

Advanced Placement Environmental Science (APES)

Syllabus

Course Overview

This AP Environmental Science course is a lecture and lab course designed to exemplify a collegiate semester course in Environmental Studies and/or Sciences. This course incorporates the following major topics: Earth Systems and Resources, The Living World, Population, Land and Water Use, Energy Resources and Consumption, Pollution and Global Change. These major topics are integrated through various units of study which include but are not limited to soil properties and dynamics, atmospheric principles, water resources and uses, ecosystem structure, energy flow and diversity, biogeochemical cycles, population concepts with particular emphasis on human population dynamics, land uses including forestry, agriculture, mining, wilderness, recreation and land-use planning, fossil fuels, nuclear energy, alternative energies, conservation of energy, water, air and land resources, air, water and land pollution, environmental and human health aspects, economic and historical implications of pollution, policy and historical practices regarding environmental issues, global warming, and loss of biodiversity.

Students will gain thorough knowledge and understanding of ecological concepts, environmental data, policy, economics and sustainability practices that underly environmental science. Students will also collect and use lab data to better understand environmental issues and problems. They will apply concepts learned through lecture, discussion and research and demonstrate understanding of the major principals of environmental science. Students will gain hands-on technical skills in lab including the use of hand-held computing technologies and develop critical thinking skills necessary to truly grasp the enormity and gravity of the interactions of organisms, particularly humans and our affect on the larger global community.

The **objectives** of this course are that students will:

- * demonstrate mastery of environmental science concepts and principles
- * apply learned knowledge to the interactions of organisms in the environment and their affect upon and within the environment
- * construct a set of personal values and views that are coherent and defensible and inspire everyday practices and behaviors that are environmentally sustainable
- * interpret and predict patterns in data to propose viable solutions to environmental issues

*gain a greater appreciation and respect for the environment, diversity of life, sustainability and our global home.

Each unit is structured so a students will have the opportunity to sufficiently learn the material through several days of lecture, discussion and research accompanied by complementary labs, essays, critical reading, relevant activities and other material as well as a review of material and a test with both written and multiple choice items.

The **textbook** for the course is the 1st Ed. of Andrew Friedland, Rick Relyea & David Courard-Hauri's Environmental Science for AP*. Students will also use the AP Environmental Study Guide. Additional labs are generated by the teacher or come from other sources of collegiate materials including collegiate web sites and other APES teachers.

AP Environmental Course Planner

Unit 1

Introduction to Environmental Science, the State of Our Earth & Environmental Systems (3 Weeks)

Chapters: 1 & 2

Lecture Topics:

- Intro to Environmental Science & State of Our Earth
- Environmental science
- Ecosystem
- Biotic and abiotic factors
- Human alteration of environment
- Ecosystem services
- Diversity and species extinction
- Resource depletion
- Human Population
- Development
- Sustainability
- Eco-footprint
- Scientific Method/Process
- History of Environmental Science

Major Figures of Environmental Science

Environmental Systems

Chemistry of Life

Energy Principles

System Analysis

Labs:

Design your own lab - Pillbugs (scientific method/process) - (1.5 class periods)

School site environmental survey (1 class period)

Tragedy of the Commons Lab (1 class period)

Ecological Footprint - Computer Lab & research project (1.5 class periods)

Activities/ Projects:

Truax & Lorax comparison activity

Take a Stand/Where Do You Stand - Environmental issues activity

Math Problem Sheet

Name Droppers Activity

Current Events Article Review and Collection (ongoing in all units)

Legislation, Laws and Treaties Activity

Cats in Borneo Activity

Videos & Various Readings:

The Lorax by Dr. Suess - Video & book

The Truax by Birkett, T. - Story from <http://woodfloors.org/truax.pdf>

And the Waters turned to Blood by Barker, R. - Pfiesteria outbreak book excerpt

Cane Toads, An Unnatural History - Video

A Silent Spring by Carson, R. - Video

Sand County Almanac by A Leopold

Walden Pond by H. Thoreau

Field Trip:

Testing The Waters - Riveredge Nature Center Water Testing Program

Select students - training (data collection and analysis)

FRQ:

1999 #2

2012 #3

Unit 2
Ecosystems & Ecological Principles
(3 weeks)

Chapters: 3-5, 6

Lecture Topics:

- Ecosystem Processes & Structure
 - Populations & Communities
 - Niche & Habitat
- Energy Flow in Ecosystems
 - Food Webs & Chains, Trophic Levels, Ecological Pyramids
- Primary Productivity
- Biogeochemical Cycles
 - Water, Carbon, Nitrogen, Phosphorus, Sulphur
- Ecosystem Services
- Climate
 - Biomes & Aquatic Ecosystems
- Biodiversity
- Speciation and Natural Selection
- Species Interactions
- Keystone Species
- Succession

Labs:

- Biodiversity in Leaf Litter Lab (1/2 class period)
- Predator/Prey Lab (1.5 class periods with data collection and analysis)
- Abiotic Influences on Organisms Lab (tygon tubing, clamps & brine shrimp)(1 class period with data collection and analysis)
- Owl Pellet Dissection (1 class period)
- Primary Productivity Lab (various amounts of time over 3 weeks with data collection and mathematical analysis)

Activities/Projects:

- Ecosystem/Biome Bingo
- Climatograms Project
- Biome & Endangered Species Research Project
- Biodiversity Activity

Videos & Various Readings

- Whooping Crane & Ultraflight
- California Condor

Tracking the Vanishing Frogs by K. Philips 1994
The Little Things that Run the World by E. O. Wilson 1987

Field Trip:

International Crane Foundation, Horicon Marsh & Cedarburg Bog

FRQ:

1998 #3
2000 #3
2001 #2
2003 #1, #3 & #4
2011 #1 & #2
2012 #4

Unit 3

Earth Systems

(2 weeks)

Chapter: 8

Lecture Topics:

Plate Tectonics
Plate Boundaries
Earthquakes
Volcanism
Rock Cycle
Convection Currents
Atmospheric Layers & Circulation
Coriolis Affect
El Nino
Weather
Ocean Circulation

Labs:

Plate Tectonics Lab/Convection Currents (1 class period)
Rocks/Minerals Lab (1 class period)
Simulating Earth's Greenhouse Effect (1 class period)
Layers of the Atmosphere (1/2 class period)

Activities/Projects:

Plate Boundaries Activity

Videos & Various Readings

Mt. St. Helens & the Fire Below

Global Dimming

Field Trip:

Devil's Lake State Park (geological principles)

FRQ:

2002 #4

2007 #4

2010 #4

Unit 4
Land Use/Soil
(4 weeks)

Chapters: 8, 10-11

Lecture Topics:

Soil Horizons & Properties

Human Land Uses

Public & Wilderness Lands

Rangelands

National & State Parks

Wildlife Refuges

Wetlands

Land Management Practices

Forestry

Fire Management

Forest Fires

Forestry Management

Agriculture

Green Revolution

Deforestation

Irrigation & Soil Salinization

Feeding the People of the World

- GM Crops and Genetic Engineering
- Farming Practices & Sustainability
- Pest Management
- Overgrazing
- Desertification
- Hydroponics & Aquaponics
- Fishing
 - Techniques
 - Overfishing/Harvesting
 - Aquaculture
- Land Use Planning
- Land Preservation

Labs:

- Soil Salinization and its affects on Fast Plant Growth (various amounts of time over 9 weeks with data collection and analysis)
- Soil Testing (chemical and physical properties) (3 class periods with data collection and analysis)
- Tragedy of the Commons Revisit Lab (1/2 class period)

Activities/Projects:

- Land Use Planning Activity
- Town Builder
- Planning with habitats in mind Activity
- Hunger Banquet - World Population Connection, Earth Matters

Videos & Various Readings:

- A Fish Story - Cape Cod Fishing Industry Collapse
- Tuna Industry Excerpts from NBC Nightline News
- Food Inc.

