

Syllabus for AP Environmental Science (2014-2015)

School:Northland Preparatory Academy

Instructor: Mr. Irvine

Course description

The AP Environmental Science course is designed to be the equivalent of an introductory college course in environmental science. The goal of this inter disciplinary course is to provide students with the scientific principles and methodologies required to understand the interrelationships of the natural world, to analyze environmental problems both natural and human-made, to evaluate risks associated with these problems, and to examine solutions for resolving or preventing them. The following themes provide a foundation for the structure of the course:

1. Science is a process.
2. Energy conversions underlie all ecological processes.
3. The Earth itself is one interconnected system.
4. Humans alter natural systems.
5. Environmental problems have a cultural and social context.
6. Human survival depends on developing practices that will achieve sustainable systems.

Teach an assigned topic every nine weeks

Long and short term labs and assignments

Students will develop data collecting skills over an extended period of time. Will hone their abilities to take qualitative as well as quantitative measurements

Guest Environmental Speakers

Speakers from Northern Arizona University and the Coconino County area.

*Students may find, approve, and organize the guest speakers visits

Textbooks and other significant readings

Miller,G: Living in the Environment. 14th edition. (Pacific Grove, CA: Brooks/Cole Thompson Publishing)

Necessary for supplemental information:

Various new articles, recordings, films (DVD's. Videos), selected URL's for relevant sites on the Internet

Laboratory Manuals

Enger,E and B. Smith. Field and Laboratory Activities. 8th Ed. McGraw Hill.

AP Instructor's Guide (to accompany Miller's Living in the Environment , 14th edition, Brooks/Cole Thompson Publishing)

Mitchell, Mark K. and William B. Stapp. Field Manual for Water Quality Monitoring. 9th edition. Thomson-Shore Printers, 1995

Summer Reading Assignment (for year 2014-2015)

10 topic articles of their choosing with 1-page structured responses to each
Excerpts from-A Sands County Almanac by Aldo Leopold

Case studies

Students will have to be aware of current issues and be able to gather information and be ready to present it.

Description of incoming students

Students should have taken biology and chemistry, and the permission of the instructor. This prerequisite results in the students being either, juniors and seniors. All students, therefore, will already have a background in the scientific method and the skills to write effective lab reports.

Teacher's Philosophy / Approach

Since this course is a laboratory and field based course, the teaching of it takes advantage of local environments and resources. While Arizona does not have marine environments, estuaries and deciduous forests, it does have coniferous forests, deserts, river/creek systems, and clearly defined watersheds. Therefore, laboratory activities that are conducted outside and are consequently dependent on the weather have to be performed at certain times during the year. Examples of this would be water quality testing, soil analysis, testing ozone levels, biodiversity to name a few.

The topics in AP Environmental Science do not lend themselves to short term memorization of facts. The emphasis of the course is on the understanding of systems and the processes.

Students should come prepared every day. Lectures and laboratory activities will supplement the required reading and homework assignments.

COURSE GRADE ASSESSMENT

- ❖ Tests-Multiple Choice ,Free Response Questions
- ❖ Homework, Chapter Reviews
- ❖ Presentations
- ❖ Lab Reports
- ❖ Field Work
- ❖ Journals

AP EXAM PREPARATION

This course will prepare students to take the AP Exam. The three hour long exam will be divided equally between a Multiple Choice and a Free Response Section.

The multiple choice section consists of 100 questions and constitutes 60% of the final grade. The free response section emphasizes the application of the principles to a greater depth and comprises 40% of the exam grade.

Unit	Topic	Chapter
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I.	Interdependence of Earth's systems: Fundamental Principles and concepts	
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❖ Background: General Overview of the Course

	<u>Environmental Issues, their causes and sustainability</u>	1.
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Activity: The Tragedy of the Commons
Using m&m's, students simulate the problems associated with the tragedy of the commons.

Activity: Footprint Activity
Using a footprint calculator on the internet, students calculate their ecological footprint based on their lifestyle.

