Woodland High School Agricultural
Environmental Science

This course provides students with a foundation of understanding, knowledge and skills to deal effectively with environmental problems. Students learn a variety of basic laboratory and field techniques including specimen sampling and processing, site monitoring, documentation, inspection and emergency response. When possible, students have the opportunity to work with or consult with experts in various environmental fields. The course incorporates both academic and applied studies. Fieldwork in the local area watershed as well as in mudflats and tide pools is an integral part of our studies. The structure and function of natural ecosystems, the history of the environmental movement, impact of laws, economic and political systems on environmental concerns is taught. Students also gain a broad awareness of environmental science and technological career opportunities. Job shadowing and internships are encouraged. An emphasis is placed on students using critical thinking and analytical skills to make positive impact on the environment.

Offered:

2 semesters: 1 hours / day
Alternate Graduation Credits
- 10 Life Science
- 10 Physical Science

Course prerequisites:

Algebra 1 passed with a "B" or better
Attainment of age 16
Status as a Junior or Senior

Recommended:

One year of Life or Physical Sciences.
Chemistry would be helpful.

Student Assessment:

Grades will be determined according to several criteria. During the second semester, selected students will be encouraged to apply for internships. If, and when, this becomes part of their training, their accountability for their internship will become part of their course assessment. At this point, the flexibility of the grading system will be adjusted accordingly.

RELATIVE WEIGHTING OF ASSIGNMENTS:

Quizzes (10 @ 5 pts.)	50
Worksheets (8 @ 10 pts.)	80
Laboratory Journal	*100
Field Notes	*100
Laboratory & Field Reports (6 @ 10 pts.)	*60
Environmental Business Interview	5
Career Poster & Oral Presentation	20
Environmental Solutions Presentation (poster or paper & oral presentation)	20
Environmental Problems Research Paper	30
Class Project Participation	100
Debate Participation	20

Flag Map		5	
Relief Map		5	
Topographical Map Interpretation		5	
Watershed Study Analysis & Presentation		*50	
Overall Participation & Professional Conduct	100		
TOTAL		750	points

* Laboratory and fieldwork directly account for over 40% of the graded work assigned.

Environmental Science and Technology

STUDENT OUTCOMES

At the completion of the course, Environmental Science and Technology, students will:

- Define and describe various ecological systems, both open and closed.
- Identify biotic and abiotic factors of an ecosystem
- Develop and interpret environmental model systems
- Apply environmental principles in designing, settingup and monitoring both field and laboratory experiments
- Understand basic principles of photosynthesis and respiration and apply these to models of energy flow including the concepts of trophic levels and food webs.
- Describe the main material cycles of nitrogen, carbon, oxygen, and phosphorous.
- Describe factors of population growth and regulation.
- Demonstrate an understanding of how human population growth and dynamics function in our biosphere.
- Utilize the concepts of succession in real and modeled ecological systems.
- Demonstrate an understanding of the principles behind and proper procedures for:
    - Soil and soil profile sampling
    - Air quality sampling
    - Water quality sampling
- Identify and understand humankind's impact on atmosphere, soils and hydrologic cycles.
- Identify renewable and nonrenewable resources.
- Demonstrate an ability to record, graph and interpret experimental data
- Assess quantitatively humankind's impact on terrestrial and marine ecosystems.
- Demonstrate competency in written and oral presentations of research data.
- Gain an understanding of the interrelationships of environment, economics, and politics in humankind's impact on the biosphere.
- Have earned 10 units including the following:

- An awareness of employment opportunities in environmental fields and the ability to research them
- An understanding of chemical safety procedures
  - ➢ Material Safety Data Sheets (MSDS)
  - ➢ NFPA Hazard Identification System
  - ➢ Hazardous chemical reactions
- An understanding of hazardous materials toxicology
- An understanding of environmental regulations including:
  - ➢ OSHA
  - ➢ DOT
  - ➢ Solid and Hazardous Waste Disposal, RCRA and CERCLA
- An understanding of recycling principals and practices

Environmental Science and Technology

Main Text:
Nebel B.J., Wright, R.T. (2000). Environmental Science, 8th ed. Prentice Hall Co. upper Saddle River, NJ.

Laboratory Manuals:
Mitchell M.K. & Stapp, W.B. Q1996), Field Manual for Water Quality Monitoring An Environmental Education Program for Schools, 10th ed. Kendall/Hunt Publishing Co., Dubuque, IA.
Enger, E.D. & Smith, B.E. (1995). Field and Laboratory Activities in Environmental Science William C. Brown Publishers, N.Y.
Sumich, J . & Dudley, G. (1992). Laboratory and Field Investigations in Marine Biology, 5th ed. Available through SargentWelch.

