AP Environmental Science

Course Profile:

AP Environmental Science has a maximum enrollment of 37 students (currently averaging about 22 students). The class meets five times per week for 55 minutes. The course is currently composed primarily of ninth graders (approx. 86%).

Course Overview:

AP Environmental Science is a study of the environment and the role humans play in that environment. Major topics include: basic scientific principles, human populations, pollution, biodiversity, conservation, and the environment and society. This is an Advanced Placement (AP) course and is taught at the collegiate level.

Assignments:

Work: All work is expected to be turned-in with a neat, professional appearance. All work must be hand written and completed in the *Composition Book*.

Labs: All Lab activities are conducted by students in small groups. Write-ups are individual and must include all categories located on the "Lab Write-up Format Sheet": statement of purpose, materials, hypothesis, procedure, data, and conclusion/discussion. Labs are conducted about one lab per week.

Exams: An exam will be given at the end of each chapter. This exam may consist of multiple choice and/or essay questions.

Text:

Living in the Environment, 12th Edition, 2002 by G. Tyler Miller

Course Content:

UNIT	CHAPTER	TOPIC
1 (Summer)	**1**	**Environmental Issues, Their Causes, and Sustainability** A. General overview of the topics covered Throughout the year
	2	**Environmental Histor**y A. How humans have adapted to and modified the environment B. Environmental history of the United States Videos: *The Spirit of Yosemite,* The Yosemite Fund

Semester 1

2	**3**	**Science Systems, Matter, and Energy** A. The scientific method B. Nature's building blocks -- a review of general chemistry C. Different forms of energy and their importance in environmental science D. Laws of matter and energy Readings: -*Tragedy of the Commons*, Garrett Hardin, 1968 -*Truax,* Terri Birkett Labs: 1. Exponential Growth Graphing Activity – Analyzing human population growth over the last 2 centuries. 2. Taxonomy and Binomial Nomenclature 3. Happy Fishing – Tragedy of the Commons in action. Students catch "fish" and observe reproductive rates as the population depletes. Videos: *The Lorax*- Dr. Seuss
	4	**Ecosystems: Components, Energy Flow, and Matter Cycling** A. Populations, communities, food chains, and webs B. Ecological pyramids and productivity C. Biogeochemical cycles Labs: 1. Food Webbing – A look at the organisms of a common Sierra Nevada Ecosystem. Students create a food web with the given organisms of that region.
	5	**Evolution and Biodiversity: Origins Niches, and Adaptation** A. Micro- and macroevolution B. Niches -- fundamental and realized, generalists and specialists C. Theories and misconceptions about Evolution Labs: 1. Habitat Loss – Field Study –A study of the species density in various sized plots. Students set up a complex grid system to measure the species density.

2. Animal Tagging Simulation
Simulation of tagging animals in the wild and recapture population size estimation
3. Quadrat Lab – Students record the number and density of species in different locations aground campus.

Videos: *Spirit of the Wild,* Family Geographic and Nature Video
The Flowing Oasis, Time Life Video

6 **Biogeography, Climate, Biomes, and Terrestrial Biodiversity**

A. Weather and climate
B. What are biomes and how do they differ?

Labs: 1. Hail in a Test Tube – Chemistry review, a study of how hail is formed. Students learn about the formation of rain, hail and snow and review several basic chemistry principles.

Videos: *Hawaii, Islands of The Fire Goddess,* Time Life Video

7 **Aquatic Ecology: Biodiversity in Aquatic Ecosystems**

A. Different types of aquatic life zones
1. Saltwater life zones
2. Freshwater life zones
a Eutrophication
b. Overturn
c. Characteristics of streams and rivers

Videos: *Forests in the Sea,* Time Life Video

8 **Community Ecology, Structure Species Interaction, Succession, and Sustainability**

A. Nonnative or exotic species
B. Indicator species and keystone species
C. Interspecific and intraspecific competition
D. Competition and symbiosis
E. Succession

Activity: Wanted Poster (Non-native Species) – students use computer publishing skills to create a poster identifying a non-native species.

Videos: *Cane Toads,* BBC

	9	**Population Dynamics, Carrying Capacity, and Conservation Biology** A. Exponential vs. logistic growth B. Biotic potential and environmental resistance C. Characteristics of r-strategists and K-strategists D. Survivorship curves
	10	**Geology: Processes, Hazards and Soil**s A. Geologic processes and plate tectonics B. Erosion and weathering C. Rocks, minerals, and the rock cycle D. Soil formation 1. Soil profiles E. Reading a soil triangle F. Oil erosion, desertification, and salinization Videos: *Rock Cycle* Labs: 1. Soil Texture and pH – study of the texture (soil triangle) and the pH of various soils. Students take soil samples from various locations and determine the texture and pH.
3	11	**The Human Population: Growth Demography, and Carrying Capacity** A. Zero population growth B. Fertility and death rates C. Age structure histograms D. Factors affecting population size E. The demographic transition Activity: - Debates (Environmental Issues) Debate format – students defend an assigned view of a current environmental issue Labs: 1. Soil Salinization – Student Designed Experiment – students are given access to materials and given the task of determining the salinity at which a plant will show a detriment in growth and where all growth will stop
	12	**Food Resources** A. Food production and nutrition B. Increasing crop production 1. Genetic engineering 2. Irrigation C. Meat production

1. Positive and negative effects

D. Harvesting fish and shellfish

13 **Water Resources**

A. Properties of water
B. Types of fresh water
C. Water shortages
D. Damming water and water transfer
E. Desalinization
F. Irrigation
G. Solutions to overuse of water
H. Flooding and floodplain management

Labs: 1. Water Use Inventory –Students analyze a local water bill and calculate values such as price per unit and annual household usage.

