Washington Office of Superintendent of
PUBLIC INSTRUCTION

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CTE

Statewide Framework Document for: 030104

AP Environmental Science

Standards may be added to this document prior to submission but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments and leadership alignment may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for one credit of lab science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a three-dimensional manner. The details about each performance expectation can be found at Next Generation Science Standards.

School District Name	
Course Title: AP Environmental Science	**Total Framework Hours:** 180
CIP Code: 030104 ☒ Exploratory ☐ Preparatory	**Date Last Modified:** December 30, 2020
Career Cluster: Agriculture, Food and Natural Resources	**Cluster Pathway:** Environmental Service System
Course Summary: A course that focuses on the application of biological, chemical, and physical principles to the study of the physical environment and the solution of environmental problems, including subjects such as abating or controlling environmental pollution and degradation; the interaction between human society and the natural environment; alternative energy, and natural resources management. Includes instruction in biology, chemistry, physics, geosciences, climatology, statistics, and mathematical modeling. As with all agriculture courses, instruction and assessment in the Supervised Agriculture Experience (SAE) is a requirement. The Supervised Agriculture Experience includes placing a student in a position where he or she will learn the practices of entrepreneurship and the fundamentals of research and experimentation in the agricultural field. Participants in the SAE will conduct exploratory projects with the purpose of learning about and improving practices in their surroundings. SAE.01. This course will include instruction in and Student involvement in Supervised Agriculture Experience Projects (SAE).	
Eligible for Equivalent Credit in: Science	**Total Number of Units:** 8

Unit 1: Earth Systems and Resources	**Total Learning Hours for Unit:** 25

Unit Summary:

This unit will focus on Earth Science Concepts, The Atmosphere, Global Water Resources and Use, and Soil and Soil Dynamics.

A. Earth Science: Geological time scale, plate tectonics, earthquakes, volcanism, seasons, solar intensity and latitude
B. The Atmosphere: Composition, structure, weather and climate, atmospheric circulation and the Coriolis Effect, atmosphere-ocean interactions; ENSO
C. Global Water Resources and Use: Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation
D. Soil and Soil Dynamics: Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Identify renewable and nonrenewable resources in the Pacific Northwest region.
- Explain how human use of natural resources stress natural processes and link that use to a possible long term consequence.
- Students define the role water plays in the environment
- Draw and label the 8 components of the hydrologic cycle, including the energy source.
- Soil Formation and Properties Lab-students learn how rocks are weathered to create soil, analyze soil horizons, determine land slope, identify soil composition and calculate bulk density.
- Porosity and Drainage rate of Soils Lab—students use a variety of substances such as sand, gravel and soil to measure porosity and drainage rates.
- Chemistry of Soil Lab—students use a test kit to determine the Nitrate, Phosphate and pH levels in various samples of soil they have collected.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

- Students access and evaluate information and produce results while completing the chemistry of soil lab.

Industry Standards and/or Competencies:

Agriculture, Food, and Natural Resources (AFNR) Standards -

NRS.01.01.01.a. Summarize and classify the different kinds of natural resources using common classification schemes.
NRS.01.03.01.a. Classify different kinds of biochemical cycles and the role they play in natural resources systems.
ESS.03.01.01.a. Identify components and structural layers of the earth's atmosphere.
CS.01.01.04.c. Create resources to complete an action or project.
CS.01.02.02.c. Engage others in conversations to respond to an obstacle when completing a task.
ESS.02.01.01.b. Identify the purposes of laws associated with environmental service systems.
ESS.03.02.03.b. Identify the physical qualities of the soil that determine its use for environmental service systems.
ESS.03.02.02.b. Relate the activities of microorganisms in soil to environmental service systems.
ESS.05.01.01.c. Evaluate the impact the burning of fossil fuels has on the environment.

ESS.05.01.02.c. Evaluate the impact of alternative energy sources on the environment.
CS.01.01.04.c. Create resources to complete an action or project.
CS.01.02.02.c. Engage others in conversations to respond to an obstacle when completing a task.
ESS.03.02. Apply soil science and hydrology principles to environmental service systems.