Other Resources:
Dufour, J.T. (1995). California Environmental Compliance Handbook California Chamber of Commerce. Sacramento, CA.
Hazardous Materials. Substances and Waste Compliance Guide 19951996 Hazardous Materials Publishing Co., Kutztown, PA.
Berman, E. A. (1994). Exploring the Environment Through Satellite Imagery. TriSpace, Inc., Virginia

Course Organization	Means of Attainment	% of Course	Activity Type	Student Assessment
I. Basic Principals and Concepts A. Main Components of Ecosystems 1. biotic	Much of the material for this section will be disseminated by standard lecture.	12.5% (45 hrs)	**Part I** Field work	• Student worksheets

2. abiotic B. Energy Flow 1. light → chemical → heat 2. photosynthesis & respiration 3. producers → consumers a. food chains & webs b. trophic levels 1.) decreasing energy availability 2.) bioamplification C. Cycling of Matter 1. carbon 2. nitrogen 3. phosphorous 4. water D. Water Realm 1. oceans a. euphotic & aphotic b. intertidal regions c. estuaries **I. Basic Principals and Concepts (cont.)** 2. freshwater a. groundwater 1.) aquifers 2.) saltwater intrusion b. surface water 1.) lakes i. oligotrophic ii. eutrophic 2.) rivers & streams E. Geophysical Realm 1. tectonic plates 2. volcanoes 3. rocks & minerals F. Atmosphere 1. layers of atmosphere 2. weather &. climate 3. interactions with geophysical realm	Several excellent videos are available that address these issues and will be used where applicable. The basic principles and concepts will be interwoven with applied material including lab work and field trips. Observation in the field will require species and behavior identification. The basic concepts will be important to the understanding of the applied work, especially as the students interpret their observations and present their findings. Understanding of Scientific Method will be stressed. General concepts will be introduced to correlate with our water studies as outlined in section III on Environmental Quality Guest lecturer from the field of environmental geology will add to this topic. Cooperative study will be carried out with use of the weather station at UC Davis and Internet weather information will be explored.		Laboratory design chemistry microscopy Use of dichotomous Keys Written & oral expression Documentation Long term study Development of critical thinking Graphing Data management both manually and by computer spreadsheet Computer use	• Written reports • Quizzes after each conceptual topic • Maintenance of field notebook periodic checks for grades • Maintenance of bound laboratory journal periodic checks for grades • Oral presentation of data & interpretation

G. Biosphere 1. populations → communities → ecosystems → biosphere 2. habitats & niches 3. biomes H. Sustainability	This topic will be woven in throughout the course			
II. Population Dynamics A. General Population 1. exponential growth 2. J & S shaped curves 3. carrying capacity 4. competition intra and extraspecific B. Human Population 1. distribution 2. demographics 3. resource utilization 4. cultural & economic influences	Lecture and computer simulated population modeling will be used. Laboratory model set up using microorganisms to: 1. simulate exceeding carrying capacity 2. simulate interspecific competition. This topic will be studied using lecture format as well as individual library research and access of recent information from the Internet.	2.5% (9 hrs)	**Part II** Computer use Lab exercise Data Manipulation Graphing Internet use Critical thinking	● Written report ● Class debate on human population growth

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III. Environmental Quality A. Water 1. Freshwater a. distribution 1.) surface 2.) groundwater 3.) global availability b. use l.) types of use 2.) depletion 3.) regulation c. quality 1.) salt intrusion 2.) contamination 3.) regulation 2. Major pollutants a. monitoring b. effects B. Soil 1. distribution 2. use a. agricultural practices b. pesticides 3. quality a. components b. significance of components c. depletion & contaminants 4. Major pollutants **III. Environmental Quality (cont.)** a. monitoring b. effects C. Air 1. components 2. Major pollutants a. monitoring b. effects 3. Regulation	The Cache Creek watershed will be used as a study area that will take into account many of the main concepts of freshwater concerns. The study will be coordinated between both school sites and SLEW/FARMS program Students will prepare training videos for water sampling and chemistry. Guest lecturer on fish sampling field studies. Soil studies and analysis will be carried out using LaMotte type analysis kits, standard sedimentation and screening apparatus as well as examining the microorganisms found in different soils through microscopy and culture. Plant growth experiments will be carried out to assess effects of soil types. LaMotte type air safety sampling kits will be used to monitor various sites in the valley to compare different temperature and seasonal differences.	7.5% (27 hrs)	**Part III** Long term Study Use of Ground water Models Field work Laboratory Chemistry Use of proper documentation Multimedia production Data manipulation and interpretation Quantitative analysis Species identification Laboratory chemistry microscopy Measurement Graphing Written presentation	• Maintenance of journal • Maintenance of field notes • Oral presentation • Written report (group work)

IV. Resources: A. Types: 1. Renewable 2. Nonrenewable 3. Potentially Renewable B. Land: use, controversy & regulation 1. agricultural 2. recreational 3. wilderness C. Mining resources 1. types 2. strategic reserves D. Forests: use, controversy & regulation 1. logging practices 2. forest management E. Energy: use, controversy & regulation 1. fossil fuels 2. hydroelectric 3. wind, tidal, geothermal 4. solar 5. hydrogen 6. nuclear	Lecture format, videos, library research into recent developments in the different areas, and classroom debate will be used. Field trips to energy production facilities: Local Farms Clear Lake Dam Woodland Cogeneration facility Laboratory Exercises: Insulation and energy transfer Biogas production	5% (18 hrs)	**Part IV** Oral presentation Field observations Laboratory project design Lab exercises (standard)	• Worksheet on resources • Grade on debate participation • Maintenance of lab journal • Grade on class project

