



## Environmental Science Course Syllabus

### Course Description:

This course examines environmental science and the concept of sustainability from scientific, personal, and philosophical perspectives. Students learn the science behind different energy resources, myriad types of pollution and their effects on the environment and human health, climate change, natural resource use and management, conservation and land use, and sustainable agriculture. While the scientific aspect forms the core of the course, it is complemented by discussion of relevant environmental laws and environmental economics, as well as discussion of personal sustainability practices and consideration of one's carbon footprint, waste production patterns, and energy use. Finally, the course is rounded out with an overview of environmental ethics and related philosophical paradigms, as well as strategies for a sustainable future.

Part 1: 5 credit hours

Part 2: 5 credit hours

### Course Outline

### Next Generation Science Standards (NGSS) Common Core State Standards

## Environmental Science, Part 1

### Unit 1: Defining Sustainability

- 1.1 What is Sustainability?
- 1.2 Root Causes of Unsustainability
- 1.3 Thinking Green: Life Cycle Assessment
- 1.4 Thinking Green: Systems Theory
- 1.5 Dissecting the Concept of Sustainability

### In Unit 1 students will learn:

To identify what is “sustainable” and the root causes of unsustainability.

To analyze the life cycle of different products, to determine how environmentally friendly they are or are not.

Perspectives on what sustainability is and how "thinking in systems" applies to thinking sustainably.

[NGSS: HS-LS2-7]

[Common Core: RST.11-12.7, WHST.9-12.7]

### Unit 2: Energy Resources and Society

- 2.1 Renewable vs. Nonrenewable Resources
- 2.2 Fossil Fuels
- 2.3 Peak Oil
- 2.4 Solar Energy
- 2.5 Wind Power
- 2.6 Geothermal Energy
- 2.7 Biofuels and Biomass
- 2.8 Nuclear Energy
- 2.9 Hydropower and Tidal Power
- 2.10 Hydrogen Fuel Cells

### In Unit 2 students will learn:

The differences between renewable and nonrenewable energy resources.

How we obtain energy from a variety of renewable and nonrenewable sources.

The pros and cons of each type of energy.

What the term "fossil fuel" means and about the concept of “peak oil.”

[NGSS: HS-LS2-7, HS-ESS3-1, HS-ESS3-2, HS-ETS1-3]

[Common Core: RST.11-12.7, WHST.9-12.7, WHST.9-12.2, RST.11-12.8]#

### Unit 3: Energy Conservation and the Home

- 3.1 A Temperature-Controlled Home
- 3.2 Energy-Efficient Appliances
- 3.3 Weatherizing
- 3.4 Installing Solar Panels
- 3.5 LEED Certification
- 3.6 Passive and Zero Energy Houses
- 3.7 Maximizing Fuel Economy

#### **In Unit 3 students will learn:**

The basics of maintaining an eco-friendly and energy-efficient home.

How to use water wisely, and to control the temperature of the home in an environmentally friendly way.

The basics of efficient appliances, weatherizing, and solar panels.

About LEED certification, as well as passive and zero energy houses.

[NGSS: HS-LS2-7, HS-ESS3-4]

[Common Core: RST.11-12.7, WHST.9-12.7]

### Unit 4: Air Pollution and Climate Change

- 4.1 Types of Pollution
- 4.2 Smog
- 4.3 Particulate Matter
- 4.4 Oxides: Carbon, Nitrogen, Sulfur
- 4.5 Lead
- 4.6 Ozone
- 4.7 Volatile Organic Compounds
- 4.8 History of Earth's Climate: The Carbon Cycle and Paleoclimatology
- 4.9 The Greenhouse Effect
- 4.10 Greenhouse Gases and Climate Change

#### **In Unit 4 students will learn:**

The different types of air pollution and their negative effects on human health and the environment.

The Earth's natural carbon cycles.

About the greenhouse effect and how greenhouse gases contribute to climate change.

[NGSS: HS-LS2-7, HS-ESS2-4, HS-ESS2-6]

[Common Core: RST.11-12.7, WHST.9-12.7, RST.11-12.1]

### Unit 5: Societal and Individual Responses to Air Pollution and Climate Change

- 5.1 The Clean Air Act
- 5.2 Kyoto Protocol and Montreal Protocol
- 5.3 Paris Climate Accord
- 5.4 Thinking About Your Carbon Footprint
- 5.5 Greening Your Commute
- 5.6 Carbon Offsets
- 5.7 Climate Action Plans

#### **In Unit 5 students will learn:**

Ways that countries, communities, and individuals are taking action regarding air pollution and climate change.

