

Wyoming Department of Education Required Virtual Education Course Syllabus

Natrona County School District # 1

Program Name	Natrona Virtual Learning	Content Area	SC
Course ID	NCV03003.1	Grade Level	9, 10, 11, 12
Course Name	Environmental Science 1	# of Credits	0.5
SCED Code	03003G0.5012	Curriculum Type	Odysseyware

COURSE DESCRIPTION

Environmental Science is an interdisciplinary course covering a wide variety of topics including biology, physics, geology, ecology, chemistry, geography, astronomy, meteorology, oceanography, and engineering. The course also considers ways in which human populations affect our planet and its processes. Of special emphasis is the concept of sustainability as a means of using resources in a way that ensures they will always be around us.

WYOMING CONTENT AND PERFORMANCE STANDARDS

STANDARD#	BENCHMARK (Standard/Indicator Use the Standards and Benchmarks as Spreadsheets")
HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-6	Construct explanations and revise, as needed, based on evidence for: 1) how carbon, hydrogen, and oxygen may combine with other elements to form amino acids and/or other large carbon-based molecules, and 2) how other hydrocarbons may also combine to form large carbon-based molecules.
HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of sugar molecules are broken and the bonds in new compounds are formed resulting in a net transfer of 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 an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions, and revise as needed.
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 biotic and abiotic interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a modified ecosystem.

HS-LS2-7	Evaluate and assess impacts on the environment and biodiversity in order to refine or design a solution for detrimental impacts or enhancement for positive impacts.
HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and /or (3) mutations caused by environmental factors.
HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily result s from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6	Create and/or use a simulation to evaluate the impacts of human activity on biodiversity.
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-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
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-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution 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-ESS3-2	Evaluate competing design solutions for developing, managing, and using energy and mineral resources based on cost - benefit ratios.

HS-ESS3-3	Use computational tools 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-ESS3-5	Analyze data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
HS-ESS3-6	Use the results of a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

SCOPE AND SEQUENCE

UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES/STUDENT CENTERED GOALS
Unit 1: Earth Systems Part 1		
LESSON 1: INTRODUCTION TO ENVIRONMENTAL SCIENCE	-HS-ESS3-6 -HS-ESS3-6 -HS-ESS3-1 -HS-ESS3-2 -HS-ESS3-4 -HS-ESS3-3	-Define environmental science and describe the field of environmental science studies. -Identify the other fields of study that contribute to environmental science. -Identify ways in which humans depend on the environment. -Give examples of renewable and nonrenewable resources. -List the five general causes of environmental degradation. -Explain what is meant by sustainability.
LESSON 2: EARTH'S HISTORY	-HS-ESS1-6 -HS-ESS2-7 -HS-ESS2-7 -HS-ESS2-7 -HS-ESS2-7	-Describe the role of fossils in the discovery of the Earth's history. -Define the terms geologic time and geologic timeline. -Describe how the geologic timeline was developed. -Explain how life on Earth has changed over time. -Differentiate groups of time on the geologic timeline.
Lesson 3: PLATE TECTONICS	-HS-ESS1-5 -HS-ESS1-5 -HS-ESS1-5 -HS-ESS1-5 -HS-ESS2-1	-Describe the theory of plate tectonics. -Summarize the evidence that supports the theory of plate tectonics. -Describe the main types of tectonic plate boundaries. -Compare and contrast the different actions that occur at each type of plate boundary. -Explain the causes of earthquakes and volcanoes.

