Standards

Geography

4.11. Identify conflicts involving use of land, natural resources, economy, and competition for scarce resources, different political views, boundary disputes, and cultural differences within Oregon and between different geographical areas.

4.12. Explain how people in Oregon have modified their environment and how the environment has influenced people's lives.

4.13. Describe how technological developments, societal decisions, and personal practices influence Oregon's sustainability (dams, wind turbines, etc.).

Economics/Financial Literacy

4.17. Analyze different buying choices and their opportunity costs while demonstrating the difference between needs and wants.

Example Activities

- Research effects of using renewable or non-renewable energy on economic, ecological and social systems (e.g., hydroelectricity and dams on fisheries, lands, air, etc.). **EL Strand 1.**
- Research how fossil fuels were created, affect living systems and are used by humans. **EL Strand 2.**
- Participate in online natural resources games or timber, municipal, mineral, energy or agricultural field trips. **EL Strand 3.**
- Participate in service-learning projects around resource use (e.g. recycling, stormwater, composting). **EL Strand 4.**
- Practice responsible resource use and sustainable design for resource use (school garden, rain garden). **EL Strand 5.**

Oregon Environmental Literacy Program

FIFTH GRADE

Description: Environmentally literate fifth grade students have knowledge of their local environment, and understand the impacts of technology and how it can be used to solve problems.

Essential and Guiding Questions

How do human activities change ecosystems over time?

- What are the factors (human and non-human) that affect an ecosystem and its inhabitants?
- How have human activities affected the ecosystem and the natural cycles of the land and organisms?
- What human solutions (scientific, technology, etc.) can be used to address these impacts?

Next Generation Science Standards Performance Expectations

Life Science

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Earth and Space Science

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

Engineering

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 a problem.

Oregon Social Sciences Standards

Geography

5.11. Describe how technological developments, societal decisions, and personal practices influence sustainability in the United States.

Social Science Analysis

5.20. Gather, use and document information from multiple sources (e.g., print, electronic, human, primary, secondary) to examine an event, issue, or problem through inquiry and research.

5.22. Identify characteristics of an event, issue, or problem, suggesting possible causes and results.

5.23. Propose a response or solution to an issue or problem and support why it makes sense, using support from research.

Example Activities

- Develop a model of a local habitat, documenting natural factors and how they impact each other. Analyze the impact of one human activity that affects the habitat, gather information about it and communicate results. **EL Strand 1.**
- Identify an activity that mitigates the impact of humans on a local environment and participate in that activity (stream clean-up, restoration). **EL Strand 4.**
- Based upon analysis of an ecosystem, choose a scientific, technological, or other approach to address human impacts, and analyze the “positive” and “negative” impacts of that approach on the ecosystem. **EL Strand 5.**

MIDDLE SCHOOL: GEOGRAPHY

Description: Environmentally literate middle school students are gaining a sense of self in their natural and human community, including their impact on others in those systems. They are able to discuss issues, take in multiple perspectives, back up personal opinions with evidence, and distinguish between opinion and fact.

Essential and Guiding Questions

What factors influence sustainability around the world?

- How have technology, societal decisions and personal practices influenced sustainability?
- How do sustainable practices vary worldwide?
- How do sustainable practices affect the environment?

Next Generation Science Standards Performance Expectations

Earth and Space Science

MS-ESS3-3. Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

Oregon Social Sciences Standards

Geography

6.15. Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

6.16. Explain how technological developments, societal decisions, and personal practices influence sustainability in the Western Hemisphere.

7.14. Explain how technological developments, societal decisions, and personal practices influence sustainability in the Eastern Hemisphere.

8.13. Explain how current and historical technological developments, societal decisions, and personal practices influence sustainability in the United States.

Example Activities

- Concept-map the effects of using sustainable versus conventional technologies. **EL Strand 1.**
- Research sustainability efforts of countries worldwide. **EL Strand 2.**
- Research the technology, decisions and practices of indigenous peoples of the Americas. **EL Strand 3.**
- Do regular journaling on the topics of sustainability and responsibility. **EL Strand 4.**
- Do a school-wide or home-scale audit on chemical or water use. Students propose and use non-toxic alternatives and efficiency measures. **EL Strand 5.**

MIDDLE SCHOOL: SOCIAL SCIENCE ANALYSIS

Description: Environmentally literate middle school students are gaining a sense of self in their natural and human community, including their impact on others in those systems. They are able to discuss issues, take in multiple perspectives, back up personal opinions with evidence, and distinguish between opinion and fact.

Essential and Guiding Questions

How do environmental problems and issues affect society?

- What are the differences between environmental problems and issues?
- How do conflicting viewpoints about environmental issues affect a society's decisions?
- What should we do about environmental problems and issues?

