

**Field Inquiry through
Citizen Science: A
Framework for
Environmental Literacy
(5th-8th Grades) -
Condensed Version**

Table of Contents

Introduction.....	3
Citizen Science	3
Framework Organization.....	3
Framework Design.....	4
Extended Version Information.....	4
Citizen Science Program Characteristics.....	5
Framework Sample Page.....	6
Individual Strands	
Strand 1.....	7
Strand 2.....	10
Strand 3.....	16
Strand 4.....	20

The Need for a Citizen Science Framework

Citizen science reaches large and varied audiences from local communities and regions to the entire nation and beyond. There are many opportunities for educators to incorporate lessons and aspects of citizen science into their classrooms and programs. The development of age appropriate curriculum to meet state and national standards, while contributing to students’ environmental literacy, can also promote citizen science objectives.

The *Field Inquiry through Citizen Science* framework was developed to assist teachers and program developers clarify the focus of their curriculum. The framework guidelines give desired outcomes for student participation in citizen science, and provide a starting point for curriculum development based on Wiggins & McTighe’s “Understanding by Design”. By developing curricula and programs that address the enclosed guidelines, educators and program developers can increase students’ environmental literacy while meeting educational standards.

The framework is meant as a guide, a place to start to improve current curricula. Finally, while the framework addresses grades five through eight, it may serve as a guiding document for high school and primary school students.

Framework Acknowledgements

The framework was created as a partial requirement for a Master of Science in Natural Resources – Environmental Education by Scott Reilly of the University of Wisconsin, Stevens Point (UWSP) with the assistance of his graduate committee. Committee members included Drs. Dan Sivek and Dennis Yockers of the College of Natural Resources, and Dr. Perry Cook of the College of Professional Studies on the campus of UWSP.

Finally, with much appreciation to the representatives of the following organizations who assisted in the framework development: University of Minnesota, Smithsonian Institute, GREEN/Earth Force, Washington Department of Fish & Wildlife, Cornell Lab of Ornithology, Great Smoky Mountains Institute at Tremont, University of MN, Duluth – Great Lakes Worm Watch, Sigurd Olson Environmental Institute – Northland College, Beaver Creek Reserve, Bronx River Alliance, Minnesota Odonata Survey Project, and Lake Erie-Allegheny Earth Force.

Standards-Based Education

In the 1990s state and the national governments developed educational standards that have been widely adopted by school districts around the country. In order to meet the changing educational climate, the North American Association for Environmental Education (NAAEE) developed the *Excellence in Environmental Education- Guidelines for Learning (Pre K-12)*. These guidelines set voluntary student expectations for environmental education curricula and programs in order to increase student's environmental literacy while meeting these new educational standards. The guidelines provide specific content expectations and examples of achievement, and can be applied successfully to developing citizen science curricula.

The *Field Inquiry through Citizen Science* framework aims to unify those guidelines specific to citizen science and how they can contribute to enhancing students' environmental literacy. The framework guidelines correlate with Wisconsin state and national educational standards. Also included are those contributing characteristics valuable in guiding curriculum development. The framework is meant to provide achievable goals for program developers, teachers, and students alike.

Citizen Science & Its Importance to Environmental Literacy

According to the Cornell Laboratory of Ornithology, citizen science is a form of environment-based learning in which students (and adults) are actively engaged in the scientific process by working with scientists to address "real-world questions."

The active engagement in citizen science by students can have numerous benefits.

- Develops students' skills in leadership, critical thinking, & teamwork;

- Increases students' sense of ownership and empowerment in addressing environmental issues;
- Addresses state & national standards;
- Addresses multiple disciplines & intelligences;
- Contributes to students' environmental literacy;
- Promotes students' environmental stewardship;
- **Facilitates students' environmental literacy.**

Environmental literacy is seen as the ultimate goal of environmental education. Disinger and Roth defined environmental literacy as "the capacity of citizens to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems" (1992).

Environmental literacy depends in part on scientific literacy and is an important goal of citizen science programs and curricula. It is an *Enduring* concept that students need to understand.

Intended Framework Audience

- Educators who work with middle school students;
- Nature centers and environmental education stations that have a citizen science component, or wish to implement one;
- Non-Governmental Organizations;
- Curriculum & citizen science program developers.

Framework Design

The framework was designed using Wiggins & McTighe's "Understanding by Design" curriculum development process which consists of three steps.

- Step 1: Identify desired results and skills, i.e., content standards & guidelines.

What is worthy and requiring of understanding?

- Step 2: Determine acceptable evidence of learning, i.e., performance standards & guidelines.

What is evidence of understanding?