LESSON 4: EARTH'S ATMOSPHERE	-HS-LS2-5 -HS-ESS1-6 -HS-ESS2-7	-Define what makes Earth's atmosphere unique from other planets in our solar system. -Compare and contrast the composition of Earth's ancient atmosphere with its current atmosphere. -Explain the significance of living organisms in the creation of an oxygen-rich atmosphere.
Lesson 5:WEATHER AND CLIMATE	-HS-ESS2-4 -HS-ESS2-4 -HS-ESS2-4	-Differentiate between the terms weather and climate. -Describe how climate varies worldwide. -Identify and explain the factors that affect climate.
LESSON 6: ATMOSPHERIC CIRCULATION	-HS-ESS3-5 -HS-ESS2-4	-Describe the relationship between latitude and the amount of solar energy that strikes an area. -Explain how the imbalance of heat between low and high latitude areas drives atmospheric circulation and ocean currents.
LESSON 7: LAB: ATMOSPHERIC CIRCULATION AND PATTERNS	-HS-ESS3-5 and HS-LS2-6	Examine fluctuations in local weather patterns and discuss how they may affect or have affected your local ecosystem.
Unit 2: Earth Systems Part 2		
LESSON 1: EARTH'S WATER	-HS-ESS2-5 -HS-ESS2-5 -HS-ESS2-5 -HS-ESS2-5	-Explain why water is an important natural resource. -Describe the differences between freshwater and saltwater. -Explain how the majority of Earth's water is not available for human use because it is either saltwater in the oceans or locked up in the polar ice caps. -Describe how freshwater is distributed worldwide.
LESSON 2: WATER USE	-HS-ESS2-5 -HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-Explain the global uses of water. -Identify the largest consumers of water. -Describe how factors such as climate, income level, and degree of industrialization relate to water use for a country. -Distinguish between consumptive and non-consumptive water use. -Describe the consequences of depleting groundwater resources.
Lesson 3:WATER CONSERVATION	-HS-ESS3-1 -HS-ESS3-1 -HS-ESS3-1	-Describe ways in which water can be wasted or made unsuitable for use. -Discuss ways in which water can be conserved in agriculture, industry, and in individual households. -Explain the importance of conserving water resources.

LESSON 4: PROJECT: EARTH'S WATER	-HS-ESS2-5 -HS-ESS3-1 -HS-ESS3-1	-Draw or create an image of different water sources on Earth -Find out where the drinking water for your community comes from -Three ways to conserve water
LESSON 5: ROCK CYCLE	-HS-ESS2-1 -HS-ESS2-1 -HS-ESS2-1 -HS-ESS2-1 -HS-ESS3-1	- Explain the difference between rocks and minerals. - List and give examples of the three main categories of rocks. - Explain the connection between the type of rock and the environment in which it forms. - Describe the rock cycle, including weathering, erosion, and sedimentation. - Explain that rocks and minerals are natural resources and describe the terms depletion time and mineral reserve.
LESSON 6: PROJECT: ROCK CYCLE	-HS-ESS2-1	-Compose a creative, imaginative story in which you take a rock and follow it through millions of years as it journeys through the rock cycle
LESSON 7:SOIL	-HS-ESS1-5 -HS-ESS3-1 -HS-ESS2-5 -HS-LS2-6	-Define soil and discuss the composition and creation of soil. -Explain why soil is an important natural resource and list functions of soil. -Explain why soils vary throughout the world. -List the biotic components of soil.
LESSON 8: SOIL CONSERVATION	-HS-ESS2-5 -HS-ESS2-5 -HS-ESS3-4 -HS-ESS3-4 -HS-ESS2-5	-Define and give examples of erosion. -Identify and describe problems associated with soil erosion. -Explain ways in which human activities accelerate erosion. -Describe ways to prevent erosion and conserve soil resources. -Explain the relationship between soil erosion and runoff and how these affect water quality.
LESSON 9: LAB: EROSION VIRTUAL EXPERIMENT	-HS-ESS2-5 -HS-ESS2-5	-Study the effects of mechanical and chemical weathering. -Examine the impact humans can have on this process.
Unit 3: Ecology Part 1		

