Environmental Science
Science

Course Description

The Environmental Science Cherokee Teaching & Learning Standards are designed to continue the student investigations that began in grades K-8. These standards integrate the study of many components of our environment, including the human impact on our planet. Students investigate the flow of energy and cycling of matter within ecosystems, and evaluate types, availability, allocation, and sustainability of energy resources. Instruction should focus on student data collection and analysis from field and laboratory experiences. Some concepts are global; in those cases, interpretation of global data sets from scientific sources is strongly recommended. Chemistry, physics, mathematical, and technological concepts should be integrated throughout the course. Whenever possible, careers related to environmental science should be emphasized.

Science standards integrate the three dimensions of **Science and Engineering Practices (SEPs)**, **Crosscutting Concepts (CCCs)**, and **Disciplinary Core Ideas (DCIs)** to provide a comprehensive framework that emphasizes active engagement, interdisciplinary connections, and core scientific principles. Together, they show how science standards engage *students* in obtaining, evaluating, and communicating information.

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Science and Engineering Practices are fundamental approaches that scientists and engineers use to investigate the natural world and solve practical problems. **Crosscutting Concepts** in science are overarching themes that bridge various disciplines, helping students and researchers see connections and deepen their understanding of the natural world. **Disciplinary Core Ideas** are fundamental concepts that students need to understand to develop a deep knowledge of science across various disciplines.

Thinking Like a Scientist (2 weeks)

Thinking Like a Scientist standards represent scientific thinking skills that should be incorporated throughout the entire course.

Overarching Standard

TLS9-12: Refine scientific inquiry skills by designing and conducting investigations, applying scientific theories, critically evaluating scientific literature, and contributing to scientific discussions.

Supporting Standards for Student Mastery

TLS9-12.a: Use specialized scientific terms and concepts to analyze and explain scientific phenomena.

TLS9-12.b: Design and conduct independent experiments with multiple variables.

TLS9-12.c: Utilize advanced tools and statistical methods for data analysis.

TLS9-12.d: Communicate complex findings through reports and presentations.

Semester 1 (August – December)

Unit 1: Living World: Ecosystems (4-5 weeks)

In this introductory unit, students will explore the flow of energy and cycling of matter within ecosystems. They will develop and use models to predict energy transfer and construct arguments on the necessity of biogeochemical cycles in supporting sustainable ecosystems. Additionally, students will compare and analyze the levels of biological organization, from organisms to biosphere, gaining a comprehensive understanding of ecosystem dynamics.

Overarching Standard for Unit 1

EV1: Obtain, evaluate, and communicate information to investigate the flow of energy and cycling of matter within an ecosystem.

EV1.b: Develop and use a model based on the Laws of Thermodynamics to predict energy transfers throughout an ecosystem (food chains, food webs, and trophic levels).
(*Clarification statement*: The first and second law of thermodynamics should be used to support the model and explain why energy decreases when moving up trophic levels.)

EV1.c: Analyze and interpret data to construct an argument of the necessity of biogeochemical cycles (hydrologic, nitrogen, phosphorus, oxygen, and carbon) to support a sustainable ecosystem.

Supporting Standards for Student Mastery in Unit 1

EV1.a: Develop and use a model to compare and analyze the levels of biological organization including organisms, populations, communities, ecosystems, and biosphere.

Unit 2: Living World: Biomes, Earth Systems & Resources (3-4 weeks)

In this unit, students will investigate relationships between physical factors and organismal adaptations within terrestrial biomes, as well as the impact of chemical and physical properties on aquatic biomes in Georgia. They will evaluate information, plan, and conduct investigations on various ecosystems while analyzing and interpreting data on natural cyclic fluctuations to understand their association with climate change.

Overarching Standard for Unit 2

EV1: Obtain, evaluate, and communicate information to investigate the flow of energy and cycling of matter within an ecosystem.