- Step 3: Plan learning experiences and instruction, i.e., curriculum material.

What learning experiences and teaching promote understanding, interest, and excellence?

The framework provides desired results for citizen science curricula (Step 1). It also shows acceptable evidence as suggested by the NAAEE to meet the guidelines (Step 2), as well as corresponding state and national standards located in the *Extended Version*. The planning of curriculum materials (Step 3) is to be completed by program developers once the necessary guidelines and assessments have been identified.

Framework Layout

The framework is comprised of various sections. (See sample on page 6.)

- Characteristics recommended for citizen science programs and curriculum.
- A sample guideline that shows each page layout.
- Four theme strands that address specific knowledge and skills addressed in the NAAEE *Guidelines*, with wording modifications that focus specifically on citizen science.

- Individual guidelines from the previous strands followed by example performance guidelines that provide suggestions for student assessment.
- The Wisconsin and national standards addressed and their page locations in the *Extended Version*, abbreviated *EV*.
- Characteristics addressed by each guideline. Throughout the framework they are abbreviated as “CRS”.
- Enduring & Important Understanding:
 - Enduring: Foundations, skills, knowledge, and characteristics seen as imperative for effective citizen science curriculum and/or programs. These guidelines refer to the “big ideas” and concepts that students should retain beyond the experience.
 - Important Understanding: Wiggins & McTighe describe these as “prerequisite knowledge and skills needed by students for them to successfully accomplish key performances”. They can also be seen as less imperative at a particular time period but may become Enduring later.
- A brief evaluation tool that looks at how well individual guidelines are addressed by a program’s curriculum.

Extended Version

The *Extended Version* presents the same information in a different, more descriptive format. It also includes extensive content and performance standards for Wisconsin and the nation, additional references, and information on various citizen science programs. This document can be accessed at www.eeinwisconsin.org.

Citizen Science Program Characteristics

The development, implementation, and evaluation of citizen science curricula relies on numerous factors. The following 15 characteristics, goals, and recommendations offer guidance to successful program and curriculum development. They were identified by citizen science professionals and can contribute to students' environmental literacy. Their implementation may also assist in successfully meeting the 28 guidelines of environmental literacy and correlate with appropriate guidelines where applicable

The italicized "Guidelines" indicate correlations with NAAEE's Guidelines for Learning (Pre K – 12) (2004).

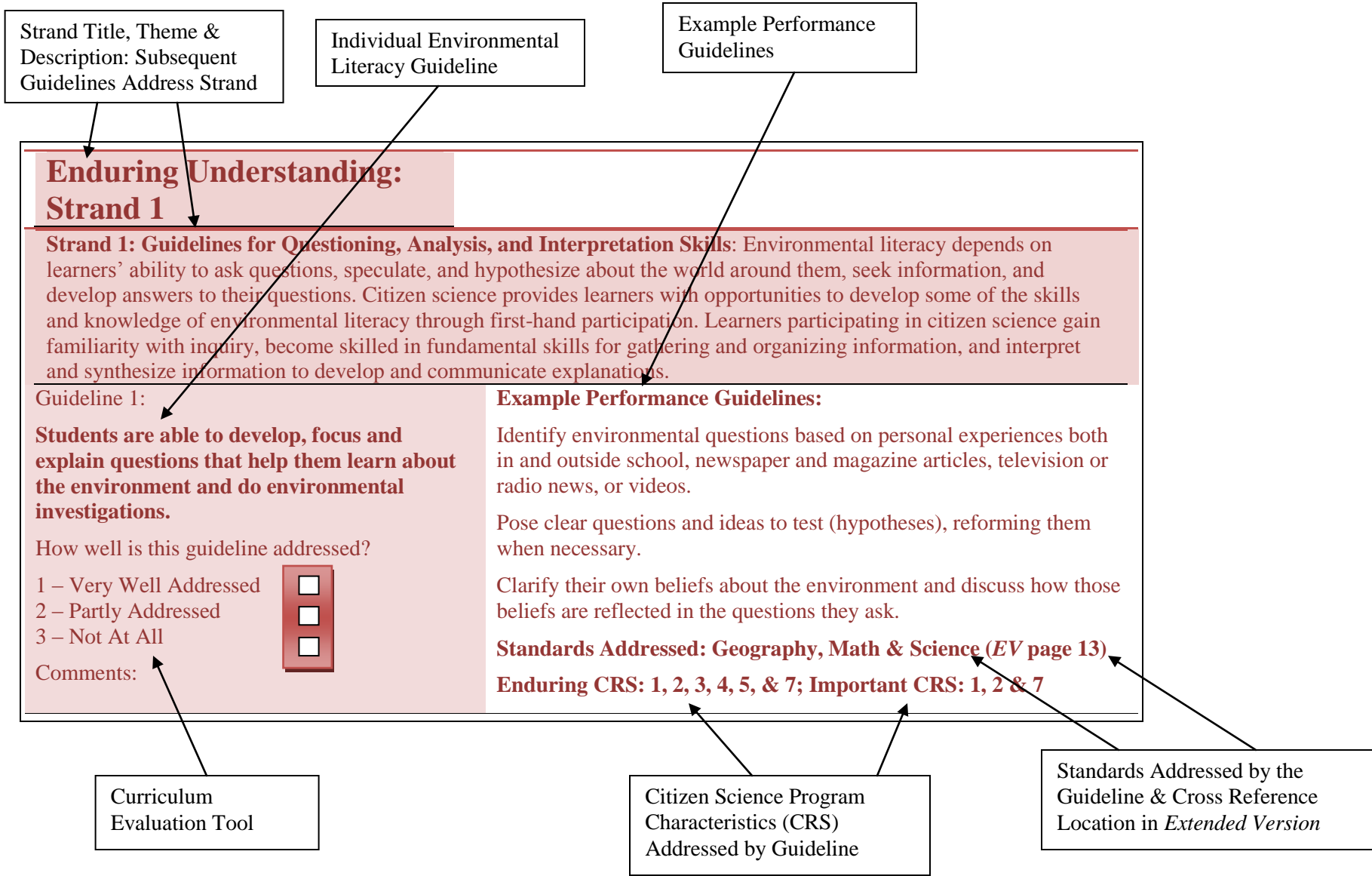
The following are *Enduring* goals, characteristics, and recommendations for successful citizen science programs and curriculum. They are referred to as "CRS" throughout the framework.