<p align="center">LESSON 1: ECOLOGY</p>	<p align="center">-HS-LS2-6 -HS-LS2-6 -HS-LS2-2 -HS-LS2-6 -HS-LS2-2 -HS-LS2-3</p>	<ul style="list-style-type: none"> -Define ecology. -Describe the interconnectedness between organisms and their environment. -Explain the concepts of habitat, niche, and biodiversity. -Describe major components of ecosystems. -Differentiate between the two major components of ecosystems. -Identify and order the levels of organization from smallest to largest: organism, species, population, community, ecosystem, biome, biosphere. -Summarize the importance of energy flow and cycling of matter in an ecosystem.
<p align="center">LESSON 2: PROJECT: ECOLOGY</p>	<p align="center">-HS-LS2-6 -HS-LS2-2 -HS-LS2-3</p>	<ul style="list-style-type: none"> -Design and create a "Basics of Ecology" poster or multimedia presentation including the levels of organization of living things on Earth (from organism to biosphere), the components of an ecosystem, how both energy and matter move in an ecosystem, and a list of goods and services provided by ecosystems
<p align="center">LESSON 3: EVOLUTION AND BIODIVERSITY</p>	<p align="center">-HS-LS3-2 -HS-LS4-2 -HS-LS4-4 -HS-ESS2-7 -HS-LS4-5 -HS-LS4-4</p>	<ul style="list-style-type: none"> -Differentiate between species diversity and genetic diversity. -Explain the underlying mechanisms of biological evolution. -Compare and contrast biological selection from artificial selection. -Describe ways in which geologic processes, climate change, and natural events affect biological evolution. -Identify mechanisms that can lead to speciation. -Define adaptation and describe how an adaptation is the key to a species' survival.
<p align="center">LESSON 4: PROJECT: EVOLUTION AND BIODIVERSITY</p>	<p align="center">-HS-LS3-2 -HS-LS4-2 -HS-LS3-2</p>	<ul style="list-style-type: none"> -Explain and give examples of both species and genetic diversity. -Explain how biological evolution occurs because of natural selection. -Explain the role of mutations in the biological evolution of species.
<p align="center">LESSON 5: ENERGY FLOW IN ECOSYSTEMS</p>	<p align="center">-HS-LS1-5 -HS-LS2-3 -HS-LS2-3 -HS-LS1-5/1-7 -HS-LS2-3</p>	<ul style="list-style-type: none"> -Describe how photosynthesis and the sun are the basis of all food chains. -Differentiate between primary and secondary production. -Describe the roles of producers, consumers, and decomposers in a ecosystem. -Contrast the processes of photosynthesis and cellular respiration. -Illustrate examples of food chains and webs, trophic levels, and energy pyramids.

LESSON 6: LOCAL FOOD WEBS	-HS-LS2-3 -HS-LS2-3	-Examine your local neighborhood or ecosystem for the different organisms that live there. -Construct a real-life food web for your area based on your observations.
LESSON 7: NUTRIENT CYCLES	-HS-LS2-3 -HS-ESS2-6 -HS-ESS3-4	-Describe how matter and nutrients cycle between various reservoirs in an ecosystem. -Examine the interactions of the carbon cycle, nitrogen cycle, and phosphorus cycle. -Explain the impact human activities have on global nutrient cycles.
LESSON 8: WATER CYCLE	-HS-ESS2-5 -HS-ESS2-5 -HS-ESS2-5 -HS-ESS2-5	-Define the terms evaporation, condensation, and precipitation. -Define watershed and list areas that are watersheds. -Describe the role of a watershed. -Describe how water enters a watershed and the factors that affect water flow through a watershed.
LESSON 9: POPULATION ECOLOGY	-HS-LS2-2 -HS-LS2-1 -HS-LS2-1	-Describe the major characteristics of a population. -Define carrying capacity and identify the factors that affect it. -Compare and contrast the reproductive strategies of R-selected and K-selected species.
LESSON 10: COMMUNITY ECOLOGY	-HS-LS2-2 -HS-LS2-6 -HS-LS2-8 -HS-LS2-2 -HS-LS2-1	-Define and list specific examples of native species, invasive species, keystone species, and indicator species. -Describe ways in which species within a community interact with each other. -Explain how similar species within a community avoid competition. -Identify some of the problems associated with invasive species. -Discuss the importance of the predator/prey relationship.
LESSON 11: ECOLOGICAL SUCCESSION	-HS-LS4-3 -HS-LS4-3 -HS-ESS2-5	-Differentiate between primary and secondary succession. -Identify examples of primary and secondary succession. -Explain ways in which ecosystems change naturally.
Unit 4: Ecology Part 2		