Video: The Lorax
Students observe the commonality of environmental problems across the world,

Case Study: Saving the Northern Spotted Owl

	<u>Environmental History: An Overview</u>	2.
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Selected Readings: Garrett Hardin,
Paul Ehrlich

- ❖ How humans have adapted to and modified the environment.
- ❖ Environmental history of the United States
- ❖ Environmental Laws

Video: Guns, Germs and Steel

	<u>Science, Systems, Matter, and Energy</u>	3.
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Lab: Scientific Method

Using various characteristics of paper towels, students propose hypothesis, and design experiments.

Lab: Design your own Experiment

Open ended question about plant growth (seedlings).

II Earth System and Resources

A. Geology: Processes, Hazards, and Soils

10

- ❖ Geological processes and plate tectonics
- ❖ Erosion and Weathering
- ❖ Rocks, minerals, The Rock Cycle

CD-ROM: Plate tectonics

Using the theory of the plate tectonics, students observe and analyze the movement of the tectonics plates

Internet: Earthquake and Volcanic Activity

Using the internet, students map the sites of recent earthquake activity.

Videos: “Earth: A Biography”

Case Study : Hot Springs in Lassen Volcanic and Yellowstone National Park

B: Soil and Soil Dynamics

- ❖ Soil formation and soil profiles
- ❖ Soil triangle
- ❖ Soil erosion, desertification and salinizations

Lab: Physical and Chemical Weathering

Students recreate the process involved in physical and chemical weathering on different kinds of rocks.

Lab: Soil Labs

Students collect soil from different sites and do physical and chemical tests using soil testing kits.

Video: “Dirt! The movie”

C: The Atmosphere

- ❖ Biogeography: Weather and Climate.

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Activity: Climatograms

Students design climatograms of assigned biomes, using data they have researched from the internet

Activity: Biome presentation

Students create travel brochures for their given biome including habitat, wildlife and climate examples

Lab: Micrometeorology

Students study the effect of weathering in a locality.

Parameters used—ambient air temperature, soil temperature, and plants.

Video: Planet Earth: Pole to Pole episode

D: Global Water Resources and Use

14

- ❖ Fresh water
- ❖ Water shortages
- ❖ Damming and water transfer
- ❖ Desalinization
- ❖ Irrigation

Activity: Personal Water Usage

❖ Students keep a daily log of their personal water usage for a week, calculate their total water usage, and analyze their impact on the environment.

Field Trip: Oak Creek (water quality and biodiversity)

Lab: Salinization

Students observe the effect of salinity on radish seeds

Video: Great wall across the Yangtze,
Blue Gold: World Water Wars

III The Living World

A: Ecosystem Structure

- ❖ Biomes and Terrestrial Ecology **6**
- ❖ Aquatic Ecology **7**
- ❖ Saltwater life zones
- ❖ Freshwater life zones: lakes, streams, rivers
- ❖ Eutrophication
- ❖ Community Ecology **8**
- ❖ Non –native; native species
- ❖ Indicator, Keystone species
- ❖ Culture specific and intraspecific compilations

- ❖ Symbiotic relationships

Project: Biomes

PowerPoint presentation on the physical characteristics flora, fauna, and the environment impacts on different biomes

Activity: Predator/Prey Simulation.

Lab: Biodiversity Study using cars parking lot

Project: Wanted Poster

Design a wanted poster for an invasive species.

Case study: Everglades

Video: Strange Days on Planet Earth: Invasive species.

B: Energy Flow

Ecosystems: Components, Energy Flow and Matter Recycling

4

- ❖ Populations, communities, food chains and webs
- ❖ Ecological pyramids and productivity

Lab: Diagram a food web

Using between 20-25 organisms found in the Sonoran Desert, students diagram a food web

Lab: Compost micro-biota identification

Lab: Owl Pellets

Students assemble a skeleton from the bones found in the pellets and calculate the biomass required to support the predator.

