
Environmental Science
Grades 9-12

Strand:

S9 Environmental Science investigates environmental problems from multiple perspectives and utilizes these perspectives to develop decision-making skills utilizing the fields of economics, social studies, and mathematics.

Standards:

Envi S9a: Identifies and describes current environmental issues, and considers of the role of beliefs, attitudes, and values in proposing solutions to environmental problems.

Components:

- S9a1. Utilizes research methods to investigate environmental questions, reevaluates their personal beliefs to accommodate new knowledge and perspectives, and is able to effectively communicate this understanding to others
- S9a2. Identifies the strengths and weaknesses of different approaches to investigating an environmental issue and identifies some of the assumptions for each approach.
- S9a3. Evaluates the advantages and disadvantages of balancing short term interests with long term welfare of the society.
- S9a4. Explains how individual activities and decisions can have an impact on the environment.
- S9a5. Identifies a variety of approaches to environmental issues and evaluates the benefits and consequences of each from a social, economic, and ecological standpoint.
- S9a6. Applies basic principles of cost-benefit analysis and shows who pays and who benefits of selected proposed interventions to environmental problems.
- S9a7. Assesses the environmental and social costs and benefits of natural resource management strategies.
Identifies a variety of approaches to environmental issues and evaluates the costs and benefits of each from a social, economic, and ecological standpoint.
- S9a8. Evaluates the ways in which government can influence environmental policy.
- S9a9. Identifies how the choices individuals make affect the environment.

Standards:

Envi S9b: identifies the effect of human activities on natural processes and interrelationships within ecosystems.

Components:

- S9b1. Identifies and describes the factors that have contributed to the growth of the human population.
- S9b2. Provides evidence for how human population growth has impacted the environment and the use of natural resources.
- S9b3. Describes the ways in which the use of technology has affected the environment and standard of living.
- S9b4. Describes the different ways the environment has been perceived by and utilized by human societies over time.
- S9b5. Provides evidence for how people impact their environment through the use of natural resources.
- S9b6. Recognizes the ways in which technology, while improving our standard of living, has increased the human impact on the environment.
- S9b7. Predicts how changes in the availability and use of natural resources will affect society and human activities.
- S9b8. Identifies and analyzes the effects of human resource use on the environment at various scales.
- S9b9. Evaluates a variety of land management practices on their ability to restore ecosystem functioning and trophic relationships.
- S9b10. Describes how people affect biodiversity through land use practices, pollution, and their use of organisms.
- S9b11. Identifies and assesses the effects of human activities on ecosystems at various scales in terms of ecosystem functioning.
- S9b12. Recognizes the ways in which technology, while improving our standard of living, has increased the human impact on the environment.
- S9b13. Assesses the environmental and societal costs and benefits of various common natural resource management strategies.

Standards:

Envi S9c: identifies a variety of Earth's finite natural resources and their formation.

Components:

- S9c1. Identifies minerals that are important to our lives and describes their distribution on Earth.

- S9c2. Explains how fossil fuels are formed and where they can be found.
- S9c3. Recognizes land, clean air, and fresh water as critical natural resources that are in increasing demand.
- S9c4. Illustrates the naturally occurring cycles of Earth's finite resources through Earth's four major systems (atmosphere, hydrosphere, lithosphere, and biosphere) by describing the path of an element or a molecule in a natural resource (for example carbon or water).
- S9c5. Recognizes that certain resources are nonrenewable because they are replenished at timescales of thousands to millions of years.

Standards:

Envi S9d: assesses the (sustainable) availability of Earth's natural resources given the growing human demand.

Components:

- S9d1. Lists natural resources that play a vital role in daily life and identifies where they come from.
- S9d2. Identifies and evaluates multiple uses of natural resources and to which extent society is dependent on them.
- S9d3. Recognizes that some natural resources are very rare and some exist in great quantities, but the ability to recover them is just as important as their abundance
- S9d4. Presents evidence that as natural resources are depleted, obtaining them becomes more difficult.
- S9d5. Assesses how changes to the availability of nonrenewable natural resources might affect society (considering, for example, manufacturing industries, agriculture, transportation).

Standards:

Envi S9e: analyzes the future availability of nonrenewable energy resources considering the trend of human consumption of energy.

Components:

- S9e1. Names and describes the three major fossil fuels (gas, coal, and oil) used in the United States and their uses.
- S9e2. Evaluates the pros and cons of using fossil fuels.
- S9e3. Compares and contrasts the historical demand for fossil fuels in various nations.

