

AP Environmental Science Syllabus

Eastern Regional High School

Class Size and Scheduling

Class size is held to 26 because of lab facilities. The class periods are 45 minutes long, and a double lab period is scheduled twice a week.

Course Description

AP Environmental Science is open to 11th and 12th grade students who have taken biology and chemistry. The students must be prepared to work outdoors for many of the labs. The scientific principles and disciplines are an integral part of the course. Students are encouraged throughout the course to consider scientific principles and disciplines when completing activities, and laboratory and/or fieldwork. Through the lab and fieldwork the students learn methods for analyzing and interpreting information and experimental data and mathematical calculations. Students are taught methods for identifying and analyzing environmental problems and learn how to identify resolutions, prevention and sustainability.

Textbook

Environmental Science: A Study of Interrelationships, 13 ed. By Eldon Enger and Bradley Smith., McGraw Hill, 2013

Topics Covered:

Unit 1: Introduction and Basic Concepts in Environmental Science (2 weeks)

Chapter 1 - Interrelatedness

General overview of the topics covered throughout the year

Lab: Jenga Ecosystem – A Game of Jenga is used to introduce data collection and create analogies to ecosystem concerns. Factors such as probability and statistics are introduced to the study of ecology.

Video: *The Lorax*

Chapter 2 - Environmental Ethics

1. How humans have adapted to and modified the environment
2. Personal decision making and philosophies

Lab: Personal Ecological Footprint

Chapter 3 - Environmental Risk

1. Environmental risk and risk management
2. Corporate environmental disasters and relevant laws

Project: Corporate Environmental Ethics – Students choose a company and complete a thorough environmental analysis of that company including ways in which the company both positively and negatively influences the environment.

Debate: Mercury Emissions - Students represent different parties in a public hearing style debate about how to control address mercury pollution. Students must identify and analyze sources of mercury, problems associated mercury contamination, and to critically examine potential solutions to these problems within the viewpoint of the party they represent.

Unit 2: Science, Systems, Matter and Energy (1 week)

Chapter 4 - Interrelated Scientific Principles: Matter, Energy, and Environment

1. The scientific method
2. Nature's building blocks—a review of general chemistry
3. Different forms of energy and their importance in environmental science
4. Laws of matter and energy

Lab: Effects of Radiation on Seed Germination and Growth— Students measure, over a series of days, the effects of three types of radiation on the germination and subsequent growth of the irradiated seeds. They then treat their data to statistical analysis in order to draw conclusions. This lab is also focused on introducing the principles of the scientific method.

Unit 3: Living World (4 weeks)

Chapter 5 - Ecosystems: Components, Energy Flow, and Matter Cycling

1. Populations, communities, food chains, and webs
2. Ecological pyramids and productivity
3. Biogeochemical cycles

Lab: What's in an Owl Pellet? Students gain insight into the habits and adaptations (such as sources and preferences of prey) of an apex predator by examining owl pellets.

Lab: Inter-and Intraspecific Competition: Students analyze the effects of population density on the growth of two plant species (radishes and wheat) growing alone and in mixed species groups. Density and species composition are manipulated. The resulting biomasses of the two species are statistically analyzed.

Lab: Brine Shrimp and Abiotic factors – and analysis of abiotic factors that affect populations of brine shrimp.

Chapter 6 - Kinds of Ecosystems and Communities

1. Weather and climate
2. What are biomes and how do they differ?
3. Succession

Internet Activity: Creating and Understanding Climatograms

Project: Biomes – Students are assigned a specific Biome from the textbook to research. Reasons for climate differences (precipitation, temperature, wind patterns, latitude, altitude) must be clearly explained, and the biotic features must be analyzed as well.

Video: *Yellowstone*

Chapter 11 - Biodiversity Issues

1. Loss of Biodiversity
 - a. Global issues
2. Effect of humans on biodiversity
3. Estimation of extinction risks
4. Value of biodiversity services
5. Methods of biodiversity protection
6. Laws and Treaties

Project: Endangered and invasive species Students complete a research paper focusing on the risks associated with environmental problems related two specific species and how to resolve them.