1. Citizen science programs are a multi-disciplinary educational approach that relies on many fields. *All Guidelines*
2. In citizen science programs, students reflect on what they have done or learned. *Guidelines 1, 8, 22, 23, 25, & 28*
3. In citizen science programs, students are empowered through increased personal responsibility for learning. *Guidelines 1, 2, 3, 4, 5, 6, 8, 19, 20, 21, 23, 24, 27, & 28*
4. In citizen science programs, students conduct valuable research that assists in meeting research objectives. *Guidelines 1, 2, 3, 4, 11, & 21*
5. Citizen science programs bring scientists and sponsoring organizations together with students. *Guidelines 1, 2, 13, 19, & 21*
6. In citizen science programs, students are involved in the data collection process. *Guidelines 2, 3, 4, & 21*
7. Student participation in citizen science develops a greater awareness of cause and effect relationships and its limitations to manipulation in citizen science programs. *Guidelines 1, 2, 4, 5, 6, 8, 9, 10, 13, 14, 16, 17, 18, 19, 20, & 21*

The following are *Important* goals, characteristics, and recommendations for successful citizen science programs and curriculum. They are referred to as "CRS" throughout the framework.

1. Citizen science programs are a component of curriculum to help meet state and national education standards. *All Guidelines*
2. In citizen science programs, students learn about and apply scientific methodologies through first-hand experience. *Guidelines 1, 2, 3, 4, 5, 11, 13, & 21*
3. In citizen science programs, students assist in answering scientific questions developed within the scientific community. *Guidelines 2, 3, 4, 5, 6, 8, 18, & 21*
4. In citizen science programs, student-collected data are valid and reliable if following rigorous protocols or verified by experts. *Guidelines 2, 4, & 21*
5. In citizen science programs, students are in the out-of-doors learning about natural resources. *Guidelines 2, 3, 10, & 21*
6. Citizen science programs also involve students in an in-door setting to learn about natural resources, i.e. energy audits. *Guidelines 2, 3, & 21*
7. In citizen science programs, students can develop their own scientific protocol following previous experiences. *Guidelines 1 & 6*
8. In citizen science programs, students interpret data. *Guidelines 4, 5, 6, 9, 11, & 18*

Framework Sample



Enduring Understanding: Strand 1

Strand 1: Guidelines for Questioning, Analysis, and Interpretation Skills: Environmental literacy depends on learners' ability to ask questions, speculate, and hypothesize about the world around them, seek information, and develop answers to their questions. Citizen science provides learners with opportunities to develop some of the skills and knowledge of environmental literacy through first-hand participation. Learners participating in citizen science gain familiarity with inquiry, become skilled in fundamental skills for gathering and organizing information, and interpret and synthesize information to develop and communicate explanations.

