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Learner Guidelines for Programs and Materials

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USDA Forest Service Conservation Education

Learner Guidelines for Programs and Materials

> The ultimate measure of success for Forest Service conservation education is an informed and engaged citizenry able to participate effectively in the actions and decisions needed to sustain the values of our natural and cultural resources for present and future generations.

Introduction

The U.S. Department of Agriculture (USDA) Forest Service brings unique strengths to the field of conservation education. The Forest Service is a leader in providing scientific knowledge and outstanding opportunities for place-based learning on more than 192 million acres of forests and grasslands within the National Forest System (NFS). Through more than 700 offices and 30,000 employees, as well as through partners such as State foresters, the agency provides an extensive delivery network for conservation education.

The Forest Service and its partners have offered an impressive number of conservation education programs. While many of these programs, curricula, and activities are grounded in science and incorporate educational expertise, no recognized national standards have existed to ensure that Forest Service conservation education programs are appropriate for the intended audiences, meet an accepted level of educational standards, and present information and themes relevant to the goals of the Forest Service.

The Forest Service conservation education program focuses on developing and delivering education around natural and cultural resources and processes. The program is accomplished through five activities: developing and providing educational material, delivering conservation education, conducting education research, providing natural resource and conservation education training, and building and using partnerships. These activities are supported by the following learner guidelines, which will serve as a tool for achieving success in conservation education.

The groundwork for success has been laid by conservation education efforts at the national level. The fiscal year 2000 report on conservation education in the Forest Service states the following:

For the Forest Service to meet its mission of "caring for the land and serving people," the public must have the knowledge to understand natural resource issues and the skills to participate meaningfully in the debates that surround them. For this reason, conservation education helps people develop the critical thinking skills and the knowledge they need to understand the complexities of ecological issues. In addition to encouraging people to take personal responsibility for their relationship with the environment, conservation education also encourages people to participate with the Forest Service and other natural resource management entities to sustain our Nation's natural and cultural resources. A guiding principle of conservation education in the Forest Service is to teach people how to think, not what to think, about the natural and cultural environment.

Purpose

The following learner guidelines are intended for use as a tool in the designing and presentation of Forest Service conservation education activities, programs, and products. Incorporating the guidelines into conservation education programs will increase the quality and effectiveness of conservation education efforts.

The Forest Service has adapted guidelines established by the North American Association for Environmental Education (NAAEE). The purpose of Excellence in Environmental Education: *Guidelines for Learning K-12*[1] developed by NAAEE is to support State and local environmental education efforts by doing the following:[1]

- Setting expectations for performance and achievement in 4th, 8th, and 12th, grades;
- Suggesting a framework for effective and comprehensive environmental education programs and;
- Defining the aims of environmental education.

The NAAEE guidelines were slightly modified to reflect Forest Service responsibilities, including education regarding cultural and natural resources and reference to direct interaction with the land.

Audience

These learner guidelines are intended for use primarily by Forest Service employees.

Basic Objectives

Building upon an individual's awareness, knowledge, values, and attitudes, Forest Service conservation education programs foster understanding, appreciation, and appropriate behaviors concerning natural and cultural resources. The following is a list of objectives[2], within the scope and perspective of Forest Service conservation education necessary for developing an environmentally literate and culturally sensitive citizenry.

Awareness and Knowledge *Conservation education should provide the knowledge necessary for interpreting the complex phenomena that shape the environment.*	Basic concepts addressed by Forest Service conservation education: • The Earth comprises renewable and non-renewable natural resources. • Natural resources are living and nonliving, both of which are necessary for life. • Resources are affected by change in cultural, political, and natural climates. • All components of the environment function as a dynamic interdependent and interrelated system. • The environment has many interacting components, including cultural, ecological, economic, moral, political, social, spiritual, and technological. • The environment is the basis of our physical lives and economy and affects our emotional well-being. • Informed resource management encourages a sustainable environment and economy. • Numerous conservation practices and alternatives are available for consideration in resource management. • Human health is linked to the quality of the environment. • The ability of the earth to support life as we know it has certain limitations. • The natural environment and historic sites can serve as places for regeneration of the human spirit.
Skills *Conservation education should provide opportunities to gain skills necessary for informed decisions and behavior.*	Basic skills promoted by Forest Service conservation education include the ability to do the following: • Analyze, synthesize, and evaluate environmental issues. • Use problem solving and decisionmaking skills relating to environmental issues and resource use. • Use creative and critical thinking skills to make conscious personal choices regarding natural resources. • Use minimum impact skills while interacting with the environment.
Values and Attitudes *Conservation education should encourage those ethical, economic, and aesthetic values and attitudes that, constituting the basis of individual behavior, will further the sustainability of the environment.*	Basic values and attitudes encouraged by Forest Service conservation education include the following: • We are responsible for the stewardship and conservation of natural and cultural resources. • Environmental issues transcend cultural, social, economic, and political boundaries. • Environmental issues have a moral and spiritual dimension. • Learning about the environment and our history is a lifelong process. • Humans have an important responsibility for maintaining the planet's biological diversity and cultural history. • Respect for and informed management of all resources, including human populations, energy, air, land, and water, will benefit future generations and contribute to our quality of life. • Cultural and environmental knowledge can help enhance quality of life, now and into the future.

	• Current and future value are derived from preserving biological, historical, and cultural diversity. • Values toward, and attitudes about, natural and cultural resources vary and are enriched by diversity of lifestyles and livelihoods.
Behavior *Conservation education should also eventually result in signs of changes in behavior, which benefit the resources and are evidenced through changes in resource management practices.*	<u>Forest Service conservation education encourages behaviors that do the following:</u> • Consider long- and short-term economic costs and benefits of personal actions on environmental quality. • Differentiate between supportive and destructive actions toward natural and cultural resources. • Evaluate the effect of personal activities and social policies on natural and cultural resources. • Take positive action to resolve and prevent negative impacts on the environment. • Develop a lifestyle that promotes environmental sustainability, human health, and sensitivity to cultural issues. • Consider and respect the diversity of cultures and their effects on, and contributions to, resolving conservation issues. • Commit to maintaining natural functions and cycles within ecosystems and commit to ensuring biological diversity.

Comparison of Grade Levels

The Forest Service supports NAAEE's emphasis on the importance of understanding the local environment, as indicated in the following:

Experiencing and observing the local environment is an essential part of environmental education. Understanding their surroundings helps learners build a strong foundation of skills and knowledge for reaching out further into the world and deeper into the conceptual understanding that environmental literacy demands. Direct experience in the environment also helps foster the awareness and appreciation that motivate learners to further questioning, better understanding, and appropriate concern and action.[3]

The following chart suggests ways in which learners at different grade levels might explore and understand the local environment.

Grades K–4	Grades 5–8	Grades 9–12 and adult
Identify basic types of habitats (e.g., forests, wetlands, or lakes). Create a short list of plants and animals found in each.	Classify local ecosystems (e.g., oak-hickory forest or sedge meadow). Create food webs to show or describe their function in terms of the interaction of specific plant and animal species.	Identify several plants and animals common to local ecosystems. Describe concepts such as succession, competition, predator/prey relationships, and parasitism.
Trace the source of their drinking water and where it goes after it is used.	Describe how drinking water and wastewater are treated.	Evaluate sources of nonpoint source pollution of local bodies of water, including sources that are not local.
Describe aspects of the environment that change on a daily, weekly, monthly, and yearly basis.	Monitor changes in water or air quality, or other aspects of the local environment.	Investigate short- and long-term environmental changes in a local watershed, and aquifer, or in air quality. Alternatively, document changes in land use and their environmental effects.

Materials and Program General Guidelines

The following guidelines are recommendations that can be used for developing new programs and evaluating existing programs. They provide one tool for assessing the quality of programs or materials and a method for determining the appropriate age levels for a given message. The following pages and the list below are copied in whole or part from the NAAEE learner guidelines and letter/number references are from those guidelines.