C. Evolution and Biodiversity: Origins, niches and Adaptations

5

- ❖ Micro and Macro evolution
- ❖ Niches-fundamental realized
- ❖ Generalist and Specialist

Lab: Natural Selection

Students conduct a simulation of the adaptation of organisms to different habitats and use simple statistical tools to analyze their data.

D: Natural Ecosystem Change

8

Lab: Ecological Succession
Study ecological succession over a period of five weeks using the eco-column.

E: Natural Biogeochemical Cycle **4**

Skit: Chemical Follies: Based on the biological cycle

IV Population

A. Population Biology Concepts

Population Dynamics, Carrying Capacity and Conservation Biology **9**

- ❖ Exponential versus Logistic Growth
- ❖ Biotic potential
- ❖ R-strategists, K-strategists
- ❖ Survivorship curves

Lab: Population Study—Drosophila
Students perform a long term study to analyze how different conditions effect (a) carrying capacity and (b) population dieback.

Video: Strange Days on Planet Earth - Predators

B. Human Population

The Human Population: Growth, Demography, and Carrying Capacity **12**

- ❖ Fertility and death rates
- ❖ Rule of 70; doubling time
- ❖ Age structure diagrams
- ❖ Factors affecting population rate
- ❖ Demographic transitions

Lab: The Power of the Pyramid
Using census data from different countries, (internet) students construct age structure pyramids and analyze those using social, economic, and political parameters.

Activity: How much land is required to feed you?
Students calculate the land area needed to grow the food they eat. Data from one-week of food intake.

Video: The World in Balance (PBS)

V Land and Water Use

A. Agriculture

Food resources

13

- ❖ Food production and nutrition
- ❖ Genetic engineering
- ❖ Irrigation
- ❖ Meat production-pros and cons
- ❖ Harvesting fish

Lab: Effect of radiation on seeds

Students measure, over a period of two weeks, the effects of radiation on the germination and growth of irrigated mustard seeds. Data is analyzed using statistical tests.

Video: Harvest of Fear

Food Inc. (segments)

Project: <mock> Congressional hearing and policy creation on GMO's

Case Study: Growing rice in an arid climate

Pesticides and Pest Control

20

- ❖ Type of Pesticides
- ❖ Pesticide use-pros and cons
- ❖ Pesticide treadmill, Circle of Poison
- ❖ Pesticide regulation
- ❖ Integrated pest management

B. Forestry

Activity: FSC

Students complete an internet lab on sustainable paper industry.

C. Rangelands

Sustaining Terrestrial Biodiversity

23

- ❖ Land use-United States, World
- ❖ Managing forests sustainably
- ❖ Sustaining national parks
- ❖ Gap analysis and ecological restoration

Sustaining Aquatic Biodiversity

24

- ❖ Protecting and sustaining marine biodiversity
- ❖ Human impact on marine and aquatic biodiversity

Video: Empty Oceans, Empty Nets (segments)

Lab: Forest Diversity Study
Students measure the diversity of trees in a riparian setting
(Quadrant Survey at Oak Creek Canyon)

Lab: Biodiversity Study using cars parking lot

D. Other Land Use

- ❖ Urbanization and urban resources
- ❖ Transportation
- ❖ Urban land use-planning and control
- ❖ Sustainable Urban areas

Project: National Parks brochure
Students research the ecology, biology, geology, botany,
natural history, and challenges faced by public lands.

Activity: Land Use
Given certain parameters, students design an
environmentally friendly town on a map

E. Global Economics

Economics, Environment, and Stability **26**

Politics, Environment, and Sustainability **27**

Environment World Views **28**

- ❖ Woven as a thread through all topics that are covered
during the year.

Project: Environmental Legislation

Project: APES in the news
Students collect, make a journal, and analyze newspaper
articles over a nine-week period,

Project: Environmental hot spots
Using www.scorecard.org students write a paper on one
of the following pollutants in their area: lead, carbon
monoxide, nitrogen oxides, particulates, sulfur dioxide,
land contamination, toxic releases.