Oregon Social Sciences Standards

Social Science Analysis

- 6.21.** Clarify key aspects of an event, issue, or problem through inquiry and research.
- 6.22.** Gather, interpret, document, and use information from multiple sources, distinguishing facts from opinions and recognizing points of view.
- 6.23.** Interpret documents and data from multiple primary and secondary sources (art, artifacts, eyewitness accounts, letters and diaries, real or simulated historical sites, charts, graphs, diagrams, written texts).
- 7.25.** Analyze evidence from multiple sources including those with conflicting information.
- 8.26.** Examine a controversial event, issue, or problem from more than one perspective.
- 8.27.** Examine the various characteristics, causes, and effects of an event, issue, or problem.
- 8.28.** Investigate a response or solution to an issue or problem and support or oppose, using research.

Example Activities

- Investigate an endangered species and efforts to protect that species. **EL Strand 2.**
- Contrast two viewpoints on a contentious issue like fracking, off shore drilling or GMOs. **EL Strand 3.**
- Propose creative writing prompts and art projects regarding personal and civic responsibility related to an environmental issue or problem of interest. **EL Strand 4.**
- Restore a section of school yard, amending soil and planting native species to attract sensitive wildlife (e.g., planting milkweed for butterflies). **EL Strand 5.**

MIDDLE SCHOOL: EARTH SCIENCE

Description: Environmentally literate middle school students are gaining a sense of self in their natural and human community, including their impact on others in those systems. They are able to discuss issues, take in multiple perspectives, back up personal opinions with evidence, and distinguish between opinion and fact.

Essential and Guiding Questions

How can humans affect their environment?

- How have humans disrupted environmental processes?
- How can humans limit their impact on the environment?

Next Generation Science Standards Performance Expectations

Earth and Space Science

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

MS-ESS3-3. Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Oregon Social Sciences Standards

Geography

6.15 Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

Social Science Analysis

8.28. Investigate a response or solution to an issue or problem and support or oppose, using research.

Example Activities

- Create model watersheds with different characteristics (area, vegetation, impervious area) and consider flood or agricultural potential.

EL Strand 1.

- Restore a natural area, plant native species and measure the impact on the terrestrial invertebrate (i.e., bug) population.

EL Strand 2.

- Design experiments to test the greenhouse effect.

EL Strand 3.

- Debate our responsibility to limit humans' impact on the earth, and consider particular issues like fossil fuel usage, overconsumption or nuclear power.

EL Strand 4.

- Organize a safe routes to school program.

EL Strand 5.

MIDDLE SCHOOL: LIFE SCIENCE

Description: Environmentally literate middle school students are gaining a sense of self in their natural and human community, including their impact on others in those systems. They are able to discuss issues, take in multiple perspectives, back up personal opinions with evidence, and distinguish between opinion and fact.

Essential and Guiding Questions

How are living and non-living components of ecosystems interconnected?

- How do environmental changes affect biodiversity?
- How can people support biodiversity and ecosystems?
- What are the values of ecosystems for both humans and other species?

Next Generation Science Standards Performance Expectations

Life Science

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

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

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Oregon Social Sciences Standards

Social Science Analysis

8.27.Examine the various characteristics, causes, and effects of an event, issue, or problem.

8.28.Investigate a response or solution to an issue or problem and support or oppose, using research.

Example Activities

- Model the components and relationships in selected ecosystems and make predictions about the impact of changes to a part of the ecosystem. **EL Strand 1.**
- Investigate and compare the variation of ecosystems around Earth. **EL Strand 2.**
- Research ecosystem services associated with species of interest. **EL Strand 3.**
- Engage in service-learning or stewardship projects that promote biodiversity. **EL Strand 4.**
- Create a mock conservation plan for a species of interest to be presented to a mock administrative board. **EL Strand 5.**

HIGH SCHOOL: GEOGRAPHY

Description: Environmentally literate high school students are inspired to be life-long learners, stewards and enthusiasts of the natural world. They are prepared to make informed decisions that consider the economic, social and environmental impacts of issues, using credible evidence.

Essential and Guiding Questions

What influences how we use natural resources, and what are the impacts of their use?

- How has resource availability influenced human geography, including settlements, patterns of movement, conflict and cooperation?
- How has human use of natural resources altered Earth's systems?
- What cultural, historic and personal perspectives affect our use of natural resources and the systems we create?

Next Generation Science Standards Performance Expectations

Earth and Space Science

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.

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.

Oregon Social Sciences Standards

Geography

HS.16. Analyze the interconnectedness of physical and human regional systems and their interconnectedness to global communities.

HS.19. Evaluate how differing points of view, self-interest, and global distribution of natural resources play a role in conflict over territory.

HS.20. Analyze the impact on physical and human systems of resource development, use, and management, and evaluate the issues of sustainability.

HS.23. Analyze the distribution and characteristics of human settlement patterns.