Conservation Education and Interpretation Materials should do the following:[4]

- Be fair and accurate in describing problems, issues, and conditions. In addition, the material should reflect many perspectives of an issue.
- Foster awareness of the natural and built or developed environments and an understanding of concepts, conditions, and issues as appropriate for different developmental levels.
- Increase awareness of the Forest Service and the roles the Forest Service plays in land management.
- Promote civic responsibility, encouraging learners to use their knowledge and personal skills as a basis for problem solving and action.
- Offer exciting and challenging interdisciplinary, interactive programs, which are designed to develop critical and creative thinking skills.
- Offer programs that attempt to guide learners through a process that begins with awareness, moves them toward knowledge, enables them to challenge preconceived ideas, and motivates them to seek constructive avenues for action. The process should use a constructive approach, which is learner driven, where teachers and resource professionals act in concert as facilitators.
- Finally, all school materials should be correlated to the national and/or State core curricula standards to assure appropriateness for the grade level and serve as a complement to learning in the formal education setting.

Users Guide

The Forest Service *Learner Guidelines for Programs and Materials* is one tool for you to use to develop new conservation education programs, activities, or products (programs) or to evaluate existing ones. This users guide will show you how to use the *Learner Guidelines* with the aide of program outline forms. If you are using the guidelines to evaluate an existing program, the forms provide a means for tracking which guidelines are covered. If you are developing a new program, the forms help you identify which guidelines you want to use and then serve as a checklist to ensure that you include them.

If you are developing a program, list only as many guidelines as you will be able to cover in the time available. Also consider how well the program you develop teaches the guidelines that you list on the program outline form.

For the most effective use of the *Learner Guidelines*, follow the three steps below to complete the appropriate program outline form on the following pages.

I. General Parameters

If creating a new program—
- Determine the target audience and use the appropriate form (K–4th, 5th-8th, high school+).
- Complete the top block including title, primary topics you will include in your program, the duration of the program (example 45 minutes), and the setting (indoors or outdoors).

If evaluating an existing program—
- Determine the target audience and use the appropriate form (K-4th, 5th-8th, high school+).
- Complete the top block, including title, primary topics covered, duration of the program, and the setting (indoors or outdoors).

II. Guidelines Included in Program

A. In the *Learner Guidelines,* find the guidelines for your target audience:
- Kindergarten–4th grade pages 14-23
- 5th–8th grades pages 24-36
- High school and beyond pages 37-51

Note: The guidelines for each target audience contain the same four major Strands (Strand 1. Questioning and Analysis Skills, Strand 2. Knowledge of Environmental Processes and Systems, Strand 3. Skills for Understanding and Addressing Environmental Issues, and Strand 4. Personal and Civic Responsibility).

B. Use the program outline form to list the guidelines you want to include or need in your program, or, if evaluating a program, list the guidelines you observe being used in the program.

C. Go through Strands 1 through 4 of the *Learner Guidelines* for the target audience and circle on the form those guidelines that are or will be included in your program, or that you observe within the program you are evaluating. Use the blank spaces for notes or reminders.
- If developing a program, circle only those guidelines you can reasonably and effectively accomplish within the parameters you listed for your program.
- When developing or evaluating a program, consider what the program is attempting to teach, the effectiveness of the program, and how well it teaches the guidelines identified on the program outline form.

III. Using the Completed Program Outline Form

If creating a new program—

- Use the completed program outline form as a guide to help you develop your program.
- Consider how you are addressing the learner guidelines you circled on the form and if your students are gaining the knowledge and experience you intended.

If evaluating an existing program—

- Use the completed program outline form to determine if the stated objectives of the program were met.
- Consider how well the program addressed the identified guidelines and, if available, how well students learned the program objectives.
- While the actual effectiveness of your program is best determined through a formal evaluation, informal use of these guidelines is a first step.

Kindergarten Through Fourth Grade
Program Outline Form

Title: _____
Primary topic(s): _____
Length of program: _____ Setting: *indoors* or *outdoors*

Strand 1. Questioning and Analysis Skills

A. 1	C. 1	E. 1
2	2	2
3	3	3
B. 1	4	4
2	5	F. 1
3	D. 1	2
	2	G. 1
		2
		3

Strand 2. Knowledge of Environmental Processes and Systems

2.1 The Earth as a Physical System	D. 1	2.4 Environment and Society
A. 1	2	A. 1
2	3	2
3	2.3 Humans and Their Societies	3
4	A. 1	B. 1
B. 1	B. 1	2
2.2 The Living Environment	2	3
A. 1	C. 1	C. 1
2	D. 1	2
3	2	3
4	3	4
B. 1	4	5
C. 1	E. 1	D. 1
2	2	2
3	3	3
		E. 1
		2

Strand 3. Skills for Understanding and Addressing Environmental Issues

3.1 Skills for Analyzing Issues		3.2 Decisionmaking and Citizenship Skills
A. 1	C. 1	A. 1
2	2	2
3	3	3
4	4	4
B. 1	D. 1	D. 1
2	2	2

Strand 4. Personal and Civic Responsibility

A. 1	B. 1	D. 1
2	2	2
3	C. 1	

Fifth through Eighth Grades
Program Outline Form

Title: _____
Primary topic(s): _____
Length of program: _____ Setting: *indoors* or *outdoors*

Strand 1. Questioning and Analysis Skills

A. 1	C. 1	E. 1
2	2	2
3	3	3
4	D. 1	F. 1
B. 1	2	2
2	3	3
3	4	G. 1
4	5	2
		3
		4

Strand 2. Knowledge of Environmental Processes and Systems

2.1 The Earth as a Physical System	C. 1	E. 1
A. 1	2	2
2	3	3
3	4	4
B. 1	D. 1	2.4 Environment and Society
2	2	A. 1
C. 1	3	2
2	2.3 Humans and Their Societies	3
2.2 The Living Environment	A. 1	B. 1
A. 1	B. 1	2
2	2	3
3	C. 1	C. 1
4	2	2
B. 1	3	3
2	D. 1	4
3	2	D. 1
4	3	2
		E. 1
		2

Strand 3. Skills for Understanding and Addressing Environmental Issues

3.1 Skills for Analyzing Issues	C. 1	3.2 Decisionmaking & Citizen Skills
A. 1	2	A. 1
2	3	2
3	4	3
B. 1	D. 1	4
2	2	B. 1
3	3	C. 1
		D. 1
		2
		3

Strand 4. Personal and Civic Responsibility

A) 1	C. 1	D. 1
2	2	2
3	3	3
		4

High School and Beyond
Program Outline Form

Title: _____
Primary topic(s): _____
Length of program: _____ Setting: *indoors* or *outdoors*

Strand 1. Questioning and Analysis Skills

A. 1	3	3
2	4	F. 1
3	5	2
B. 1	D. 1	3
2	2	G. 1
3	3	2
C. 1	E. 1	3
2	2	4

Strand 2. Knowledge of Environmental Processes and Systems

2.1 The Earth as a Physical System	4	2.4 Environment and Society
A. 1	5	A. 1
2	D. 1	2
3	2	3
4	3	4
B. 1	2.3 Humans and Their Societies	5
2	A. 1	B. 1
C. 1	B. 1	2
2.2 The Living Environment	2	3
A. 1	3	4
2	C. 1	C. 1
3	2	2
4	3	3
B. 1	D. 1	4
2	2	D. 1
3	3	E. 1
C. 1	E. 1	2
2	2	
3	3	

Strand 3. Skills for Understanding and Addressing Environmental Issues

3.1 Skills for Analyzing Issues	4	3.2 Decisionmaking & Citizen. Skills
A. 1	C. 1	A. 1
2	2	2
3	3	3
4	4	4
5	D. 1	B. 1
B. 1	2	C. 1
2		D. 1
3		2
		3

Strand 4. Personal and Civic Responsibility

A. 1	3	D. 1
2	4	2
3	C. 1	3
B. 1	2	4
2		

Footnotes

[1] North American Association for Environmental Education (NAAEE), *Excellence in Environmental Education: Guidelines for Learning K-12*. (Rock Spring, GA: NAAEE, 1999.) This document served as a foundation for the USDA Forest Service *Learner Guidelines for Programs and Materials*.

[2] Gallagher, F., "Environmental Education in New Jersey: A Plan of Action." Unpublished document, 1993. The foundation of this document was the UN Educational, Scientific and Cultural Organization (UNESCO) meetings on environmental education at T'bilisi (1977) and Belgrade (1976). The general structure for the basic objectives in the Forest Service *Learner Guidelines* was compiled from references listed below and individual objectives modified from the Gallagher document.

[3] NAAEE, *Excellence in Environmental Education: Guidelines for Learning K-12*. (Rock Spring, GA: NAAEE, 1999.) A foundation for the USDA Forest Service *Learner Guidelines for Programs and Materials*.