The basics of international treaties like the Kyoto Protocol, Montreal Protocol, and the Paris Accord.

U.S. legislation like the Clean Air Act.

How to reduce your own carbon footprint as an individual.

How to make a community Climate Action Plan.

[NGSS: HS-LS2-7, HS-ESS3-4, HS-ETS1-3]

[Common Core: RST.11-12.7, WHST.9-12.7, RST.11-12.1]

### Unit 6: Water Pollution and its Effects

- 6.1 Chemical Pollution
- 6.2 Groundwater Pollution
- 6.3 Agricultural Runoff
- 6.4 Thermal Pollution
- 6.5 Oil Pollution
- 6.6 Noise Pollution
- 6.7 Plastic Pollution

#### **In Unit 6 students will learn:**

About the different types of water pollution in rivers, oceans, lakes and what causes each type.

The negative effects of each type of water pollution on humans, animals and the environment.

[NGSS: HS-LS2-7, HS-ESS3-4]

[Common Core: RST.11-12.7, WHST.9-12.7, RST.11-12.1]

- 6.8 Ocean Acidification
- 6.9 Coral Bleaching
- 6.10 Nutrient Pollution and Eutrophication

### Unit 7: Water Sustainability

- 7.1 Earth's Freshwater Resources
- 7.2 Water Shortages and Climate Change
- 7.3 Water Rights
- 7.4 Water Quality and Wastewater Treatment
- 7.5 Using Water Wisely
- 7.6 Water-Smart Tips for Your Lawn
- 7.7 Rainwater Catchment Systems
- 7.8 Water Audits for the Home
- 7.9 What is Okay to Put Down the Drain

### **In Unit 7 students will learn:**

About Earth's freshwater resources.

About water scarcity and water rights on a local and global scale.

How water treatments plants work.

What not to put down the drain.

Strategies that individuals can take to conserve water and use it more efficiently.

**[NGSS: HS-LS2-7, HS-ESS3-1, HS-ESS3-4]**

**[Common Core: RST.11-12.7, WHST.9-12.7, WHST.9-12.2, RST.11-12.1]#**

## Environmental Science, Part 2

### Unit 1: Agriculture and Land Use

- 1.1 Evolution of Agriculture Over Time
- 1.2 Fertilizer and The Green Revolution
- 1.3 Soils and Soil Health
- 1.4 Growing Fuel
- 1.5 Deforestation
- 1.6 Biodiversity
- 1.7 Tragedy of the Commons
- 1.8 Over-fishing
- 1.9 Urban Sprawl

#### **In Unit 1 students will learn:**

About the evolution of agriculture over time, fertilizer and Norman Borlaug's Green Revolution in agriculture, and relevant topics in soil health and biodiversity.

About major land-use issues and their effects on ecosystems and the climate are discussed, including using land for growing biofuel, deforestation, over-fishing, and urban sprawl.

The philosophical/economic idea of the Tragedy of the Commons.

[NGSS: HS-LS2-6, HS-LS2-7, HS-ESS3-1]

[Common Core: RST.11-12.7, WHST.9-12.7, WHST.9-12.2]#

### Unit 2: Food and Agricultural Sustainability

- 2.1 Sustainable Agriculture
- 2.2 Organic, Free Range, and Grass fed
- 2.3 Fair Trade Products
- 2.4 Farmers Markets and Community Supported Agriculture
- 2.5 Meat and the Environment
- 2.6 Permaculture
- 2.7 Community Gardens
- 2.8 Native and Food Forest Gardens

#### **In Unit 2 students will learn:**

The multifaceted concept of "sustainable agriculture" as well as the connection between cattle farming and greenhouse gas production.

Many different strategies that farmers, communities, and consumers adopt in an attempt to make their food consumption or agricultural operation more environmentally-friendly. Such strategies include: organic, free-range and grass-fed products, Fair Trade products, farmers' markets and community supported agriculture, permaculture, community gardens, native gardens, and food forest gardens.