Example Activities

- Concept-map the effects of using particular natural resources on economic, ecological and social systems. **EL Strand 1.**
- Analyze water quality along an urban-to-rural gradient. **EL Strand 2.**
- Research the historical trends of settlement based on resource availability and different cultural uses, management of and stewardship of different natural resources. **EL Strand 3.**
- Do a personal reflection of the value of natural resources and how that may affect your consumer choices. **EL Strand 4.**
- Conduct a school-wide or home-scale energy audit and calculation of associated costs (financial and ecological). Propose and enact efficiency measures and calculate the net change of associated costs (financial and ecological). **EL Strand 5.**

HIGH SCHOOL: SOCIAL SCIENCE ANALYSIS

Description: Environmentally literate high school students are inspired to be life-long learners, stewards and enthusiasts of the natural world. They are prepared to make informed decisions that consider the economic, social and environmental impacts of issues, using credible evidence.

Essential and Guiding Questions

How do environmental problems and issues affect society?

- What are the differences between environmental problems and issues?
- How do conflicting viewpoints about environmental issues affect a society's decisions?
- What should we do about environmental problems and issues?

Oregon Social Sciences Standards

Social Science Analysis

HS.57. Define, research, and explain an event, issue, problem, or phenomenon and its significance to society.

HS.58. Gather, analyze, use, and document information from various sources, distinguishing facts, opinions, inferences, biases, stereotypes, and persuasive appeals.

HS.59. Demonstrate the skills and dispositions needed to be a critical consumer of information.

HS.60. Analyze an event, issue, problem, or phenomenon from varied or opposing perspectives or points of view.

HS.61. Analyze an event, issue, problem, or phenomenon, identifying characteristics, influences, causes, and both short- and long-term effects.

HS.62. Propose, compare, and judge multiple responses, alternatives, or solutions to issues or problems; then reach an informed, defensible, supported conclusion.

HS.63. Engage in informed and respectful deliberation and discussion of issues, events, and ideas.

Example Activities

- Investigate the leading causes of biodiversity, methods for conserving biodiversity, and their economic costs.

EL Strand 2.

- Debate and advocate for different types of land use on nearby natural areas. **EL Strand 3.**

- Research the environmental effects of building code violations (e.g., building on wetlands, toxic materials) and work with the school district to perform an audit of best practices. **EL Strand 4.**

- Organize a rideshare program to curb carbon emissions, diverting stormwater from a school grounds' impervious areas into a rain garden to improve water quality. **EL Strand 5.**

HIGH SCHOOL: EARTH SCIENCE

Description: Environmentally literate high school students are inspired to be life-long learners, stewards and enthusiasts of the natural world. They are prepared to make informed decisions that consider the economic, social and environmental impacts of issues, using credible evidence.

Essential and Guiding Questions

Why do we need to have discussions about climate change?

- How might climate change affect Oregon (environment, people)?
- How might climate change affect you?
- What can you do about climate change?

Next Generation Science Standards Performance Expectations

Earth and Space Science

HS-ESS2-4. Use a model to describe how variation in the flow of energy into and out of Earth's systems result in changes in climate.

HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere and biosphere.

HS-ESS3-1. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

HS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

HS-ESS3-6. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Oregon Social Sciences Standards

Social Science Analysis

HS.57. Investigate a response or solution to an issue or problem and support or oppose, using research.

HS.61. Analyze an event, issue, problem, or phenomenon, identifying characteristics, influences, causes, and both short- and long-term effects.

HS.62. Propose, compare, and judge multiple responses, alternatives, or solutions to issues or problems; then reach an informed, defensible, supported conclusion.

Example Activities

- Assess how personal choices can affect climate change positively and negatively.

EL Strand 1.

- Discover the process of carbon cycling through Earth's systems, and how heat is stored in and around Earth. Further exploration may include inquiry projects to demonstrate the greenhouse effect.

EL Strand 2.

- Research how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and in ocean acidification, with resulting impacts on sea organism health and marine populations. **EL Strand 3.**

- Explore and assess individual, regional and national efforts to mitigate the impact or reduce the progress of climate change. **EL Strand 4.**

- Do a social media outreach campaign on a simple action peers can adopt to reduce carbon emissions or energy consumption. **EL Strand 5.**

HIGH SCHOOL: LIFE SCIENCE

Description: Environmentally literate high-school students are inspired to be life-long learners, stewards and enthusiasts of the natural world. They are prepared to make informed decisions that consider the economic, social and environmental impacts of issues, using credible evidence.

Essential and Guiding Questions

What is the value of biodiversity?

- How is biodiversity lost?
- How does biodiversity loss affect the health of an ecosystem?
- How can you support biodiversity?