[4] NAAEE*, Environmental Education Materials: Guidelines for Excellence*. (Rock Spring, GA, NAAEE, 1999.) Gallagher was also referenced.

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Wisconsin Center for Environmental Education "Environmental Literacy Framework." Unpublished paper. University of Wisconsin—1992)

Hungerford, H.R., T. Volk, R. Wilke, R. Champeau, T. Marcinkowski, T. May, W. Bluhm, and R. McKeown-Ice, "Environmental Literacy Framework," Unpublished paper. (Carbondale, IL: Environmental Education Literacy Consortium, Southern Illinois University, 1994)

Iozzi, L., D. Laveault, and T. Marcinkowski, *Assessment of Learning Outcomes in Environmental Education*. (Paris: UNESCO, 1990)

Roth, C., *Environmental Literacy: Its Roots, Evolution and Directions in the 1990s.* (Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education, 1992)

Learner Guidelines for Kindergarten Through Fourth Grade

Things to keep in mind for K-4th grade programs….

- Learners should be able to meet the guidelines included in this section by the end of the fourth grade.
- The kindergarten through fourth grade years are a time of tremendous cognitive development. By third and fourth grades, learners have developed some basic skills that help them construct knowledge. Instructors addressing earlier grade levels should use these fourth grade guidelines as a target, extrapolating from this end goal appropriate activities and lessons for younger learners.
- In these early years of formal education, learners tend to be concrete thinkers with a natural curiosity about the world around them. Environmental education can build on these characteristics by focusing on observation and exploration of the environment—beginning close to home.
- Basic guidelines for examining environmental issues with kindergarten through fourth graders are: 1) keep it simple; 2) keep it local; 3) make close links with what they're observing and learning about the local environment.

Strand 1 Questioning and Analysis Skills

A. Questioning

Learners are able to develop questions that help them learn about natural and cultural environments and do simple investigations.

1. Generate ideas and questions about objects, organisms, events, places, and relationships within the environment.
2. Identify questions they are likely to be able to answer by combining their own observations and investigations of the environment with existing information.
3. Pose questions based on experiences in their own community and local environment as well as from media presentations about environmental phenomena and other places.

B. Designing investigations

Learners are able to design simple investigations.

1. Speculate about the possible answers to their own questions, developing and discussing simple alternative answers (hypotheses).
2. Design ways of answering questions based on systematic observations.
3. Design simple experiments to answer questions and test ideas they have about the environment.

C. Collecting information

Learners are able to locate and collect information about the environment and environmental topics.

1. Observe and record characteristics, differences, and changes in objects, organisms, events, places, and relationships in the environment.
2. Find, assess, select, and use resources such as atlases, databases, charts, tables, graphs, and maps.
3. Use basic field skills, such as interviewing and measuring, to collect information.
4. Use tools such as rulers, thermometers, watches, scales, magnifiers, and microscopes to make observations and measurements.
5. Use computers and calculators to conduct investigations and manipulate information.

D. Evaluating accuracy and reliability

Learners understand the need to use reliable information to answer their questions. They are familiar with some basic factors to consider in judging the merits of information.

1. Provide specific examples of information they believe to be factual, fictitious, or of questionable merit and explain their reasoning.
2. Identify some of the factors that might influence the credibility of a specific source of information; for example, who created it, how old it is, and what kinds of arguments or evidence are used.

E. Organizing information

Learners are able to describe data and organize information to search for relationships and patterns concerning cultural and natural resources.

1. Summarize observations and describe data.
2. Construct, read, and interpret maps, graphs, tables, diagrams, and other primary sources of data, such as diaries, letters, and documents.
3. Identify regularities in events, designs, organisms, and sets of numbers.
4. Describe mathematical relationships and use those relationships as a way of organizing data.

F. Working with models and simulations

Learners understand that relationships, patterns, and processes can be represented by models.

1. Interpret information and situations by noting associations and similarities, and recognizing patterns, trends, relationships and sequences.
2. Use a number of types of models such as geometric figures, graphs, and maps to summarize observations of the environment.

G. Developing explanations

Learners can develop simple explanations that address their questions about the environment.

1. Summarize information, compare findings, and use simple mathematics to analyze data.
2. Identify information that is not relevant to a proposed explanation and explain their reasoning.
3. Use models and examples to explain their thinking.

Strand 2 Knowledge of Environmental Processes and Systems

2.1 The Earth as a Physical System

A. Processes that shape the Earth

Learners are able to identify changes and differences in the physical environment.

1. Identify some of the forces that cause erosion and other changes within their own region, pointing out factors such as freezing and thawing, wind, soil-building processes, and gravity.
2. Identify some distinctive landforms within their region and, using maps and images, in other areas of the world.
3. Differentiate among climates, considering factors such as precipitation, temperature, and resident plants and animals.
4. Observe and record seasonal differences.

B. Changes in matter

Learners are able to identify basic characteristics of and changes in matter.

1. Describe the basic elements of the hydrologic cycle and geologic processes, including erosion, transportation, and deposition. Locate examples of these in the local environment.

2.2 The Living Environment

A. Organisms, populations, and communities

Learners understand basic similarities and differences among a wide variety of living organisms.

1. They understand the concept of habitat.
2. Identify similarities and differences among living organisms ranging from single-celled organisms that they can observe under microscopes to plants and animals that they encounter through direct observation, videos, books, or other media.
3. Classify or group organisms using categories such as how animals bear their young, anatomical features, or habitats.
4. Describe the basic needs of all organisms and explain how organisms meet their needs in different types of environment such as deserts, lakes, or forests.

B. Heredity and evolution

Learners understand that plants and animals have different characteristics and that many of the characteristics are inherited.

1. Identify some basic traits of plants and animals. Give examples of how those traits may vary among individuals of the same species.

C. Systems and connections

Learners understand the basic ways in which organisms are related to their environments and to other organisms.

1. Describe ways in which an organism's behavioral patterns are related to its environment. Identify examples of environment change and discuss how these changes may be helpful or harmful to particular organisms.
2. Identify ways in which organisms (including humans) cause changes in their own environments. Discuss how these changes may help or harm both the organisms that caused the change and other organisms.
3. Identify ways in which organisms interact with each other. For example, some animals eat plants, some fish depend on other fish to keep them free of parasites, and earthworms keep soil loose and fertile.

D. Flow of matter and energy

Learners know that living things need some source of energy to live and grow.

1. Explain how most living organisms depend on the sun as the source of their life energy. Give examples that illustrate the understanding that animals ultimately depend on plants for this energy and that plants depend on the sun. Use this idea to trace the energy in the food they eat for lunch back to the sun.

2. Describe how matter can be recycled, sometimes in a changed form from the original material. Use examples from their own experience, such as recycling bottles and newspapers.
3. Explain the process of life, growth, death, and decay of living organisms as a form of recycling. For example, use a log on a forest floor as an example of natural recycling of organic materials.

2.3 Humans and Their Societies

A. Individuals and groups

Learners understand that people act as individuals and as group members and that groups can influence individual actions.

1. Give examples of influences on individual behavior, particularly behavior that affects natural and cultural resources.

B. Culture

Learners understand that people with different cultural backgrounds may interpret experiences and places differently, at different times, or with other frames of reference.

1. Describe a favorite place or their own community from a variety of perspectives, including their own.
2. Compare how people live in different regions and how different cultures meet basic human needs.

C. Political and economic systems

Learners understand that government and economic systems exist because people living together in groups need ways to do things such as provide for needs and wants, maintain order, and manage conflict.

1. Discuss what might happen if no laws existed to protect the environment in their area. Consider possible positive and negative effects on plants and animals, specific natural areas, landowners, specific businesses, water users, and others.

D. Global connections

1. Learners understand how people are connected at many levels by actions and common responsibilities that concern the environment.
2. Identify ways in which individual needs and wants are related to environmental concerns such as energy use and environmental protection.
3. Describe how trade connects people around the world and enables them to have things they might not be able or willing to produce themselves.
4. Identify possible environmental concerns that might come up in other regions or countries as a result of producing or shipping products that learners use regularly.

E. Change and conflict

Learners recognize that change is a normal part of individual and social life. They understand that conflict is rooted in different perceptions and how actions affect different individuals and groups.

