

AP Environmental Science

Course Syllabus 2025-26



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Grade level: 11-12
Course Length: Two semesters
Credit: 1 credit
Prerequisites: Two years of high school laboratory science

Description

Environmental Science is an overview of components of ecosystems, including energy flow and the structure and dynamics of populations and communities. The student will study the processes that affect natural environments, examine the impact of human activities on ecosystems, and discuss current environmental issues. You will see that environmental science draws its principles from various disciplines. For example, we will look at the development of Beaver, Minnesota which involves history, economics, geography, agriculture and human behavior. Throughout the course the student is encouraged to demonstrate respect for the environment and also to develop concern that others are not hurt or harmed by how we act.

The course is online and is designed to prepare high school students to take the College Board Advanced Placement (AP) exam on this subject. Components in the course that are required by AP are indicated by numbered **(C)** markers.

From the College Board: "The authorization of this syllabus is an official recognition by the College Board that it meets or exceeds the expectations colleges and universities have for your AP subject. Your syllabus was reviewed by experienced college and university faculty, who have confirmed that it outlines how you provide a college-level learning experience for your students. This authorization grants you permission to use the "AP" designation on your students' transcripts in association with the authorized course."

Each individual lesson will be detailed by a lesson guide with supporting readings, studies and videos on the website. A more detailed time schedule of the lessons is posted on the website. Please download this for your reference. Many of the lessons will ask you to participate in a discussion about environmental issues in an online forum. Here you will analyze the problems, suggest possible resolutions, prevention and sustainable options for managing the problems **(C15)**.

Field projects and first hand investigations will be required. In these activities you will be applying scientific methods: carefully observing, making hypotheses, measuring, recording data, graphing, using mathematics, controlling variables, identifying assumptions, identifying problems, modifying hypotheses, and coming to conclusions. Methods for analysis and interpretation of data will be taught. As an applied science course you will find that our understandings draw from various scientific disciplines **(C11 & C13)**.

Because the college to which you apply may ask to see your work before granting college credit for this course, you should keep organized copies of each lab report in a folder. Your lab reports should be complete enough to allow another person to repeat what you have done. All calculations should be shown.

The first semester includes a minimum of 15 hours of lab work. The second semester requires an hour for an energy audit and a major field investigation designed by you and approved by the instructor that is equivalent to a minimum of 14 hours. The time you spend on lab activities and reports is very likely to exceed these estimates depending on your dedication to learning the subject matter **(C17)**.

This is a college-level course delivered online. Online work requires discipline and can be challenging for some students. You should be prepared to work hard to prepare yourself for the AP exam. At your school you will need to have a proctor to monitor your tests and provide support. Always feel free to contact me with any questions or concerns.

Course Outcomes:

- Understand the interrelationships in God's Creation
- Increased concern for the stewardship of the Creation
- Understanding that sustainable activity is necessary goal in dealing with resources
- Understanding that many disciplines intersect in this area of study
- Use and understanding of techniques used by environmental scientists
- Increased ability to express and explain the concepts and challenges in this field
- Preparation for the AP exam

Outline of Topics

The following outline of major topics serves to describe the scope of the AP Environmental Science course and exams. The exact schedule will be posted on the web site. The instructor reserves the right to make adjustments that serve better instruction as the course proceeds. The percentage after each major topic heading shows the approximate proportion of multiple-choice questions on the AP exam that pertain to that heading.

Semester 1

1 Motivation Throughout the Course (Week 1)

Having respect for the work of the Artist and love for your neighbor (that others are not hurt or harmed) are Christian motivations.

Consider Barry Commoner's Principles and a few more

Forum Activity: Based on the assigned reading, evaluate and respond to the argument that God will not allow the Earth to end until He wishes it. Therefore, if He is in control we do not need to worry about the Earth. Identify counter arguments that indicate a need to be concerned about environmental issues **(C15)?**

2 Earth Systems and Resources (10–15%) (Weeks 2 – 4) (C1, C2).

2.1. Earth Science Concepts (Geologic time scale; plate tectonics, earthquakes, volcanism; seasons, solar intensity and latitude, deep time)

Chapter 12

Lab: Measure the Heating and Lighting Effects as a Functions of the Angle of the Incoming Radiation: You will model the effect using a light source and measure the areas impacted by the radiation when the angle is varied. This exercise especially attacks a common misconception about the seasons **(C14)**.