Aligned Washington State Academic Standards

Science	**Environmental and Sustainability Standards** ESE Standard 1: Ecological, Social, and Economic Systems. Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels. ESE Standard 2: The Natural and Built Environment: Students engage in inquiry and systems thinking and use information gained through experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments. ESE Standard 3: Sustainability and Civic Responsibility. Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability **Washington State Science Standards:** HS-ESS1- 5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS2-7 Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth. HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept

Unit 2: The Living World	**Total Learning Hours for Unit:** 25

Unit Summary:

This unit will include instruction on Ecosystem Structure, Energy Flow, Ecosystem Diversity, Natural Ecosystem Change, and Natural Biogeochemical Cycles.

A. Ecosystem Structure: Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes

B. Energy Flow: Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids

C. Ecosystem Diversity: Biodiversity; natural selection; evolution; ecosystem services

D. Natural Ecosystem Change: Climate shifts; species movement; ecological succession

E. Natural Biogeochemical Cycles: Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Create a travel brochure for a specific biome. Include analysis of altitude, the role of geochemical cycles, food webs, and keystone species within that biome.
- Explain how climate shift leads to ecological succession via natural selection.
- Case Study: Study current research on how climate shift is affecting a specific species (i.e. polar bears)
- Ecocolumn lab—students set up mini ecosystems, observe the changes over several weeks, test water quality, and analyze the health of their ecosystem.
- Benthic Macro invertebrate lab

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

- Students think creatively, work in diverse teams, and communicate clearly to complete case studies related to the living world and share their findings with their peers.

Industry Standards and/or Competencies:

Agriculture, Food, and Natural Resources (AFNR) Standards -

ESS.03.04. Apply microbiology principles to environmental service systems.

ESS.03.05. Apply ecology principles to environmental service systems.

ESS.03.04.01.b. Assess how the activities of microorganisms in soil affect environmental service systems and ecosystem biodiversity.

ESS.03.05.01.c. Evaluate the biodiversity of an area and predict the impact of changing the levels of biodiversity on environmental service systems.

ESS.03.05.02.c. Evaluate the importance of habitat to environmental service systems and devise strategies to minimize the future loss of habitats.

ESS.03.05.02.b. Assess the impact of the current rate of habitat loss on environmental service systems.

ESS.03.05.03.b. Assess and describe the impact of a population exceeding its carrying capacity on environmental service systems.

ESS.03.05.03.a. Research and explain how carrying capacities relate to environmental service systems (e.g., waste processing, rate or production of pollution, disease, etc.).

ESS.03.05.02.a. Examine and explain the role played by habitats on environmental service systems.

ESS.03.05.04.b. Evaluate the benefits and drawbacks of using bioindicator species in environmental service systems.	
Aligned Washington State Academic Standards	
Science	**Environmental and Sustainability Standards** ESE Standard 1: Ecological, Social, and Economic Systems. Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels. ESE Standard 2: The Natural and Built Environment: Students engage in inquiry and systems thinking and use information gained through experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments. ESE Standard 3: Sustainability and Civic Responsibility. Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability. **Washington Science Standards (Next Generation Science Standards):** HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales HS-LS2-3: Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity HS-LS2-8: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

	HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS- ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept

Unit 3: Populations	**Total Learning Hours for Unit:** 20

Unit Summary:

This unit will include instruction on Population Biology Concepts and Human Populations.

A. Population Biology Concepts: Population ecology; carrying capacity; reproductive strategies; survivorship
B. Human population dynamics: Historical population sizes; distribution; fertility rates; growth rates and doubling times; demographic transition; age-structure diagrams
C. Population size: Strategies for sustainability; case studies; national policies
D. Impacts of population growth: Hunger; disease; economic effects; resource use; habitat destruction

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- *Evaluate* the conditions necessary for rapid *population growth* (e.g., given adequate living and nonliving resources and no disease or predators, *populations* of an *organism* increase at rapid rates).
- Given *ecosystem* data, calculate the *population density* of an *organism*.
- Analysis of a Sustainability case study
- Policy Paper: Analyze human population growth and related policies in a specific region of the world. Consider resource availability and use as well as issues of disease.
- Population Density and Biomass Lab
- Duckweed Lab—students grow duckweed over 30 days in distilled vs. saline water, record growth rate, record the carrying capacity and mathematically calculate whether the difference in growth rate is significant.
- Natural Selection Lab—shows population change
- Case Studies: Yellowstone wolves, Kaibab deer, Lynx/Hare dynamic, China, Rapa Nui (Easter Island)
- Videos: Farming for Future video, Hunger Banquet video, Hungry Planet video
- Nations Report—students choose a nation from list, research and make a poster showing population dynamics of that nation.
- Activity: Sugar Cube population growth—a modeling activity to demonstrate exponential growth and impact of birth/death rates