EV1.d: Evaluate claims, evidence, and reasoning of the relationship between the physical factors (e.g., insolation, proximity to coastline, topography) and organismal adaptations within terrestrial biomes.

EV1.e: Plan and carry out an investigation of how chemical and physical properties impact aquatic biomes in Georgia. (*Clarification statement*: Consider the diverse aquatic ecosystems across the state such as streams, ponds, coastline, estuaries, and lakes.)

Supporting Standards for Student Mastery in Unit 2

EV2.a: Analyze and interpret data related to short-term and long-term natural cyclic fluctuations associated with climate change. (*Clarification statement*: Short-term examples include but are not limited to El Niño and volcanism. Long-term examples include but are not limited to variations in Earth's orbit such as Milankovitch cycles.)

Unit 3: Living World: Biodiversity (3-4 weeks)

In this unit, students will study the importance of biodiversity and its role in ecosystem resilience. They will construct arguments supporting the value of diverse species in maintaining ecosystem stability and evaluate the relationship between factors within biomes. Students will predict changes in ecosystems through ecological succession.

Overarching Standard for Unit 3

EV2: Obtain, evaluate, and communicate information to construct explanations of stability and change in Earth's ecosystems.

EV2.d: Construct an argument to support a claim about the value of biodiversity in ecosystem resilience including keystone, invasive, native, endemic, indicator, and endangered species.

Supporting Standards for Student Mastery in Unit 3

EV1.d: Evaluate claims, evidence, and reasoning of the relationship between the physical factors (e.g., insolation, proximity to coastline, topography) and organismal adaptations within terrestrial biomes.

EV1.e: Plan and carry out an investigation of how chemical and physical properties impact aquatic biomes in Georgia.

(*Clarification statement*: Consider the diverse aquatic ecosystems across the state such as streams, ponds, coastline, estuaries, and lakes.)

EV2.c: Construct an argument to predict changes in biomass, biodiversity, and complexity within ecosystems, in terms of ecological succession.

Unit 4: Populations (4-5 weeks)

In this unit, students will explore the effects of human population growth on global ecosystems. They will construct explanations about how quality of life is influence by multiple factors in developing and developed countries, and the resulting environmental impacts. Students will design, evaluate, and refine solutions to reduce human impact on the environment and evaluate the ecological effects of human innovations.

Overarching Standard for Unit 4

EV5: Obtain, evaluate, and communicate information about the effects of human population growth on global ecosystems.

EV5.a: Construct explanations about the relationship between the quality of life and human impact on the environment in terms of population growth, education, and gross national product.

Supporting Standards for Student Mastery in Unit 4

EV4.b: Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

EV4.c: Construct an argument to evaluate how human population growth affects food demand and food supply (GMOs, monocultures, desertification, Green Revolution).

EV5.b: Analyze and interpret data on global patterns of population growth (fertility and mortality rates) and demographic transitions in developing and developed countries.

EV5.c: Construct an argument from evidence regarding the ecological effects of human innovations (Agricultural, Industrial, Medical, and Technological Revolutions) on global ecosystems.

EV5.d: Design and defend a sustainability plan to reduce your individual contribution to environmental impacts, taking into account how market forces and societal demands (including political, legal, social, and economic) influence personal choices.

Semester 2 (January – May)

Unit 5: Energy (3-4 weeks)

In this unit, students will explore energy resources and predict the sustainability potential of these resources, considering risks and benefits of each energy type. Students will investigate the effects of human activities on natural resources and assess the ecological impacts of human innovations on global ecosystems.

Overarching Standard for Unit 5

EV3: Obtain, evaluate, and communicate information to evaluate types, availability, allocation, and sustainability of energy resources.

EV3.d: Construct an argument to support a claim about the value of biodiversity in ecosystem resilience including keystone, invasive, native, endemic, indicator, and endangered species.

