A.P. Environmental Science

Submitted by Dr. Fran Hess -
Course Offered at Cooperstown High School, Cooperstown, NY

Note: Items directly related to climate change are highlighted but many other topics and activities included climate change related topics.

Course Content: Themes & Units

Major Themes:

Stewardship & Sustainability
Science of Earth Systems
Integration of Human & Earth Systems Relationships
Regional & Global Implications

Unit 1: Ecosystems: Basic Units of the Natural World

1. A Sustainable Future
2. Ecosystems: What They Are
3. Ecosystems: How They Work
4. Ecosystems: How They Change

Unit 2: The Human Population

1. The Human Population: Dimensions
2. Population and Development

Unit 3: Renewable Resources

1. Water: Hydrologic Cycle and Human Use
2. Soil: Foundation for Land Ecosystems
3. The Production and Distribution of Food
4. Wild Species and Biodiversity
5. Ecosystem Capital: Use and Restoration

Unit 4: Energy

1. Energy from Fossil Fuels
2. Energy from Nuclear Power
3. Renewable Energy

Unit 5: Pollution and Prevention

1. Environmental Hazards and Human Health
2. Pests and Pest Control
3. Water pollution and Its Prevention
4. Municipal Solid Waste: Disposal and Recovery
5. Hazardous Chemicals: Pollution and Prevention
6. The Atmosphere: Climate, Climate Change, and Ozone Depletion
7. Atmospheric Pollution

Unit 6: Towards a Sustainable Future

1. Economics, Public Policy, and the Environment
2. Sustainable Communities and Lifestyles

Activities and Laboratory Investigations

Eating at a Lower Trophic Level

1. Calculate and compare human food needs at different trophic levels, using the data to construct a biomass pyramid.
2. Analyze the benefits and drawbacks of eating at lower trophic levels on a global scale.

Oh Deer (Project Wild)

Develop and understanding of the importance of relationships between organisms including the concepts of competition, energy flow and cycling of matter.

Owl Pellet Lab: Food Webs, Biomass Pyramids

Develop an understanding of the research necessary to conduct a study of food webs and biomass pyramids.

Predator-Prey Simulation

1. To simulate and analyze the interactions between a predator population of coyotes and a prey population of mice.
2. Organize and graph data using a simulation and predicting future populations.
3. Compare simulation results to data taken from nature and apply revised simulation techniques to other population problems.

Populations: Basic Statistics

Overview of basic statistical methods used in human population studies.

Populations: Age Structure

Study in the age structure of human population comparing populations in developing and developed countries with age structure diagrams of human population distributions.

Populations: Growth

Study of human population growth based on age and location with online activity.

World Population Growth

1. Graph and mathematically analyze the rates of human population growth through history.
2. Project human populations into the future based on generalizations from various data sources for modern times.

National and Local Water Use

1. Use the Internet to gather and interpret water use data at the national, state, and local levels.
2. Analyze water use patterns over time to compare consumption with local rainfall.

Water Quality Index

1. Perform tests to determine the Water Quality Index (WQI) of a local body of water
2. Perform follow-up WQI tests to establish an ongoing record and basis for possible water remediation.

Water Loss – Drop by Drop

1. Estimate household water loss from common leaks.
2. Extrapolate water loss to the surrounding community.

Net Primary Productivity

1. Measure new primary productivity (NNP) of rye grass, comparing NPP measurement methods for reliability.
2. Apply the NPP concept to problems of crop growth and higher trophic level support.

Energy & Recycling

1. Compare energy costs of recycling aluminum cans to making cans from raw materials
2. Investigate extrinsic benefits and disadvantages of recycling, such as environmental and economic factors

Personal Energy Use Audit

1. Record and calculate appropriate personal energy use in the home today
2. Compare the amounts by products, and dollar costs of competing fuels that are necessary to support personal energy consumption.

Solar Absorption

1. Design and experiment to calculate and compare the heat-absorbing capacities of various fluids under solar radiation.
2. Determine efficient applications and models for fluid solar-energy collectors, based on experimental results.
3. Compute heat absorption rates for passive solar materials

Toxic Sites in Your Neighborhood

Research and analyze environmental problems locally, determining their causes, ecological and public health impacts and possible resolutions.

Solid Waste Collection

1. Quantify and analyze household solid waste.
2. Propose general strategies for reduction and recycling of solid waste.

Auto & Truck Tires and the Environment

1. Calculate the energy available from burning tires to generate electricity.
2. Compute reductions in sulfur dioxide emissions from burning tires in place of coal for cement production
3. Propose ways of conserving and reusing tires.

CO_2 Emissions from Fossil-Fuel Burning

1. Track long term energy production (1751-2000) and correlate the data to emissions and atmospheric concentrations of CO_2
2. Investigate the effects of CO_2 and other greenhouse gases on global temperatures.