2.2. The Atmosphere (Composition; structure; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere–ocean interactions; ENSO)

Chapter 15

Activity: In this activity you model the Coriolis Effect.

Lab: Measuring the Effect of Increased CO₂ on Heat Retention: Measure graph and analyze the loss of heat in a container of a greenhouse gas (carbon dioxide—CO₂) and compare this data against an atmosphere with lower levels of CO₂. You also examine data on the green house gases in the atmosphere to identify concerns (S44 in the text) **(C12, C14, C15)**.

2.3. Global Water Resources and Use (Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)

Chapter 11

Forum Discussion: How would life be affected if the structure of the water molecule were different?

Lab: Solar Still: Construct a solar still to see how freshwater is produced in nature. The students also evaluate the practicality of this method and consider ways to increase the yield. In Yen Martel's novel *Life of Pi*, the main character, Piscine Molitor Patel (Pi), survives on a lifeboat in the Pacific with a Bengal tiger by using twelve solar stills to extract fresh water from saline ocean water.

Lab: Checking for a Silent-toilet Water Leak: Students use food coloring as a tracer to see if the toilet is wasting water and become aware of sources of hidden losses of valuable resources. Students also consider other ways that could be used to detect a leak. Management and prevention are discussed in a forum **(C15)**.

2.4. Soil and Soil Dynamics (Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation). You will take a hard look at what happened at the town of Beaver, Minnesota.

Lab: Soil Types: Students take a sample of soil in their area and learn how to classify soil types. Consideration is given to the properties or functions of various soil types that relate directly to proposed use by industry or agriculture. Problems are identified. Students suggest possible ways to guard and remediate soil **(C15)**.

Lab: Reading Geological Maps: Read USGS maps for Beaver, Minnesota and calculate the slope at that location. Evaluate the use of this land **(C13)**.

Forum: Propose sustainable solutions that could have saved the town of Beaver **((C15))**.

3 The Living World (10–15%) (Weeks 5 – 8) (C3).

3.1. Ecosystem Structure (Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)

Chapter 3

Lab: Ecosystem Structure: Find a creature that lives near you and list the essentials of its niche description that you can determine by observation. Post and share your results. Comment and add to other posts.

Week Five: Proctored Test on Units 1 and 2

3.2. Energy Flow (Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)

Chapter 13

Lab: Energy Flow: Diagram a food web near your home and share it with the group. Using data from a published data set, analyze and explain the varying concentrations of DDT found in creatures that are part of a web. Why is this happening? Predict the concentration if another creature were added to the web (**C15**).

Activity: Consider the food pyramid and calculate the number of kilocalories of corn needed by a cow to supply you with a 100 kilocalories (**C3, C14**).

Forum: Submit a food chain with several trophic levels which has creatures with which you are familiar. Look at two other submissions and add constructive comments (**C3**).

3.3. **The Value of Ecosystem Diversity** (Biodiversity; natural selection; evolution; ecosystem services)

Lab: Quadrats: In an area of the student's choice, students learn how to use quadrats to sample and estimate the density of a plant in a field. The method itself will be also evaluated (**C3, C14**).

Chapter 8

3.4. Natural Ecosystem Change (Climate shifts; species movement; ecological succession)

Chapter 9

Lab: Observing Change: Model change in a community by changing variables using a computer simulation (**C3**).

3.5. Natural Biogeochemical Cycles (Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)

Forum: Critically reflect on the "The Story of Stuff" by Annie Leonard (**C3**).