Supporting Standards for Student Mastery in Unit 5

EV3.a: Analyze and interpret data to communicate information on the origin and consumption of renewable forms of energy (wind, solar, geothermal, biofuel, and tidal) and non-renewable energy sources (fossil fuels and nuclear energy).

EV3.b: Construct an argument based on data about the risks and benefits of renewable and nonrenewable energy sources. (Clarification statement: This may include, but is not limited to, the environmental, social, and economic risks and benefits.)

EV3.c: Obtain, evaluate, and communicate data to predict the sustainability potential of renewable and non-renewable energy resources.

EV4.a: Construct and revise a claim based on evidence on the effects of human activities on natural resources.

Human Activities	Natural Resources
Agriculture	Land
Forestry	Water
Ranching	Air
Mining	Organisms
Urbanization	
Fishing	
Water use	
Pollution	
Desalination	
Waste water treatment	

EV5.c: Construct an argument from evidence regarding the ecological effects of human innovations (Agricultural, Industrial, Medical, and Technological Revolutions) on global ecosystems.

Unit 6: Land - Use & Pollution (5-6 weeks)

In this unit, students will investigate the various ways human activities impact natural resources and develop strategies to mitigate these effects. They will construct and revise claims based on evidence regarding the effects of activities like agriculture, forestry, mining, and urbanization on land and organisms. This unit emphasizes the need for sustainable practices and innovative solutions to reduce human impact on the environment.

Overarching Standard for Unit 6

EV4: Obtain, evaluate, and communicate information to analyze human impact on human resources.

EV4.b: Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

Supporting Standards for Student Mastery in Unit 6

EV4.a: Construct and revise a claim based on evidence on the effects of human activities on natural resources.

Human Activities	Natural Resources
Agriculture	Land
Forestry	Water
Ranching	Air
Mining	Organisms
Urbanization	
Fishing	
Water use	
Pollution	
Desalination	
Waste water treatment	

EV4.c: Construct an argument to evaluate how human population growth affects food demand and food supply (GMOs, monocultures, desertification, Green Revolution).

Unit 7: Air – Structure & Pollution (3-4 weeks)

In this unit, students will explore the structure of the atmosphere and the various ways human activities impact air quality. They will analyze and interpret data to understand how changes in atmospheric chemistry impact the greenhouse effect. Students will design, evaluate, and refine solutions to mitigate human impact on air quality and the broader environment.

Overarching Standard for Unit 7

EV4: Obtain, evaluate, and communicate information to analyze human impact on human resources.

EV4.b: Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

Supporting Standards for Student Mastery in Unit 7

EV2.b: Analyze and interpret data to determine how changes in atmospheric chemistry (carbon dioxide and methane) impact the greenhouse effect.

EV4.a: Construct and revise a claim based on evidence on the effects of human activities on natural resources.

Human Activities	Natural Resources
Agriculture	Land
Forestry	Water
Ranching	Air
Mining	Organisms
Urbanization	
Fishing	
Water use	
Pollution	
Desalination	
Waste water treatment	

Unit 8: Water – Structure & Pollution (3-4 weeks)

In this unit, students will study the structure of water ecosystems and the various ways human activities impact water quality. They will investigate issues such as water pollution, urbanization, agricultural runoff, and industrial discharge. Students will analyze and interpret data to understand how human growth and activities influence water demand, water supply, and water quality. This unit emphasizes the need for sustainable practices and innovative solutions to mitigate human impact on water ecosystems and ensure the health and sustainability of water resources.

Overarching Standard for Unit 8

EV4: Obtain, evaluate, and communicate information to analyze human impact on human resources.

EV4.b: Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

Supporting Standards for Student Mastery in Unit 8

EV4.a: Construct and revise a claim based on evidence on the effects of human activities on natural resources.

Human Activities	Natural Resources
Agriculture	Land
Forestry	Water
Ranching	Air
Mining	Organisms
Urbanization	
Fishing	
Water use	
Pollution	
Desalination	
Waste water treatment	