1. Identify aspects of family and community life that have remained constant over generations, as well as aspects that have changed.
2. Give examples of rules related to the environment at home, in school, or elsewhere that have changed and others that have stayed the same.
3. Identify some basic ways in which individuals, groups, and institutions, such as schools, resolve conflict concerning the environment.

2.4 Environment and Society

A. Human/environment interactions

Learners understand that people depend on, change, and are affected by the environment and society.

1. Identify ways in which people depend on the environment; for example, for food, water, air, recreation, minerals, and other resources.
2. Identify ways in which human actions change the environment. For example, list changes within the community such as building houses or stores with parking lots, farming, or damming rivers.
3. Describe how the environment affects human activities in their community, or region.

B. Places

Learners understand that places differ in their physical and human characteristics.

1. Identify and describe places in their region that they or others think are important.
2. Discuss how humans create places that reflect their ideas, needs, and wants, as well as the physical environment. Illustrate with examples of places within their experience such as playgrounds, parks, classrooms, and homes.
3. Compare their neighborhood or town with another nearby place, or compare their favorite park with another park they know.

C. Resources

Learners understand the basic concepts of resources and resource distribution.

1. Explain what natural and cultural resources are and give examples.
2. Distinguish among resources that are renewable and nonrenewable, and resources such as running water or wind that are available only in certain places at certain times.
3. Identify ways they use resources in their daily lives.
4. Locate sources of various resources on a map.
5. Link patterns of human settlement and other activities with the presence of specific resources such as mineral deposits, rivers, or fertile farming areas.

D. Technology

Learners understand that technology is an integral part of human existence and culture.

1. Describe technologies as tools and ways of doing things that humans have invented.
2. Identify drawbacks and benefits of specific technologies. Consider the fact that technologies can benefit some humans and other organisms while harming others.
3. Identify important technological systems such as agriculture, transportation, and manufacturing.

E. Environmental issues

Learners are familiar with some local environmental issues and understand that people in other places experience environmental issues as well.

1. Discuss some local environmental issues by identifying some changes or proposals that people disagree about.
2. Discuss how people in other places with similar conditions might react or perceive the situation in similar ways.

Strand 3 Skills for Understanding and Addressing Environmental Issues

3.1 Skills for Analyzing and Investigating Environmental Issues

A. Identifying and investigating issues

Learners are able to identify and investigate issues in their local environments and communities.

1. Identify and describe a current or historical environmental issue in their community.
2. Apply ideas of past, present, and future to local environmental issues. For example, describe what has changed, is changing, and is expected to change or how long the issues have existed.
3. Identify people and groups of people who are involved.
4. Identify some of the decisions and actions related to the issue.

B. Sorting out the consequences of issues

As learners come to understand that environmental and social phenomena are linked, they are able to explore the consequences of issues.

1. Observe and speculate about social, economic, and environmental effects of changes, conditions, and proposed solutions to issues. For example, describe short-term and long-term effects of existing uses of land or another resource in the home, community, and region.
2. Discuss how an environmental issue affects different individuals and groups.

C. Identifying and evaluating alternative solutions and courses of action

Learners understand there are many approaches to resolving issues.

1. Identify proposed solutions to an issue and discuss arguments for and against them.
2. Explain why various strategies may be effective in different situations and how each proposed strategy is likely to have a different effect on society and the environment.

3. Describe some of the different levels at which actions can be taken; for example, by individuals, families, school classes, different levels of government, or businesses. Identify ways that these groups might take action on a specific issue.
4. Propose alternative approaches to problems.

D. Working with flexibility, creativity, and openness
Learners understand the importance of sharing ideas and hearing other points of view.
1. Hear and respect different perspectives and communicate with people whose lives, cultures, and viewpoints are different from their own.
2. Identify ideas and interpretations that differ from theirs. Ask questions about different perspectives and discuss their strong points and drawbacks.

3.2 Decisionmaking and Citizenship Skills

A. Forming and evaluating personal views
Learners are able to examine and express their own views on environmental issues.
1. Identify and express their own ideas about environmental issues and alternatives to address them.
2. Test their views against what they know and believe, remaining open to new information and ideas.
3. Identify unanswered questions.
4. Identify, clarify, and express their own beliefs and values regarding the environment.

D. Evaluating the results of actions
Learners understand that civic actions have consequences.
1. Describe the apparent effects of their own actions and actions taken by other individuals and groups.
2. Discuss some of the reasons why identifying the effects of actions may be difficult. Consider, for example, the time required to see effects, the influences of others' actions, and other changes in the situation.

(Note: NAAEE Guidelines 3.2 B&C are not included in this Forest Service adaptation.)

Strand 4
Personal and Civic Responsibility

A. Understanding societal values and principles

Learners can identify fundamental principles of U.S. society and explain their importance in the context of environmental issues.

1. Identify examples of beliefs that many U.S. citizens hold in common, such as the importance of individual property rights, the right to pursue happiness, the public or common good, and the well-being of future generations.
2. Discuss how their own beliefs about the environment, natural and cultural resource issues, and society compare to these general, societal beliefs.
3. Recognize tensions that occur when basic values and beliefs differ. Illustrate with examples from local resource issues.

B. Recognizing citizens' rights and responsibilities

Learners understand the basic rights and responsibilities of citizenship.

1. Identify examples of the personal, political, and economic rights of U.S. citizens.
2. Discuss rights and responsibilities in the context of local environmental issues.

C. Recognizing efficacy

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

1. Identify ways in which they have made a difference through their own actions. Give examples from situations over which learners have some control (for example, in the classroom, at home, or in the community) and that are appropriate to their level of understanding.

D. Accepting personal responsibility

Learners understand that they have responsibility for the effects of their actions.

1. Identify and describe some of the effects that they and the groups they belong to (for example, family or school class) have on the environment and culture.
2. Discuss the notion of responsibility and identify some of their personal responsibilities.

Learner Guidelines for Fifth Through Eighth Grades

Things to keep in mind for fifth through eighth grade programs….

- Learners should be able to meet the guidelines included in this section by the end of eighth grade.
- In the fifth through eighth grades, learners develop greater skills in abstract and creative thinking—and along with these, the ability to understand the interplay of environmental and human systems in greater depth. Environmental education can foster this development by focusing on investigation of local environmental systems, problems, and issues. As learners become actively engaged in deciding for themselves what is right and wrong, educators can use environmental problems to help learners explore their own responsibilities and ethics.

Strand 1 Questioning and Analysis Skills

A. Questioning

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

1. Identify environmental questions based on personal experiences in and outside school, newspaper and magazine articles, television or radio news, or videos.
2. Summarize an environmental problem or situation to provide context for a particular question, or explain the origin of that question.
3. Pose clear questions and ideas to test hypotheses, reformulating them when necessary.
4. Clarify their own beliefs about the environment and discuss how those beliefs are reflected in the questions they ask.

B. Designing investigations

Learners are able to design environmental investigations to answer particular questions—often their own questions.

1. Select types of inquiry appropriate to their questions.
2. Define the scope of their inquiry, identifying the main variables and phenomena to be studied.
3. Select appropriate systems of measurement and observation.
4. Select tools that are appropriate for their investigations, based on the question asked and the type of information sought.

C. Collecting information

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

1. Observe systematically, measure accurately, and keep thorough and accurate records, which may include written notes and data tables, sketches, and photographs.
2. Understand and use various systems of measurement and derived measurements such as rates.
3. Assess, choose, and synthesize materials from resources such as aerial photographs, satellite images, and geographical information systems; library and museum collections, historical documents, and eyewitness accounts; computerized databases and spreadsheets; and government records.

D. Evaluating accuracy and reliability

Learners are able to judge the weaknesses and strengths of the information they are using.

1. Identify and evaluate vague claims they hear on television or through other media. For example, examine the credibility of results of public opinion polling about environmental topics, considering such factors as sampling methods, logical conclusions, and appropriate analogies.
2. 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 resulting from omission, suppression, or invention of factual information.
3. Examine evidence, identify faulty reasoning, and apply other basic logic and reasoning skills in evaluating information sources.
4. Identify gaps in information that indicate a need for further discovery or inquiry.
5. Evaluate data and evidence for accuracy, relevance, significance, appropriateness, and clarity.

E. Organizing information

Learners are able to classify and order data, and to organize and display information in ways that help analysis and interpretation.