Videos: *Cadillac Dessert: The Last Oasis*
Cadillac Desert: The American Nile

14 **Geologic Resources: Nonrenewable Mineral & Energy Resources**

A. Identifying, locating, and removing nonrenewable mineral resources
1. Types of mining
2. Environmental effects of mineral extraction

B. Oil extraction, refining, and use
C. Natural gas
D. Coal
E. Nuclear energy

Labs: 1. Energy Use Inventory – Students examine local electric and gas bills to calculate values such as price per unit and annual household usage
2. Energy Conservation – Calculations of energy usage and common conversions. Students practice converting values between different units of resources
3. "Cookie" Mining (Surface Mining) – A simulation to demonstrate the economic and environmental costs of mining. Students "mine" their cookie with tools purchased to determine costs associated with mining

15 **Energy Efficiency and Renewable Energy**

A. Energy efficiency and how to improve it

B. Solar energy

1. Passive solar energy
2. Active solar energy

C. Hydroelectricity
D. Wind power
E. Biomass
F. Solar-hydrogen
G. Geothermal energy
H. Micropower
I. Sustainable energy use

Activity: Renewable and Nonrenewable Resources (Internet) – Group Powerpoint presentation comparing the two using current resources form the internet

Semester 2

4 **17** **Air and Air Pollution**

A. Outdoor air pollution
1. Photochemical and industrial smog
2. Inversions
3. Acid deposition

B. Indoor air pollution
1. Types and sources
2. Effects on human health

C. Solutions to air pollution

Labs: 1. Airborne Particulates – Students collect samples of airborne particulates at home and examine them in the lab under the microscope. An area plot is created showing the pollution sample levels collected.

18 **Climate Change and Ozone Loss**

A. Natural greenhouse effect
B. Global climate change
C. Possible solutions
D. Ozone depletion
1. Causes and chemical reactions
2. Effects on human health

Labs: 1. Tropospheric Ozone – Using KI, students make ozone detector strips and place them in various locations to detect the presence of ozone. The strips are collected and compared to a master strip.

Videos: *What's Up with the Weather?*, Nova
Chasing El Nino, Nova

19 **Water Pollution**

A. Main types of water pollutants and how they are measured
B. Point and non-point sources of pollution
C. Stream pollution
    1. Oxygen-sag curves
D. Groundwater pollution
E. Ocean pollution
F. Wastewater treatment

Labs: 1. Water Quality Testing – Students test water quality looking again at pH.

Videos: *Finite Oceans,* The Discovery Channel

20 **Pesticides and Pest Control**

A. Types of pesticides
B. Pros and cons of pesticide use
C. Pesticide treadmill and circle of poison
D. Pesticide regulations in the United States
E. Alternatives to the use of pesticides
F. Integrated pest management

Activity: -A Quandary in Ponder (Town Council Meeting: pesticide use) As a class, students are assigned characters to simulate a town meeting where the resolution to a pesticide problem is discussed and resolved.

21 **Solid and Hazardous Waste**

A. Municipal Solid Waste (MSW)
B. Hazardous waste
C. Reduce, reuse, recycle
D. Detoxifying, burning, burying, and exporting waste
E. Land disposal

F. Laws regarding hazardous waste in the United States

Labs: 1. Solid Waste Prevention and Management – Paper and pencil lab, students use provided information on waste disposal to answer questions and make calculations.

5 **22** **Sustaining Wild Species**

A. Effect of humans on biodiversity
B. Estimation of extinction risks
C. Instrumental, ecological, economic, and intrinsic values of biodiversity
D. Causes of extinction
E. Laws and treaties to prevent extinction

of species (National and International)
F. Wildlife management

Activity: Endangered Species (Internet) – Students use the internet to identify and write a report on a current endangered species.

Videos: *Costa Rica: Science in the Rainforest,* CNN

23 **Sustaining Terrestrial Biodiversity: The Ecosystem Approach**

A. Land use in the United States and the world
    1. Laws to manage public lands
B. Managing forests sustainability
    1. Types of tree harvesting
    2. Importance of fires
C. Managing tropical forests
D. Sustaining national parks
E. Gap analysis and ecological restoration

Labs: 1. Species Diversity – A simulation where students use cars in two separate parking lots to simulate different environments. Students use the Shannon Index to calculate the "richness" of the ecosystem.

24 **Sustaining Aquatic Biodiversity**

A. Importance and human impact on marine and aquatic biodiversity
B. Protecting and sustaining marine biodiversity

Videos: -*City of Coral*, Nova

25 **Sustainable Cities: Urban Land Use and Management**

A. Urbanization and Growth
B. Urban resources
C. Transportation
D. Urban Land-Use planning and Control

4 **16** **Risk, Toxicology, and Human Health**

A. Risks and hazards
B. Toxicology
    1. Bioaccumulation and biomagnification
    2. Poisons
C. Chemical hazards
D. Transmittable diseases
E. Risk analysis

		Survey: -Human Risk Factors – Students develop and conduct a survey to assess peoples perceptions and misconceptions of risk
6	**26, 27, 28**	**Environment and Society** Covered throughout the year

*AP ENVIRONMENTAL SCIENCE EXAM

Remainder of year	Students work on the "Your World Environmental Project". This project requires students to create a campaign and presentation to increase public awareness of a particular environmental issue. Students work in small groups and include research, props, handouts, technology, free samples, etc. to push their cause.