Guideline 1:

Students are able to develop, focus and explain questions that help them learn about the environment and do environmental investigations.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Identify environmental questions based on personal experiences both in and outside school, newspaper and magazine articles, television or radio news, or videos.

Pose clear questions and ideas to test (hypotheses), reforming them when necessary.

Clarify their own beliefs about the environment and discuss how those beliefs are reflected in the questions they ask.

Standards Addressed: Geography, Math & Science (EV page 13)

Enduring CRS: 1, 2, 3, 4, 5, & 7; Important CRS: 1, 2 & 7

Guideline 2:

Students are able to locate and collect reliable information about the environment or environmental topics using a variety of methods and sources.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Observe systematically, measure accurately, and keep thorough and accurate records.

Understand and use various systems of measurement and derived measurements.

Assess, choose, and synthesize materials from resources such as aerial photographs, topographic maps, and satellite images; library and museum collections, historical documents, and eyewitness accounts; computerized databases and spreadsheets; the internet; and government records.

Collect firsthand information about their own community using field study skills.

Standards Addressed: Arts, ELA, History, Math, Science & Social Studies (EV page 14)

Enduring CRS: 1, 3, 4, 5, 6, & 7; Important CRS: 1, 2, 3, 4, 5, & 6

Important to Know & Do: Strand 1

Guideline 3:

Students are able to design environmental investigations to answer particular questions – often their own questions.

How well is this guideline addressed?

1 – Very Well Addressed

2 – Partly Addressed

3 – Not At All



Comments:

Example Performance Guidelines:

Select types of inquiry appropriate to their questions.

Define the scope of their inquiry, identifying the main variables and phenomena to be studied.

Select appropriate systems of measurement and observation.

Select tools that are appropriate for their environmental investigations based on the questions asked and the type of information sought.

Standards Addressed: Math & Science (EV page 15)

Enduring CRS: 1, 3, 4, & 6; Important CRS: 1, 2, 3, 5, & 6

Guideline 4:

Students are able to assess the strengths and weaknesses of the information they are using.

How well is this guideline addressed?

1 – Very Well Addressed

2 – Partly Addressed

3 – Not At All



Comments:

Example Performance Guidelines:

Identify and evaluate vague claims they hear on television or through other media.

Identify factors that affect the credibility of information, including assumptions and procedures used to create it; the social, political, and economic context in which the information was created; and potential bias due to omission, suppression, or invention of factual information.



Examine evidence, identify faulty reasoning, and apply other basic logic and reasoning skills in evaluating information sources.

Identify gaps in information that indicate a need for further discovery or inquiry.

Evaluate data and evidence for accuracy, relevance, significance, appropriateness, and clarity.

Standards Addressed: History, Math & Science (EV page 16)

Enduring CRS: 1, 3, 4, 6 & 7; Important CRS: 1, 2, 3, 4, & 8

<p>Guideline 5:</p> <p>Students are able to classify and order data, and organize and display information in ways that help analysis and interpretation.</p> <p>How well is this guideline addressed?</p> <p>1 – Very Well Addressed 2 – Partly Addressed 3 – Not At All</p>  <p>Comments:</p>	<p>Example Performance Guidelines:</p> <p>Present environmental data in a variety of formats including charts, tables, plots, graphs, maps, and flow charts.</p> <p>Explain why they chose specific ways of ordering and displaying information. Consider factors such as the question being answered, the type of information, and the purpose of the display.</p> <p>Present environmental data in ways that demonstrate possible relationships between sets of information such as population census counts of bird species and the prevalence of certain tree species or habitat types.</p> <p>Standards Addressed: Arts, ELA, Geography, Math & Science (EV page 17)</p> <p>Enduring CRS: 1, 3 & 7; Important CRS: 1, 2, 3, & 8</p>
<p>Guideline 6:</p> <p>Students are able to synthesize their observations into coherent explanations.</p> <p>How well is this guideline addressed?</p> <p>1 – Very Well Addressed 2 – Partly Addressed 3 – Not At All</p>  <p>Comments:</p>	<p>Example Performance Guidelines:</p> <p>Distinguish between description and explanation and give examples of each based on their own environmental investigations.</p> <p>Consider the possible relationships among two or more variables.</p> <p>Propose explanations based on what they observed or learned through research, selecting which evidence to use and accounting for discrepancies. Synthesize and interpret information from a range of sources.</p> <p>List strengths and weaknesses of proposed explanations. Discuss how the proposed explanation could be rejected or its reliability improved.</p> <p>Use proposed explanations to form new questions and suggest new avenues of inquiry.</p> <p>Standards Addressed: ELA, Geography, History, Math & Science (EV page 18)</p> <p>Enduring CRS: 1, 3 & 7; Important CRS: 1, 3, 7, & 8</p>

Enduring Understanding: Strand 2

Strand 2 – Guidelines for Knowledge of Environmental Processes & Systems: Gaining an understanding of the processes and systems that comprise the environment, including human social systems and influences is an important component of environmental literacy. That understanding is based on knowledge synthesized from across traditional disciplines. Environmental processes and systems addressed by citizen science are dependent on the types of projects learners are involved in.