4 Population (10–15%) (Week 9) (C4).

Chapter 7

4.1. Population Biology Concepts (Population ecology; carrying capacity; reproductive strategies; survivorship) Human population dynamics (Historical population sizes; distribution; fertility rates; growth rates and doubling times; demographic transition; age-structure diagrams)

Population size (Strategies for sustainability; case studies; national policies)

Impacts of population growth (Hunger; disease; economic effects; resource use; habitat destruction)

Lab: Estimating Population Size: Model and understand the capture – recapture Method. Identify

the assumptions in the calculation. Evaluate the method **(C12, C13, C14)**.

Lab: Population Growth: Grow mold on bread: graph the growth over time, vary the environmental factors, recognize exponential growth in the data and the carrying capacity. Using a formula for exponential growth calculate the area that the mold would occupy without the limits of carrying capacity **(C12, C14)**.

Activity: Study and plot data on human population growth. Extrapolate to estimate when the population will reach 12 billion. Identify assumptions. Explore possible resolutions

interpret the meaning of the slope of a population growth graph at various points

analyze and calculate the doubling time for a population from a table or graph

compare and contrast the age structures of various populations in different areas of the world **(C12, C13, C14, C15)**.

Week Nine: Proctored Test on Unit 3

5 Land and Water Use (10–15%) (Weeks 10 – 15) (C5, C6).

Chapter 10

5.1. Agriculture

1. Feeding a growing population (Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture)

Activity: Read the EPA information on nitrates **(C6, C16)**.

2. Controlling pests (Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws)

Lab: Composting: Make soil. How does composting benefit the environment?

Lab: Problems with Irrigation: You will become aware of one of the side effects of irrigation. Investigate the effects of salinization on seed germination and plant growth. Set up an experiment with a control **(C6, C15)**.

Forum: Discussion on what you would change if you could change only one thing **(C16)**.

5.2. Forestry (Tree plantations; old growth forests; forest fires; forest management; national forests)

Forum: Which forestry practice from your textbook reading do you regard as the most important?

5.3. Rangelands (Overgrazing; deforestation; desertification; rangeland management; federal rangelands)

5.4. Other Land Use

5.4.1. Urban land development (Planned development; suburban sprawl; urbanization)

Week Thirteen: Proctored Test on 3.1 through 5.3

5.4.2. Transportation infrastructure (Federal highway system; canals and channels; roadless areas; ecosystem impacts)

5.4.3. Public and federal lands (Management; wilderness areas; national parks; wildlife refuges; forests; wetlands)

Activity: Public Land: Locate a public land that you would like to visit. Justify your choice. Post on the forum.

Activity; Identify the assumptions in the arguments being made on both sides of the dispute over the use of the range lands. How do you feel and what would you do? Justify your position.

5.4.4. Land conservation options (Preservation; remediation; mitigation; restoration)

5.4.5. Sustainable land-use strategies

Lab: Land Use: Using National Geographic web sources. What Can We Learn From Satellite Images? Students look at map and satellite images to see how various settled parts of the Earth have changed over the past few decades. They will then draw maps of their hometown, showing how it might have looked in satellite images in the 1970s and today **(C13)**.

5.5. Mining (Mineral formation; extraction; global reserves; relevant laws and treaties)

Activity: After reading the article on “frac” sand mining and seeing the video of the sand train. Do some math on the value of the sand in the fracturing process and share your thoughts on the forum. A gondola can carry 100 tons.

5.6. Fishing (Fishing techniques; overfishing; aquaculture; relevant laws and treaties)

5.7. Global Economics (Globalization; World Bank; Tragedy of the Commons; relevant laws and treaties)

Activity: After viewing the videos on the Tragedy of the Commons, share your reactions in the Forum discussion.

Week 16: Proctored Comprehensive Exam

Semester 2

Using What You Know

Project: Propose and design an environmental study project that you can conduct in your area. Your project will be conducted during the major part of this semester. Your study should include careful observations of an environmental problem and reflect understandings that you have gained in the course. State your hypothesis. Indicate the techniques you will use to collect your data. Include a plan to mathematically analyze and interpret the data. Are there confounding variables that need to be identified? Submit your plan to the instructor for approval and advice before starting. After modification and approval, carry out your project. Submit a report that communicates what you have done along with your conclusions. Remember that the reader needs enough information to be able to evaluate your technique and to be able repeat your study. Propose further questions for study **(C12, C13, C14)**.