Video: *Cane Toads*

Lab: Biodiversity in Leaf Litter: A Berlese funnel is used to collect organisms from leaf litter. Biodiversity is calculated using both the Shannon-Weiner and the Simpson's Diversity Index.

Debate: Dune protection for the piping plover – Students hold discussions in which they analyze environmental problems, possible resolutions, prevention and sustainable options for managing the habitat of the piping plover.

Unit 4: Populations (3 weeks)

Chapter 7 - Populations: Characteristics and Issues

1. Exponential versus logistic growth
2. Biotic potential and environmental resistance
3. Characteristics of r-strategists and K-strategists
4. Survivorship curves
5. Human population growth
6. Fertility and death rates
7. Age structure histograms
8. Factors affecting population size
9. The demographic transition

Lab: Duckweed Population Growth Lab: Students observe the growth of duckweed, an aquatic floating plant, and how its growth rate yields a logistic curve, illustrating concepts of population growth rates, carrying capacity, and limiting factors (such as light, pH, etc.).

Lab: Power of the Pyramids—Constructing Age-Sex Histograms: Students use census data to construct and analyze age-sex population pyramids.

Lab: Let's Go Fishing—Mark/Recapture Activity: Students sample, mark, and resample in order to use the Petersen Method to determine the fish populations.

Project: Population Dynamics of a foreign country

Debate: Global Population Growth – Students represent different countries in a Model UN style debate about how to control global populations. Students must identify and analyze problems associated with global

population growth, and to critically examine potential solutions to these problems within the viewpoint of the country they represent

Video: *The People Bomb*

Video: *Mother: Caring for 7 Billion*

Unit 5: Energy Resources and Consumption (6 weeks)

Chapter 8 - Energy and Civilization – Patterns of Consumption

1. Units for measuring energy
2. Energy Efficiency
3. Energy consumption around the world
4. Global impact of energy consumption
5. Future projections of energy use

Lab: Thermal insulation and energy consumption

Lab: Personal Energy Audit – An Analysis of personal energy consumption using reading from a home electricity and gas meter. Calculations are made to determine amount of energy consumed overall. This amount is then compared with average energy consumption in various countries.

Chapter 9 - Non-Renewable Energy Sources

1. Identifying, locating, and removing nonrenewable mineral resources
2. Types of mining
3. Environmental effects of extraction/refining/use of:
 - a. Oil
 - b. Natural gas
 - c. Coal
 - d. Nuclear energy

Lab: Oil Spill Clean up

Lab: Energy comparisons of fossil fuels – Students use mathematical methods to analyze the energy outputs of different fossil fuels for comparison.

Chapter 10 - Renewable Energy Sources

1. Solar energy (passive and active)
2. Hydroelectricity
3. Wind power
4. Biomass
5. Hydrogen
6. Geothermal energy

Lab: Creating and analyzing Biofuels Students will synthesize their own biofuels and then analyze these fuels to calculate their energy density. These values will be compared to previously tested fossil fuels.

Project: Renewable and Nonrenewable Energy Sources—Pros and Cons

Unit 6: Land Use, Resources, and Pollution (5 weeks)

Chapter 12 - Land Use Planning

1. Land use in the United States and the world, including laws to manage public lands
2. Managing forests sustainably
3. Types of tree harvesting
4. Managing tropical forests
5. Rangelands
6. Sustaining national parks
7. Urban planning
8. Noise and light pollution

Chapter 13 - Soil and Its Uses

1. Earth science
 1. Geologic processes and plate tectonics
 2. Volcanoes
 3. Geologic time scales
2. Erosion and weathering
3. Rocks, minerals, and the rock cycle
4. Soil formation and soil profiles
5. Characteristics of soil and reading a soil triangle
6. Soil erosion, desertification, and salinization
7. Soil Pollution

Lab: Tectonic Plates

Lab: Urban Design – Students are tasked with designing a growing town expansion project. They must use land use planning principles to ensure the project is carried out in a way that will be efficient for both humans and the environment.