<p>LESSON 1: THREATENED AND ENDANGERED SPECIES</p>	<p>-HS-LS2-2 -HS-LS2-2 -HS-LS4-6 -HS-LS4-6 -HS-LS4-5</p>	<p>-Define threatened, endangered, and extinct. -Identify causes of species extinction. -Describe the effect that human activities can have on the survival of species. -Explain how habitat fragmentation and biomagnification of pollutants affects wildlife. -Explain why some species are better suited to survive environmental change than others.</p>
<p>LESSON 2: PROJECT: THREATENED AND ENDANGERED SPECIES</p>	<p>-HS-LS2-2 -HS-LS4-5</p>	<p>The Raccoon and the Mountain Gorilla -Which species is most vulnerable to extinction? Give at least three reasons why. -Which species would be most harmed by environmental change that wiped out one area of its habitat? Why?</p>
<p>LESSON 3: PROTECTING BIODIVERSITY</p>	<p>-HS-LS2-2 -HS-LS2-2 -HS-LS2-2 -HS-LS2-2</p>	<p>-Describe the efforts of the Convention on International Trade in Endangered Species (CITES) and the U.S. Endangered Species Act. -Explain why efforts to prevent extinction and endangerment are sometimes controversial. -Explain the role of wildlife sanctuaries and zoos in protecting Earth's biodiversity. -Describe the role of wilderness in wildlife conservation.</p>
<p>LESSON 4: TERRESTRIAL BIOMES</p>	<p>-HS-LS2-2 -HS-ESS2-4 -HS-LS2-6</p>	<p>-Define biome and identify the major factors used to categorize terrestrial biomes. -Relate climatic conditions to the characteristics of each biome. -Describe the characteristics of the major terrestrial biomes.</p>
<p>LESSON 5: AQUATIC LIFE ZONES</p>	<p>-HS-LS4-6 -HS-ESS2-7 -HS-ESS3-3</p>	<p>-Discuss the importance of marine life zones and some ways humans are having an impact on them. -Describe how coral reefs are formed and how human activity is affecting coral reefs. -Identify the ecological functions of estuaries.</p>
<p>LESSON 7: FRESHWATER LIFE ZONES</p>	<p>-HS-LS2-2 -HS-LS2-2 -HS-ESS3-3</p>	<p>-Describe the ecological and economic services of freshwater life zones. -Describe the functions of wetlands. -Identify some ways that humans have affected freshwater life zones.</p>