- Explain and apply the fundamentals of demography
- Outline and assess the concept of demographic transition
- Population Math—students use formulas to calculate growth rates, death rates etc.
- Population Growth (POGIL)
- Population Growth INVESTIGATION
- Colony Collapse Disorder and an Analysis of Honey Bee Colony Numbers (NGSS Classroom Task)
- Carrying Capacity, Human population, Natural Resources, and Biodiversity PROJECT

Leadership Alignment: (Districts to complete for each unit)
Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.
Example:

- Students make judgements and decisions, implement innovations, and communicate clearly while researching, analyzing, and presenting findings related to policy related sustainability.

Industry Standards and/or Competencies:
Agriculture, Food, and Natural Resources (AFNR) Standards –
NRS.01.06.01.a. Differentiate between population ecology, population density and population dispersion and describe the importance of these concepts to natural resource systems.
NRS.01.06.01.b. Analyze the factors that influence population density and population dispersion in natural resource systems.
ESS.02.02. Compare and contrast the impact of current trends on regulation of environmental service systems (e.g., climate change, population growth, international trade, etc.).
ESS.02.02.01.a. Research and categorize the purpose, implementation and impact of greenhouse gas emission policies (e.g., cap-and-trade, emission offsetting, zero-emissions, carbon-neutrality, carbon sequestration, etc.).
ESS.02.02.02.a. Research the impact of environmental service systems regulations on international trade.
ESS.02.02.03.a. Examine and summarize the impact that population growth has on environmental service systems.
ESS.02.02.03.b. Analyze the correlation between increased population size and the need for regulation of environmental service systems.
ESS.02.02.03.c. Predict the impact of future population growth on the regulation of environmental service systems and evaluate how changes made today will impact future regulations.

Aligned Washington State Academic Standards

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	ESE Standard 3: Sustainability and Civic Responsibility. Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability **Washington Science Standards (Next Generation Science Standards):** HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-ETS1-3 Evaluate a solution to complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing Explanations and Designing Solutions	PS3.A: Definitions of Energy	Cause and Effect

Unit 4: Land and Water Use	**Total Learning Hours for Unit:** 25

Unit Summary:

This unit will include instruction in agriculture, forestry, rangelands, and other land use.

A. Agriculture: Feeding a growing population: Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture)

B. Agriculture: Controlling pests: Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws

C. Forestry: Tree plantations; old growth forests; forest fires; forest management; national forests

D. Rangelands: Overgrazing, deforestation, desertification, rangeland management, federal rangelands

E. Urban Land Development: Planned development, suburban sprawl, urbanization

F. Transportation infrastructure: Federal Highway system, canals and channels, roadless areas, ecosystem impacts

G. Public and federal lands: Management, wilderness areas, national parks, wildlife refuges, forests, wetlands

H. Land conservation options: Preservation, remediation, mitigations, restoration, Sustainable land-use strategies.

I. Mining: mineral formation, extraction, global reserves, relevant laws and treaties

J. Fishing: fishing techniques, overfishing, aquaculture, relevant laws and treaties
K. Global Economics: Globalization, World Bank, Tragedy of the Commons, relevant laws and treaties

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Define the role water plays in the environment.
- Correlate how history has impacted natural resources use and management
- Distinguish the roles animals play in the forest and will identify ways to improve wildlife habitat.
- Where Did the Water Go?: Watershed Study (NGSS Classroom Task)
- Salinization Lab – students germinate lettuce seeds in a variety of salt concentrations to determine the threshold for soil in terms of salt content – implication for farmers.
- Water Quality Testing (S.A.E.) – various field experiences throughout the year to determine pH, temperature, dissolved oxygen, nitrates, turbidity, and salinity.
- Land Use Activity – Given certain parameters, students will design an environmentally friendly township and present it to the class.
- Agricultural Practices, Soil and Biodiversity Project
- Exam in Water, Agriculture, and Land Use
- Labs: Salinization, DNA Depot, Cookie Mining, Serotinous Cone Lab, Water Quality Testing, Ocean Science, Oil Spill
- Case Studies: Central Case: Plumbing the Colorado River, Central Case: Seeding the Seas with Marine Reserves

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

- Students use and manage information, manage goals and time, and produce results when presenting solutions to land use issues.