Next Generation Science Standards Performance Expectations

Life Science

HS-LS2-1. Use a mathematical and/or computational representation to support explanations of factors that affect the carrying capacity of ecosystems at different scales.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Example Activities

- Compare the relationships among interdependent ecological factors including boundaries, resources, climate and competition. **EL Strand 1.**
- Investigate and compare the variation of biodiversity around Earth. **EL Strand 2.**
- Research particular places on Earth, or particular species, that demonstrate either protection or loss of biodiversity. Show the causes and effects of these changes from a human perspective. **EL Strand 3**
- Engage in service-learning or stewardship projects that promote biodiversity. **EL Strand 4.**
- Mitigate human activities such as urbanization, building dams, and dissemination of invasive species. **EL Strand 5.**

Oregon Social Sciences Standards

Social Science Analysis

HS.61. Analyze an event, issue, problem, or phenomenon, identifying characteristics, influences, causes, and both short- and long-term effects.

8.28. Analyze an event, issue, problem, or phenomenon, identifying characteristics, influences, causes, and both short- and long-term effects.

Appendix A

Chapter 3: Educational Standards and Graduation Requirements

Learning outdoors and in the community is central to the Oregon Environmental Literacy Plan. To be effective, education for environmental literacy must be integrated throughout the curriculum of every Oregon classroom, providing connected and sustained opportunities for all students to participate in



outdoor learning experiences. To facilitate this process, the following Environmental Literacy Strands articulate a comprehensive framework for learning content and skills. Upon graduation from 12th grade, environmentally literate students will demonstrate proficiency in each of these five areas, along with evidence that they acquired these proficiencies outdoors.

In a companion document, these Environmental Literacy Strands have been aligned with the Oregon Academic Standards, making it possible to identify where the learning content for cultivating environmentally literate citizens is supported.

With this goal in mind, we have used language in the Environmental Literacy Strands that appears in state and national standards. We recommend

incorporating these strands across all curricular areas and grades in support of Oregon Academic Standards.

These strands were developed with input from the task force and working groups. Much of this material was adapted from *Oregon Academic Standards; Excellence in Environmental Education Guidelines for Learning (K-12)* (NAAEE, 2010); and *Education for Sustainability Standards* (Cloud Institute, 2010).

Specific instructional strategies for implementing education for environmental literacy are addressed in Chapter 4: Professional Development.

Summary of Environmental Literacy Strands

The Environmental Literacy Strands are organized into five broad areas:

- 1) Systems thinking
- 2) Physical, living and human systems
- 3) Interconnectedness of people and the environment
- 4) Personal and civic responsibility
- 5) Investigate, plan and create a sustainable future

Note: Systems thinking is purposefully placed as the first strand. With its associated set of habits, concepts, tools and skills, systems thinking is applied throughout environmental literacy

education because it provides a foundation for understanding the whole of a system as well as the interrelationships among parts.

Systems thinking is not limited to any one subject and can be practiced through all curricular areas.

The Partnership for 21st Century Skills calls systems thinking—which it defines as the ability to “analyze how parts of a whole interact with each other to produce overall outcomes in complex systems”—a critical skill for all students.

To learn more, visit http://p21.org/documents/P21_Framework_Definitions.pdf.

The Five Environmental Literacy Strands and their Elements^{8, 19, 20}

1) Systems thinking

Students study systems and issues holistically, striving to understand the relationships and interactions between each system's parts. They use the knowledge gained to assess the effects of human choices on economic, ecological and social systems, and to optimize outcomes for all three systems.

- a. System structure. Understand how the complex structure of a system determines its outcome. Describe a system's structure, and model changes to that structure.
 - Dynamic systems consist of interdependent parts that change over time and produce outcomes.
 - Complex systems are made up of smaller subsystems.
 - The relationship between the parts of a system (its structure) determines its outcomes and behaviors.
 - Changing the outcomes of a system requires changing its structure.
 - Dynamic systems have circular feedback loops (e.g., A affects B; B affects C; and C affects A, beginning the cycle again).
- b. Habits of systems thinking. Understand the habits of systems thinking, and identify opportunities to apply them.
 - Question and test assumptions.
 - Use understanding of system structure to identify possible leverage actions.
 - Recognize the impact of time delays on cause-and-effect relationships.
 - Recognize the circular nature of complex cause-and-effect relationships.
 - Understand that a system's structure generates its behavior.
 - Consider how mental models affect current and future reality.
 - Consider short- and long-term consequences of actions.
 - Consider issues fully, resisting the urge to come to a hasty conclusion.
 - Seek new perspectives to increase understanding.
 - Check results and change actions as needed (successive approximation).
 - Notice how system elements change over time, generating patterns and trends.
 - Identify where unintended consequences emerge.
 - Seek to understand the big picture.

