AP Environmental Science Course Syllabus

Course Description

Class Schedule

Regular class periods are 50 minutes long, five days per week. Each semester consists of two nine week grading periods.

Lab Schedule

At least one entire class period per week will be spent in lab (in addition to data gathering trips to our outdoor classroom nearby). Please see *lab component* below.

Course Prerequisites

APES is open to Juniors and Seniors who have successfully completed Physical Science and Biology I.

Course Requirements

Students are required to: Complete reviews of professional research papers. Complete multiple internet "survey writings" over timely topics relevant to our curriculum. Participate in classroom discussions over timely topics relevant to our curriculum. Be able to support their own views with facts from recognized sources. Maintain a bi-weekly "conditions log" of our outdoor classroom including humidity, water temperature, air temperature, water level, dissolved oxygen level, percent cloud cover, wind speed and any/all wildlife sightings/captures per visit.. Be tested over the relevant topics in the textbook every one to two weeks using AP style questioning (see course outline). Recently released AP test questions will be used as study aids and will guide test writing. Students must be willing to work outside for many of our lab activities as well as our data gathering trips to our outdoor classroom.

Textbook

The text is Living in the Environment, 13th Edition by G. Tyler Miller Jr. (Brooks/Cole, part of the Thomson Corporation).

Lab Manual

Laboratory Manual for Miller's Environmental Science Texts, Fourth Edition, by C. Lee Rocket and Kenneth J. Van Dellen

Course Outline

First Semester:

Topic/Duration

*Science, Systems, Matter, and Energy/ 1 week[C8]
*Ecosystems: Components, Energy Flow, and Matter Cycling/1 week[C2]
*Evolution and Biodiversity: Origins, Niches, and Adaptation/ 1 week[C2]
*Aquatic Ecology: Biodiversity in Aquatic Systems/2 weeks[C2]

*Community Ecology: Structure, Species Interaction, Succession, and Sustainability/ 2 weeks[C2]
*Population Dynamics, Carrying Capacity, and Conservation Biology/ 1 week[C3]
*Biogeography: Weather, Climate, Biomes, and Terrestrial Biodiversity/ 1 week[C7]
*Geology: Processes, Hazards, and Soils/ 1 week[C5]
*Risk, Toxicology, and Human Health/ 1 week[C10]
(includes the recognition, analysis, and solution of environmental problems)
*The Human Population: Growth, Demography, and Carrying Capacity/ 1 week[C3]
*Global Food Resources and Agriculture/ 1 week[C4]
*Geologic Resources: Nonrenewable Mineral and Energy Resources/ 1 week[C5]
(including fossil fuel resources and their use)
*Environmental Problems, Their Causes, and Sustainability/ 1 week[C10]
*Environmental History: An Overview/ 1 week
*Human Population, Resources, and Sustainability/ 2 weeks[C3]

Second Semester:

Topic/Duration

*Air and Air Pollution, Climate Change and Ozone Loss/ 1 week total[C6]
*Water Pollution, Pesticides and Pest Control/ 1 week total[C6]
*Solid and Hazardous Waste/1 week[C1]
*Sustaining Wild Species/ 1 week[C2]
*Sustaining Terrestrial Biodiversity: The Ecosystem Approach/ 2 weeks[C2]
*Sustaining Aquatic Biodiversity/ 1 week[C2]
*Sustainable Cities: Urban Land Use and Management/ 2 weeks[C4]
*Economics, Environment, and Sustainability/ 2 weeks[C8]
*Statistical Analysis/1 week (applied in labs throughout entire year)[C9]
*Politics, Environment, and Sustainability/ 2 weeks[C10]
*Environmental Worldviews, Ethics, and Sustainability/ 2 weeks[C10]

Lab Component [C11]

Please see "Content Areas Abbreviated" at bottom of document.

Lab experiences include experiments from lab manuals, data sets, fieldwork, and student-designed experiments. Lab groups will range in size from 2-4 students depending upon the nature of the investigation. Most of the following labs will require multiple class periods (50 minutes each) to complete. Students, upon completion of this APES course, will be able to analyze and interpret data, make conclusions based on the validity and quality of a given experimental set up, and communicate accurately and meaningfully about observations and conclusions. Below are listed the labs to be conducted in APES. These are in addition to the Class Projects which are each experimental in nature and listed below as well.