VI	Energy Resources and Consumption	
	<u>A. Energy Concepts and Consumption</u>	3
	<u>Problems Sets:</u> Dealing with energy	
	<u>B. Fossil Fuel Resources and Use</u>	
	<i>Nonrenewable mineral and energy resources</i>	15
	<ul style="list-style-type: none"> ❖ Formation of mineral resources ❖ Finding and removing mineral resources ❖ Evaluating energy resources ❖ Coal, gas, natural gas, nuclear energy 	
	<u>Video:</u> A Crude Awakening Last Mountain Standing	
	<u>Lab:</u> Cookie Mining	
	<u>C. Nuclear Energy</u>	
	<u>Problem sets:</u> Radioactive Half-Life	
	<u>Video:</u> Chernobyl (segments)	
	<u>D. Renewable Energy</u>	
	<i>Energy Efficiency and Renewable Energy</i>	16
	<ul style="list-style-type: none"> ❖ Energy efficiency and how to improve it ❖ Different forms of alternate energy ❖ Sustainable energy 	
	<u>Lab:</u> Personal Energy Audit	
VII	Pollution	
	<u>A. Pollution Types</u>	
	<i>Air and Air Pollution</i>	17
	<ul style="list-style-type: none"> ❖ Outdoor air pollution ❖ Photochemical and industrial smog ❖ Acid deposition ❖ Indoor air pollution ❖ Solutions to air pollution 	

Lab: Airborne Particulates

Using prepared test strips, students monitor and calculate the number and size of particulates in various locations

Lab: Exhausting problems

Using the socks, students observe the amount of pollutants emitted by their pre and post legislative action cars.

B. Water Pollution

19

- ❖ Types of Water pollution and how they are measured
- ❖ Point and non-point sources
- ❖ Oxygen Sag Curves
- ❖ Groundwater pollution
- ❖ Ocean pollution
- ❖ Wastewater treatment

Lab: Eco-column/Water Quality Lab

Using test kits, students measure chemical parameters (nitrates, phosphates, pH, carbon dioxide, Dissolved oxygen, hardness, chlorine) in an eco-column which they have built. Pasco Probes are also used.

Lab: No water off a duck's back

Students simulate the damage done to birds as the result of an oil spill.

Video: Frontline: Poisoned Waters

Students assess the health of a mountain stream

Parameters : aquatic invertebrates, dissolved oxygen, pH, nitrate, phosphate, Hardness, carbon dioxide, pH, temperature

Pasco Software: Probes used to support water quality data obtained from kits.

Field Trip : Oak Creek Canyon (Sedona, AZ). Three test sites along the creek testing up and downstream of development.

D. Solid and Hazardous Waste

21

Lab: Grass Decomposition

Students look at patterns of decomposition over a 4 week period.

Lab: A Lab of Rot
Students compare the decomposition rates of banana peels and newspapers under varying conditions as well as in a worm bin

Lab: Recycling Game
Students observe various recycling issues on the website

Video: Modern Marvels: Garbage

Case Study: Diving

E. Impacts on Human Health

Risk, Toxicity and Human Health **11**

Lab: Toxicity Studies
Students check the effect of common household chemicals on brine shrimp and calculate the LD-50 levels

Activity: Risk perception and risk reality

Video: Legacy of Love Canal

VIII Global Change

A. Stratospheric Ozone

Ozone Loss **18**

Lab: Measuring Ozone Levels
Students make ozone test strips and check ozone levels in surrounding areas.

Use Eco Badges to verify data

Video: Suntan Now, Cancer Later
Ozone: The Hole Story

B. Global Warming

Climate Change and Ozone Loss **18**

Lab: Greenhouse Effect
Students investigate the processes that might occur in global warming using open and covered containers

Lab: Fossil Fuels

Students keep a daily log of their driving for a week and calculate how much carbon dioxide they have generated.

Video: Coral bleaching clips

C. Loss of Biodiversity

Project: Endangered Species

Students create folder projects on 20 endangered or threatened species