1. Present environmental data in a variety of formats, including charts, tables, plots, graphs, maps, and flowcharts.
2. 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.

3. Present environmental data in ways that demonstrate possible relationships between sets of information such as population census counts of certain bird species and the prevalence of certain tree species or habitat types.

F. Working with models and simulations

Learners understand many of the uses and limitations of models.

1. Describe how models are used to think about long-term processes such as population growth or processes that are difficult to see such as bird migration.
2. Use models to represent and investigate the physical world, and to manipulate mathematical and physical models using a computer.
3. Evaluate models based on the question being investigated, accounting for variables such as the complexity of the model, its scale, its ability to represent important features of the process being modeled, and its reliability and accuracy.

G. Developing explanations

Learners are able to synthesize their observations and findings into coherent explanations.

1. Distinguish between description and explanation and give examples of each based on their own environmental investigations.
2. Consider the relationships between two variables, or among three or more variables.
3. 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.
4. Use their proposed explanations to form new questions and suggest new avenues of inquiry.

Strand 2
Knowledge of Environmental Processes and Systems

2.1
The Earth as a Physical System

A. Processes that shape the Earth

Learners have a basic understanding of most of the physical processes that shape the Earth. They are able to explore the origin of differences in the physical patterns.

1. Analyze physical patterns such as climate, areas of geothermal activity, soil types, and arid regions, suggesting reasons for these patterns. Explain 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.
2. Predict the consequences of specific physical phenomena such as a hurricane in a coastal area or heavy grazing in an arid region.
3. Relate physical processes and patterns such as climate, weather phenomena, and seasonal change to the Earth/Sun relationship.

B. Changes in matter

Learners understand the properties of the substances that make up objects or materials found in the environment.

1. Describe a variety of chemical reactions and offer examples from daily life and the local environment.
2. Explain an object's characteristics based on its composition and how it was formed. For example, describe the characteristics of different types of rock and account for these characteristics based on their constituent parts and the processes by which they were formed.

C. Energy

Learners begin to grasp formal concepts related to energy by focusing on energy transfer and transformations. They are able to make connections among phenomena such as light, heat, magnetism, electricity, and the motion of objects.

1. Trace the flow of energy in examples that encompass several different transfers and transformations of energy.

2. Explain how the process of life is based on the conversion, use, storage, and transfer of energy. For example, create a visual display that shows how plants or animals use energy, where that energy comes from, and where it goes.

2.2 The Living Environment

A. Organisms, populations, and communities

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

1. Define and give examples to illustrate the concepts of species, populations, communities, and ecosystems. Trace and give examples of connections among organisms at those levels of organization.
2. Link features of internal and external anatomy with the ability of organisms to make or find food and reproduce in particular environments.
3. Understand that some animals and plants have adapted to extreme environmental conditions. Give examples of adaptations that are behavioral, such as the migration of Canada geese and other birds, and others that are physical such as the ability of desert animals and plants to exist on minimal amounts of water.
4. 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 frequently (such as a hummingbird). Predict the habitat needs of these different types of organisms.

B. Heredity and evolution

Learners have a basic understanding of the importance of genetic heritage.

1. Describe some ways in which variation among individuals of the same species can sometimes give certain individuals an advantage within a specific environment.
2. 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.
3. Define extinction, cite evidence of extinction, and identify some of its causes. Define rare, threatened, and endangered species and identify some of the causes, as well as current actions being taken to stabilize or otherwise affect populations.
4. Discuss the possible implications of permanent loss of a species and its social, behavioral, and genetic heritage.

C. Systems and connections

Learners understand major kinds of interactions among organisms or populations of organisms.

1. Describe and give examples of producer/consumer, predator/prey, and parasite/host relationships.
2. 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.
3. Describe relationships among organisms that are characterized by competition for limited resources or by mutual benefit to the organisms.
4. Summarize how abiotic and biotic components in combination influence the structure of an ecosystem. For example, create a regional map that shows average temperature and rainfall correlated with forest, grassland, or desert ecosystems.

D. Flow of matter and energy

Learners understand how energy and matter flow among the abiotic and biotic components of the environment.

1. Trace the flow of energy through food webs that identify relationships among organisms in natural systems.
2. Explain how matter is transferred among organisms and between organisms and their environment in these food webs.
3. Describe how energy, which enters ecosystems as sunlight, changes form and is transferred in the exchanges (production, consumption, and decomposition) that compose food webs.

2.3 Humans and Their Societies

A. Individuals and groups

Learners understand that how individuals perceive the environment is influenced in part by individual traits and group membership or affiliation.

1. Identify and critique instances of stereotyping based on group affiliation. For example, discuss how people who are all identified as "environmentalists" may have very different perspectives from one another.

B. Culture

As they become familiar with a wider range of cultures and subcultures, learners gain an understanding of cultural perspectives on the environment and how the environment may, in turn, influence culture.

1. Explain how the environment is perceived differently by various cultures, and how these perspectives may influence individuals' perceptions of the environment.
2. Explain how new technologies can change cultural perceptions and social behavior.

C. Political and economic systems

Learners become more familiar with political and economic systems and how these systems take the environment into consideration.

1. Differentiate among public and private resources, using environment-related resources to illustrate.
2. Identify economic and political features of the local community and State, and describe how these economic and political systems and actors can influence environmental decisions.
3. Identify ways in which governments and economic systems work to protect the environment and distribute natural resources.

D. Global connections

Learners become familiar with ways in which environmental, social, economic, cultural, and political systems are linked.

1. Explain international trade in terms of uneven distribution of resources. Include discussions on supply and demand.
2. 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. Explore how resource management differs in various countries.
3. Explain how an environmental change in one part of the world can have consequences for other places.

E. Change and conflict

Learners understand that human systems change over time and that conflicts sometimes arise over differing and changing viewpoints about the environment.

1. 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.
2. Explain how change affects individuals and groups differently and give examples of the tradeoffs involved in decisions and actions ranging from the individual to the societal levels. For example, discuss how a decision about where to reintroduce a wildlife species, build a chemical plant, or locate a new highway might affect different neighborhoods, businesses, workers, and others.
3. Describe and analyze examples of tensions between individual rights and benefits and the societal good.
4. Identify some of the formal and informal ways that groups (including governments) attempt to anticipate, avoid, or resolve conflicts related to the environment.

2.4 Environment and Society

A. Human/environment interactions

Learners understand that human-caused changes have consequences for the immediate environment as well as for other places and future times.

1. 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, such as particular irrigation methods or use of synthetic pesticides.
2. Explain how human-caused environmental changes cause changes in other places. For example, discuss the consequences of building a dam on downstream plant and animal communities, as well as on human communities.
3. Describe the environmental effects of a local environmental restoration effort, such as wetlands creation. Speculate about long-term consequences of such efforts, or a particular restoration project.

B. Places

Learners begin to explore the meaning of places, both close to home and around the world.

1. Analyze physical and human characteristics of places and make inferences about how and why these characteristics have developed and changed over time.
2. Identify ways in which personal perceptions, culture, and technology influence people's perception of places. Discuss the importance of some places such as the Columbia River Gorge or the Sierra Nevada mountain range as cultural symbols.
3. Identify regions based on different criteria such as watershed boundaries and describe the relationships between the physical and human characteristics of regions.

C. Resources

Learners understand that uneven distribution of resources influences their use and perceived value.

1. 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 and ratios of consumption in different countries.
2. Explain why certain resources, such as wood, are key to the development of human societies, and identify resources that were critical to development at different times in history.

3. Explain conflicts among 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.
4. Examine changes in resource management practices over time and consider the passage of time, which allows for observations on effects of past management practices. Also examine changes in natural resource science as more knowledge is gained over time.

D. Technology

Learners understand the human ability to shape and control the environment as a function of the capacities for creating knowledge and developing new technologies.

1. Discuss technologies in the context of larger systems that have shaped the course of human history as well as human relationships with the environment.
2. Analyze how the ability to develop and use technology gives humans great influence over the environment and other living things.

E. Environmental issues

Learners are familiar with a range of environmental issues at scales that range from local to national to global. They understand that people in other places around the world share many of the issues they are concerned about locally.

1. Identify other places, either contemporary or historical, experiencing issues similar to those in the learner's community or region.
2. Explain how issues arise because of conflicting points of view about a specific proposal, event, or condition in the environment.

