Virginia Western Community College
BIO 270
General Ecology

Prerequisites

BIO 101 and BIO 102 or division approval

Course Description

Studies interrelationships between organisms and their natural and cultural environments with emphasis on populations, communities, and ecosystems.

Semester Credits: 4 **Lecture Hours: 3** **Laboratory/Recitation Hours: 3**

Required Materials

Textbooks:
Elements of Ecology. Smith & Smith. 9th edition. Benjamin Cummings. ISBN 9780321934185

Course Outcomes

At the completion of this course, the student should be able to:

- Explain what ecology is.
- Relate how the physical environment, particularly climate, affects which biomes occur where in the biosphere.
- Describe the water cycle and explain how the unique properties of water affect life on Earth.
- Explain how properties of light and soil affect terrestrial biodiversity.
- Describe how adaptations provide evidence for the concept of natural selection in populations.
- Relate plant and animal adaptations to their environment.
- Explain the nature of various species interactions including interspecific competition, predation, parasitism, mutualism and commensalism.
- Describe factors that influence the structure of communities, including food webs and plant succession.
- Relate decomposition and nutrient cycling, particularly carbon, nitrogen and phosphorus.
- Explain the key characteristics of aquatic ecosystems.
- Describe how hydrology structures wetland ecosystems.

Topical Description

Chapter 1

- What is ecology?
- Organisms interact with the environment in the context of an ecosystem
- Ecological systems form a hierarchy
- Ecologists study pattern and process at many levels

Chapter 2

- Solar radiation – patterns and effects on climate
- Global patterns of air circulation, temperature and precipitation
- Effects of topography on climate
- Concept of microclimates

Chapter 3

- Physical properties of water
- How light and temperature vary with water depth
- Oxygen as a limiting factor in aquatic environments

Chapter 4

- Soil formation – 5 inter-related factors
- Distinguishing physical characteristics of soil, soil horizons
- Cation exchange capacity, base saturation and soil fertility

Chapter 5

- Darwin's definition of natural selection
- Genetic variation in populations
- Adaptations as products of natural selection

Chapter 6

- Review of C3 photosynthesis
- C4 and CAM photosynthesis – adaptations for improved water use
- Adaptations of plants to different light environments
- Plant adaptations to nutrient availability
- Plant adaptations to wetland environments

Chapter 7

- Consequences of body size in animals
- Different strategies for acquisition of energy and nutrients
- Digestive tracts of ruminants, non-ruminant herbivores and carnivores
- Strategies for temperature regulation in animals and tradeoffs of endothermy and ectothermy
- Heterothermy – the best of both worlds?
- Torpor and hibernation to meet high energy costs of staying warm

Chapter 12

- How species interactions are classified
- Species interactions as drivers of natural selection
- The influence of species interactions on niches and adaptive radiation

Chapter 13

- What is interspecific competition?
- Experimental evidence for the competitive exclusion principle
- Non-resource factors as drivers of Interspecific competition
- Competition along environmental gradients
- Resource partitioning
- What is a niche? The concepts of fundamental vs. realized niche

Chapter 14

- Forms of predation
- Optimal foraging theory
- Co-evolution of predator and prey
- Predator defenses
- Herbivory as a form of predation
- Herbivore defenses
- Vegetation-herbivore-carnivore systems of Interspecific competition

Chapter 15

- Characteristics of parasites
- Parasite-host relationships, direct and indirect transmission, intermediate hosts (vectors)
- Host responses to parasitic infections
- What is mutualism? Obligate vs. facultative mutualism
- Importance of mutualism in nutrient uptake in plants, pollination and seed dispersal
- What is commensalism?

Chapters 16 & 17

- Species diversity in communities
- Dominants and keystone species
- Food webs
- Physical structure and zonation in communities

Chapter 18

- Succession as a natural process in communities
- Primary vs. secondary succession
- Autogenic and allogenic factors driving succession

Chapter 21

- The importance of nutrient cycling
- Decomposition processes and the factors influencing decomposition
- Nutrient mineralization and soil organic matter
- Important processes in the rhizosphere

- Factors affecting rates of nutrient cycling
- Nutrient cycling in stream ecosystems

Chapter 22

- What are biogeochemical cycles? What natural and anthropogenic factors affect these?
- The carbon cycle
- The nitrogen cycle
- The phosphorus cycle

Chapter 23

- Environmental factors driving ecosystem distribution
- Characteristics of plant community and soils, rates of productivity and decomposition, representative animals for each of the following biomes:
  - Tropical forests
  - Tropical savannas
  - Temperate grasslands
  - Deserts
  - Chaparral
  - Temperate forests
  - Boreal forests
  - Tundra – arctic and alpine

Chapter 24

- Lakes – seasonal stratification and zonation of life
- Rivers – adaptations of organisms to different flowing water habitats
- River continuum concept as energy and nutrients move downstream
- Importance of estuaries

Chapter 25

- Importance of salt marshes
- Importance of mangrove forests
- What are freshwater wetlands and what are their key functions
- Hydrology determines wetland plant communities – examples in Virginia

Notes to Instructors

1. Departmental policy dictates that instructors do not allow students to keep tests.
2. A comprehensive final exam counting 15%-20% of the total grade will be given at the end of the semester.
3. The syllabus should state what the course grade will be based on, such as tests, quizzes, a comprehensive final exam, and any other assignments made by the instructor.
4. The VWCC Biology Department uses a 10-point grading scale.

Suggested Timeline and Sequence

Week	Topic
1	Chapter 1 – The Nature of Ecology Chapter 2 - Climate
2	Chapter 3 – The Aquatic Environment
3	Chapter 4 – The Terrestrial Environment
4	Chapter 5 – Ecological Genetics Chapter 6 – Plant Adaptations to the Environment
5	Chapter 6 – Plant Adaptations to the Environment Chapter 7 – Animal Adaptations to the Environment
6	Chapter 7 – Animal Adaptations to the Environment
7	Chapter 12 – Species Interactions Chapter 13 – Interspecific Competition
8	Chapter 14 – Predation Chapter 15 – Parasitism & Mutualism
9	Chapter 15 – Parasitism & Mutualism
10	Chapters 16 & 17 – Community Structure Chapter 18 – Community Dynamics
11	Chapter 18 – Community Dynamics Chapter 21 – Decomposition & Nutrient Cycling
12	Chapter 21 – Decomposition & Nutrient Cycling
13	Chapter 22 – Biogeochemical Cycles
14	Chapter 23 – Terrestrial Ecosystems Chapter 24 – Aquatic Ecosystems
15	Chapter 25 – Coastal & Wetland Ecosystems
Exam Week	Final Exam – Cumulative (with new material from Chapters 23-25)

ADA Statement (PDF)
Title IX Statement (PDF)