ADVANCED ENVIRONMENTAL SCIENCE
COURSE SYLLABUS

OVERVIEW OF THE COURSE:
The Advanced Environmental Science course is the equivalent of a one-semester introductory college course in environmental science that includes laboratory and field study components. The course is designed to provide students with the scientific principles, concepts and methodologies required to understand the interrelationships of the natural word, to identify and analyze environmental problems both natural and human-made, to evaluate the risks associated with these problems and to examine alternative solutions for resolving and/or preventing them.

COURSE PROFILE:
Class sizes are held to 24 students. The class blocks are 43 minutes long meeting seven times per week. The extra meeting time allows the students to complete the laboratory component of the course. The course meets for the entire year.

COURSE PREREQUISITES:
Grade of B or better in Biology and Chemistry. Students will also be required to complete a summer reading packet and complete a test on the material on the first full day of classes.

COURSE REQUIREMENTS:
- Class attendance is critical for success in this course.
- Independently reading the assigned text material.
- Complete all assignments and activities.
- Take all quizzes, tests and exams in a timely fashion.
- Conduct laboratory work according to safety rules.
- Constructive thinking in observation and analysis of lab exercises
- Work in teams/groups in collaborative settings
- Take comprehensive exams each quarter.
- Complete a midterm and a comprehensive 4th quarter exit exam, as well as the culminating AP exam.

*Students enrolled will be required to complete a summer reading assignment and take a quiz on the first full day of class.

TEXTBOOK: G. Tyler Miller: "Living in the Environment", 2007, Brooks/Cole, 15th edition with CD-ROM

COURSE OUTLINE
This course provides instruction in each of the seven AP Environmental Science Course Descriptions and the following:

TOPIC	DURATION
Introduction to Environmental Problems CHAPTER 1: Environmental problems, their causes, and sustainability & Environmental history.	**2 weeks**
Matter and Energy Resources CHAPTER 2:Science Systems, Matter and Energy, Energy Conversions, Thermodynamics, Basic Chemistry (acids, bases, salts)	**1 week**
Ecosystems CHAPTER 3: Ecosystems: Components, Energy Flow, and Matter Recycling (C, N, P, S, water), Sustainability CHAPTER 4 & 7: Niches, Interactions, Succession	**2 weeks**
Climate and Weather CHAPTER 5 &7: Biogeography: Weather, Climate, Biomes & Biodiversity	**2 weeks**
Population Dynamics CHAPTER 8: Population Dynamics, Carrying Capacity, and Conservation Biology and Evolution of a Species	**2 weeks**
Earth Science CHAPTER 13: Geology: Process, Hazards, and Soils	**2 weeks**
Human Populations CHAPTER 9: The Human Population: Growth, Demography	**2 weeks**
Global Problems CHAPTER 10/11/12: Forests, Deforestation, Loss of Biodiversity, Endangered, Plants and Animals CHAPTER 20: Greenhouse Effect, Global Warming, Ozone Depletion, Solutions of Problems	**3 weeks**
Energy Resources CHAPTER 15/16: Geologic Resources: Nonrenewable Mineral and Energy Resources CHAPTER 17: Energy Efficiency and Renewable Energy	**3 weeks**
Human Health CHAPTER 18: Risk, Toxicology, and Human Health	**2 weeks**
Air and Air Pollution CHAPTER 19: Atmosphere, Smog, Acid Deposition, Effects,	**1 week**
Water and Water Pollution CHAPTER 14: Water Resources CHAPTER 21: Water Pollution	**2 weeks**
Soil CHAPTER 13: Mineral supplies, soil structure, erosion, conservation	**1 week**
Toxic and Solid Waste CHAPTER 22: Solid and Hazardous Waste	**2 weeks**
Food Resources CHAPTER13: Food Production, World Problems, Sustainable	**1 week**
Pesticides and Pest Control CHAPTER 13: Types and Uses, Regulations, Solutions	**2 weeks**
Land Management and Diversity CHAPTER 10: Sustaining Terrestrial Biodiversity CHAPTER 11: Sustaining Wild Species CHAPTER 12: Sustaining Aquatic Biodiversity	**2 weeks**
Economics, Politics, and Ethics CHAPTER 24: Economics, Environment, and Sustainability CHAPTER 25: Politics, Environmental and Sustainability CHAPTER 26: Environmental Worldviews, Ethics, and Sustainability	**2 weeks**

Laboratory and Field Investigations
The goal of the laboratory and field investigation component of the AP Environmental Science course is to complement the classroom portion by allowing students to learn about the environment through firsthand observation. Experiences both in the laboratory and in the field provide students with important opportunities to test concepts and principles that are introduced in the classroom, explore specific problems with a depth not easily achieved otherwise, and gain an awareness of the importance of confounding variables that exist in the "real world." A significant amount of time, approximately 30-40%, will be spent on doing experiments and analysis of experiments and research.

Research Projects
My students will be involved with year-round hands-on research. The students will be responsible for setting up and maintaining estuary tanks in the classroom created with water and organisms from Long Island Sound. Using these tanks they will be able to study and graph the natural cycles of nutrients, chemicals and species. Using the graphs and data collected the students will modify the organisms living in the tank so that there is a natural balance and cycle.

Long Island Sound
My students will be immersed throughout the year studying Long Island Sound. The Science Department at our school budgets bus trips so that we can take these valuable experiences. While at the Sound, the students will be collecting biotic and abiotic data on various habitats. They will compile their data and compare it against previous years looking for changes. They will discover there is a hypoxia problem in the Sound and develop possible solutions, with which they will be able to educated local residents with this.