Guideline 7 – The Living Environment:

Students understand that biotic communities are made up of plants and animals that are uniquely adapted to live in particular environments.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Define and give examples to illustrate the concepts of species, population, community, and ecosystem. Trace and give examples of connections among organisms at those levels of organization.

Link features of internal and external anatomy with the ability of organisms to make or find food and reproduce in particular environments.

Understand that some animals and plants have adapted to extreme environmental conditions. Give examples that are behavioral (e.g., the migration of Canada geese and other birds) and physical (e.g., physical structures that enable desert animals and plants to exist on minimal amounts of water).

Describe how organisms differ in how they use energy. For example, identify organisms that use energy quickly for growth and metabolism, and therefore must replace it quickly (e.g., a hummingbird) and others that use energy more slowly and therefore need to replace it less frequently (e.g., a python). Predict the habitat needs of these different types of organisms.

Standards Addressed: Geography & Science (EV page 20)

Enduring CRS: 1; Important CRS: 1

Guideline 8 – Environment & Society:

Students are able to explain that human-caused changes have consequences for the immediate environment as well as for other places and future times.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Describe intended and unintended environmental and social consequences associated with the changing use of technologies. Consider consequences that may be positive as well as negative.

Explain how human-caused environmental changes cause changes in other places on human and natural environments.

Describe the effects of a local environmental restoration effort, such as wetlands creation. Predict the long-term consequences of such efforts, or a particular restoration project.

Standards Addressed: Geography & Science (EV page 21)

Enduring CRS: 1, 2, 3, & 7; Important CRS: 1 & 3

Important to Know & Do: Strand 2

Guideline 9 – The Earth As a Physical System:

Students are able to relate the differences in physical patterns to their causes, e.g. how seasonal change is affected by the Earth/sun relationship.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Analyze physical patterns such as climate, areas or geothermal activity, soil types, and arid regions, suggesting reasons for these patterns. Explain these patterns in terms of abrupt forces (such as earthquakes or major storms) and long-term processes (such as erosion and rock formation), as well as those that are human-caused (such as suburban development or agricultural practices).

Predict the consequences of specific physical phenomena such as a hurricane in a coastal area or heavy grazing in an arid region.

Relate physical processes and patterns (such as climate, weather phenomena, and seasonal change) to the Earth/sun relationship.

Standards Addressed: Science (EV page 22)

Enduring CRS: 1 & 7; Important CRS: 1 & 8

Guideline 10 – The Living Environment:

Students recognize and describe the importance of genetic variation in species and possible implications of species extinction.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Describe some ways in which variation among individuals of the same species can sometimes give certain individuals an advantage within a specific environment.



Describe in general terms the theory of natural selection for particular traits and how that process can result in descendants that are quite different from their ancestors.

Define extinction, cite evidence of extinction, and identify some of its causes.

Discuss the possible implications of permanent loss of a species and how it affects interdependence within an ecosystem.

Standards Addressed: Science (EV page 23)

Enduring CRS: 1 & 7; Important CRS: 1 & 5

<p>Guideline 11 – The Living Environment:</p> <p>Students identify and describe major kinds of interactions among organisms or populations of organisms.</p> <p>How well is this guideline addressed?</p> <p>1 – Very Well Addressed 2 – Partly Addressed 3 – Not At All</p> <p>Comments:</p> 	<p>Example Performance Guidelines:</p> <p>Describe and give examples of producer/consumer, predator/prey, and parasite/host relationships.</p> <p>Identify organisms that are scavengers or decomposers. Describe the roles they play within particular systems focusing on their relationship to other organisms and physical elements of the system.</p> <p>Summarize how abiotic and biotic components combine to influence the structure of an ecosystem. For example, create a map for the local region that shows average temperature and rainfall correlated with local forest, grassland or desert ecosystems. Or discuss the process of soil formation in terms of the interaction of climate, geology, and living organisms.</p> <p>Standards Addressed: Geography & Science (EV page 24)</p> <p>Enduring CRS: 1 & 6; Important CRS: 1, 2 & 8</p>
<p>Guideline 12 – The Living Environment:</p> <p>Students describe how energy and matter flow among the biotic and abiotic components of the environment.</p> <p>How well is this guideline addressed?</p> <p>1 – Very Well Addressed 2 – Partly Addressed 3 – Not At All</p> <p>Comments:</p> 	<p>Example Performance Guidelines:</p> <p>Trace the flow of energy through food webs that identify relationships among organisms in natural systems.</p> <p>Explain how matter is transferred among organisms and between organisms and their environment in these food webs.</p> <p>Describe how energy, which enters ecosystems as sunlight, changes form and is transferred in the exchanges (production, consumption, and decomposition) that comprise food webs.</p> <p>Standards Addressed: Science (EV page 25)</p> <p>Enduring CRS: 1; Important CRS: 1 & 2</p>

