ESS 0001 - INTRODUCTION TO ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

Catalog Description

Formerly known as INT 1
Advisory: Eligibility for ENGL 1A
Hours: 54 lecture
Description: A study of the natural world and how it is influenced by human activity. This course will introduce and analyze the scientific basis of major environmental issues and evaluate potential solutions within the context of diverse human cultures and societies. Topics include principles of physical and biological systems, biogeochemical cycles, global climate, natural laws, land, air and water resources, consumption and waste, pollution, toxicology, human population growth, and sustainability on a local, regional and global level. (C-ID ENVS 100) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Identify and describe the five interacting subsystems of the earth (biosphere, lithosphere, hydrosphere, atmosphere and anthrosphere) and explain how a change in one system will affect the others.
- CSLO #2: Apply scientific principles & social science concepts in evaluating environmental issues and solutions regarding the biodiversity crisis, global climate change, exponential human population growth, resource depletion and pollution.
- CSLO #3: Interpret and analyze scientific data and effectively make evidence-based claims about scientific questions.
- CSLO #4: Articulate the concept of ecological sustainability and assess whether or not human particular activities are truly sustainable.

Effective Term

Fall 2024

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

Through examinations, written work, group projects, and oral presentations, students will:
I. Introduction
A. Define the term environment and describe the field of environmental science
B. Characterize the nature of environmental science
C. Describe the scientific method and the process of science
D. Analyze and interpret quantitative data and visual representations of data (throughout the course)
E. Evaluate the importance of natural resources and ecosystem services to living organisms
F. Distinguish between renewable and nonrenewable natural resources and energy
G. Evaluate the consequences of human population growth and resource consumption
H. Diagnose and illustrate some of the pressures on the global environment
I. Articulate the concept of sustainability
II. Earth's Physical System
A. Apply the fundamentals of matter and chemistry to real-world situations
B. Differentiate among forms of energy and articulate the basics of energy flow in the earth system
C. Apply Natural Laws (matter & energy) to photosynthesis, cellular respiration, and chemosynthesis, and summarize their importance to living things
D. Explain how plate tectonics and the rock cycle shape the landscape and impact environmental systems
E. List major types of geologic hazards and describe ways to mitigate their impacts
III. Earth's Biological System
A. List the levels of ecological organization
B. Assess logistic growth, carrying capacity, limiting factors, and other fundamental concepts in population ecology
C. Explain natural selection and cite evidence for this process
D. Describe how evolution influences biodiversity
E. Discuss reasons for species extinction and mass extinction events
F. Compare and contrast the major types of species interactions
G. Characterize feeding relationships and energy flow, using them to construct trophic levels and food webs
H. Distinguish characteristics of keystone species
I. Characterize disturbance, succession, and notions of community change
J. Perceive and predict the potential impacts of invasive species in communities
K. Explain the goals and the methods of restoration ecology
L. Describe biomes and identify the terrestrial biomes of the world
M. Define ecosystems and evaluate how living and nonliving entities interact
N. Compare and contrast how water, carbon, nitrogen, and phosphorus cycle through the environment (biogeochemical cycles)
O. Evaluate human impacts on biogeochemical cycles
P. Characterize the scope and importance of biodiversity on Earth
Q. Evaluate primary causes of biodiversity loss: habitat destruction, invasive species, pollution,
population growth, climate change, overconsumption (HIPPCO)
R. Assess the science and practice of conservation biology
IV. The Atmosphere
A. Describe the composition, structure, and function of Earth's atmosphere
B. Relate weather and climate to atmospheric conditions
C. Identify major pollutants,
D. Evaluate the scope of outdoor and indoor air pollution, and assess solutions
E. Apply Natural Laws to stratospheric ozone depletion