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V. Waste A. municipal & industrial 1. landfill 2. hazardous 3. nuclear 4. sewage treatment 5. incineration B. regulation	Visits to Yolo County Landfill site/ tour. Class debate on pros & cons of waste disposal types Guest lecturer on legal aspects of Altamont site and environmental law in general. Guest lecturer on Yucca Mountain site. Visit to Wastewater treatment center, field monitoring downstream (see water study)	2.5% 9 hrs)	**Part V** Lecture Critical thinking Library research Field work Oral Expression	● Worksheet ● Class debate participation ● Field notes
VI. Human Health Impact A. agents B. effects C. toxicology D. risks E. regulations 1. federal a. DOT b. OSHA 2. California a. Cal/OSHA F. Compliance	Guest lecturer on environmental toxicology. Guest lecturer on federal and state regulations.	2.5% 9 hrs)	**Part VI** Library & Internet research Oral Expression	● Quiz ● Poster and oral presentation on a key environmental regulation
VII. Economic & Political Considerations A. cost benefit analysis B. risk assessment C. social implications D. property rights E. use of Commons	Guest lecturer in economics. Class debate	2.5% (9 hrs)	**Part VI:** Oral Presentation Critical Thinking	● Class participation on debate

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VIII. Environmental Careers A. academic/research B. government C. industrial D. legal E. private & public sector F. technical possibilities G. educational / training requirements H. job shadowing and/or internships	Exploration into various careers will be accomplished by use of guest lecturers in various fields of the environment, and visits to industrial, municipal and natural sites. Students will be introduced to use the career centers in their respective high schools as well as to use the Career & Transfer Center at Las Positas College. Opportunities for internships and job shadowing will vary with individual students. With instructor guidance, each student will work on obtaining their own site as part of workplace and career development preparation.	2.5% (9hrs)	**Part VIII** Interviewing skills Oral presentation Written presentation Computer use Library & Internet research	● Oral report on "cold call" to company or foundation listed as "environmentally or ecologically" active. ● Poster presentation on an environmental career.
IX. Basic Laboratory Techniques A. Procedural concepts 1. serial dilution 2. titration 3. accuracy & precision 4. use of immunochemistry B. Instrumentation 1. spectrophotometry 2. microscopy	Basic laboratory and field techniques will be introduced prior to use in the field or for laboratory aspects that compliment the field studies an dsampling. Students must be able to demonstrate proficiency in these techniques and understanding of their applicability. They must also demonstrate professionalism in the conducting of their applied studies. The use of documentation will be stresses as well as basic scientific method.	2.5% (9 hrs) Note: A great deal more lab time will be spent in conjunctio n with other areas of the course.	**Part IX** Critical thinking Scientific method Lab technique development Data manipulation Quantitative analysis	● Proficiency in basic lab techniques must be demonstrated before students can fully participate in class research activities. ● Maintenance of lab journal
X. Basic Field Techniques A. sampling: water, soil, air, organisms B. use of transects C. grids D. compass & orienteering E. map making & reading F. radiometry	General orienteering and mapmaking will be taught on campus in preparation for field work. Relief mapmaking & topography contouring. Guest lecturer on use of radiometry.	2.5% (9 hrs)	**Part X** Field work Graphing Structural visualization	● Mapping of flagged field ● Relief map ● Topographical map interpretation and cross-section graph

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XI. Hazardous Materials A. In the lab setting 1. identification 2. storage 3. handling B. In field & industrial settings 1. identification 2. storage 3. handling C. Use of MSDS D. Remediation	Laboratory exercise utilizing inert UV detectable substance to monitor handling of potentially hazardous chemicals Guest lecturer on general aspects and regulations involving hazardous materials. Mock spill utilizing materials and procedures in hazardous materials handling.	2.5% (9 hrs)	**Part XI** Field work Lab exercises Team coordination	● Worksheet ● Quiz ● Cleanup participation
XII. Data Analysis & Presentation A. data compilation B. graphing C. interpretation D. presentation in posters and papers E. oral presentation	Data in written format to be graded on completeness, presentation, and interpretation. Classes will participate in the writing of a paper reporting their Livermore watershed study. Poster topics on various aspects of environmental studies will be properly researched and prepared in lieu of term papers and presented to science classes.	5% 18 hrs) Incorporated into other areas of the course	**Part XII** Quantitative analysis Critical thinking Library & Internet research Oral expression Written expression	● Research paper on major environmental problem (10 pp end of year) ● Poster & oral presentation on an environmental solution
TOTAL		100% (180 hrs)		