This project is due on Friday of Week 13.

6 Energy Resources and Consumption (10–15%) (Weeks 1 – 6) (C7, C8).

Chapter 2

6.1. Energy Concepts (Energy forms; power; units; conversions; Laws of Thermodynamics)

Week 1: Lab - Submit proposal for study.

6.2. Energy Consumption

6.2.1, History (Industrial Revolution; exponential growth; energy crisis)

6.2.2. Present global energy use

6.2.3. Future energy needs

6.3. Fossil Fuel Resources and Use (Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/ disadvantages of sources)

Week 3: Progress Report on study

6.4. Nuclear Energy (Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion)

6.5. Hydroelectric Power (Dams; flood control; salmon; silting; other impacts)

Forum: After watching the video on the life cycle of salmon, discuss what threatens the population of this keystone creature and the effects of its loss **(C15)**.

6.6. Energy Conservation (Energy efficiency; CAFE standards; hybrid electric vehicles; mass transit)

6.7. Renewable Energy (Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy; small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages)

Lab: Energy Use In the Home: Do a home energy audit and compare your results to typical use found in the population. Identify problem areas and consider solutions. Discuss ways to conserve on the forum **(C13, C15)**.

7 Pollution (25–30%) (Weeks 7 - 11) (C9).

Chapter 14

7.1. Air pollution (Sources—primary and secondary; major air pollutants; measurement units; smog; acid deposition—causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; 7.1.1 Clean Air Act and other relevant laws) 7.1.2 Noise pollution (Sources; effects; control measures)

Week 7: Proctored Test on Unit 6

7.2 Water pollution (Types; sources, causes, and effects; cultural eutrophication; ground-water pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws) **(C6)**.

7.3 Solid waste (Types; disposal; reduction)

7.4. Impacts on the Environment and Human Health

7.5. Hazards to human health (Environmental risk analysis; acute and chronic effects; dose-response relationships; air pollutants; smoking and other risks) **(C16)**.

Chapter 16

Forum: Prepare for a discussion on the various uses of lead in industry and commerce, where it is found in the environment, and the effects that have been noticed in humans. Consider how to manage this problem **(C15)**.

7.6. Hazardous chemicals in the environment (Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws)

7.7. Economic Impacts (Cost-benefit analysis; externalities; marginal costs; sustainability)

8 Global Change (10–15%) (Weeks 12 – 15) (C10).

8.1. Stratospheric Ozone (Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties)

Chapter 17

Week 12: Proctored Test on Unit 7

8.2. Global Warming (Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties)

Week 13: Field Project Due

8.3. Loss of Biodiversity

1. Habitat loss; overuse; pollution; introduced species; endangered and extinct species
2. Maintenance through conservation
3. Relevant laws and treaties

Week 15: Proctored Comprehensive Exam

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Materials For The Course

Texts: For both semesters - G. Tyler Miller, and Scott E. Spoolman. *Environmental Science*. Belmont, CA: Brooks/Cole, 2013.

Study Helps: Students will be enrolled and directed to study questions on the AP webstie.

For the second semester - Nate Blakeslee. *American Wolf; A True Story of Survival and Obsession in the West*. New York: Broadway Books, 2017. Understanding different viewpoints and also appreciating the effects of a top predator in an ecosystem are the goals of reading this interesting book.

Each lesson has a guide that is posted on the web. The lesson is followed by an online quiz covering the major points in the lesson that is immediately scored. You are free to repeat these quizzes as learning devices for a better score.

Additional Readings in the Course:

Aldo Leopold. *A Sand County Almanac*. New York: Ballantine, 1949.

Lynn White. "The Historical Roots of Our Ecologic Crisis." *Science*, 155, 1203-1207.

Jared Diamond. "Easter's End." *Discover*, August, 1995.

Paul R. Boehlke. "Entrusted with God's Earth." *Forward in Christ*, April 2008.

NOAA: Selections from "National Weather Service: Jetstream Online School for Weather."