V. Climate Change
A. Describe Earth's climate system
B. Construct a visual model and written or verbal description of how radiation and gasses interact in the troposphere
C. Explain the factors influencing global climate
D. Describe how global climate has changed historically
E. Characterize human influences on the atmosphere and on climate
F. Summarize how researchers study climate
G. Compare climate models and scenarios to predict future trends and impacts of global climate change
H. Suggest ways humans may respond to climate change, differentiating between mitigation and adaptation
VI. Ocean Systems
A. Describe where water resources are located on earth.
B. Utilizing data, determine percentage of water found in oceans, glaciers, groundwater, rivers, lakes, soil, the atmosphere and living organisms
C. Evaluate how the oceans influence and are influenced by climate
D. Assess impacts from HIPPCO on marine systems and determine solutions
VII. Human Population
A. Calculate human population growth
B. Evaluate how human population, affluence, and technology affect environmental impact (I=PAT)
D. Explain and apply the fundamentals of demography to human population growth models
E. Outline and assess the concept of demographic transition
F. Assess how social factors and environmental conditions impact population growth
H. Describe the scale of urbanization, locally and globally
C. Outline city and regional planning and land use strategies
D. Evaluate sustainable development options
VIII. Agriculture
A. Evaluate the importance of natural resources and ecosystem services to agriculture
B. Outline the goals, methods, and consequences of major developments in the history of agriculture, including the agricultural and green revolutions
C. Summarize pathways to sustainable agriculture
IX. Consumption & Waste
A. Evaluate the rate of human resource consumption and degradation
B. Summarize and compare the types of waste humans generate
C. List the major approaches to managing waste
D. Evaluate efficacy of approaches for reducing waste: source reduction, reuse, composting, and recycling
X. Environmental Health & Toxicology
A. Explain the goals of environmental health and identify major environmental health hazards
B. Evaluate impacts of toxicants on human and environmental systems
C. Describe the types of toxic substances in the environment and the factors that affect their toxicity
C. Compare philosophical approaches to risk and how they relate to regulatory policy
XI. Ethics, Economics, Policy & Sustainable Development
A. Compare major approaches in environmental ethics
B. Characterize the influences of culture and worldview on resource utilization and environmental impact
C. Articulate how human economic systems exist within environmental systems
D. Differentiate how classical, neoclassical, environmental and ecological economics view, utilize and impact natural capital
E. Evaluate how/if environmental protection can enhance economic well-being by analyzing case studies such as the economic and environmental impacts of the Clean Air Act
F. Describe environmental policy and assess its societal context by analyzing case studies such as the exemptions made to fracking companies exempting them from certain environmental laws
G. Outline the environmental history of the United States
H. Categorize the different approaches to environmental policy
I. Analyze the role of science in policymaking
J. Identify the institutions important to U.S. environmental policy and recognize major U.S. environmental laws
K. Describe ways nations handle transboundary and international environmental issues
XII. Sustainable Solutions (throughout course)
A. Identify and brainstorm local and global approaches to sustainability
B. Assess key approaches to designing sustainable solutions, identifying challenges and opportunities. (examples: environmental policy and law based upon sound science, conservation, land use planning, restoration, alternative and renewable energy and technology, public lands, zero waste, cradle to cradle, biomimicry, environmental heroes and heroines, NGOs, etc)
C. Evaluate the scientific basis for proposed solutions

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Behavioral Sciences
  - AA/AS - Life Sciences
  - AA/AS - Physical Sciences
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B1 Physical Science
  - CSUGE - B2 Life Science
  - CSUGE - D7 Interdisciplinary Soc/Behav
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 4G Intrdis Social/Beha
  - IGETC - 5A Physical Science
  - IGETC - 5B Biological Science

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: In small groups or with the whole class, discuss the differences of climate mitigation and adaptation, providing several examples of each, and evaluating the challenges and opportunities of each example.
- Essay Examinations
  - Example: Answer an essay question addressing a major environmental problem (e.g.: ocean pollution), detailing several aspects of the problem (geographic, economic, ecologic, etc.). Identify the sources of the problem and identify solutions and practical (economic and otherwise) applications of such solutions.
- Objective Examinations
  - Example: Take standard examination consisting of a variety of question formats, evaluating all levels of performance according

to Bloom's taxonomy, such as: "List the four types of biological diversity. Utilizing the photo and the description of the ecosystem provided, identify and describe why this ecosystem does or does not exhibit each type of biological diversity that you listed."

- Projects
  - Example: Working in small groups, analyze biodiversity data, comparing the relationship between rainfall and amphibian species richness in ecosystems throughout California. Graph your data and develop a poster that displays background, methods, data and discussion. Present your poster to the class. Posters should include images, text and visual representations of data. All resources must be from robust, credible sources and cited properly.
- Reports
  - Example: Conduct a field study of a protected ecosystem, and submit a written report that details physical and biological system present, human impacts observed, etc.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. Instructor will lecture and demonstrate topics (e.g.: Biological Diversity) as they relate to required readings by students. Time will be provided during each session for student reaction, review, evaluation and discussion of each topic.
2. Instructor will provide students with a current events topic that relates to course topics, such as the Great Pacific Garbage Patch, the sailing of the Plastiki, and efforts to clean up plastic pollution in the oceans. Instructor will facilitate a discussion where students will be challenged to relate the current events to course topics including use of petroleum, solid waste management, water pollution, biodiversity crisis, and law of conservation of matter.