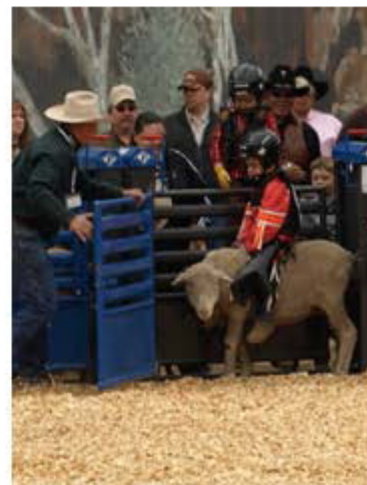
- c. Strategic responsibilities of systems thinking. Apply the habits and techniques of systems thinking to decision-making.
 - Envision, design, plan, act, and assess outcomes with the whole system in mind.
 - Explain how human action or inaction affects the systems in which we live.
 - Recognize that mental models develop gradually from our experiences and surroundings and can therefore limit our perspective.
 - Draw on an understanding of mental models when developing action plans.
 - Explore system structures to deepen understanding and to plan actions that achieve positive systemic impacts.
 - Consider the intentional and unintentional short- and long-term consequences of actions in order to determine whether the rewards are worth the risks, and develop a plan to mitigate risk as much as possible.
 - Consider the effects of human choices on economic, ecological and social systems.
 - Monitor system outcomes, and make adjustments where necessary to maintain or improve desirable outcomes.
 - Ask probing questions when things don't work as planned; reexamine the system's structure and propose changes.



2) Physical, living and human systems

Students understand the characteristics of Earth's physical, living and human systems.

- a. Structure, function, interaction and change in physical systems. Explain the dynamic and interconnected nature of Earth's physical systems, including:
 - The structure and composition of the atmosphere, geosphere and hydrosphere
 - Changes in matter (physical and chemical properties of elements and compounds; the global carbon cycle)
 - The properties of energy (e.g., transfer of energy; energy transformation and conservation; the laws of thermodynamics)
 - The cycling of matter and energy between system components
 - Evidence for geologic, climatic and environmental changes over time
 - Climate (Sun-Earth relationships; processes that drive and regulate climate variability; interrelationships of climate and Earth's other physical and living systems)



- The influence of oceans on weather and climate; interrelationships of oceans and Earth's other physical and living systems
- Earth systems' indicators of sustainability

b. Structure, function, interaction and change in living systems. Explain the dynamic and interconnected nature of Earth's living systems, including:

- The structure and function of organisms, populations, communities, ecosystems and biomes
- The principles of ecology, including biodiversity; carrying capacity; habitat sources and sinks; population dynamics; and ecosystem change
- Heredity, evolution, species change, and the process of natural selection



- Matter and energy flow in organisms (i.e., processes by which plants and animals obtain energy and materials for growth and metabolism; biogeochemical cycling)
- The interdependence of plants, animals and the environment, and how adaptation influences survival
- Ecological indicators of sustainability

c. Structure, function and interconnectedness of human systems. Explain the dynamic and interconnected nature of political, economic, social and cultural systems.

- Compare and contrast the structure and function of political systems, including:
 - The organization, responsibilities and interactions of governments at local, state, tribal, national and global levels
 - The roles and activities of political parties, interest groups, and mass media, and their effect on the beliefs



and behaviors of local, state and national constituencies

- Concepts of political power, authority, conflict and conflict management
 - Relationships between government and citizens, including forms of civic participation in local, state, tribal, national and global communities
 - The impact of government functions and processes on societies and citizens, including how different levels of government provide services and protect citizens
 - Concepts of public, private and common good, and how governments define, support and limit each
 - Instances of common interests among nations and global collaboration
- Compare and contrast the structure and function of economic systems, including:
- Allocation of scarce resources through individual choice, market interaction, and public policy; and the cost and benefits of these decisions to individuals and societies
 - Definition of economic terms (e.g., elasticity, substitution, externalities, regulation, legislation) and examples of these terms as they relate to the current economy, with particular attention to the use of natural resources
 - The history, philosophy and patterns of various economic systems and activities, and their effects on equity, prosperity, cultural diversity, and the environment
 - Economic input-output analysis and life cycle analysis of resource use, manufacturing, and end-of-life options for products (i.e., recycling, disposal, remanufacturing)
 - The production, distribution, consumption and disposal of goods, and the effect of these human choices on the sustainability of Earth's natural, economic and social systems
 - The relationship between public and private ownership and the commons, including characteristics of the commons and property
 - Relationships between property ownership, entrepreneurship and economic growth, and how these can be balanced with the common good

- Consumption and consumer choice (e.g., how consumption choices affect the health of places and people, and how the media shape consumption patterns)
 - Economic indicators of sustainability
- Compare and contrast the structure and function of social and cultural systems, including:
- The characteristics of diverse cultures, and how they change over time
 - How experiences and places are interpreted by people with different cultural backgrounds; at different times; or with other frames of reference
 - How different people understand the commons and the types of measures needed to maintain its health
 - How individuals relate to others, including relationships between individual identity, family, society and culture
 - Concepts of responsibility, fairness and equity, especially as they relate to intergenerational relationships, environmental conditions, consumer choice, resource use, and sustainability
 - How individual and societal actions value or devalue the worth and potential of other human beings
 - The influence of individual traits and group affiliations on perception of the environment
 - The effect of individual and group actions on the environment, and how groups can work to promote and balance their interests
 - Shared and conflicting societal values and principles
 - Social indicators of sustainability
- Analyze the social, cultural and economic indicators of sustainability.