S9e4. Compares and contrasts the estimated supply of fossil fuel and the projected demand.

Standards:

Envi S9f: describes the current and potential future effects of the burning of fossil fuels on the environment considering the trend of human consumption of energy.

Components:

S9f1. Summarizes how the burning of fossil fuels generates the power that is used in homes and offices and how it has an impact on the environment.

S9f2. Defines and applies the concept of the human carbon footprint.

S9f3. Compares the effects of natural and human-caused activities that either contribute to or challenge an ecologically sustainable environment.

S9f4. Critiques the use of fossil fuels from an economic and environmental point of view.

Standards:

Envi S9g: proposes renewable energy resources that are alternatives to the burning of fossil fuels and technological developments that can reduce the human carbon footprint.

Components:

S9g1. Lists alternative energy resources and assesses the costs and benefits of these alternative resources on society and the environment.

S9g2. Compares and contrasts the economics of investing into nonrenewable or renewable energy sources for the society.

S9g3. Assesses how changes in the availability of energy will affect society and human activities, such as transportation, agricultural systems, and manufacturing.

S9g4. Concludes that the use of renewable energies and the development of superior technologies can reduce the rate of depletion of natural resources and decrease the human impact on the environment.

S9g5. Outlines the ways in which individuals can alter their own behavior to reduce the human carbon footprint.

Standards:

Envi S9h: explains how geochemical cycles and ecological processes on Earth interact through time to cycle matter and energy and how human activity can alter the rates of these processes.

Components:

- S9h1. Recognizes that the different spheres such as the atmosphere are resources.
- S9h2. Provides examples and explains that the Earth is a complex system with connected and interconnected components and processes.
- S9h3. Describes the major (carbon) reservoirs within Earth's systems.
- S9h4. Diagrams and explains multiple pathways of carbon movement between reservoirs.
- S9h5. Presents evidence that Earth is a system containing essentially a fixed amount of each stable chemical atom or element which moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of geochemical cycles.
- S9h6. Lists potential consequences of increased use of fossil fuels or drastic reduction of vegetation on earth's dynamic equilibrium.
- S9h7. Use computer modeling/simulations to predict the effects of carbon dioxide on Earth's systems.

Standards:

Envi S9i: relates the theory of biological evolution to geologic time and addresses speciation, biodiversity, natural selection, and biological classification.

Components:

- S9i1. Describes the ways in which biodiversity is important to ecosystems and human society.
- S9i2. Assesses the potential value of a single species to a particular ecosystem.
- S9i3. Explains how organisms are adapted to the environment in terms of ecological niches and natural selection [DEVELOPED].
- S9i4. Investigates and explains how natural selection acts as the mechanism for evolution and can lead to speciation.
- S9i5. Provides evidence that natural selection can explain both the unity and diversity of life.
- S9i6. Relates the importance of genetic diversity and population size to the conservation of a species.

Envi S5j: analyzes ecology as interrelationships of biotic and abiotic factors and explains the transfer of matter and energy within ecosystems.

Components:

- S9j1. Recognizes that the Earth is primarily a closed system with respect to matter.
- S9j2. Identifies the factors limiting population growth in a given area (carrying capacity).
- S9j3. Gives examples that illustrate how a change in one part of a system can have an impact on other parts of the system.
- S9j4. Identifies and describes the factors that have contributed to the growth of the human population and examine the impact this growth will have on the environment.
- S9j5. Identifies environmental issues in terms of interrelationships among natural systems in time and space.
- S9j6. Evaluates the factors that impact resource availability and explains why certain natural resources are becoming depleted.
- S9j7. Takes into consideration that Earth's systems exist in a state of dynamic equilibrium and that certain compositions of the Earth's system(s) may fluctuate on short or long time scales but the Earth's system will generally stay within a certain narrow range for millions of years.
- S9j8. Identifies environmental issues in terms of the interconnectedness of nature.
- S9j9. Analyzes the natural processes of change in the environment, including examples of succession, evolution, and extinction.
- S9j10. Analyzes how the stability and sustainability of ecosystems change as a result of changes in environmental conditions.
- S9j11. Identifies factors that influence patterns of ecological succession, including invasive species, loss of biodiversity, change in abiotic conditions, and catastrophic events.
- S9j12. Evaluates the factors that determine the plant life existing in a given biome.
- S9j13. Predicts changes in population size in response to altered environmental conditions.
- S9j14. Assesses the stability and sustainability of ecosystems as a result of changes in environmental conditions.