Distance Learning

1. After synthesizing the information from the textbook reading and the instructor-recorded lecture on climate change, students will participate in an online discussion. Some students will answer the following set of questions, and all students will comment on at least two student responses, providing constructive feedback based on the arguments provided. Instructor will assess posts and comments. (Post Topic, Climate Change. Address all aspects of the following: Define mitigation with regards to climate change. Provide three specific and feasible steps you think we should take to mitigate climate change. Support your answer. Define adaptation with regards to climate change? Provide three specific and feasible steps you think should take now to be better adapted for climate change. Support your answer. Do you think mitigation or adaptation is more important? Why? Support your claim, providing evidence and discussing certainty.)

Typical Out of Class Assignments

Reading Assignments

1. Read the chapter in your textbook: "Earth's Physical Systems: Matter, Energy, and Geology." Take notes and be prepared to discuss topics and ask questions during lecture. 2. Read the following peer-reviewed scientific journal article, take notes, and be prepared to discuss in class and complete an assignment based on the reading: Olsen, C., Kline, J., Ager, A., Olsen, K., & Short, K. (2017) Examining the influence of biophysical conditions on wildland-urban interface homeowners' wildfire risk mitigation activities in fire-prone landscapes. Ecology and Society, 22(1).

Writing, Problem Solving or Performance

Example #1. A written assignment: Scientific argumentation is the practice of making evidence-based claims about scientific questions. Throughout this assignment, you will engage in scientific argumentation as you explore the distribution of fresh water on Earth and learn about how various factors affect Earth's water supplies. You will watch videos, complete simulations, and interpret data. To complete this assignment, type your answers to the following questions: 1. What is the difference between a scientific argument and a regular argument? 2. Why do you think there is uncertainty in science? 3. Is talking about uncertainty important in science? Why or why not? 4. Scientific Claim: Based on the graph above, when was the the salinity of the water near Lee's Ferry the highest? (Tip: a good claim is based on evidence from charts, graphs and models provided by reliable resources) 5. Support the claim you made in the previous question. (Tip: A good explanation will cite specific evidence that backs up the claim. When there is a graph or table, you can cite evidence directly from the source. When there is a model, you can describe what happened in the model. A good explanation combines evidence with scientific knowledge.) 6. Certainty: Explain how certain you are (ranging from not certain at all to very certain) about the scientific claim you stated in question 4. (Tip: A good certainty explanation will explain why you are certain or uncertain about your response. This may be based on how well the scientific knowledge fits the evidence from models, charts, or graphs. It may also reflect on the source and quality of the evidence or investigation that produced the evidence. Some topics are more certain than others. Consider the completeness of the evidence, biases in the evidence, and changes that could affect the trends over time.) Example #2. A Written Assignment (Excerpt from a larger climate change assignment) The Sun, Earth's atmosphere, and other systems interact to create conditions favorable to life on Earth. This model shows a simplified Earth system with land, atmosphere, and solar radiation. The yellow arrows show ultraviolet and visible energy originating from the Sun and the red arrows show infrared energy radiating from the Earth system. As we begin this section, run the computer model, and experiment with the controls to see how the model works. Then manipulate the variables and answer the following questions. 1. Based on this model, what two things can happen when energy from the Sun interacts with the ground? 2. How does carbon dioxide (CO_2) interact with the two types of radiation (sunlight and infrared) shown in this model? 3. How does atmospheric carbon dioxide affect global temperature? 4. What happens if you remove all of the carbon dioxide from the atmosphere? Explain your claim. 5. How certain are you of this claim? Explain why. (Tip: recall the "Scientific Argumentation" assignment)

Other (Term projects, research papers, portfolios, etc.)

1. Students may write a field report based upon research, visitation, and observation of an appropriate facility, park, preserve, etc. The report will include: 1) description of the physical environment based upon research, 2) description of the biological environment based upon research, 3) personal observations of the environment, including field notes, 4)description of the type of legal protection afforded the area including management agency obligations, 5) analysis of direct and indirect human impacts on the system, and 6) reflection on values of public land. Formatting will follow scientific paper guidelines, with abstract, introduction, etc. 2. Students may research and write a term paper on a major environmental issue (problems, location, costs, solutions, etc.). Formatting will follow scientific paper guidelines, with abstract, introduction, etc.

Required Materials

- Environment: The Science Behind the Stories, 6th ed
  - Author: Withgott, Jay; Laposata, Matthew
  - Publisher: Pearson
  - Publication Date: 2017
  - Text Edition: 6th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Environmental Biology
  - Author: Alexandra Geddes, Jonathan Tomkin, Kamala Doršner, Matthew R. Fisher, OpenStax, Tom Theis
  - Publisher: OpenOregon
  - Publication Date: 2017
  - Text Edition:
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.