3) Interconnectedness of people and the environment

Students understand the interdependence of humans and the environment, and appreciate the interconnectedness of environmental quality and human well-being.

- a. Sense of place, region, nation and global community. Explain "sense of place" as the connection between people and a place, encompassing the interrelationships

between patterns of human settlement; social and cultural relationships; communities and regions; and the natural world.

- Analyze the characteristics of their community and region, including:
- Spatial concepts (location, distance, direction, scale and movement)
 - Natural features, including flora, fauna, climate, and geologic features such as soils and watersheds
 - Distribution and settlement patterns
 - The cultural and economic heritage, and current character, of the community and region, including local food and transportation systems and livelihoods associated with the regional economy
 - Continuity and changes in places over time
 - Physical and human characteristics of places and regions, and their connections and interdependence
 - Why places and regions are important to human identity
- Analyze the interconnectedness of physical and human regional systems and the global community, including:
- Relationships between Earth's major physical and human features
 - How the human and physical aspects of places and regions relate to development and human identity, and serve as symbols that unify or fragment society
 - How knowledge of one region can be applied to the study of others
 - The interdependence of renewable and nonrenewable resource use at the local, regional, national and global scale
 - The causes of human migration, and its impact on physical and living systems
 - Economic, cultural and environmental factors that influence population changes (including food production capacity, medical advances, and disease control), and the consequences of these changes
 - The roles that self-interest, differing points of view, and the global distribution of natural resources play in territorial conflicts





- Conflicts involving land use, economics, resource competition, political views, boundary disputes, and cultural differences within and between geographic areas

- b. Interrelationships between the environment and human activities. Analyze how environmental changes affect human systems; how human activities and systems change the environment; and the connection between environmental quality and human well-being.
 - Analyze how environmental changes affect political, social, cultural, economic and health systems.
 - Analyze how human activities and systems change Earth's physical systems (e.g., atmosphere, ocean, climate, soil, landforms) and living systems (e.g., ecosystems, biodiversity, carrying capacity).
 - Explain the interrelationships between environmental quality—including air quality; water quality and quantity; biodiversity; climate change; disease vectors; and natural disasters—and human health and well-being, including the ability to produce and access nutritious food, to access shelter, and to achieve and maintain mental and physical health.
 - Describe the human ability to shape and control the environment by developing new knowledge and technologies, including agricultural and food systems; transportation systems; waste management systems; communication systems; energy systems; and habitation systems.
- c. Resource distribution and use. Analyze how resource distribution and use shape our political, economic, physical and social

environments, and how they influence cooperation, competition, territorial conflict, and national security.

- Explore the relationship of the environment to national security, including energy security, food security, and climate change.
- Describe how human cooperation and competition for resources shape our political, economic, physical and social environment.
- Explain human dependence on renewable and nonrenewable natural resources for life, adequate sustenance and quality of life.
- Describe the roles that differing points of view; self-interest; political and economic systems; and global distribution of natural resources play in conflicts over territory.
- Explain how resource competition lead to conflicts between and within geographic areas (e.g., land use, food, water, energy sources, boundary disputes, and human migration).

4) Personal and civic responsibility

Students understand the rights, roles, responsibilities and actions associated with leading or participating in the creation of healthy environments and sustainable communities.

- a. Rights and responsibilities of citizens. Analyze citizens' rights and responsibilities and their importance in making choices locally and globally.
 - Explain the personal, political and economic rights of U.S. citizens.
 - Describe the personal responsibilities of citizens in a community, state and nation.
 - Analyze civic ideals (e.g., freedom, rule of law, equality, responsibility, civic participation, equity, respectful deliberation).
 - Compare and contrast views on individual responsibility to the commons.
 - Explain the importance of civic dispositions including trust, honesty, patience, self-discipline, respect and open-mindedness.
 - Consider whether civic obligations require individuals to subordinate their interests or desires to the public good.
 - Evaluate how conflicts arise between individual rights and societal interests,

such as a healthy environment and a sustainable community.

b. Sense of personal responsibility.

Identify and describe personal and group responsibility; the effect of human actions on the future; and the importance of fulfilling personal responsibilities by participating thoughtfully and effectively in decision-making.

→ Explain the notion of responsibility; identify basic personal responsibilities; and compare their view of their own responsibilities with commonly accepted societal views.

→ Evaluate responsibilities in terms of their short- and long-term effects.

→ Analyze the effects that they and the groups they belong to (e.g., family or classroom) have on environmental and community sustainability.