LESSON 8: POPULATION AGE STRUCTURE	-HS-LS2-1	-Use age structure diagrams to predict future trends for a population.
LESSON 9: EFFECTS OF A GROWING HUMAN POPULATION	-HS-LS2-1 -HS-LS2-1 -HS-LS4-6	-Define exponential growth and explain how the human population is growing exponentially. -Discuss the factors that influence population growth rates, fertility, and mortality. -Give examples of resources that humans use and ways that humans impact the environment.
LESSON 10: PROJECT: EFFECTS OF A GROWING HUMAN POPULATION	-HS-LS2-1	-Consider that agricultural and technological advances allow for a much larger carrying capacity of humans on the planet. Would you be in favor of this?
Unit 5: Resource Management		
LESSON 1: FOOD RESOURCES	-HS-LS1-6 -HS-LS2-7 -HS-ESS3-4 -HS-ESS3-4	-Differentiate and identify macronutrients and micronutrients needed for human nutrition. -Describe ways that we can increase food security. -Describe advantages and disadvantages of industrial agriculture. -Describe methods of sustainable agriculture.
LESSON 3: FORESTRY	-HS-LS2-2 -HS-LS2-7 -HS-LS2-7 -HS-LS2-2	-Describe human impacts on forests. -Discuss some of the environmental effects of deforestation. -Describe how fires can benefit or harm forest ecosystems.
LESSON 4: PROJECT: FORESTRY	-HS-LS2-2 -HS-LS2-2 -HS-LS2-2 -HS-LS2-2 -HS-LS2-2 -HS-ESS2-5	-Logging trees is often controversial. Why would some people support logging and some people not support logging? -Describe one way fire is beneficial to a forest and one way fire is harmful to a forest. -What is the connection between poverty, population growth, and deforestation? -Why are old-growth forests often more ecologically valuable than second-growth forests? -How does clear cutting compare with selective cutting, and why is selective cutting considered more sustainable than clear cutting? -How can deforestation contribute to flooding and water pollution?

<p>LESSON 5: RANGELANDS</p>	<p>-HS-ESS3-1 -HS-ESS3-1 -HS-LS2-7 -HS-LS2-7</p>	<p>-Define grassland, rangeland, and pasture. -Describe the uses of rangeland. -Describe the effects of overgrazing. -Describe possible management practices for rangelands and their environmental implications.</p>
<p>LESSON 6: PROJECT: RANGELANDS</p>	<p>-HS-ESS3-1 -HS-LS2-7 -HS-LS4-6</p>	<p>-Explain how grassland can become like a desert by the action of livestock like cows -Explain how farmers can practice sustainable use of rangeland -Explain how your individual life would be directly or indirectly affected if all of America's rangelands were disturbed to the point that they could no longer be used</p>
<p>LESSON 7: LAND CONSERVATION</p>	<p>-HS-LS2-7 -HS-LS2-7 -HS-LS2-7</p>	<p>-Discuss the origin and current problems of national parks, wildlife refuges, and nature preserves in the U.S. and other countries. -Describe the trade-offs between conservation and economic development. -List the issues related to the design of protected lands.</p>
<p>LESSON 8: PROJECT: LAND CONSERVATION</p>	<p>-HS-LS2-7 -HS-LS2-7 -HS-LS2-7 -HS-LS2-7 -HS-LS2-7</p>	<p>-Why, or under what circumstances, might it be hard to establish a large area of protected land? -How can habitat corridors be beneficial to species that need large areas in which to live and move around? -What are two benefits provided by protected lands such as national parks? -How could buffer zones help mitigate the problems of overcrowding, development, pollution, and invasive species in national parks? -Make a list of three things you think a country's government should do in order to make sure that ecotourism does not do more harm than good</p>
<p>LESSON 9: MINING</p>	<p>-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2</p>	<p>-Define surface and subsurface mining. -List some of the environmental impacts of mining. -Discuss various mining options by describing how they operate and their environmental advantages and disadvantages.</p>

<p>LESSON 10: PROJECT: MINING</p>	<p>-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2</p>	<p>-What is the difference between spoils and tailings? -Why must mine tailings be stored and disposed of carefully? -Describe the process of mountaintop removal and why it is controversial. -What is the purpose of the SMCRA and what requirements does it dictate?</p>
<p>LESSON 11: FISHERIES</p>	<p>-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3</p>	<p>-Describe methods of industrial fish harvesting and outline some of their environmental impacts. -Describe the causes and problems associated with overfishing. -Describe the basics of the aquaculture industry and its advantages and disadvantages.</p>
<p>SEMESTER REVIEW</p>	<p>Comprehensive review over standards presented in above unit.</p>	<p>Evaluation of Semester 1 Environmental Science</p>
<p>MIDTERM EXAM</p>	<p>Comprehensive review over standards presented in above unit.</p>	<p>Evaluation of Semester 1 Environmental Science</p>