Guideline 13 – Humans & Their Societies:

Students identify and explain ways in which the world’s environmental, societal, economic, cultural, and political systems are linked. Environmental justice would be an appropriate example.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Explain international trade in terms of uneven distribution of resources.

Describe ways in which the global environment is affected by individual and group actions, as well as by government policies and actions having to do with energy use and other forms of consumption, waste disposal, resource management, industry, and population.

Explain how an environmental change in one part of the world can have consequences for other places.

Identify a variety of global links, including transportation and communication systems, treaties, multi-national corporations, and international organizations.

Standards Addressed: Civics & Government, Geography, Science & Social Studies (EV page 26)

Enduring CRS: 1, 5 & 7; Important CRS: 1

Guideline 14 – Humans & Their Societies:

Students explain and analyze that human social systems change over time and that conflicts sometimes arise over differing viewpoints about the environment.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Describe patterns of change within and across cultures, communities, and other groups.

Consider the rapidity of change, mechanisms that helped spread change, and what motivated change.

Explain how change affects individuals and groups differently and give examples of the trade-offs involved in decisions and actions ranging from the individual to the societal levels. For example, discuss how a decision about where to site a landfill, build a chemical plant, or locate a new highway might affect different neighborhoods, businesses, workers, people of varying socio-economic status, and others. Role-play their reactions.

Describe and analyze examples of tensions between individual rights and benefits and the societal good.

Identify some of the formal and informal ways that groups (including governments) attempt to anticipate, avoid, or resolve conflicts related to the environment.

Standards Addressed: Science & Social Studies (EV page 27)

Enduring CRS: 1 & 7; Important CRS: 1

Guideline 15 – Environment & Society:

Students explore differences in perceptions and importance of places close to home and around the world.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All



Comments:

Example Performance Guidelines:

Analyze physical and human characteristics of places and make inferences about how and why these characteristics have developed and changed over time. For example, use maps and satellite photographs to examine how cities change in response to natural disasters such as floods, hurricanes, or earthquakes.

Identify ways in which personal perceptions, culture, and technology influence people’s perceptions of places. Discuss the importance of some places (such as Yellowstone National Park or the Mississippi River) as cultural symbols.

Identify regions based on different criteria such as watershed boundaries, sales and service areas for different businesses, or the area from which sports teams draw fans or symphony orchestras attract audiences.

Standards Addressed: Arts, Geography & Social Studies (EV page 28)

Enduring CRS: 1; Important CRS: 1

Guideline 16 – Environment & Society:

Students are able to discuss and explain why uneven distribution of resources around the world influences the use of these resources and their perceived value.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All



Comments:

Example Performance Guidelines:

Map and discuss distribution and consumption patterns for specific resources, such as metals, fresh water, or certain types of forests. Note resources that are being rapidly depleted.

Explain why certain resources (such as oil, coal, or natural gas) are important to development of human societies, and identify resources that were critical to development at different times in history.

Explain conflicts between individuals, states, regions, or nations noting factors such as differing attitudes about the use of specific resources and scarcity of natural resources.

Illustrate with local or regional examples such as conflicts over water rights and use of habitat for local endangered species.

Standards Addressed: Economics, Geography, History & Science (EV page 29)

Enduring CRS: 1 & 7; Important CRS: 1

Guideline 17 – Environment & Society:

Students relate to and discuss how people in other places around the world experience environmental issues similar to the ones they are concerned about locally.

How well is this guideline addressed?

1 – Very Well Addressed

2 – Partly Addressed

3 – Not At All

Comments:

Example Performance Guidelines:

Identify other places, either contemporary or historical, experiencing issues similar to those in the learner’s community or region.