Global Climate Change

1. Analyze and graphically depict interrelationships between a complex effects of global warming.
2. Apply the analysis of effects to environmental, economics, and sociopolitical events, both locally and generally.

Particulate Air Pollution

Measure particulate matter locally and evaluate the data by EPA standards.

Political Activism Letter

1. Investigate the environmental issue of whether to drill for oil and gas in the Arctic National Wildlife Refuge (ANWR) in northeastern Alaska.
2. Write a letter to a nationally elected government official, urging him to take a specific course of action.

River Study – Participation in a Longitudinal Study

Gathering of data regarding the physical, chemical and biological aspects of a site-specific location along a stream.

Swamp Sanctuary Project

To recognize the value of preserving areas often overlooked and to experience the enjoyment of learning about local resources in simple settings.

Longitudinal Forest Plot Study

Participation in a long-term study of selected forest plots at a local commercial forest and develop an appreciation for the link between the environmental and economic needs of a community.

School Nature Center

Provide opportunity for students to become involved in a local stewardship project and to become aware of local environmental resources.

Note: Labs and activities may vary from year to year depending on school scheduling issues and student interest. Some activities relate to more than one topic area and may be used with different chapters from one year to the next.

Long Term Assignments

Overall Goal: To help students develop level of responsibility to work on long term projects independently and learn to use research databases.

Summer Legislative Research

Comprehensive overview of national and international environmental laws, treaties, agreements and laws.

Summer Annotated Current Events Scrapbook

To help students become aware of the abundance of local, regional and global environmental issues.

Local Issue PowerPoint Presentation

Research and present a local environmental issue.

Book Review

Comprehensive review of one environmentally based book. See list provided. Students may obtain approval for other appropriate books not on list but of specific interest to them.

Self-Designed Research Study

To raise awareness, understanding, and appreciation of the procedures and problems encountered in conducting a scientific research study project.

Part II: Course Year Plan

Topics	Time/ Weeks	Activities/ Laboratory Investigations/ Videos
Introduction 1. A Sustainable Future	1	
Unit 1: Ecosystems: Basic Units of the Natural World 1. Ecosystems: What They Are 2. Ecosystems: How They Work 3. Ecosystems: How They Change	4	Eating at a Lower Trophic Level[1] Oh Deer - Project Wild Owl Pellet Lab: Food Webs Biomass Pyramids Predator-Prey Simulation[1]
Unit 2: The Human Population 1. The Human Population: Dimensions 2. Population and Development	4	Populations: Basic Statistics[2] Populations: Age Structure[3] Populations: Growth[4] World Population Growth[1] National Geographic Case Study Video: Riding the Commuter Rail to Bombay
Unit 3: Renewable Resources 1. Water: Hydrologic Cycle and Human Use 2. Soil: Foundation for Land Ecosystems 3. The Production and Distribution of Food 4. Wild Species and Biodiversity 5. Ecosystem Capital: Use and Restoration	7	National & Local Water Use[1] Water Quality Index[1] Water Loss - Drop by Drop[1] Net Primary Productivity[1] Global City: Water Conservation Save the Species Fisheries National Geographic Case Study Videos: Colorado River Wars The Florida Panther: Endangered Species Comeback Restoring the Cod to Newfoundland's Aquaculture's Next Wave

Unit 4: Energy

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1. Energy from Fossil Fuels
2. Energy from Nuclear Power
3. Renewable Energy

Energy & Recycling[1]
Personal Energy Use Audit[1]
Solar Absorption[1]

Global City: Power Up

National Geographic Case Study Videos:
Wind Turbines: Snatching Power Out of Thin Air
Fuel Cells: Complement to Solar & Wind Power

Film: Who Killed The Electric Car?

Unit 5: Pollution and Prevention

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1. Environmental Hazards and Human Health
2. Pests and Pest Control
3. Water pollution and Its Prevention
4. Municipal Solid Waste: Disposal and Recovery
5. Hazardous Chemicals: Pollution and Prevention
6. The Atmosphere: Climate, Climate Change, and Ozone Depletion
7. Atmospheric Pollution

Toxic Sites In Your Neighborhood[1]

Solid Waste Collection[1]
Solid Waste Collection: Auto & Truck Tires and the Environment[1]
CO_2 Emissions from Fossil-Fuel Burning[1]
Global Climate Change[1]
Particulate Air Pollution[1]

Global City: Risky Business
Stop the Pest
Find the Sample
Breathe Free

National Geographic Case Study Video:
Lyme Disease: Fastest Spreading Emerging Disease in US

Film: An Inconvenient Truth

Field Trip: Village Sewage Treatment Plant

Unit 6: Towards a Sustainable Future

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1. Economics, Public Policy, and the Environment
2. Sustainable Communities and Lifestyles