In collaboration with the Department of Environmental Protection and the Greenwich Conservation Commission, my students will be assisting in fisheries research and horseshoe crab counts as well as other organisms, for the State of Connecticut. Students will be volunteering their time at a local fishway to assist in monitoring and counting migrating fish (alewives, herring and eels). The student will then graph and analyze data over the past 7 years to see how the populations of the fish have fluctuated and determine possible causes.

Students will also be assisting in an ongoing horseshoe crab study. They will need to determine when is the best time of day and the best tide to do this study. They will collect on mating pairs of crabs as well as single crabs then compare their data with previous data from the past 10 years. They will come to conclusions about the cyclic patterns of populations of crabs.

Stream Analysis
Students will be conducting a stream study in cooperation with the DEP of the local stream that is on the perimeter of school grounds. Students will need to sample two different sites at different areas of the stream. Students will sample water quality using the ecology of the stream and the water chemistry of both sites. This past year the school our school laid new sports fields, including a new turf field. The student will analyze their data with older data to see how the fields are affecting the quality of the stream.

The following is a list of materials* used in both research projects:

Probe (DO, salinity, pH, temperature)	Buckets	Screen sorters
Seine net	Hip waders	DO chemical test kit
Plankton net	Rubber boots	Nitrate chemical test kit
D-frame net	Dredges	Ammonia test kit
	Measuring tape	Phosphate test kit

*These materials are already owned by the Science Department.

By completing all of these ongoing research projects with local and state government agencies, the students will be able to conduct meaningful research, use scientific principles and concepts to understand the interconnectedness of our world, biological and chemical. Upon completion the students will write up a very extensive lab report in the fall and the spring. The student will analyze the local environmental issues facing the stream, Long Island Sound, the fisheries and horseshoe crabs and evaluate the problem, the ecological and human impacts of these issues. They will hypothesize a resolution and research the feasibility of the solution.

Other Labs that will be conducted during the year (additional labs will be added from the cited laboratory manuals):

1. Population Lab

The student will travel to Long Island Sound and complete a Japanese invader crab population lab. They will mark off quadrants to determine the population size and analyze the invasive species effects on native species.

2. Comparison of Daily Weather Data with Microclimate Data. *

The students will collect data at two on-campus stations and compare and contrast to the weather conditions reported locally and nationally.

3. Testing for Tropospheric Ozone Pollution*

The students will prepare and carry out tests for tropospheric ozone pollution. They will analyze the ozone pollution test results for local variation and possible impact on human health.

4. Global Warming and Atmospheric Carbon Dioxide Correlation*

Students will research carbon dioxide concentrations in the atmosphere for the last 420,000 years and correlate the data mathematically to global temperatures.

5. Natural vs. Synthetic Chemical Fertilizers*

Student will create two garden plots grown with natural and synthetic fertilizers. They will compare crop samples grown by measuring the amount of produce, testing the soil chemistry and organisms. They will analyze the data and draw conclusions.

6. Land Use Changes in Connecticut*

The students will research and record the land use changes in town. They will analyze the land use trends for their environmental impact

7. Brownfield Sites
The students will research and visit a local Brownfield site in town. The will collect data on the soil chemistry and biodiversity. The students will analyze their data and draw conclusions. They will develop a land use plan for this once toxic site.

8. Shannon-Weiner Diversity Index on Campus*
Student will collect data and count organisms at multiple habitats on the school grounds. They will analyze and apply data to biodiversity problems using the Shannon-Weiner Diversity Index.

9. Population Distribution and Survivorship*
Student will visit a local cemetery (only a 10 minute walk) to collect data from headstones. They will use this data to develop a survivorship curve and age-sex population pyramid. They will also predict characteristics of future populations based on the sex, age, and fertility.

10. Acid Rain *
Student will measure and compare pH levels in precipitation at several on-campus sites and their homes for 3 months. They will analyze and account for varying concentration of oxides and pH reading in precipitation.

11. Solid Waste Collection*
Students will quantify and analyze their household waste and the schools. They will propose general strategies for reduction and recycling of solid waste.

12. Dirty Water
Students will be given a sample of dirty "sewage" water. They will be responsible for removing the pollutants and developing a strategy for effective water treatment.

13. Global Climate Change*
Students will research and collect data on temperature changes over the last 100 years. They will analyze and graphically depict interrelationships among a complex of effects of global warming. They will apply the analysis of effects to the environment, economic and sociopolitical events, both locally and internationally.

14. Adoption of a Developing Nation
Students will adopt a developing nation and investigate various aspects of the nation's physical, population, economic and social characteristics.

*The labs starred were taken from the Molnar Lab Manual cited below.

RESOURCES

Books

Carsen, Rachel, *Silent Spring*. Mariner Books, 2002 (new edition).

Miller, Tyler G., *Living in the Environment*, 2004, Brooks/Cole, 13th edition with CD-ROM

Safina, Carl, *Song for the Blue Ocean: Encounters Along the World's Coasts and Beneath the Seas*. Owl Books, 1999

Lab Manuals

Enger, Eldon D. and Bradley F. Smith, *Field and Laboratory Exercises in Environmental Science.* McGraw-Hill Companies, 2000.

Molnar, William, *Laboratory Investigations: AP Environmental Science*. The Peoples Publishing Group, Inc. 2005.

Rockett, C. Lee and Kenneth J. Van Dellen, *Laboratory Manual for Miller's Living in the Environment, Environmental Science, and Sustaining the Earth*. Wadsworth, Inc. 1993.

Video Tapes

Planet Earth. PBS. 2007
Journey to Planet Earth. PBS. 2006

Newspapers

New York Times
Greenwich Times

Other Resources

U.S. Census Bureau www.census.gov/ipc///www/idbsum.html
Global Change Data and Information Systems http://globalchange.gov/