Explain how issues arise because of conflicting points of view about a specific proposal, event, or condition in the environment. For example, discuss conflicting perspectives about past and present proposals to build large-scale dams such as the Three Gorges project in China, the Hetch-Hetchy dam in the U.S., or a similar project in the learner’s region.

Discuss how disagreements at the heart of environmental issues make them difficult to resolve. Consider the role of understanding, creativity, or compromise in finding solutions.

Standards Addressed: Geography (EV page 30)

Enduring CRS: 1 & 7; Important CRS: 1

Enduring Understanding: Strand 3

Strand 3 – Guidelines for Skills for Understanding & Addressing Environmental Issues: Skills and knowledge are refined and applied in the context of environmental issues. These environmental issues are real-life dramas where differing viewpoints about environmental problems and their potential solutions are played out. Environmental literacy includes the abilities to define, learn about, evaluate, and act on environmental issues, and they are valuable goals to include in citizen science curricula.

Guideline 18 – Skills for Analyzing & Investigating Environmental Issues:

Students apply their knowledge of ecological and human processes and systems to identify the consequences of specific environmental issues.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Describe the effects of human actions on specific elements, systems, and processes of the environment.

Analyze issues by looking at trade-offs that have been made. For example, consider where various human activities (such as landfills, highways, chemical factories, or hazardous waste incinerators) are located and their effects on different places and different segments of the population.

Speculate about the effects of a proposed state or local environmental regulation. For example, consider effects on different sectors of the economy, neighborhoods, public health, particular plant and animal species and communities, and overall environmental quality.

Predict the consequences of inaction or failure to resolve particular issues.

Standards Addressed: Geography & Social Studies (EV page 32)

Enduring CRS: 1 & 7; Important CRS: 1, 3 & 8

Guideline 19 – Skills for Analyzing & Investigating Environmental Issues:

Students identify and develop action strategies for addressing particular issue such as environmental stewardship.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Identify different proposals for resolving an environmental issue. Recognize and explain the perspectives on the issue that is embedded in those views.

Explain why various strategies may be effective in different situations. Consider their likely effects on society and the environment.

Independently and in groups, develop original strategies to address issues.

Discern similarities and differences in problem situations which might affect their ability to apply strategies that were successful in other places and times.

Standards Addressed: ELA, History & Social Studies (EV page 33)

Enduring CRS: 1, 3, 5, & 7; Important CRS: 1

Guideline 20 – Decision-Making & Citizenship Skills:

Students begin to see themselves as citizens taking active roles in their communities. They plan for and engage in citizen action at levels appropriate to their maturity and preparation.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Develop action plans they can carry out individually, in small groups, or with a class, club, or larger organization. Include clear reasons and goals for action. Base these plans on knowledge of a range of citizen action strategies and the results of their environmental issue investigations.

Set realistic goals for action and include measures of success consistent with learners’ abilities and an understanding of the complexity of the issue.

Decide whether their plan should be implemented immediately or at another time, changed, or abandoned; and carry through with action when appropriate.

Standards Addressed: Civics & Government & Social Studies (EV page 34)

Enduring CRS: 1, 3 & 7; Important CRS: 1

Important to Know & Do: Stand 3

Guideline 21 – Skills for Analyzing & Investigating Environmental Issues:

Students use primary and secondary sources of information, and apply their growing research and analytical skills to investigate environmental issues, beginning with those in their own community. Primary sources of information are based on first-hand student experiences while secondary sources are gathered from books/literature, community members, teachers, etc.

Example Performance Guidelines:

Clearly articulate and define environmental issues. For example, describe the history and origins of the issue, actions that have been taken to address the issue, the apparent effects of these actions, and the current situation.

Identify key individuals and groups involved, their view points, and the types of action they support. Describe areas of conflict and agreement.

Investigate the issue using secondary sources and original research where needed.

Examine how others have analyzed and understood the issue, identifying their approaches and the assumptions behind them.

Compare the issue with similar issues from other places and times.

Standards Addressed: Geography, History & Social Studies (EV page 35)

Enduring CRS : 1, 3, 4, 5, 6, & 7; Important CRS: 1, 2, 3, 4, 5, & 6

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Guideline 22 – Skills for Analyzing & Investigating Environmental Issues:

Students consider the assumptions and interpretations that influence the conclusions they and others draw about environmental issues.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Explain how the interplay of ideas and perspectives strengthens the process of inquiry and the societal ability to address issues.

Receive questions and alternative explanations that others offer in discussions as well as in readings.

Explain why it is not always possible to select one correct explanation or a single best approach to addressing an issue.