Minnesota Humanities Center: "American Indian Gardening (Dakota and Ojibwe)"

“Pioneer Life In Upper Canada, Grist Mill”

Susan Schoenian. “Sheep 201: A Beginners Guide to Raising Sheep – Grazing Management”

US Army Corps of Engineers: “Deer Management at Lake Georgetown”

EPA: “Basic Information about Nitrate in Drinking Water”

Paul R. Boehlke. “The United States Bans PCBs.” *Great Events from History II: Ecology and the Environment*. Frank N Magill (ed.). Pasadena: Salem Press, 1995, 1420-1424.

The Nature Conservancy. “Our History – History & Milestones of the Nature Conservancy”

National Wildlife Federation. “Protecting Public Lands”

Videos (Linked to the Lessons):

UN International Strategy for Disaster Reduction: “Lessons Save Lives”

National Geographic: “Earth’s Atmosphere”

Annenberg Learner: “Water Resources”

Teacher Tube: “Contour Plowing”

Annie Leonard: “The Story of Stuff”

Rainforest Alliance: “Rainforest Alliance”

Myung Chun: “The Last Cowboy: When the Range Disappears”

McKinsey Global Institute: “A Study of China’s Urbanization”

Elizabeth Press: “Curitiba’s BRT: Inspired Bus Rapid Transit Around the World”

Nancy Pearlman: “An Interview with Garrett Hardin on the Tragedy of the Commons and Resource Allocation”

U.S. Army Corps of Engineers: “Life Cycle of Salmon”

1995cnw1: “Wisconsin Northern Low Side Gondola Sand Train”

Films for Human Rights: “Jamaica Nuff Problems Man, Part 1/3”

Evaluation & Grading Scale

98-100 A+	87-89 B+	87-89 C+	67-69 D+	
93-97 A	83-86 B	73-76 C	63-66 D	0-59 F
90-92 A-	80-82 B-	70+72 C-	60-62 D-	

Grade Allotment

	<u>Semester 1</u>	<u>Semester 2</u>
Tests	40%	40%
Quizzes, Forums, Lab Reports, Activities	40%	30%
Project (in the second semester)		10%
Final Exam	<u>20%</u>	<u>20%</u>
	100%	100%

Instructor Policies

Expected of Students:

1. Check in on the course on a daily basis, Monday through Friday. It is important to keep up with the schedule so that forum discussions are shared on a timely basis. Generally, students have been scheduled by their school to work on this course at a specific time each school day. Be faithful in using this time to work on this course. If you will be absent from class on a particular day, or if you miss class because of illness, be sure to let me know. Late work that indicates a lack of faithfulness will lose points.
2. Expectations for this course are high, but reasonable. Everyone is very busy with their other courses, activities, and responsibilities, yet you are expected to complete all work on time. If you need an extension of time, please make the request via private email prior to the due date.
3. Communicate! If you have questions or concerns on a particular assignment or activity, please send me a private email or make a public posting in the Instructor's Office Forum. Good two-way communication is very important to having a successful experience!

The Book Report (Second Semester):

In the second semester the student is expected to read and report on Blakeslee's book on the reintroduction of wolves into Yellowstone. The report should include contrasting the views of those that wanted the wolves and those that did not. The student should explain the two views showing understanding of the complexity of the issue. The student also should outline the effects of the wolves on the ecosystem in Yellowstone.

The Project (Second Semester): Students should identify an issue or problem in their environment and take steps to encourage change.

AGVA Policies:

AGVA policies are listed in the ***Student Handbook***, available on the AmazingGraceVA.org website under [Resources, Handbooks](#). This includes policies on non-discrimination, anti-harassment, student expectations, attendance, academic honesty, student discipline, student grades, course add/drop, etc.

Please note the policy on **attendance** that states in part:

“Even if a student’s local school does not have school on a particular day (snow day, teacher’s conference, quarter break, choral fest, class trip, etc.) AGVA courses will continue to meet and students are expected to complete required work on time.”

If students are not full-time students at AGVA, they also fall under the policies of the school where they attend as a full-time student. When applicable, that school's policies will also be applied to enrollment in AGVA courses.