1. Global Warming and Greenhouse Effect. Students explore the affects of substrate and atmospheric conditions on thermal gain. Screening of *An Inconvenient Truth* with class discussion linking this information to biomes and changing biogeography, and a critique will accompany this lab. 2 days

2. Physical Characteristics of Soil. Students define and determine how capillary action, particle size, consistence, and permeability affect the ability of soil to sustain plant life and a variety of human activities. 3 days

3. Exploring Porosity and Permeability. To establish the link between surface water and groundwater we evaluate the roles of porosity and of permeability. Groundwater recharge is an important issue everywhere, especially in suburban/rural farming communities like ours. 2 days

4. Landfills and the Environment. Through the simulation of a real sanitary landfill students will determine what factors play a key role in the degradation of solid waste materials. A timely application of the behavior of soils learned through the porosity lab above. Periodic upkeep over 4 weeks.

5. Groundwater Exploration. This lab allows students to visualize how different soil horizons affect the mobility of water/contaminants underground. Students prior knowledge of soil and water characteristics will enable them to predict the rate of groundwater recharge and contaminant infiltration. 1 day

6. The World Beneath Our Feet. We will be identifying the types of soil microorganisms present in our study area. Students will observe, count, and

record microorganisms present in student-collected soil samples through the use of Gram staining. 2 days

7. Chemical Composition of Soil. Students will determine the chemical make up of soil samples they collect in our study area. 3 days

8. Population Estimate of Daphnia. Students will come to understand the assumptions behind estimating population by removal sampling, as well as the importance of consistent sampling technique. We will use both Hayne's and Zippen's methods. 2 days

9. LC 50: How Much Is Too Much? Students perform a bioassay to determine the LC_{50} value of copper sulfate for Daphnia. 3 days

10. Acid Deposition. Students will explore the characteristics and sources of acid rain through a series of prepared samples as well as field samples. 2 days

11. Air Pollution. These field activities relate the study of air pollution and to the levels of greenhouse gases in the atmosphere. The activities involve students in measuring concentrations of gases in air and calculating the quantities of gases produced from various everyday sources/activities. 2 days

12. Water Pollution and Wastewater Treatment. This lab allows students to construct a working model to demonstrate the processes in a large-scale commercial water treatment facility. Students will understand each step of the water treatment process as well as evaluate the effectiveness of these steps. 3 days

13. Rapid Radish Mutagenesis. Students will sow and grow Rapid Radish seeds which have been exposed to varying amounts of radiation. Differential plant growth and plant condition will be graphed and the effect of ultraviolet radiation on Rapid Radish seeds determined. This lab is very involved and will take place late in the year. Periodic upkeep over 5 weeks.

14. Exploring Biodiversity. We will be calculating diversity values for sampled habitats using three indices; species richness, Shannon-Wiener, and Simpson's. Students will be able to weigh the biological advantages versus public interest concerns while analyzing case studies of proposed biological preserves. 3 days

Field Trip [C11]
We will have at least one field trip. We will complete a wildlife survey of both terrestrial and aquatic species in a local preserve. Humane capture and release will be practiced at all times. "Field Trip," as used here denotes a data gathering outing to an area other than our often-frequented outdoor classroom.

Small-Group Activities [C11]
Problem solving, design projects, and internet research provide the basis for small-group activities. These will provide the opportunity for brainstorming, application, and synthesis of material from lectures, reading assignments, and data collected as a class.

Class Projects [C11] [C10]
The APES program will be responsible for the remediation and maintenance of the 1 acre pond in our privately owned 33 acre outdoor classroom. There will be various parameters of water quality in the pond and creek defined and monitored. There will be a *summary presentation made by student representatives* of the APES program to the owners of our outdoor classroom indicating our stewardship of the area.

The APES program will be responsible for conducting a species census of our outdoor classroom using track identification and night vision digital scouting cameras (pending grant award).

The APES program will be responsible for establishing and maintaining a captive aquaculture system in the outdoor classroom raising food quality channel catfish for harvest/transplant and sale to support the program.

The APES program will be responsible for the continued care of the schools indoor fountain and fish pond.

The APES program will be responsible for building the fry grease burning diesel project car as a mascot for APES and our high school.

Content Areas Abbreviated:
[C1] The course provides instruction in Earth Systems and Resources.
[C2] The course provides instruction in The Living World.
[C3] The course provides instruction in Population.
[C4] The course provides instruction in Land and Water Use.

[C5] The course provides instruction in Energy Resources and Consumption.

[C6] The course provides instruction in Pollution.

[C7] The course provides instruction in Global Change.

[C8] The course provides students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. The curriculum draws upon various scientific disciplines.

[C9] The course includes methods for analyzing and interpreting information and experimental data, including mathematical calculations.

[C10] The course teaches students how to identify and analyze environmental problems, to evaluate the ecological and human health risks associated with these problems, and to critically examine various solutions for resolving or preventing them.

[C11] The course includes a laboratory and/or field investigation component. A minimum of one class period per week is spent engaged in laboratory and/or field work.