[NGSS: HS-LS2-7, HS-ESS3-1, HS-ESS3-4]

[Common Core: RST.11-12.7, WHST.9-12.7, WHST.9-12.2, RST.11-12.1]#

### Unit 3: Hazardous Waste and Plastic Pollution

- 3.1 Landfills and Plastic Pollution
- 3.2 Avoiding Waste
- 3.3 Recycling
- 3.4 Upcycling and Reuse
- 3.5 Electronic Waste
- 3.6 Disposing of Old Cars and Used Motor Oil
- 3.7 Disposing of and Alternatives to Harmful

#### **In Unit 3 students will learn:**

About the production of waste, where it goes, and strategies for disposing of waste on both societal and individual scales.

What individuals should do with certain types of hazardous waste, and teaches how to properly dispose of the following (as well as the effects it has on the environment if they dispose of it incorrectly):

- Chemicals and Cleaners
- 3.8 Disposing of Old Medicines
- 3.9 Cleaning up Plastic Pollution

#### Unit 4: Ecology, Economics, and Governance

- 4.1 Population and Carrying Capacity
- 4.2 Environmental Economics
- 4.3 The Growth Economy
- 4.4 The Triple Bottom Line
- 4.5 Cost-Benefit Analysis and Externalities
- 4.6 Natural Capital and Ecosystem Valuation
- 4.7 Carbon Pricing: Cap and Trade Systems, Carbon Taxes
- 4.8 Sustainable Development
- 4.9 Types of Conservation and Preservation

#### Unit 5: Environmental Ethics and Philosophy

- 5.1 Corporate Social and Environmental Responsibility
- 5.2 Environmental Value Systems
- 5.3 The Resource Conservation Ethic and the Land Ethic
- 5.4 Bioregionalism
- 5.5 The Rights of Nature
- 5.6 Environmental Justice
- 5.7 The Gaia Hypothesis

#### Unit 6: Strategies for a Sustainable Future

- 6.1 Biomimicry
- 6.2 Transition Towns
- 6.3 Ecovillages and Ecocities
- 6.4 Green Technology
- 6.5 Geoengineering
- 6.6 Climate Change Mitigation and Adaptation

old cars, used motor oil, harmful chemicals and cleaners, and old medicines.

[NGSS: HS-LS2-7, HS-ESS3-2]

[Common Core: RST.11-12.7, WHST.9-12.7, RST.11-12.8]

#### In Unit 4 students will learn:

Ecological principles related to consumption, growth, and environmental economics. Principles of environmental economics that are discussed include the basics of what environmental economics is, the triple bottom line, cost-benefit analysis, externalities, natural capital and ecosystem valuation, carbon pricing (cap-and-trade systems and carbon taxes), as well as how the concept of the "growth economy" relates to the idea of sustainability.

Relevant ecological issues discussed here include population growth and Earth's carrying capacity, as well as the contrast of conservation vs preservation. A relevant governance concept discussed in this unit is the idea of sustainable development.

[NGSS: HS-LS2-1, HS-LS2-7]

[Common Core: RST.11-12.7, WHST.9-12.7, RST.11-12.1, WHST.9-12.2]

#### In Unit 5 students will learn:

About corporate social and environmental responsibility, environmental value systems (technocentrism, ecocentrism, anthropocentrism), Gifford Pinchot's Resource Conservation Ethic versus Aldo Leopold's Land Ethic, bioregionalism, the legal rights of nature, environmental justice, and chemist James Lovelock's Gaia Hypothesis.

[NGSS: HS-LS2-7, HS-ESS3-2]

[Common Core: RST.11-12.7, WHST.9-12.7, RST.11-12.8]

#### In Unit 6 students will learn:

Some strategies that regions and societies are adopting to deal with climate change and other environmental issues. Strategies discussed include: biomimicry in products and architecture; transition towns, ecovillages and ecocities as ways of making towns and cities more sustainable; green technology; geoengineering and other means of climate change mitigation; and climate change adaptation

[NGSS: HS-LS2-7, HS-ESS3-1, HS-ESS3-4, HS-ESS3-5]

[Common Core: RST.11-12.7, WHST.9-12.7, WHST.9-12.2, RST.11-12.1]#