→ Evaluate the importance of fulfilling personal responsibilities for themselves, as well as for society, the commons, people in other places, and other living beings.

→ Develop self-confidence in their effectiveness as citizens (self-efficacy) by understanding:

- How individual and group action can create beneficial change, meet individual needs, and promote the common good
- How citizen action and public opinion can influence environmental policy
- How citizen action has affected environmental quality and sustainability
- How students of their own age have affected environmental quality and sustainability
- Ways in which their own actions have made a difference

→ Show a willingness to work individually and collectively to resolve issues and to participate thoughtfully and respectfully in decision-making.

→ Explain how the decisions of one generation create opportunities for, and impose constraints on, future generations.

→ Apply the strategic responsibilities of systems thinking to real-world decision-making (see Strand 1 c).



5) Investigate, plan and create a sustainable future

Students apply civic action skills that are essential to healthy, sustainable environments and communities.

a. Work with flexibility, creativity, openness and perseverance. Form and evaluate personal views; engage in informed deliberation; and use creativity to make previously unrecognized connections.

→ Form and evaluate personal views:

- Identify personal mental models about the world, and recognize them as guiding constructs that change in response to new knowledge and applied insight.
- Articulate multiple sides of an issue, and propose defensible conclusions that address diverse perspectives.
- Evaluate, communicate and justify personal views.
- Evaluate personal beliefs and values, using such criteria as personal well-being; equity; social and environmental welfare; economic vitality; and concern for living beings.
- Consider differing viewpoints, and assess credible information that challenges their positions.
- Evaluate whether and how differing views should affect their own views.
- Apply a global perspective to contemporary and historical issues.
- Evaluate the strength of conclusions by differentiating evidence-based reasoning from reasoning based on incomplete information, opinions, fear, bias, or exaggeration.





- Engage in informed and respectful deliberation on local, state, tribal, national and global issues:
 - Demonstrate knowledge of diverse cultural, linguistic and artistic expressions.
 - Communicate and collaborate cross-culturally.
 - Work with people who have different perspectives.
 - Seek to identify the interests that underlie people's positions and behaviors.
 - Cooperate productively in work teams to identify and solve problems.
 - Display initiative and demonstrate respect for other team members while completing tasks.
 - Exhibit a strong work ethic, including responsibility and reliability.
 - Apply upstream problem identification and systems thinking.
- Think creatively to make previously unrecognized connections:
 - Explore connections, consider analogies, and synthesize ideas to arrive at new ways of thinking.
 - Explore concepts that connect economic opportunities and job creation with sustainable communities and a healthier environment (e.g., innovations in food production, energy generation and use, transportation, and water management).

- Generate new ideas by making novel connections between concepts.
 - Demonstrate flexibility.
 - Take opportunities to express ideas and emotions.
- b. Assess the accuracy and reliability of information sources. Evaluate the quality of information from primary and secondary sources.
 - Gather and organize relevant data.
 - Use basic logic and reasoning skills to evaluate the reliability of information.
 - Identify logical errors and spurious statements in everyday communications, such as advertising and political rhetoric.
 - Look for and explain logical flaws in arguments, such as faulty or misleading use of statistics; misrepresentation of data; and biased selection of data to support a claim (cherry-picking).
 - Explain why some research results are more credible than others.
 - Identify sources and evidence of bias in interpretation, funding sources, and research procedures.
 - c. Identify and analyze strategies that address challenges and create desired futures. Investigate problems, evaluate possible solutions, and propose actions.
 - Investigate differing perspectives on a current issue:
 - Consult various unbiased sources to define and clarify the dimensions of the issue.
 - Develop a method to explore relationships between key dimensions of the issue.
 - Identify key individuals and groups, including those who are affected by the issue.
 - Explain various perspectives on the issue and the reasoning behind them.
 - Examine contextual elements that shape the issue, and identify historical antecedents or contemporary parallels.
 - Analyze the characteristics, causes and consequences of the issue.
 - Develop and use indicators to measure movement toward or away from goals.
 - Use the concept of cumulative effects to explain why specific changes or human actions cannot be considered in isolation from others.



- Identify the most upstream problems to address within their sphere of influence.
- Identify and evaluate alternative courses of action, and propose solutions or support actions:
 - Synthesize various perspectives, data, and methods of analysis to devise solutions or actions.
 - Use knowledge of functional relationships, modeling, and statistical analysis to evaluate options.
 - Use cost/benefit analysis, cumulative effects analysis, environmental impact analysis, ethical analysis, risk analysis and related methods.
 - Propose and justify actions that are likely to be effective.
- d. Demonstrate effective decision-making and citizen action. Analyze options, plan actions, evaluate outcomes, and reach evidence-based conclusions.
 - Evaluate the need for action:
 - Decide whether action is warranted, based on available evidence about the issue and proposed solutions; the scale of the concern; the legal, social, economic and ecological consequences; and alternatives to citizen action.
 - Identify options for citizen action, including consumer choices; resource use choices; writing letters to the editor; drafting legislation, ordinances or policies; environmental stewardship projects; and communicating with decision-makers.
 - Speculate on the probable effects of specific actions and the likelihood that they will resolve the problem.
 - Decide whether to take personal action, based on their own values, skills, resources and commitments.
 - Communicate decisions clearly and support them with reasoned arguments.
 - Plan and take action:
 - Envision a desired endpoint.
 - Articulate clear reasons and goals for action.
 - Develop a plan for individual and collective action.
 - Set measurements for success that are consistent with the abilities of the groups involved.