Political Activism Letter[1]

National Geographic Case Study Video:
Potomac River Sprawling Megalopolis

Field Trip/Lab: River Study
Field Trip/Project: Swamp Sanctuary
Field Trip/Research: Longitudinal Forest Plot Study
Field Trip/Stewardship: School Nature Center

RESEARCH PROJECT 4 - 5 Self-Designed Scientific Research Project

Lab Source:

[1]Molnar, William. Laboratory Investigations: AP Environmental Science. Saddle Brook, NJ: Peoples, 2005.
[2]http://esa21.kennesaw.edu/population.htm
[3]http://esa21.kennesaw.edu/activities/populationage/populationage.pdf
[4]http://esa21.kennesaw.edu/activities/populationgrowth/populationgrowth.pdf

Global City - Problem-solving activities utilizing real data to apply and critically evaluate information related to current environmental issues.

National Geographic Case Study Brief Video Clips

Textbook Website: www.prenhall.com/wright

Part III: Resources

Local Resources:

School Nature Center
Otsego Lake & Susquehanna River
Swamp Sanctuary
Biological Field Station on Otsego Lake
Hospital & Library
Historical Library
Village Libraries
Village Water Treatment Facilities
Sewage Treatment Plant
State University of New York
Hartwick College
Local Forest and Lumberyard Facilities

School Media Center

Books – See Addendum Third Marking Period: Book Review

Environmental Science Journals

The journals listed in bold are available to students in the school library. The other journals are available through the various online databases available through the school library. These databases include EBSCO, Gale Databases, Proquest, and Student Resource Center—Junior. Some of the databases have full-text in HTML format or in PDF format. The articles not available in full-text can be obtained through interlibrary loan.

Agricultural Research
American Midland Naturalist
Bioscience

Conservationist
Current Science

Discover
Earth
Earth Science
Environment
Environment
Foreign Affairs
Futurist
Journal of Environmental Health

National Wildlife
Nature
Nature Alert
New Scientist

New York State Conservationist
Physics Today

Popular Science
Rocks & Minerals
Rocks & Minerals
Science
Science
Science & Society
Science Magazine
Science News
Science World

Scientific American
Social Alternatives
Social Research
Social Science Journal

The following articles are available through FirstSearch, the online college database that is a school purchased subscription database. The articles that are not available in full-text can be accessed through interlibrary loan.

Antipode
Applied Environmental Education and Communication
Biodiversity and Conservation
Capitalism Nature Socialism
Civil Engineering and Environmental Systems

Clean Technologies and Environmental Policy

Contemporary Justice Review
Cultural Geographies
Democracy & Nature
Earth Interactions
Ecosystem Health
Ecotoxicology
Ecotoxicology and Environmental Safety
Ecumene
Energy Sources
Environment and Behavior
Environment and Development Economics
Environmental and Ecological Statistics
Environmental and Resource Economics
The Environmental Communication Yearbook
Environmental Education Research
Environmental Geochemistry and Health
Environmental Management and Health
Environmental Modeling and Assessment
Environmental Policy and Law
Environmental Politics
Environmental Practice
Environmental Research
Environmental Reviews
Environmental Sciences
The Environmentalist
Ethics & the Environment
Ethics, Place and Environment
Evaluation Review
Geographical and Environmental Modelling
GeoJournal
Global Change Biology
Global Ecology & Biogeography
Global Environmental Politics
The Holocene
Instrumentation Science & Technology
Integrated Environmental Assessment and Management
International Environmental Agreements: Politics, Law and Economics
International Journal of Environmental Studies
International Journal of Sustainability in Higher Education
International Transactions in Operational Research
Journal for Nature Conservation
Journal of Agricultural and Environmental Ethics
Journal of Environment & Development
Journal of Environmental Assessment Policy and Management
Journal of Environmental Economics and Management
Journal of Environmental Engineering and Science
Journal of Environmental Management
Journal of Environmental Planning and Management
Journal of Environmental Policy & Planning
Journal of Environmental Psychology
Journal of Environmental Science
Journal of Environmental Science and Health, Part A - Toxic/Hazardous Substances & Environmental Engineering
Local Environment
Mitigation and Adaptation Strategies for Global Change
Organization & Environment
Philosophy and Geography
Progress in Environmental Science
Regional Environmental Change
Review of Policy Research
Reviews in Environmental Science and Biotechnology
Science and Global Security
Society and Natural Resources
Strategic Environmental Management
Strategic Planning for Energy and the Environment Journal
Toxic Substance Mechanisms

Key Website Resources

Introduction

Textbook Site / Resources
wps.prenhall.com/esm_wright_envisci_9

Unit 1 Ecosystems: Basic Units of the Natural World

Predator Prey Simulation - Messiah College
home.messiah.edu/~deroos/CSC171/PredPrey/PPIntro.htm