Standards Addressed: Arts, ELA, Geography, Science, & Social Studies (EV page 36)

Enduring CRS: 1 & 2; Important CRS: 1

Guideline 23 – Decision-Making & Citizenship Skills:

Students identify, justify, and clarify their views on environmental issues and alternative ways to address them.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All

Comments:

Example Performance Guidelines:

Discuss personal perspectives with classmates, remaining open to new ideas and information.

Justify their views based on information from a variety of sources, and clear reasoning.

Discuss their own beliefs and values regarding the environment and relate their personal view of environmental issues to these.

Identify ways in which others' views correspond or differ with their own views.

Standards Addressed: Arts, Geography, History & Social Studies (EV page 37)

Enduring CRS: 1, 2 & 3; Important CRS: 1

Guideline 24 – Decision-Making & Citizenship Skills:

Students evaluate whether they believe action is needed in particular situations, and decide whether they should be involved.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All



Comments:

Example Performance Guidelines:

Discuss whether action is warranted. Account for factors such as the scale of the problem; legal, social, economic, and ecological consequences; and alternatives to citizen action.

Identify different forms of action that citizens can take in the economic, political, and legal spheres, as well as actions aimed at directly improving or maintaining some part of the environment or persuading others to take action.

Speculate about the likely effects of specific actions on society and the environment, and the likelihood these actions will resolve a specific environmental issue.

Point out advantages and disadvantages of their personal involvement, considering factors such as their own skills, resources, knowledge, and commitment.

Standards Addressed: Social Studies (EV page 38)

Enduring CRS: 1 & 3; Important CRS: 1

Guideline 25 – Decision-Making & Citizenship Skills:

Students evaluate the effects of their own actions and actions taken by other individuals and groups.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All



Comments:

Example Performance Guidelines:

Analyze the effects of decisions, policies, and actions taken by individuals and groups on a particular issue.

Analyze their own actions, explaining apparent effects and discussing them in light of students' goals and reasons for acting.

Describe some of the reasons why analyzing the results of actions may be difficult, including the scale of the issue, the time required to see effects, and the influence of other actions and factors.

Standards Addressed: History & Social Studies (EV page 39)

Enduring CRS: 1 & 2; Important CRS: 1

Important to Know & Do: Strand 4

Strand 4 – Guidelines for Personal & Civic Responsibility: Environmentally literate citizens are willing and able to act on their own conclusions about what should be done to ensure environmental quality. As learners develop and apply concept-based learning and skills for inquiry, analysis, and action, they also understand that what they do individually and in groups can make a difference. Citizen science curricula should be developed with learners in mind in order to meet the following personal and civic responsibilities.

Guideline 26:

Students identify and describe the rights and responsibilities of citizenship and their importance in promoting the resolution of environmental issues.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All



Comments:

Example Performance Guidelines:

Identify rights and responsibilities associated with citizenship, including personal and civic responsibilities.

Describe ways in which commonly accepted rights and responsibilities of citizenship motivate people to help resolve environmental issues. Consider rights and responsibilities such as acquiring, using and selling property; the right to vote; freedom of speech and assembly; accepting responsibility for the consequences of one's actions; obeying the law; and respecting the rights and interests of others.

Standards Addressed: Civics & Government & Social Studies (EV page 41)

Enduring CRS: 1; Important CRS: 1

Guideline 27:

Students possess a realistic self-confidence in their effectiveness as citizens.

How well is this guideline addressed?

- 1 – Very Well Addressed
- 2 – Partly Addressed
- 3 – Not At All



Comments:

Example Performance Guidelines:

Explain the ways in which citizen action and public opinion influence environmental policy decisions.

Describe how individuals and groups act within society to create change, meet individual needs and promote the common good. Illustrate with examples from environmental issues.

Describe ways in which their actions have made a difference. Use examples that begin in the classroom and the home, and extend beyond to encompass the broader communities in which students begin to see possibilities for action.

Standards Addressed: Civics & Government & Social Studies (EV page 42)

Enduring CRS: 1 & 3; Important CRS: 1

Guideline 28:

Students understand that their actions can have broad consequences and that they are responsible for those consequences.

How well is this guideline addressed?

1 – Very Well Addressed

2 – Partly Addressed

3 – Not At All



Comments:

Example Performance Guidelines:

Analyze some of the effects that their actions (and the actions of their families, social groups, and communities) have on the environment, other humans, and other living beings.

Describe actions in terms of their effects that reach into the future.

Describe their personal responsibilities, comparing their view of their responsibilities with commonly accepted societal views.

Identify ways in which they feel responsible for helping resolve environmental issues within their community.

Standards Addressed: Civics & Government (EV page 43)

Enduring CRS: 1, 2, & 3; Important CRS: 1