Lab: Soil structure and Soil Profiles – Soil samples are taken from various places around the school and analyzed using a soil triangle.

Lab: Rocks and the Rock Cycle

Lab: Soil pollutant analysis – Soil pollutants are added on varying amounts to germinated seed trays. Data is collected and analyzed on the effects of pollutants on the growth of seeds.

Project: Land Protections

Chapter 14: Agricultural Methods and Pest Management

1. Food production and nutrition
2. Increasing crop production
3. Genetic engineering
4. Irrigation
5. Meat production—Positive and negative effects
6. Harvesting fish and shellfish

Video – Food Inc.

Lab – Overfishing modeling

Unit 7: Water Management and Pollution (5 weeks)

Chapter 15: Water Resources

1. Water Resources
 - a. Hydrological cycle

- b. Freshwater/saltwater
 - c. Surface and groundwater
 - d. Human uses for water
- 2. Water Conservation
- 3. Water pollution
 - a. Types and sources
 - b. Human health impact
 - c. Ecosystem impact
 - d. Economic impact
- 4. Water filtration and purification
- 5. Wastewater and storm water systems
- 6. Toxicology
 - a. Bioaccumulation and biomagnification

Lab: Toxicology—Testing LD-50: Four kinds of cleaning solutions (sodium hypochlorite, quaternary ammonium compounds, vinegar, and borates), are analyzed to determine the lethal dose 50 percent for yeast. Students write a report addressing dangers of current practices, effects on wildlife and people and make recommendations for more sustainable practices.

Lab: Creating and Testing a Water Filter – Students create and test water filters built using common materials. The designs are then analyzed for their performance, cost, and ease of use.

Lab: Testing local Ponds for Water Pollutants – Repeated 4 times throughout the year for seasonal comparisons.

Video: *The Power of Water* (National Geographic)

Field Trip – Atlantic County Wastewater treatment center

Unit 8: Atmosphere and Air Pollution (4 weeks)

Chapter 16 – Air Quality Issues

- A. Structure of the Atmosphere
 - a. Composition
 - b. Structure
 - c. Circulation
- B. Pollution
 - a. Types and sources of pollutants
 - b. Human health effects
 - c. Ecosystem effects
 - d. Economic effects
 - e. Acid deposition
 - f. Thermal inversions
 - g. Pollution solutions
 - h. Indoor air pollution
- C. Global Changes
 - a. Stratospheric o-zone
 - i. Formation
 - ii. Function
 - iii. Causes of depletion
 - iv. Strategies and laws for replenishing
 - b. Global Warming

- i. Greenhouse gasses
- ii. Effects of global warming
- iii. Strategies and possible solutions

Lab: Measuring Automobile Pollutants

Lab: High Volume Air sampler for indoor air testing – A high volume air sampler is used to measure particulate matter. The samplers filter disks are analyzed using calculation methods discussed In class to determine the concentration of particulate matter in the air.

Lab: High Volume Air sampler for outdoor air testing - A high volume air sampler is used to measure particulate matter. The samplers filter disks are analyzed using calculation methods discussed In class to determine the concentration of particulate matter in the air.

Lab: Measuring Tropospheric O₃

Debate: Carbon Tax - Students represent different parties in a public hearing style debate about how to control address carbon emissions. Students must identify and analyze problems associated carbon emissions, and to critically examine potential solutions to these problems within the viewpoint of the party they represent.

Unit 9: Waste Disposal (1 week)

Chapters 17 and 18

Topic: Solid and Hazardous Waste

1. Municipal Solid Waste (MSW) Hazardous waste
2. Laws regarding hazardous waste in the United States
3. Reduce, reuse, recycle
4. Detoxifying, burning, burying, and exporting waste Land disposal

Lab: Waste Production – Students use scales and common materials to calculate the waste that their family produces.

Field Trip – Atlantic County Landfill

Field Trip – Camden County Waste Incinerator

Video: *Endangered Planet*

Unit 10: Other Topics

Chapter 19 - Environmental Laws

Worked throughout the year as other topics are covered

Laws regarding hazardous waste in the United States