Strand 3 Skills for Understanding and Addressing Environmental Issues

3.1 Skills for Analyzing and Investigating Environmental Issues

A. Identifying and investigating issues

Learners are able to use primary and secondary sources of information and apply growing research and analytical skills to investigate environmental issues, beginning in their own community.

1. 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.
2. Identify key individuals and groups involved, their viewpoints, and the types of action they support. Describe areas of conflict and agreement.
3. Examine how others have analyzed and understood the issue, identifying their approaches and the assumptions behind them.

B. Sorting out the consequences of issues

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

1. Describe the effects of human actions on specific elements, systems, and processes of the environment.
2. Analyze issues by looking at trade-offs that have been made. For example, consider where various human activities, such as forest roads, are located and their effects on different places and different segments of the population.
3. Project the consequences of inaction or failure to resolve particular issues.

C. Identifying and evaluating alternative solutions and courses of action

Learners are able to identify and develop action strategies for addressing particular issues.

1. Identify different proposals for resolving an environmental issue. Recognize and explain the perspectives on the issue that are embedded in those views.
2. Explain why various strategies may be effective in different situations. Consider their likely effects on society and the environment.
3. Independently and in groups, develop original strategies to address issues.

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

D. Working with flexibility, creativity, and openness

Learners are able to consider the assumptions and interpretations that influence the conclusions they and others draw about environmental issues.

1. Explain how the interplay of ideas and perspectives strengthens the process of inquiry and the societal ability to address issues.
2. Receive questions and alternative explanations that others offer in discussions as well as in readings.
3. Explain why it is not always possible to select one correct explanation or a single best approach to addressing an issue.

3.2 Decisionmaking and Citizenship Skills

A. Forming and evaluating personal views

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

1. Discuss personal perspectives with classmates, remaining open to new ideas and information.
2. Justify their views based on information from a variety of sources and clear reasoning.
3. Discuss their own beliefs and values regarding the environment and relate their personal view of environmental issues to these.
4. Identify ways in which others' views correspond or differ from their own views.

B. Evaluating the need for citizen action

Learners are able to evaluate whether they believe action is needed in particular situations and decide whether they should be involved.

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

C. Planning and taking action

As learners begin to see themselves as citizens taking active roles in their communities, they are able to plan for and engage in citizen action at levels appropriate to their maturity and preparation.

1. 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.

D. Evaluating the results of actions

Learners are able to analyze the effects of their own actions and actions taken by other individuals and groups.

1. Analyze the effects of decisions, policies, and actions taken by individuals and groups on a particular issue.
2. Analyze their own actions, explaining apparent effects and discussing them in light of learners' goals and reasons for acting.
3. 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.

Strand 4 Personal and Civic Responsibility

A. Understanding societal values and principles

Learners understand that societal values can be both a unifying and a divisive force.

1. Discuss conflicting views about the meaning and application of shared values in specific issues. For example, explore conflicting views about the idea that one person's rights end where they infringe on another's.
2. From speeches and writings on specific environmental issues, identify ways in which advocates appeal to values such as individual freedoms, property rights, the public good, economic well-being, and patriotism.
3. Evaluate the principle of stewardship as a shared societal value.

(Note: NAAEE Guideline 4.B is not included in this Forest Service adptation.)

C. Recognizing efficacy

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

1. Explain the ways in which citizen action and public opinion influence environmental policy decisions.
2. 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.
3. 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.

D. Accepting personal responsibility

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

1. Analyze some of the effects their actions (and the actions of their families, social groups, and communities) have on the environment, other humans, and other living things.
2. Describe actions in terms of their effects that reach into the future.
3. Describe their personal responsibilities, comparing their view of their responsibilities with commonly accepted societal views.
4. Identify ways in which they feel responsible for helping to resolve environmental issues within their community.

Learner Guidelines for High School and Beyond

Things to keep in mind for 9-12th grade and adult programs….

Learners should be able to meet the guidelines included in this section by the time they graduate from high school.

By the end of the 12th grade, learners are well on their way to environmental literacy. They should possess the basic skills and dispositions they need to understand and act on environmental problems and issues as responsible citizens—and to continue the learning process throughout their lives. In the 9th through 12th grades, environmental education can promote active and responsible citizenship by challenging learners to hone and apply problem-solving, analysis, persuasive communication, and other higher level skills—often in real-world contexts.

Strand 1 Questioning and Analysis Skills

A. Questioning

Learners are able to develop, modify, clarify, and explain questions that guide environmental investigations of various types. They understand factors that influence the questions they pose.

1. Articulate an environmental phenomenon or topics to be studied at scales ranging from local to global.
2. Pose a research question or hypothesis, identifying and defining key variables, based on primary and secondary sources of information. For example, develop hypotheses about land use in a region drawing on maps, newspaper articles, databases, and personal observations.
3. Identify historical and current ideas and beliefs—for example, about the environment, human perceptions of the environment, or the nature of knowledge—that inform their questions.

B. Designing investigations

Learners know how to design investigations to answer particular questions about the environment. They are able to develop approaches for investigating unfamiliar types of problems and phenomena.

1. Select appropriate means of inquiry, including scientific investigations, historical inquiry, and social science observation and research.
2. Select and develop appropriate formulas and procedures for conducting environmental investigations.
3. Incorporate a wide range of tools and technologies as appropriate, including complex maps, measurement instruments and processes, and computer-based analysis.

C. Collecting information

Learners are able to locate and collect reliable information for environmental investigations of many types. They know how to use sophisticated technology to collect information, including computer programs that access, gather, store, and display data.

1. Use basic sampling techniques such as spatial sampling and random sampling. Evaluate when these techniques are appropriate.
2. Apply observation and measurement skills in field situations, such as interviewing community members about environmental concerns or sampling water in a local stream.
3. Gather information from a variety of sources including historical sites, censuses, tax records, statistical compilations, economic indicators, interviews or surveys, geographic information systems, and other data banks.
4. Adjust information collection strategies to compensate for potential bias in information sources.
5. Perform basic statistical analyses to describe data using quantitative measures such as mean, median, and mode.

D. Evaluating accuracy and reliability

Learners can apply basic logic and reasoning skills to evaluate completeness and reliability in a variety of information sources.

1. Identify logical errors and spurious statements in everyday situations such as political speeches about the environment or commercial advertising.
2. Look for and explain flaws, such as faulty or misleading use of statistics, misrepresentation of data that is presented graphically, or biased selection of data to support a claim. For example, analyze the public debate over an environmental issue.
3. Explain why some research results are judged to be more credible than are others. Consider factors such as possible sources of bias in interpretation, funding sources, and research procedures.

E. Organizing information

Learners are able to organize and display information in ways appropriate to different types of environmental investigations and purposes.

1. Attend to details, such as the type and accuracy of data, scale, accuracy of representation, and ease of interpretation.
2. Work with technology designed to relate and display data, such as database and mapping software.
3. Integrate and summarize information using a variety of media ranging from written texts to graphic representations, and from audiovisual materials to maps and computer-generated images.

F. Working with models and simulations

Learners are able to create, use, and evaluate models to understand environmental phenomena.

1. Use algebraic and geometric models to represent processes or objects, such as movement along earthquake fault lines, traffic flows, or population growth.
2. Use computers to create models and simulations. For example, project the effects of habitat fragmentation on species diversity, the air-quality effects of a new factory, the economic impacts of proposed air-quality rules, or the visual changes a new housing development will make on the landscape.
3. Compare the applicability of models for particular situations, considering the models' assumptions as one factor. Explain how a single model may apply to more than one situation and how many models represent a single situation.

G. Developing proposed explanations

Learners are able to use evidence and logic in developing proposed explanations that address their initial questions and hypotheses.

1. Use basic statistical analyses and measures of probability to make predictions and develop interpretations based on data.
2. Differentiate between causes and effects and identify when causality is uncertain.
3. Speak in general terms about their confidence in proposed explanations as well as possible sources of uncertainty and error. Distinguish between error and unanticipated results in formulating explanations. Consider the assumptions of models and measuring techniques or devices as possible sources of error.
4. Based on experience, develop new questions to ground further inquiry. For example, draw on the results of a stream monitoring project to develop questions that guide an investigation into water-quality issues in the community or the watershed.