Unit 2 The Human Population

Population & Age Structure Activity
esa21.kennesaw.edu/activities/populationage/populationage.pdf
Population Growth Activity
esa21.kennesaw.edu/activities/populationgrowth/populationgrowth.pdf
World Population Information
www.census.gov/ipc/www/world.html
Population Pyramids
www.census.gov/ipc/www/idbpyr.html

Unit 3 Renewable Resources

US Water Resources
water.usgs.gov

Unit 4 Energy

Compendium of Data on Global Change
cdiac.esd.ornl.gov/trends/emis/em_cont.htm
EPA Site on Global Warming
yosemite.epa.gov/oar/globalwarming.nsf/content/climate.html
Natural Renewable Energy Laboratory
www.nrel.gov/
Calculator Determining Gasoline Savings
www.sierraclub.org/mpg
Home Energy Saver Calculator
hes.lbl.gov/
American Solar Energy Society
www.ases.org/
Interactive Energy Calculators
www.infinitepower.org/calc_watts.htm
Study Guide to Alternative Fuel Vehicles
www.energyquest.ca.gov/transportation/

Unit 5 Pollution & Prevention

Weather Resource Site
www.weather.com
National Hurricane Center
www.nhc.noaa.gov/index.shtml

Weather Resource Site
www.usatoday.com/weather/wtrack.htm
Global Climate Animations – University of Oregon
geography.uoregon.edu/envchange/clim_animations/index.html
Search Zip Codes, City, County for Local & Regional Environmental Issues
www.epa.gov/enviro/http://www.epa.gov/enviro/
In-depth Pollution Report – Specific Community's Air, Water, Chemicals, etc.
scorecard.org/
Information on Tides - Worldwide
tidesonline.nos.noaa.gov
Information on Phases of Moon
aa.usno.navy.mil/data/docs/MoonPhase.html
Virtual Global Warming Activities
www.sciencecourseware.org/eec/GlobalWarming/

Unit 6 Towards a Sustainable Future

Library of Congress - Congressional Records, Contacts, etc.
www.congress.gov
E-mail Contacts on Various Environmental issues
secure2.convio.net/sierra/site/Advocacy?JServSessionIdr004=
16qxbjme52.app5a&page=UserActionInactive&id=175

Research Projects

General Information, Possible Topics and Write Up Instructions
www.sciencebuddies.org/mentoring/project_research_paper.shtml
www1.eere.energy.gov/biomass/pdfs/highschool_projects.pdf
Solar Energy Science Projects
www.jc-solarhomes.com/projects.htm

News & General Resources

CNN News www.cnn.com
CNBC News www.cnbc.com
US Department of Energy www.energy.gov
U.S. Fish & Wildlife: Arctic National Wildlife Refuge arctic.fws.gov/issues1.htm
Union of Concerned Scientists www.ucsusa.org
American Petroleum www.api.org
Sierra Site www.sierraclub.org
Audubon Society www.audubon.org
Wilderness Society www.wilderness.org
American Association for the Advancement of Science www.eurekalert.org

Environmental News Network www.enn.com
EnviroLink Network www.envirolink.org
Environmental & Energy Publishing LLC www.eenews.net
Environmental Distance Learning www.edlonline.org/default.asp
Environmental Science Activities esa21.kennesaw.edu/activities/activities.htm
Arkansas State University & Kennesaw State University
Environmental Literacy Council www.enviroliteracy.org/teachers-index.php

How Stuff Works – Science Behind It auto.howstuffworks.com/
Geology Animations – West Virginia University
www.geo.wvu.edu/~donovan/geol101/animationindex-mh.htm
Astronomical Data – Sun Rise/Sunset, Lunar Phases, aa.usno.navy.mil/
Seasonal Data, Celestial Navigation
Plastics Resources www.plasticsresource.com/s_plasticsresource/index.asp
Hudson River Estuary Program www.dec.state.ny.us/website/hudson/hrep.html
Conservation International www.conservation.org/xp/CIWEB/home/

Governmental Sites

Environmental Protection Agency www.epa.gov
United State Geological Survey www.usgs.gov
National Oceanic & Atmospheric Administration www.noaa.gov
National Aeronautics & Space Administration www.nasa.gov
USDA Forest Service www.fs.fed.us
New York State Departmental Conservation www.dec.state.ny.us/
US Food & Drug Administration hwww.fda.gov/
Center for Disease Control www.cdc.gov/

Journals, Periodicals

American Association of Advancement of Science www.sciencemag.org
Scientific American www.sciam.com
New Scientist www.newscientist.com
Science News www/sciencenews/prg
New York Times - Science www.nytimes.com/pages/science/index.html
UN's Our Planet www.ourplanet.com/