Industry Standards and/or Competencies:

Agriculture, Food, and Natural Resources (AFNR) Standards -

NRS.01.04.02.a. Examine and describe the importance of ground water and surface water to natural resources.
NRS.01.05.02.a. Compare and contrast techniques associated with soil management.
NRS.02.03.01.a. Summarize and categorize the different social considerations in regards to the use of natural resources.
NRS.02.03.01.b. Analyze how social considerations can affect the use and sustainability of natural resources.
ESS.02. Evaluate the impact of public policies and regulations on environmental service system operations.
ESS.02.01. Interpret and evaluate the impact of laws, agencies, policies and practices affecting environmental service systems.
ESS.02.01.01.c. Evaluate the impact of laws associated with environmental service systems for their impact on wildlife, people, the environment and the economy.

Aligned Washington State Academic Standards

Science	**Environmental and Sustainability Standards** ESE Standard 1: Ecological, Social, and Economic Systems. Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate

	understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels. ESE Standard 2: The Natural and Built Environment: Students engage in inquiry and systems thinking and use information gained through experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments. ESE Standard 3: Sustainability and Civic Responsibility. Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability **Washington Science Standards (Next Generation Science Standards):** HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept

Unit 5: Energy Resources and Consumption	**Total Learning Hours for Unit:** 25

Unit Summary:
This unit will include instruction in Energy Concepts, Energy Consumption, Fossil Fuels Resources and Use, Nuclear Energy, Hydroelectric Power, Energy Conservation, and Renewable Energy.
A. Energy Concepts: Energy forms; power; units; conversions; Laws of Thermodynamics
B. Energy Consumption: History; Industrial Revolution; exponential growth; energy crisis, Present global energy use, Future energy needs
C. Fossil Fuel Resources and Use; Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/disadvantages of sources
D. Nuclear Energy: Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion
E. Hydroelectric Power: Dams; flood control; salmon; silting; other impacts
F. Energy Conservation: Energy efficiency; CAFE standards; hybrid electric vehicles; mass transit
G. Renewable Energy: Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy; small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages

Performance Assessments: (Districts to complete for each unit)
Example assessments for this unit include:

- Explain how scientific concepts and findings relate to a resource issue currently under discussion in the state of Washington (e.g., removal of dams to facilitate salmon spawning in rivers; construction of wind farms).
- Explain how the concept of sustainable development may be applied to a current resource issue in the state of Washington, the U.S. and the World.
- Labs: Burn oil to measure heat and toxic fumes, Solar panel cookers lab, Capturing the Wind Lab
- Videos: Get Energized DVD, Balancing Coal and the Environment, "Who killed the electric car?," "Future Cars"
- Case Studies: Central Case: Alaska's North Slope, Central Case: Sweden's Search for Alternative Energy Central Case

Leadership Alignment: (Districts to complete for each unit)
Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.
Example:

- Students interact effectively with others, guide and lead others, and work effectively in diverse teams to work to design solutions to energy resource issues.

Industry Standards and/or Competencies:
Agriculture, Food, and Natural Resources (AFNR) Standards -
NRS.01.01.01.a. Summarize and classify the different kinds of natural resources using common classification schemes.
NRS.01.03.02.a. Research and summarize how climate factors influence natural resource systems.
NRS.01.03.02.b. Analyze the impact that climate has on natural resources and debate how this impact has changed due to human activity.
NRS.03.01.03.a. Compare and contrast the cost and benefits of mineral extraction to the local, state and/or national economy.
NRS.03.01.04.a. Compare and contrast the cost and benefits of fossil fuels to the local, state and/or national economy.
NRS.03.01.05.a. Compare and contrast the cost and benefits of shale oil from fracking to the local, state and/or national economy.
NRS.03.01.06.a. Compare and contrast the cost and benefits of alternative sources of energy
ESS.04.04. Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental service systems.
ESS.04.04.01.a. Research conventional energy sources and list conservation measures to reduce the impact on environmental service systems.
ESS.04.04.01.b. Assess the advantages and disadvantages of conventional energy sources in regards to environmental service systems.
ESS.04.04.02.a. Research alternative energy sources and describe the motivations for seeking alternatives to conventional energy sources as they relate to environmental monitoring.
ESS.04.04.02.b. Identify advantages and disadvantages of alternative energy sources as they pertain to environmental service systems.
ESS.04.04.02.c. Evaluate the impact alternative energy sources have on environmental conditions.
ESS.04.04.04.a. Research the impact on environmental service systems that occur because of energy consumption.
ESS.04.04.05.a. Examine and explain how energy consumption and the carbon cycle relate to environmental monitoring.
ESS.04.04.05.b. Calculate the impact of the carbon cycle imbalance (due to energy consumption) and assess how this imbalance affects environmental service systems.