FRQ:

- 1999 #4
- 2004 #4
- 2005 #2
- 2006 #4
- 2008 #3
- 2009 #4
- 2011 #4

Unit 5
Energy & Mineral Use
(3 weeks)

Chapters: 8, 12-13

Lecture Topics:

- Worldwide Energy Use
- Energy Efficiency
- Energy Consumption
- Energy Conservation
- Energy Concepts
 - Power
 - BTU's
 - Conversions
- Nonrenewable Energies
 - Fossil Fuels
 - Coal
 - Oil
 - Natural Gas
 - Nuclear Energy
- Renewable Energies
 - Wind
 - Solar
 - Geothermal
 - Hydroelectric
 - Biomass Fuels
 - Tidal
- Mining & Mineral Extraction
- Mineral Distribution
- Reclamation

Labs:

- Nuclear Waste Disposal Mini Lab (1/2 class period)
- Cookie Mining Labs (2 labs over 2 days with data collection & analysis)
- Fossil Fuel Use Lab (1 class period)
- Solar Oven Design (2 class periods)
- Solar Power House Kit Lab (several class periods and various amounts of time over 3 weeks with data collection and mathematical analysis)

Activities/Projects:

- Mining Types & Env. Impact Research

Energy Calculation Problems
Watts the Cost Calculations
Alternative Energies Debate

Videos & Various Readings:

Coal Country - Movie on Mountaintop Mining
Excerpts from "Yellow Dirt" - Uranium Mining and the Navajo People
Exxon Valdez Video
Jason Jones 180 Nantucket Wind Farm Video Clip
Gas Land Movie
Three Gorges Dam
Hetch Hetchy Debate
China Syndrome Excerpts

FRQ:

1998 #2
2001 #1
2005 #3 & #4
2006 #1
2012 #1

Unit 6
Population
(3 weeks)

Chapters: 6-7

Lecture Topics:

Population Characteristics
Factors of Size
 Density Dependent
 Density Independent
Growth Models
Reproductive Strategies
 Fertility Rates
 Growth Rates
Human Population Growth
 Factors of Growth & Limitations
 Distribution
 Resource Allocation & Economics

Carrying Capacity
Demographic Transition
Age Structure Pyramids
Impacts of Affluence

Labs:

Natural Selection Activity & Lab (1.5 class periods)
Quadrat Study (1.5 class periods with data collection & analysis)
Mark & Recapture Lab (1 class period with mathematical analysis)
Power of Doubling Lab (1 class period with mathematical analysis)
Biotic Potential Lab - Jelly Bean Evolution (1 class period)

Activities/Projects:

Poster-Based Activity on Per Capita Incomes
Population Pyramids Activity
The World's Table - Population Demographics

Videos & Various Readings:

The People Bomb
World Population - World Population Connection
Population Paradox - NOVA

FRQ:

2000 #4
2003 #2
2005 #1
2008 #4

Unit 7:
Water & Water Pollution
(3 weeks)

Chapters: 9 & 14

Lecture Topics:

Worldwide Water Distribution
Saline vs. Fresh Water Resources

Ground Water & Aquifers
Surface and Atmospheric Water
Fresh Water Availability
 Desalination
 Filtration
Water Conservation
Water Pollution
 Eutrophication
 Point & Non-Point Pollution
 Biomagnification
Wastewater & Its Treatment
Water Legislation
Thermal Pollution

Labs:

Water Toxicity Testing Lab (1.5 class periods with data collection and mathematical analysis)
Water Testing (WQI Index) Labs (4 class periods and field work with data collection and mathematical analysis)
Benthics Testing (1 class period)
Waste Water Treatment Lab (Various amounts of time over course of several days with data collection and analysis)

Activities/Projects:

Water in the US Activity
Personal Water Use Monitoring Project

Videos & Various Readings

Outrage at Valdez - Video on Exxon Spill
State of the Great Lakes, Lake Michigan
The Love Canal - Reading & Youtube Video Clip

Field Trip:

Milwaukee Metropolitan Sewerage District Tour

FRQ:

1999 #1
2001 #4
2002 #2 & #3
2007 #2

Unit 8
Air & Other Pollutants
2 weeks

Chapters: 15

Lecture Topics:

- Noise Pollution
- Light Pollution
- Air Pollutants
 - Primary Pollutants
 - Secondary Pollutants
 - Acid Rain & Smog
 - Acid Deposition
- Sources of Air Pollutants
 - Thermal Inversion
- Sick Building Syndrome
- Air Pollution Control & Legislation

Labs:

- CO₂ & CO Exhaust Monitoring Lab (2 class periods with data collection and mathematical analysis)
- Ozone Monitoring Lab (1/2 class period)
- Measuring Albedo Lab (1/2 class period)
- Particulates Measurement Lab (1/2 class period)

Activities & Projects:

- Primary and Secondary Air Pollutants Activity

Videos and Various Readings:

- Can Buildings Make You Sick (NOVA)
- An Inconvenient Truth

FRQ:

- 1999 #3
- 2000 #1
- 2007 #3
- 2009 #1

Unit 9
Solid Waste
(2 weeks)

Chapters: 16

Lecture Topics:

- Municipal Solid Waste Generation
- Solid Waste Stream
- Landfills
- Incineration
- Reduce, Reuse, Recycle
- Composting
- Hazardous Waste
- Heavy Metals & Toxic Chemicals
- Brownfields

Labs:

- Trash Analysis Lab (2 class periods with data collection and analysis)

Activities/Projects:

- Garbage Pizza Math

Videos & Various Readings:

- Auto & Truck Tires & the Environment
- Agent Orange by John Trinh
- The Majestic Plastic Bag Clip from YouTube
- Chernobyl Revisited

Guest Speaker:

- Waste Management Services

FRQ:

- 2000 #2
- 2004 #3
- 2006 #3
- 2007 #1
- 2008 #2
- 2009 #2

Unit 10
Environmental & Human Health
(2 Weeks)

Chapter: 17

Lecture Topics:

- Human Health & Health Risks
- Risk Analysis & Management
- Infectious Disease
- Toxicology
- Lethal Dose & Lethal Concentration
- Smoking

Labs:

- Household Mystery Illness Lab & Project (Toxrap) (various amounts of time over 2 weeks)

Activities/Projects:

- Local Environmental Risk Assessment
- Risk Assessment Survey Activity

Videos & Various Readings:

- Excerpts from Outbreak (Ebola - NOVA)

FRQ:

- 2001 #3
- 2004 #1
- 2010 #1

Unit 11
Global Change & Sustainability
(3 weeks)

Chapters: 18-20

Lecture Topics:

- Global Decline of Genetic & Species Diversity
- Exotic Species

- Invasive Species
- Introduced Species
- Habitat Loss
- Overharvesting
- Conservation Legislation
- Sustainable Practices
- Climate Change/Shift
- Stratospheric Ozone
 - UV Radiation
 - Ozone Depletion
 - Ground Level Ozone
- Global Warming & Its Consequences
 - Greenhouse Effect & Sources
 - Changing CO₂ Concentrations
 - Global Temps Throughout History
 - Kyoto Protocol
- Supply & Demand
- Kuznets Curve
- Natural & Human Capital
- Worldviews
- Precautionary Principle
- World Agencies
- Measures of Sustainability
- Poverty
- Individual Action
- Environmental Justice

Labs:

- Global Warming Lab on Carbon Release (1 class period)
- Recycling Lab (1 class period)
- Species Barcoding Lab with PCR Analysis (2 full class periods + additional research time with data collection and analysis)

Videos & Various Readings

- Global Warming News Clips
- Earth in the Balance by A. Gore, 1992
- The Burning Season by A. Revkin 1990
- Life in the Balance by N. Eldridge 2000
- Easter Island - NOVA Youtube Excerpt

Field Trips:

- Prairie Burn - Local Elementary School Prairies

FRQ:

1998 #1
2006 #2
2008 #1
2010 #2 & #3

Unit 12

Environmental Decision Making Process & Review

(2 weeks)

Lecture Topics:

Environmental Decision Making Process
Review of All Concepts in Preparation for the Exam

Activities/Projects:

Environmental Issue Debates & Research Project

Field Trip:

2 Night Overnight Trip to Wyalusing State Park for
Forestry Management
Invasive Species Control
Water and Soil Testing (data collection & analysis)
Public Land Preservation
Geology of WI/Unglaciated Location
Recreational Uses: Canoeing, Rappelling, Hiking, Campfires, & Cookouts

FRQ:

1998 #4
2002 #1
2004 #2
2009 #3
2011 #3
2012 #2

AP Exam - Monday, May 6th

Final 5 weeks of School

Week 1:

Video - A Civil Action (Water Pollution Litigation, based on a true story)

Week 2:

PSA Project Introduction and Work Time

Week 3:

Elementary School Visitation and Programming

Week 4:

PSA Project Presentations

Week 5:

Videos: The Cove; The Dark Side of the Digital Age

Teaching Strategies

Lectures cover selected concepts from each chapter and are supplemented with diagrams, teaching aids, visuals, examples, demonstrations and in-depth explanations.

Students are not required to take the AP Environmental Science Exam, but most, if not all, will. Throughout the year, students will be prepared to take this exam. Each unit or subunit test will be comprised of 50-80 multiple-choice questions of higher educational objectives such as synthesis, analysis and comprehension. Students will also be given released APES exams periodically during the year. Students will also be asked to write responses to a minimum of 2 free-response questions within each unit. These questions will be previous APES Tests Free Response questions and are designated as potential FRQ's in each unit. Students will also be asked to construct arguments and defend various positions on environmental topics and issues during the course of the year to better prepare them for writing free-response questions on the AP Exam. Students will be further encouraged and asked to do outside research and reading from a variety of mediums including internet and current news articles. Assignments that supplement & coincide with the respective units will be also be given periodically.

Labs

All labs will be graded and scored individually. Students will be given ample time to complete lab reports and answer questions. Lab reports will be graded on their quality and should contain evidence of clear understanding of the lab as well as the following required elements: title, introduction, purpose, procedure, data/results, analysis (which generally will include graphs/charts), conclusion, limitations and recommendation. Students will spend approximately 1.5 to 2 hours in lab or field work each week. Labs will require the collection and analysis of data. Students will be taught methods for data and mathematical analysis and interpretation. They will further use their analyses and mathematical insights to discuss plausible and sustainable resolutions and/or management of various environmental problems.

Evaluation

Students will be evaluated on their performance of the unit/subunit tests, essays, and labs and occasional homework. Each category is weighted and determines final grade average.

Homework – 10%

Labs & Projects – 30%

Tests & Quizzes – 60%

School Demographics & Schedule

Cedarburg High School is a suburban, affluent public school approximately 20 miles north of Milwaukee just slightly west of Lake Michigan. Approximately 1100-1200 students attend CHS with very small percentages of minorities in the population. Each class period is approximately 52 minutes in length and meets every day for 7 of 8 days. CHS utilizes a drop schedule. Students are enrolled in 8 periods but only 7 periods meet each day with a different hour dropping every day for 8 days. APES will meet for 1 full class period for a full year. Our previous non-AP course met for only 1 semester. APES will be open to all students who have successfully completed biology, but will be encouraged to have completed chemistry, particularly honors chemistry or be concurrently enrolled. Current enrollment is 27 students per section and 2 full sections are running for a combined total of 54 students.