

# BIO-1060: ENVIRONMENT, ECOLOGY, AND EVOLUTION

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## Cuyahoga Community College

**Viewing: BIO-1060 : Environment, Ecology, and Evolution**

**Board of Trustees:**

March 2022

**Academic Term:**

Fall 2022

**Subject Code**

BIO - Biology

**Course Number:**

1060

**Title:**

Environment, Ecology, and Evolution

**Catalog Description:**

Designed for non-science majors. Questions about the natural world are explored through an introduction to the principles of evolution and ecology, including how populations change over time and how organisms interact with each other and the environment. Topics include scientific inquiry; nature of science; evolutionary processes; diversity of life; population, community, and ecosystem ecology; human impacts on the environment; environmental stewardship; and regional environmental concerns.

**Credit Hour(s):**

3

**Lecture Hour(s):**

3

**Lab Hour(s):**

0

**Other Hour(s):**

0

## Requisites

**Prerequisite and Corequisite**

ENG-0995 Applied College Literacies, or appropriate score on English Placement Test. Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

## Outcomes

**Course Outcome(s):**

Analyze using supporting evidence how populations change genetically over time through the process of evolution resulting in the unity and diversity of life.

**Objective(s):**

1. Use current models and theories to describe and explain the evolutionary relationships among taxa.
2. Compare and contrast the major characteristics of the domains, kingdoms, and phyla of life.
3. Use current models and theories to predict the effect of a changing environment on the gene pool of a population.
4. Differentiate among the mechanisms by which populations change genetically over time.
5. Identify and explain the evidence supporting the theory of evolution.

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**Course Outcome(s):**

Apply the process of scientific inquiry to explore questions about the natural world.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

1. Distinguish among an observation, hypothesis, experiment, conclusion and theory.
2. Distinguish between observations and inferences.
3. Use scientific methods of inquiry to gather data, write a hypothesis, design an experiment, analyze data, draw a conclusion, and communicate results.
4. Demonstrate an understanding that scientific data must be reproducible but that it shows intrinsic variation and can have limitations.
5. Evaluate evidence-based scientific arguments in a logical fashion, and distinguish between scientific and non-scientific evidence and explanations.

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**Course Outcome(s):**

Identify, discuss, and analyze the relationships and interactions between living things and their environment.

**Objective(s):**

1. Identify different types of community interactions.
2. Describe the flow of energy through different trophic levels in the ecosystem.
3. Describe the major geochemical cycles in an ecosystem.
4. Compare and contrast the biotic and abiotic characteristics of the major terrestrial and aquatic biomes.
5. Describe and analyze characteristics of populations.

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**Course Outcome(s):**

Analyze causes, evaluate effects, and propose solutions regarding human impact on the environment in order to make informed environmental decisions in daily life.

**Objective(s):**

1. Explain the effects of human activities on selected aquatic and terrestrial ecosystems.
2. Compare the costs and benefits of renewable and nonrenewable energy sources.
3. Recognize local, regional, and global environmental concerns.
4. Identify current approaches to conservation and sustainability of our planet's biosphere and natural resources.

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**Methods of Evaluation:**

1. Exams
2. Quizzes
3. Interactive in-class quizzes
4. Class discussions
5. Assignments
6. Class activities
7. Article reviews/summaries
8. Journals/portfolios
9. Oral/written reports
10. Poster presentations

**Course Content Outline:**

1. Science as a process
  - a. Observations
  - b. Questions
  - c. Hypotheses
  - d. Predictions
  - e. Experiment
  - f. Data
  - g. Variables
  - h. Controls

- i. Conclusions
- j. Inferences
- k. Theory
- 2. Evolutionary processes
  - a. Speciation
  - b. Natural selection
    - i. Stabilizing selection
    - ii. Disruptive selection
    - iii. Directional selection
  - c. Mutation
  - d. Genetic drift
  - e. Gene flow
  - f. Migration
  - g. Non-random mating
  - h. Adaptation
    - i. Convergent evolution
    - j. Parallel evolution
  - k. Adaptive radiation
    - a. Extinction
    - b. Darwin's impact on biology
- 3. Evidence for evolution
  - a. Fossil record
  - b. Comparative anatomy
  - c. Molecular biology
  - d. Biogeography
  - e. Direct observation
- 4. Tools for studying evolution
  - a. Population genetics
  - b. Phylogenetic analysis
  - c. Comparative biology
- 5. Classification of Life
  - a. Taxonomy
  - b. Linnaean nested hierarchy
  - c. Correspondence to evolutionary history
  - d. Evolutionary tree of life on a geological time scale
- 6. Ecology
  - a. Population ecology
    - i. Distribution
    - ii. Growth
    - iii. Survivorship
    - iv. Demography
    - v. Density-dependent and independent regulation
  - b. Community ecology
    - i. Predator-prey interactions and adaptations
    - ii. Symbiotic relationships
    - iii. Competition and competitive exclusion
    - iv. Ecological niche
    - v. Ecological disturbance and succession
    - vi. Biodiversity
    - vii. Foundation and keystone species
  - c. Ecosystem ecology
    - i. Energy flow
    - ii. Trophic structure
    - iii. Biomagnification
    - iv. Biogeochemical cycling
      - 1. Water
      - 2. Carbon
      - 3. Nitrogen

- 4. Phosphorous
- 5. Sulfur
- v. Watersheds
- vi. Terrestrial and aquatic biomes
- 7. Conservation of biodiversity and our environment
  - a. Types of biodiversity
    - i. Genetic
    - ii. Chemical
    - iii. Species
    - iv. Ecosystem
  - b. Patterns of biodiversity
  - c. Value of biodiversity
    - i. Pharmacological resources
    - ii. Food and water resources
    - iii. Economic benefits
  - d. Threats to biodiversity
    - i. Habitat alteration and destruction
    - ii. Pollution
    - iii. Overharvesting
    - iv. Extinction
    - v. Invasive exotic species
    - vi. Global warming
  - e. Preserving biodiversity
    - i. Habitat preservation
    - ii. Resource conservation
    - iii. Preserves
    - iv. Habitat restoration
    - v. Bioremediation
- 8. Science versus non-science
  - a. Science's role in shaping policy
    - i. Endangered species act
    - ii. Clean air act
    - iii. Clean water act
  - b. Evolution as a scientific theory
  - c. Sustainability
  - d. Tragedy of the commons
  - e. Environmental stewardship

## Resources

Fowler, Samantha, Rebecca Roush, and James Wise. *Concepts of Biology*. Houston: OpenStax College, 2013. July 26, 2021. <https://openstax.org/details/books/concepts-biology>

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Mader, Sylvia. *Essentials of Biology*. 6th ed. McGraw-Hill, 2021.

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Audesirk, Teresa, Gerald Audesirk, and Bruce Byers. *Biology: Life on Earth*. 12th ed. Upper Saddle River: Pearson Prentice Hall, 2020.

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Enger, Eldon, and Bradley Smith. *Environmental Science: A Study of Interrelationships*. 15th ed. Boston: McGraw-Hill, 2019.

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Cunningham, William, and Mary Ann Cunningham. *Principles of Environmental Science: Inquiry & Applications*. 9th ed. New York: McGraw-Hill, 2020.

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Molles, Manuel. *Ecology: Concepts & Applications*. 8th ed. Boston: McGraw-Hill, 2019.

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Hoefnagels, Marielle. *Biology: Concepts and Investigations*. 5th ed. New York: McGraw-Hill, 2020.

**Resources Other**

Tree of Life web project: <http://www.tolweb.org/tree/>

Understanding Evolution website from UC Berkeley: [https://evolution.berkeley.edu/evolibrary/article/0\\_0\\_0/nature\\_01](https://evolution.berkeley.edu/evolibrary/article/0_0_0/nature_01)

Howard Hughes Medical Institute BioInteractive Evolution page: <http://www.hhmi.org/biointeractive/evolution-collection>

Animal Diversity Web  
<https://animaldiversity.org/>

**Instructional Services****OAN Number:**

Ohio Transfer 36 TMNS

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