Aligned Washington State Academic Standards

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Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept

Unit 6: Pollution	**Total Learning Hours for Unit:** 35

Unit Summary:

This unit will include instruction in Pollution Types, Impacts on the Environment and Human Health, and Economic Impacts.

A. Air pollution: Sources — primary and secondary; major air pollutants; measurement units; smog; acid deposition — causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws

B. Noise pollution: Sources; effects; control measures

C. Water pollution: Types; sources, causes, and effects; cultural eutrophication; groundwater pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws

D. Solid waste: Types; disposal; reduction

E. Hazards to human health: Environmental risk analysis; acute and chronic effects; dose-response relationships; air pollutants; smoking and other risks
F. Hazardous chemicals in the environment: Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws)
G. Economic Impacts: Cost-benefit analysis; externalities; marginal costs; sustainability

Performance Assessments: (Districts to complete for each unit)
Example assessments for this unit include:

- Give an example of a physical, biological and chemical parameter that we monitor to manage water quality.
- Explain the role for green urban planning work to lower pollution.
- Labs: Consumer evaluation lab—Household Hazardous Waste, LC-50 Lab, Acid Rain, Exploring Air Pollution Generated by Fossil Fuels, Air Quality survey, Air pollution assay, Landfill Decomposition,
- Slime INVESTIGATION – Students develop a water purification system to purify a sample of mysteriously contaminated water.
- Eco-Column INVESTIGATION – Students learn how biogeochemical cycles work within a closed system.
- Exams in Air & Water Pollution and Solid Waste
- Case Studies: Central Case: Endocrine Disrupters, London's Killer Smog
- Videos: Health Effects of Smog, EPA Pay as you Throw, Time and Again
- Risk assessment activity
- 10 Sources of Indoor Air Pollution handout
- Field trip-to LRI landfill/recycling center on S. Meridian, Graham
- Recycle City –website in computer lab

Leadership Alignment: (Districts to complete for each unit)
Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.
Example:

- Students collaborate with others, access and evaluate information, and apply technology effectively while determining human health hazards and potential economic impacts of these hazards.
- Students are self-directed learners while completing environmental health related investigations

Industry Standards and/or Competencies:
Agriculture, Food, and Natural Resources (AFNR) Standards -
NRS.01.03.01.a. Classify different kinds of biogeochemical cycles and the role the play in natural resources systems.
ESS.04. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).
ESS.04.01. Use pollution control measures to maintain a safe facility and environment.
ESS.04.01.01.a. Identify and distinguish types of pollution and distinguish between point source and nonpoint source pollution.
ESS.04.01.01.b. Assess how industrial and nonindustrial pollution has damaged the environment.
ESS.04.01.01.c. Evaluate evidence for a given area for industrial and nonindustrial pollution.
ESS.04.01.02.a. Research ways in which pollution can be managed and prevented and propose solutions to meet the needs of local systems.
ESS.04.01.02.b. Conduct tests to determine the presence and extent of pollution.

ESS.04.01.02.c. Create a plan for pollution remediation, management or prevention for a given area.
ESS.04.01.03.a. Interpret the conditions necessary for waste to be labeled as hazardous.
ESS.04.01.03.b. Classify examples of pollution as hazardous or nonhazardous.
ESS.04.03. Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations

Aligned Washington State Academic Standards

Science	**Environmental and Sustainability Standards** ESE Standard 1: Ecological, Social, and Economic Systems. Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels. ESE Standard 2: The Natural and Built Environment: Students engage in inquiry and systems thinking and use information gained through experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments. ESE Standard 3: Sustainability and Civic Responsibility. Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability **Washington Science Standards (Next Generation Science Standards):** HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept

Unit 7: Global Change	**Total Learning Hours for Unit:** 20

Unit Summary:
This unit will include instruction in Stratospheric Ozone, Global Warning, and Loss of Biodiversity.
A. Stratospheric Ozone: Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties
B. Global Warming: Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties

C. Loss of Biodiversity: Habitat loss; overuse; pollution; introduced species; endangered and extinct species, Maintenance through conservation, Relevant laws and treaties

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- *Explain that* Earth is warmer near the equator and cooler near the poles due to the uneven heating of Earth by the Sun.
- *Explain that* it's warmer in summer and colder in winter for people in Washington State because the intensity of sunlight is greater and the days are longer in summer than in winter. Connect these seasonal changes in sunlight to the tilt of Earth's axis with respect to the plane of its *orbit* around the Sun
- *Explain how* the *climate* in the Pacific Northwest region is affected by seasonal weather *patterns*, as well as other *factors* such as the addition of greenhouse *gases* to the *atmosphere* and proximity to mountain ranges and to the ocean.
- *Describe factors* that change climates over long periods of time and cite methods that scientists have found to gather information on ancient climates.
- Design a conservation and critique program
- Evaluate the human impact on the environment by calculating carbon Footprint
- A Tale of Four Cities: Using Data to Model Variations in Regional Climate in the Western United States (NGSS Classroom Task)
- Analyzing Floods: Understanding Past Flood Events and Considering Future Flood Events in a Changing Climate (NGSS Classroom Task)
- Human Activity & Global Climate Change PROJECT (ESSS2-4, ESS3-3, and ESS3-6)
- Exams on Global Change & Sustainability
- Lab:Ice Cubes Lab
- Case Study: Central Case-Rising Temperatures and Seas may take the Maldives Under
- Videos: Life in the Balance, Strange Days on Planet Earth-invasive species, National Parks CD-ROM Invasive Species, "Endangered Species, Don't Say Goodbye", "Glaciers" on Views of the National Parks CD-ROM, An Inconvenient Truth, Wildlife and Wetlands Video
- Endangered Species Model
- Island Biogeography Activity—students use beans to determine which islands would receive the most biodiversity.
- Debate over aspects of Climate change

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

- Students demonstrate the ability to communicate clearly through their group project presentation.

Industry Standards and/or Competencies:

NRS.01.03.02.a. Research and summarize how climate factors influence natural resources systems.

NRS.01.03.02.b. Analyze the impact that climate has on natural resources and debate how this impact has changed due to human activity.

NRS.01.03.02.c. Assess the primary causes of climate change and design strategies to lessen its impact on natural resources systems.

ESS.03. Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology,
microbiology, chemistry and ecology.

ESS.03.01.02.a. Analyze how meteorological conditions influence air quality.
ESS.03.01.04.a. Examine and summarize factors that affect the earth's balance of energy.
ESS.03.01.03.a. Research climate change and summarize evidence that climate change is occurring.
ESS.03.01.02.b. Analyze and articulate the relationship between meteorological conditions, air quality and air pollutants.
ESS.03.01.03.c. Evaluate the predicted impacts of global climate change on environmental service systems.
ESS.03.03.03.a. Examine and summarize how chemistry affects air quality and function (e.g., heat retention, formation of smog and acid rain, etc.).

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Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept

Unit 8: Supervised Agricultural Experience	**Total Learning Hours for Unit:** 5

Unit Summary:

The unit will include instruction in the types of Supervised Agricultural Experience (SAE).

- Explain the history of SAE.
- Explain the benefits of SAE projects to skill development, leadership and career success.
- Explain the connection between SAE and FFA.
- Explain the five types of SAE. (Entrepreneurship, Placement, Research, Exploratory, Improvement)
- Explore ideas for SAE projects.
- Explain how SAE projects support academic achievement.
- Select and establish an SAE project.
- Explain and keep records on established SAE projects.
- Explain SAE project Supervision, visitation and assessment.
- Explain how SAE projects benefit the community.
- Seek recognition for SAE project accomplishments.
- Explain the three circle concept for SAE, FFA Leadership, and Classroom/Laboratory in an Agriculture Education program.

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Select and complete a Supervised Agricultural Experience Project in the area of Entrepreneurship, Placement, Research, Exploratory or Improvement.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

- Students will work independently, produce results, and communicate clearly through the selection, implementation, and presentation of their SAE project.

Industry Standards and/or Competencies:

Agriculture, Food, and Natural Resources (AFNR) Standards -

CRP.01. Act as a responsible and contributing citizen and employee.

CRP.01.01. Model personal responsibility in the workplace and community.

CRP.02. Apply appropriate academic and technical skills.

CRP.04. Communicate clearly, effectively and with reason.

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Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept