

# AP Environmental Science

## *2018-2019 Syllabus*

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**HHS Room:** B236 and B221

**Planning:** Gold-3 and Black-2

**Course Website:** <http://blackhawklabs.weebly.com/>

**Online Platform:** schoology.dodea.edu

## Course Description

AP Environmental Science (AP-ES) is a full year course designed to be the equivalent of a one-semester, introductory college course in environmental science. Unlike most other introductory-level college science courses, environmental science is often offered from a wide variety of departments, including geology, biology, environmental studies, environmental science, chemistry, and geography. The AP-ES course has been developed to be a rigorous science course, with a laboratory component, that stresses scientific principles and analysis. As such, it is intended to enable students to undertake, as first-year college students, a more advanced study of topics in environmental science or, alternatively, to fulfill a basic requirement for a laboratory science which would then free-up time for taking other courses. In both breadth and depth of detail, the content of the AP-ES course reflects what is found in many introductory college environmental science courses.

## Course Goal

AP-ES will instruct students in the scientific principles, concepts, and methodologies required to:

1. understand the interrelationships of the natural world,
2. identify and analyze natural and human-made environmental problems,
3. evaluate the relative risks associated with environmental problems,
4. examine alternative solutions for resolving and/or preventing environmental problems, and
5. develop and focus their own perspectives related to environmental science topics.

## Course Themes

Environmental science is a very interdisciplinary field of study (i.e., it embraces a wide variety of topics drawn from very different subjects). However, there are many unifying concepts that cut across those

varying subjects. The following themes provide a foundation for the structure of the AP Environmental Science course:

1. Science is a process.
2. Energy conversions underlie all ecological processes.
3. The Earth is a single, highly interconnected system.
4. Humans alter natural systems.
5. Environmental problems have scientific, cultural, and social contexts.
6. Human survival depends on developing practices that will achieve sustainability within systems.

## Text

Frieland, A., R. Relyea, and D. Courard-Hauri. 2011. Environmental Science for AP. W.H. Freeman and Company. ISBN: 978-0716738497

## Additional Resources

In addition to the textbook, the course will draw information from supplemental environmental science textbooks, laboratory manuals, periodicals, readings, case studies, videos, and the Internet.

Students are encouraged – but not required – to use resources such as “5 Steps to a 5: AP Environmental Science 2018 (5 Steps to a 5 on the Advanced Placement Examinations Series) 6th Edition” by Linda Williams. Such independent resources are not often endorsed by College Board® but can be very useful in providing additional practice for the AP-ES exam. If a student decides to purchase and use any such resources, it is strongly recommended that the course instructor review the material in the resource to ensure content accuracy.

## Course Assessment

### Proficiency Indicators

At a minimum, the students will:

1. demonstrate a working knowledge of laboratory safety policies and procedures.
2. apply scientific methodologies to laboratory and field investigations.
3. outline the flow of energy and cycling of matter within the natural systems of Earth.
4. explain the relationships among plate tectonics, earthquakes, and volcanism.
5. outline the rock cycle and its relationship to soil formation
6. construct a food web showing interrelationships among organisms in an ecological community.
7. describe and analyze population growth, including the dynamics of human populations.
8. explain the factors that lead to the endangering of species and the loss of biodiversity.
9. compare the benefits/problems associated with agriculture and food production in the present world.

10. characterize renewable and nonrenewable resources, including distribution, ownership, use, and degradation.
11. discuss the current state of the Earth's atmosphere in terms of weather, climate, air pollution, ozone, and greenhouse gases.
12. analyze the environmental quality of air, soil, and water.
13. explain how usable energy is generated from fossil, nuclear, and other fuel sources and the associated trade-offs with their use.
14. outline the processes involved in water and sewage treatment.
15. identify the problems associated with the disposal of solid and toxic wastes.
16. identify global environmental changes and their consequences.
17. explain environmental concerns and problems in relation to their scientific, social, legal, cultural, and economic factors.
18. relate the AP Environmental topics to local problems faced by local residents.
19. demonstrate an awareness of careers related to environmental science.
20. discuss the effects of environmental quality on human health.

## Homework

Examples of homework expectations include (but are not limited to):

1. reading the current unit content
2. answering the textbook questions
3. reviewing lecture notes
4. reading additional texts and case studies.
5. providing a thorough write-up for laboratories
6. writing essays

Late assignments will not be accepted, except in extenuating situations identified in the Humphreys High School Student handbook (e.g., excused absences). The course policy for late homework will strictly follow DODEA and Humphreys High School guidelines for late assignments.

## Tests

Multiple choice and essay test questions will comprise the tests in AP-ES. Tests will be due on the date and time entered on the course calendar. Tests will be comprised of multiple choice questions and essay questions - reflecting the format of the College Board AP Environmental Science Exam.

The majority of the multiple choice questions on tests will come from lecture notes and text material. However, some questions will be derived from laboratory/field activities and other resources used in the course. Multiple choice question tests will be modeled after the College Board AP Environmental Science Exam approaches, in which 100 questions must be answered in 90 minutes.

For the essay portion of the College Board AP Environmental Science Exam, students will be given four free-response (essay) questions - for which the student will have 90 minutes to complete. To be effective, students will need to organize their thoughts and construct their responses for each question in 22.5

minutes. To prepare for this need, we will take a very pragmatic approach to writing by practicing how to formulate responses, then incorporating the essay development as part of the test, and conducting the tests under timed circumstances. These essays will be corrected strictly based on both content inclusion and required answer format.

Possible essay topics will be provided as a means of studying for tests and to allow students to outline in advance. However, this will not be available as a resource for the College Board AP Environmental Science Exam.

### **Additional Information:**

- Students must pass a safety test before participating in any labs or fieldwork
- Quizzes will be regular events (at least one per week - as many as one per class)
  - These points add up quickly and can significantly affect a final grade
- One test per chapter will be given
- One Unit Test will be given following each Unit.
- Block schedule means that class meets every other day for 90 minutes
- There will likely be one semester-long assignment completed each semester.
- Online classroom resources (e.g., Schoology, Google, Weebly, etc...will be heavily embedded in the course and used on a daily basis for providing resources, homework completion, calendar reminders, and testing)

# Course Outline

## Unit 1 (Introduction to Environmental Science):

- Studying the State of our Earth
  - Important insights into our world
  - Humans alter natural systems
  - Monitoring natural systems for signs of stress
  - Human well-being depends on sustainability
  - Science is a process
  - Unique challenges of environmental science
- Environmental systems
  - Earth as a single system
  - Matter
  - Energy
  - Energy conversions underlie all ecological processes
  - Systems analysis
  - Natural systems change over space and time

### Internet Activity: What Is Your Ecological Footprint?

### Possible Labs/Field Activities:

- The Impact of Human Disturbance on Biodiversity
  - The effect of human disturbance on ant biodiversity
- Who's got the power?
  - Exploring the relationship between power and work.

### Demonstrations:

- Scientific Method
- Converting acres to hectares
- Metric Conversions

### Videos:

- YouTube
  - Neuse River
  - Pfiesteria Update: An Enduring Debate
  - San Francisco Leads the U.S. in Environmental Sustainability
  - Treasure Island: San Francisco's Sustainable Land
  - Lessons from Mono Lake
  - Transforming the Picayune Strand
  - Faka Union Video News Release
  - Kissimmee River Restoration

- Ozone Layer Danger
- DVD
  - *Planet Earth*. The Discovery Channel
  - *Science in Action for Conservation*. The Field Museum

## Unit 2 (The Living World):

- Ecosystem Ecology
  - Interactions between the living and non-living
  - Energy flows through ecosystems
  - Matter cycles through the biosphere
  - Ecosystems respond to disturbance
  - Ecosystems provide valuable services
- Global Climates and Biomes
  - Weather and Climate
  - Climate determines terrestrial plant growth
  - Salinity, depth, and water flow determine aquatic biomes
- Evolution of Biodiversity
  - Species diversity
  - Evolution
  - Speciation and extinction
  - Ecological niches and species distribution

### Internet Activity:

- Photosynthesis Game
- Nitrogen Cycle
- Carbon Cycle
- Sulfur Cycle
- Phosphorous Cycle
- Food Chain
- Water Cycle

### Possible Labs/Field Activities:

- Mark-Recapture Lab
- Hotspots Lab
- Geologic Time Scale Lab

### Demonstrations:

- Calculating Ecological Efficiency
- Graphing Temperature vs. Altitude
- Shannon's Index of Diversity

### Video:

- *The One Degree Factor* National Geographic Strange Days on Planet Earth, Episode 2,

- *The Nitrogen Cycle*, How Stuff Works
- *Common Ground: Saving the Chesapeake's Oysters*, Chesapeake Bay Foundation
- *Biomes: Assignment Discovery*, The Discovery Channel
- *Evolution Lost*, Earth Touch

## Unit 3 (Biological and Human Populations):

- Population and Community Ecology
  - Levels of complexity
  - Abundance and distribution
  - Growth models
  - Species interactions
  - Community composition
  - Species richness
- The Human Population
  - Earth's carrying capacity
  - Population growth
  - Demographic transitions
  - Population size and consumption
  - Sustainable development

### Internet Activity:

- Ecoplexity.org
- WorldBalance; PBS
- Age Structure Diagrams

### Possible Labs/Field Activities:

- Determining Population Size
- World Population

### Demonstrations:

- Exponential Growth
- Rule of 70
- Calculating national and global growth rates

### Video:

- *World Population*, ZPG
- *Predators*, National Geographic Strange Days on Planet Earth
- *World In Balance*, NOVA
- *The Human Footprint*, National Geographic
- *The People Bomb*, CNN

## Unit 4 (Earth Systems and Resources):

- Earth Systems
  - Availability of Earth's resources
  - Earth's dynamic environment
  - Rock cycle
  - Soil
  - Distribution of mineral resources
- Water Resources
  - Water abundance and availability
  - Human effect on water availability
  - Water uses
  - Future of water availability

**Internet Activity:**

- Earthscience world.org
- Sciencecourseware.com
- EarthLabs
- Water: USGS
- National Geographic Xpeditions

**Possible Labs/Field Activities:**

- Soil Texture and Permeability
- Copper-Acid Mining
- Eco-bottle

**Demonstrations:**

- Calculating the speed of crustal plate movement
- Calculating water usage for showers
- Calculating cost per year to heat water

**Video:**

- *How the Earth was Made*, The History Channel
- *Geology (Parts 1 & 2)*, The Standard Deviants
- *Modern Marvels: Water*, The History Channel

**Unit 5 (Land Use):**

- Land, Public and Private
  - Effects of human land use
  - Classification of public lands
  - Land management practices
  - Residential land use
- Feeding The World
  - Human nutritional requirements
  - Industrial farming methods

- Genetic engineering and agriculture
- Alternatives to industrial farming
- Modern farming of meat and fish

**Internet Activity:**

- Tragedy of the Commons
- Solution Center for Nutrient and Irrigation Management

**Possible Labs/Field Activities:**

- Tragedy of the Commons
- Hunger

**Demonstrations:**

- Using ratios to calculate # of trees per acre
- Using graphs to extract data
- Using graph data to calculate percent change

**Videos:**

- The Lorax
- Ocean Fisheries Managing for the Future: The Tragedy of the Commons Revisited
- Huell Howser's California's Gold: Hetch Hetchy
- Food, Inc.
- We Feed The World