- Decide whether to modify the plan—and when and whether to implement it—and take appropriate action.
- Identify, compare and evaluate results (outcomes and responses) to reach an evidence-based conclusion:
 - Analyze the long- and short-term consequences of action and inaction.
 - Consider the intended and unintended effects of action and inaction on themselves, others and the environment.
 - Evaluate the apparent effects of actions in terms of action goals, societal goals, and ethics.
 - Articulate lessons learned.
 - Account for any difficulties in evaluating the results of actions.

Graduation Requirements (adapted from Oregon Department of Education)

In January 2007, the Oregon State Board of Education voted to adopt new high school graduation requirements that will better prepare each student for success in college, work and citizenship. To earn a diploma, students must complete the credit requirements, show proficiency in essential skills, and meet personalized learning requirements. Students will also have the option of earning credit for proficiency. The phase-in schedule (2007 to 2014) allows students, families, schools and teachers to prepare for these new requirements.

Proficiency in essential skills could be demonstrated through environmental literacy. Essential skills are "process skills" that cross



academic disciplines and are embedded in the content standards. They are not content-specific and can be applied in a variety of courses, subjects and settings.

Essential skills include:

- 1) Reading and comprehending a variety of texts
- 2) Writing clearly and accurately
- 3) Applying mathematics in a variety of settings
- 4) Listening actively and speaking clearly and coherently
- 5) Thinking critically and analytically
- 6) Using technology to learn, live and work
- 7) Civic and community engagement
- 8) Demonstrating global literacy
- 9) Demonstrating personal management and teamwork skills

Students are also responsible for Personal Learning, which includes:

- **Plan and Profile.** With adult help, students develop a plan for classes and experiences they require to prepare for their post-high school goals. They will document their progress and accomplishments along the way.
- **Career-Related Learning Experiences.** Students participate in experiences that connect the classroom with the workplace and community.
- **Extended Application.** Students apply knowledge and skills relating to their interests and goals by demonstrating critical thinking, problem-solving or inquiry in real-world contexts.

An environmental literacy context should support students in satisfying their personalized learning diploma requirement, in learning beyond the classroom, and in connecting with the adult world.

In adopting the new diploma requirements, the Oregon State Board of Education noted, "A key feature of the future diploma will be wider use

of proficiency, ensuring that all students will have the opportunity to choose to earn credit by demonstrating proficiency."

To enhance the relevance of education for students, the State Board also broadened the definition of courses that meet the math and science requirements of the diploma. In a decision paper published in 2007, the Board endorsed the concept of meeting math requirements through courses such as Integrated Math, Applied Math, Construction Math, and Business Math, provided they meet the content threshold of Algebra I or higher. Similar flexibility is encouraged in courses offered for science credit. Recognizing environmental literacy as a context to help students satisfy diploma requirements by demonstrating proficiency in math and science should also be explored.

As these new requirements are phased in, many districts are considering alternatives to traditional academic coursework in math, science, and language arts. Oregon has been working to enhance mathematics, science and other core academic concepts embedded in Career & Technical Education (CTE), in conjunction with the national Math-in-CTE curriculum integration model sponsored by the National Center for Research in Career and Technical Education. CTE program courses, integrated academic course sequences, and project-based learning are delivery models in which students earn full or partial credit by meeting academic area content expectations. These approaches give students the opportunity to show proficiency by applying academic content in real-world situations.

Students may demonstrate proficiency inside the classroom; outside the classroom (where hours of instruction may vary); by documenting prior learning; by appropriate examination; or through any combination of the above. Thus, Credit for Proficiency is well suited to support education for environmental literacy as a vehicle for student pursuit of the Oregon diploma.

Essential skills, Personal Learning, and Credit for Proficiency are flexible options for aligning existing graduation requirements with the Plan. Examples of requirements that can be met and assessed through environmental literacy activities should be further developed and disseminated. In developing examples, priority for skills and activities should be given to Environmental Literacy Strand components that are not satisfied by current Oregon Academic Standards.

Also, a new graduation requirement for environmental literacy should be considered, following the example of Maryland's proposed plan (Robelen, 2010). Last, we recommend that graduation requirements include outdoor experiences.