Strand 2 Knowledge of Environmental Processes and Systems

2.1 The Earth as a Physical System

A. Processes that shape the Earth

Learners understand the major physical processes that shape the Earth. They can relate these processes, especially those that are large-scale and long-term, to characteristics of the Earth's surface.

1. Relate different types of climate and their distribution to processes such as the transfer of heat energy, the movement of wind and ocean currents, and the cycling of water.
2. Use examples such as the El Niño effect or the Santa Ana winds to illustrate how changes in wind patterns or ocean temperatures can affect weather in different parts of the world and the subsequent effects on the land.
3. Explain distinctive landforms in terms of the physical processes, particularly those related to changes in the Earth's crust or long-term processes, such as erosion, that shaped them.
4. Describe possible relationships between surface water and ground water and possible positive and negative effects to both.

B. Changes in matter

Learners apply their understanding of chemical reactions to round out their explanations of environmental characteristics and everyday phenomena.

1. Explain everyday chemical reactions such as burning fossil fuels, the act of photosynthesis, or the creation of smog in terms such as the release or consumption of energy, the products of these reactions, and how these products may be involved in further chemical reactions and/or affect biogeochemical cycles.
2. Explain the chemical components of biological processes such as photosynthesis, respiration, nitrogen fixation, or decomposition and how biological and physical processes fit in the overall process of biogeochemical cycling.

C. Energy

Learners apply their knowledge of energy and matter to understand phenomena in the world around them.

1. Use the laws of thermodynamics to explain why natural systems need a certain amount of energy input to maintain their organization.

2.2 The Living Environment

A. Organisms, populations, and communities

Learners understand basic population dynamics and the importance of diversity in living systems.

1. Discuss the relationship of habitat changes to plant and animal populations. Consider factors such as variations in habitat size, fragmentation, and fluctuation in conditions such as pH, oxygen, available light, or water level. For example, describe the effects of a lake's eutrophication on plant, insect, bacteria, and fish populations; or explain some of the factors that affect the size and spatial distribution of populations, including human populations.
2. Explain how diversity of characteristics among organisms of a species increases the likelihood of the species surviving through changing environmental conditions.
3. Explain how variation among species in a system increases the likelihood that at least some species will survive changes in environmental conditions.
4. Explain how diversity of ecosystems over a landscape relates to diversity of species within that landscape.

B. Heredity and evolution

Learners understand the basic ideas and genetic mechanisms behind biological evolution.

1. Describe the mechanisms of natural selection, incorporating factors such as genetic variation, the effect of heritable characteristics on individual survival and reproduction within a given environment, and the effects of environmental change.
2. Use the theory of natural selection and concepts such as mutation, gene flow, and genetic drift to account for the adaptation of species to specific environments.
3. Explain the idea that the more biological diversity there is today, the more there may be in the future. Offer examples of exceptions to this general rule, and use them to help explain past mass extinctions.

C. Systems and connections

Learners understand the living environment to be comprised of interrelated, dynamic systems.

1. Apply the concepts of ecosystem and ecoregion to organize the multitude of relationships among organisms and environments encountered in earlier studies.
2. Discuss the interactions among organisms and their environments. Explain ecosystem change with respect to variables such as climate change, the introduction of new species, and human impacts; and explain processes, such as desertification and soil formation, as mechanisms for such change.
3. Describe succession in ecosystems and their constituent plant and animal communities. Illustrate this idea with examples such as the slow transformation of a volcanic island from barren rock to rain forest as initial plant colonizers create conditions favorable to other species, or the more rapid changes that occur after beavers dam a stream.
4. Describe how adding a species to, or removing one from, an ecosystem may affect other organisms and the entire system.
5. Discuss the relative stability of ecosystems over long spans of time, using ideas such as interdependence, cyclic fluctuations, equilibrium, and coupled oscillations for example, in predator-prey relationships).

D. Flow of matter and energy

Learners are able to account for environmental characteristics based on their knowledge of how matter and energy interact in living systems.

1. Illustrate how energy for life is provided primarily by continual inputs from the sun, captured by plants through photosynthesis, and converted into carbon-based molecules.
2. Trace the flow of matter and energy through living systems, and between living systems and the physical environment. For example, show how oxygen is released to the atmosphere by the interaction of plants, animals, and nonliving matter in the carbon cycle.
3. Explain how the abundance and distribution of living organisms are limited by available energy and certain forms of matter such as water, oxygen, and minerals, as well as by the ability of the ecosystem to recycle dead organisms.

2.3 Humans and Their Societies

A. Individuals and groups

Learners understand the influence of individual and group actions on the environment and comprehend how groups work to promote and balance interests.

1. Predict how the environmental effects of their personal actions might change over time. Consider variables such as technological advances, lifestyle changes, or taking on such roles as business owners, employees, or parents.

B. Culture

Learners understand cultural perspectives and dynamics and apply their understanding in context.

1. Analyze how cultural change and altered views of the environment are related. For example, discuss how the shift away from a largely rural society to a predominantly urban one may influence changing perceptions of the environment.
2. Recognize diverse cultural views about humans and the environment. Anticipate ways in which people from different cultural perspectives and frames of reference might interpret data, events, or policy proposals.
3. Describe and compare historical and contemporary societal strategies for adapting to environmental or social change while preserving and transmitting culture. For example, describe ways resource-dependent communities (those whose economies traditionally relied on activities such as mining or timber harvesting) work to maintain their identities in the face of mine closures or declining timber harvests.

C. Political and economic systems

Learners understand how different political and economic systems account for, manage, and affect natural resources and environmental quality.

1. Compare the U.S. political and economic systems using the economic idea of scarcity and the geographic idea of uneven distribution of resources.
2. Evaluate the environmental and societal costs and benefits of allocating resources in different ways (for example, through public or private sectors). For example, explain problems such as over-fishing, over-grazing, and deforestation, considering what can happen to resources that are commonly owned and openly accessible. Or examine successful common property management systems that promote a sustainable use of resources.
3. Explain current and historical environmental issues in terms of political and economic ideas. For example, analyze the role of private property rights and the concept of general welfare in shaping decisions about the use and protection of wetlands in the United States.

D. Global connections

Learners are able to analyze global, social, cultural, political, economic, and environmental linkages.

1. Explain regional and national economic specialization and international trade in terms of uneven distribution of resources.
2. Describe global connections in systems such as the economy, transportation, and communication. Evaluate the effects of changes in these systems on communities and the environment at a global scale.
3. Evaluate the connections among interests, decisions, and actions taken at the individual, community, regional, national, and global levels. Consider their effect on global issues such as human rights, economic development, health, resource allocation, and environmental quality.

E. Change and conflict

Learners understand the functioning of public processes for promoting and managing change and conflict and can analyze their effects on the environment.

1. Explain how public decisionmaking about the environment takes into account or fails to take into account uneven distribution of, or different types of, costs and benefits; future or distant consequences; and difficulties assessing the value of certain costs or benefits such as ecosystem services or clean air.
2. Evaluate the role of social, political, and economic institutions in the United States in managing change and conflict regarding environmental issues. Account for the influence of institutions such as the legal system and property rights, as well as organizations and special interest groups.

3. Evaluate the conditions and motivations that lead to conflict, cooperation, and change among individuals, groups, and nations. Look particularly at the effects of these forces on the control of natural resources. For example, examine the origins and effects of international treaties and accords on whaling or commercial fishing.

2.4 Environment and Society

A. Human/environment interactions

Learners understand that humans are able to alter the physical environment to meet their needs and that there are limits to the ability of the environment to absorb impacts or meet human needs.

1. Evaluate ways in which technology has changed humans' ability to alter the environment and its capacity to support humans and other living organisms.
2. Analyze specific examples of environmental change in terms of qualitative and quantitative costs and benefits for different groups of people and specific species or ecosystems.
3. Describe factors that limit the physical environment's capacity to support particular types of human activity, such as suburban development, flood control, or agricultural practices.
4. Evaluate the cumulative effects of human actions on a specific species or environmental system, such as a stream or a watershed.
5. Use the concepts of carrying capacity and ecological footprint to analyze the sustainability of current trends in world population growth and natural resource consumption.

B. Places

Learners understand "place" as humans endowing a particular part of the Earth with meaning through their interactions with that environment.