**Unit 6 (Energy Resources and Consumption):**

- Nonrenewable Energy Sources
  - Nonrenewable energy accounts for most of our energy use
  - Electricity
  - Fossil fuels
  - Nuclear energy
- Achieving Energy Sustainability
  - What is renewable energy
  - How can we use less energy
  - Biomass as "energy."
  - Kinetic energy of water
  - Capturing the Sun's energy
  - Earth's internal heat
  - Wind energy
  - Hydrogen fuel cells
  - Planning our energy future

**Internet Activity:**

- Chernobyl

- Solar
- Wind
- Geothermal
- Water

**Possible Labs/Field Activities:**

- Coal Investigations
- Solar Energy

**Demonstrations:**

- Calculating the cost of using an appliance
- Scientific Notation and its use
- Efficiency of Travel
- Calculating Electrical Supply
- Calculating Half-lives
- Energy Star

**Videos:**

- *Chernobyl Nuclear Disaster*, ABC News Nightline
- *Fossil Fuels*
- *Nuclear Energy, Nuclear Waste*
- *Alternative Energies: Fuels for the Future*
- *Saved by the Sun*, NOVA
- *Who Killed the Electric Car*

**Unit 7 (Pollution):**

- Water Pollution
- Air Pollution and Stratospheric Ozone Depletion
- Waste Generation and Waste Disposal
- Human Health and Environmental Risks

**Internet Activity:**

- EPA website
- cbf.org
- Zero Waste America
- Love Canal

**Possible Labs/Field Activities:**

- Waste and its effect on carbon dioxide
- Ozone sampling lab
- What is in our waste
- LD-50 with brine shrimp

**Demonstrations:**

- Percent Change calculation
- Building a manure lagoon
- Ozone molecules being destroyed by CFC's
- Calculating annual sulfur reductions
- Calculating Draper solid waste footprint
- How much leachate might be collected?
- Calculating safe levels of pesticides for humans and other mammals
- Estimating LD-50 values

**Videos:**

- *Water Quality*, Schlessinger Media
- *A Civil Action*
- *Erin Brockovitch* (outtakes)
- *Scientists and the Alask Oil Spill: The Wildlife, The Cleanup, The Outlook*
- *Acid Rain: The Invisible Threat*, Video-Lab
- *Modern Marvels: Trash*, The History Channel
- *Silkwood*

**Unit 8 (Global Change):**

- Conservation of Biodiversity
  - The 6<sup>th</sup> extinction
  - Causes of declining biodiversity
  - Single species focus
  - Ecosystem focus
- Global Change
  - Climate change and warming
  - Solar radiation and greenhouse gases
  - Sources of greenhouse gases
  - Links between CO<sub>2</sub> and global temperatures
  - Feedback loops
  - Consequences of global warming
  - The Kyoto Protocol
- Sustainability, Economics, and Equity
  - Sustainability is the ultimate goal
  - Economics of scarce resources
  - Economic health, natural capital, and human welfare
  - Agencies, laws, and regulations for protecting resources
  - Approaches to measuring and achieving sustainability
  - Reducing poverty
  - Stewarding the environment

**Internet Activity:**

- Endangered Species
- IUCN Redlist Species
- Global Climate Change
- Sustainability
- Global Footprint

**Possible Labs/Field Activities:**

- Wanted Lab
- Climate Change Lab
- Scarcity lab
- How Hot Is It Here on Earth?
- Global Warming and Greenhouse Effects

**Demonstrations:**

- Calculating Percent increase using graphs
- Calculating rising sea levels
- Projecting future increases in CO<sub>2</sub>
- Calculating net change in CO<sub>2</sub>

**Videos:**

- *The Climate Puzzle*
- *Wetlands Steward*
- *The Brown Tree Snake on Guam*, Animal Planet
- *Don't Say Goodbye*, National Geographic
- *The Cove*
- *Cane Toads, Invasive Species*
- *An Inconvenient Truth*
- *Dimming the Sun*
- *Discovery Project Earth*
- *Avatar*