1. Analyze how places change over time as the physical environment changes and as human use and perceptions change. For example, examine the effects of the automobile and the interstate highway system on different places.
2. Explain the importance of places to human identity. For example, discuss changes in land use and personal and community identity that occur in a rapidly growing town or city, or one in which the economy has stagnated.
3. Describe how regions change over time, examining factors such as human migration and population change, technological change, environmental degradation, and seismic activity.
4. Compare how people adapt to living in areas prone to natural hazards, such as floods or earthquakes.

C. Resources

Learners understand that the importance and use of resources change over time and vary under different economic and technological systems.

1. Describe how changes in technology alter the use of resources. Illustrate with examples, such as the ability to harvest timber on steep slopes using helicopters or building technologies that incorporate nontraditional or recycled materials.
2. Evaluate public policies related to resource use. Consider variables such as their impacts on the resource and short-and long-term economic effects. For example, anticipate the relationship between water use and the growth of a city such as Las Vegas, Nevada, which is in a desert area that receives only four inches of rainfall per year.
3. Identify ways in which various resources can be recycled and reused.
4. Examine changes in resource management practices over time and consider the passage of time, which allows for observations on effects of past management practices. Also examine changes in science as more knowledge is gained over time.

D. Technology

Learners are able to examine the social and environmental impacts of various technologies and technological systems.

1. Explain how social and economic forces influence the direction of technological development, and how technologies shape societal values and beliefs. For example, consider the ability to build large dams for water storage or hydropower, or the social impact of the first photos of the Earth from space.

E. Environmental issues

Learners are familiar with a range of environmental issues at scales that range from local to national to global. They understand that these scales and issues are often linked.

1. Place local issues in the context of broader or larger-scale issues, drawing parallels and noting important similarities and differences. Use the broader issue to point to important local dynamics or perspectives of which to be aware. For example, consider local air pollution problems in the context of larger issues such as global climate change or acid precipitation in other parts of the country.
2. Identify links among issues; for example, the relationships among traffic congestion, poor air quality, and suburban sprawl. Explain key relationships among technological, social, ecological, economic, and other aspects of issues.

Strand 3
Skills for Understanding and Addressing Environmental Issues

3.1 Skills for Analyzing and Investigating Environmental Issues

A. Identifying and investigating issues

Learners apply their research and analytical skills to investigate environmental issues ranging from local issues to those that are regional and global in scope.

1. Define and clearly articulate issues to be investigated and identify connections with other issues. Characterize the issue, considering factors such as connections with other issues, the pervasiveness of its effects, whether it is a long-term issue or one that is motivated by a sudden change or crisis, and whether it is unique to a particular area.
2. Identify key individuals and groups involved. Identify different perspectives on the issue and approaches to resolving it. Discuss assumptions and goals that underlie each position.
3. Examine contextual elements that shape the issue and alternative courses of action. Use those elements to help identify relevant historical antecedents or contemporary parallels that may shed light on the selected issue.
4. Investigate the issue, as well as similar issues and proposals, using secondary sources of information.
5. Where needed, conduct original research, applying research methods from the natural and social sciences in investigating issues. For example, using a random sample, survey a community about an environmental issue.

B. Sorting out the consequences of issues

Learners are able to evaluate the consequences of specific environmental changes, conditions, and issues for human and ecological systems.

1. Evaluate the consequences of an environmental issue. For example, bring to bear historical perspectives, an understanding of the impacts of different technological developments, and knowledge of similar issues.
2. Discuss the social, political, economic, and ethical implications of environmental issues. For example, trace the root causes of flooding in a community and examine the conditions, uses, and changes within the related watershed area.

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3. Project the likely consequences for specific human and environmental systems of failure to resolve the issue.
4. Use the idea of cumulative effects to explain why one set of environmental changes or human actions cannot be considered in isolation from others.

C. Identifying and evaluating alternative solutions and courses of action
Learners are able to identify and propose action strategies that are likely to be effective in particular situations and for a particular purpose.

1. Synthesize different perspectives, types of data, and means of analysis to propose solutions to environmental issues.
2. Apply knowledge and functional relationships, modeling, and statistical analysis to evaluating issues and different approaches to resolving them.
3. Evaluate proposed solutions using gauges such as likely impacts on society and the environment and likely effectiveness in resolving the issue. Use methods such as cost/benefit analysis, ethical analysis, environmental impact analysis, and risk analysis.
4. Define and provide examples of citizen's actions appropriate to the proposed solution.

D. Working with flexibility, creativity, and openness
While environmental issues investigations can bring to the surface deeply held views, learners are able to engage each other in peer review conducted in the spirit of open inquiry.

1. Question, offer alternative explanations, and defend interpretations in group discussions.
2. Understand and explain the importance of such characteristics as honesty, openness, skepticism, and suspending judgment in the process of building knowledge.

3.2 Decisionmaking and Citizenship Skills

A. Forming and evaluating personal views

Learners are able to communicate, evaluate, and justify their own views on environmental issues and alternative ways to address them.

1. Articulate a position on an environmental issue. Justify the position based on an analysis of information from a variety of sources, personal beliefs and values, and clear reasoning.
2. Evaluate personal beliefs and values using criteria such as personal well-being, social and environmental welfare, economic vitality, and concern for other living beings.
3. Articulate elements of their own environmental ethic and discuss whether personal positions on issues are consistent with this ethic.
4. Consider viewpoints that differ from their own and information that challenges their position. Evaluate whether and how such information might affect their views.

B. Evaluating the need for citizen action

Learners are able to decide whether action is needed in particular situations and whether they should be involved.

1. Evaluate whether action is warranted in specific situations, accounting for factors such as available evidence about the issue and proposed solutions; the scale of the issue; legal, social, economic, and ecological consequences; and alternatives to citizen action.

C. Planning and taking action

Learners know how to plan for action based on their research and analysis of an environmental issue. If appropriate, they take actions that are within the scope of their rights and consistent with their abilities and responsibilities as citizens.

1. Develop plans for individual and collective action involving groups such as a small group of classmates, a school club, a community organization, or a church. Include clear reasons and goals for action. In planning, refer to their knowledge of a range of citizen action strategies and the results of their environmental issue investigations.

D. Evaluating the results of actions

Learners are able to evaluate the effects of their own actions and actions taken by other individuals and groups.

1. Discuss the intended and unintended effects of citizen actions on specific environmental issues. Consider the apparent effects of citizen action on the environment, the political situation, and the individuals involved.
2. Analyze their own actions, evaluating apparent effects in terms of learners' goals, ethics, and broader societal goals.
3. Account for some of the difficulties they encounter in evaluating the results of their actions.

Strand 4 Personal and Civic Responsibility

A. Understanding societal values and principles

Learners know how to analyze the influence of shared and conflicting societal values.

1. Identify shared political values and principles that unite U.S. citizens and analyze conflicting views about their meaning and application.
2. Analyze how societal institutions, such as banks, corporations, nonprofit organizations, lobbying groups, government agencies, and the courts, embody and perpetuate certain societal values and principles.
3. Describe and suggest ways that individuals can work to change how societal institutions function and, consequently, to change their environmental impacts.

B. Recognizing citizens' rights and responsibilities

Learners understand the importance of exercising the rights and responsibilities of citizenship.

1. Evaluate conflicts between individual rights and other societal interests such as a healthy environment. Discuss when individuals' civic obligations require them to subordinate their personal interests or desires to the public good.
2. Explain the importance and evaluate the usefulness of civic dispositions such as trust, patience, self-discipline, respect, and open-mindedness to individuals and to society.
3. Explain the influence of citizen action and public opinion on particular policy decisions that affect the environment.
4. Reflect on the impact of citizen participation—particularly learners' own—on public concerns related to the environment and on the community.

C. Recognizing efficacy

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

1. Evaluate the extent to which an individual or group action creates change, meets individual needs, and promotes the common good.
2. Identify ways in which learners, individually and collectively, are able to help maintain environmental quality and resolve problems and issues.

D. Accepting personal responsibility

Learners understand that their actions can have broad consequences and accept responsibility for recognizing those effects and changing their actions when necessary.

1. Evaluate the effects of their actions (and the actions of larger social groups of which they are part) on the environment, other humans, and other living things.
2. Explain ways in which the decisions of one generation create opportunities and impose constraints for future generations.
3. Evaluate the importance of fulfilling personal responsibility for themselves, society, and the environment.
4. Demonstrate a willingness to work individually and collectively toward the resolution of environmental issues and to participate thoughtfully and effectively in environmental decisionmaking.