

## SCHOOL OF HEALTH AND SCIENCES

### SYLLABUS

<b>TITLE:</b>	Ecology
<b>CODE:</b>	BIO 302
<b>PREREQUISITE:</b>	BIO 112
<b>CO-REQUISITE:</b>	BIO 302L
<b>CREDITS:</b>	4 credits   45 contact hours   45 lab hours   1 term

### DESCRIPTION

Study of fundamental principles of ecology from a broad and understanding perspective towards the processes and mechanisms that control the stability of natural ecosystems. Elements such as abiotic and biotic components, structure and functioning, population dynamics, trophic interactions, energy flow, and recycling of materials are discussed. It also works on the impact of population growth and technological development on the quality of ecosystems and biodiversity. The discussion of topics is supported by lectures, field trips, examination of samples, and the highlighting of exemplary local ecosystems. Participation in a community outreach project is included. The analytical approach and practical experiences of the course provides the student with the acquisition of a holistic, fundamental, and profitable knowledge about ecology.

### JUSTIFICATION

Ecology integrates the natural sciences with mathematics, social sciences, and economics. This allows students to know and understand how these disciplines are applied to achieve a rational management of natural ecosystems. The course provides a broad understanding of the environment and how human decisions affect the stability of natural systems. These topics contribute to the formation of professionals capable of facing management problems and collaborating in their solution. The course exposes students to work and experiences that facilitate the development of an ethic of service and social responsibility, strengthening their leadership, self-esteem, self-confidence, and collaborative work skills.

## **COMPETENCES**

The course develops the following competences in students:

- **Critical questioning**
- **Entrepreneurship and innovation**
- **Research and exploration**

## **OBJECTIVES**

After completion of the course, students will be able to:

1. Demonstrate that ecology is a discipline that allows us to better understand the condition and problems of the environment.
2. Explain the concept of ecosystem as a functional unit and identify the principles related to its structure and functioning.
3. Explain the concept of food chain from the perspective of interactions between food webs.
4. Analyze the importance of the water cycle and biogeochemical cycles, using carbon, nitrogen, and phosphorus cycles as an example.
5. Critically reflect on the biodiversity of local tropical ecosystems, their current status, and alternatives for their conservation and management.
6. Identify the elements necessary to ensure ecologically sustainable environments.

## **CONTENTS**

- I. Introduction to Ecology
  - A. Background and relevance
  - B. Branches and applications
  - C. Fundamental concepts
    1. Nature of the ecosystem
    2. Components (biotic and abiotic)
    3. Structure and functioning
- II. Physical Environment
  - A. Climate
    1. Regulating elements
      - a. Light, temperature, water, topography
    2. Microclimates
  - B. Aquatic environment
    1. Physicochemical properties of water
    2. Hydrological cycle: Processes and components
    3. Concept of watershed
  - C. Terrestrial environment

1. Attributes and diversity
  2. Soil: types, properties, and formation mechanisms
- III. Organisms and Their Environment
  - A. Evolution and natural selection
    1. Genetic variation
    2. Speciation process
  - B. Plant and animal adaptations
    1. Limiting factors
  - C. Life cycle patterns
    1. Mating and reproduction systems
- IV. Populations
  - A. Properties of populations
    1. Structure, density, and dispersion
  - B. Population growth
    1. Exponential and logistic model
  - C. Intraspecific regulation
    1. Population Fluctuation Patterns
    2. Regulation theories
  - D. Metapopulations
    1. Structure and dynamic
- V. Interactions Between Species
  - A. Interspecific competition
    1. Concept of niche
  - B. Predation, parasitism, and mutualism
- VI. Ecology of Communities
  - A. Community structure
    1. Biodiversity
    2. Functional groups
    3. Biological structure
  - B. Influencing factors
    1. Key species
  - C. Community dynamics
    1. Spatial and temporal variation
    2. Primary and secondary succession
- VII. Ecosystem Ecology
  - A. Energy capacity
    1. Precepts of thermodynamics
    2. Primary and secondary productivity
  - B. Energy flow

1. Food chains and webs
  2. Ecological pyramids
  - C. Nutrient recycling
    1. Decomposition processes
    2. Biogeochemical cycles
      - a. Carbon – nitrogen – phosphorus
  - D. Ecosystem services
- VIII. Ecological Biogeography
- A. Biomes – regions – distribution
  - B. Biodiversity pattern
  - C. Terrestrial ecosystem
  - D. Aquatic ecosystems
  - E. Coastal ecosystems
- IX. Landscape Ecology
- A. Mosaics and components
    1. Patch-corridor-matrix landscape model
  - B. Processes and flow dynamics
- X. Human Ecology
- A. Population growth
  - B. Use of resources and sustainability
  - C. Modified environments (agricultural-urban)
  - D. Ecosystem management and conservation
    1. Current issues
      - a. Climate change, deforestation, contamination

## LABORATORY EXPERIENCES

- A. Study of in-campus mahogany trees
- B. Characterization of an aquatic ecosystem
- C. Characterization of a terrestrial ecosystem

## METHODOLOGY

The following strategies from the active learning methodology are recommended:

- Lectures supported by audiovisual content
- Cases discussion
- Oral and written reports
- Field visits
- Research work
- Lab experiences

## EVALUATION

Partial assignments	40%
Immersion experience	30%
Final project or exam	20%
Participation	10%
<b>Total</b>	<b>100%</b>

## LEARNING ASSESSMENT

The institutional assessment rubric is applied to the course's core activity.

## BIBLIOGRAPHY

### TEXTBOOK

Smith, T., Smith, R. L. (2007). *Ecología*. (6<sup>th</sup> ed.). Addison Wesley.

Brower, J.E., Zar, J.H., & von Ende, C.N. (2008). *Field and Laboratory Methods for General Ecology* (5<sup>th</sup> ed.). McGraw-Hill Co.

### REFERENCES

Allan, D. J. (2012). *Stream Ecology, Structure and Function of Running Waters*. Kluwer Academic Publishers. ISBN 0 412 29430 3.

Dodds, W. K. (2004). *Freshwater Ecology: Concepts & Environmental Applications (Aquatic Ecology)*. Academic Press. ISBN: 0122191358.

Forman, R.T. (1995). *Land Mosaics: The ecology of landscapes and regions*. Cambridge University Press.

Grau, H. R. (2003). The ecological consequences of socioeconomic and land-use changes in post agriculture Puerto Rico. *Bioscience*, 53(12), 1,159-1,169.

Miller, G. L., Lugo, A. E. (2009). *Guide to the ecological systems of Puerto Rico*. [Technical report ITF-GTR-35]. U. S. Forest Service.

Odum, E. P. (2006). *Fundamentos de ecología* (5<sup>th</sup> ed.). Thomson.

Wetzel, R. G. (2001). *Limnology, Lake, and River Ecosystems* (3<sup>rd</sup> ed). Acad. Press.

## ELECTRONIC RESOURCES

Water Resources of Puerto Rico. <http://www.recursoaquapuertorico.com/>

Espeleorevista. Federación Espeleológica de Puerto Rico.

<https://cuevaspr.org/publicaciones/>

Caribbean Ecological Services Field Office. US Fish & Wildlife.

<http://www.fws.gov/southeast /caribbean/>

Para la Naturaleza. Fideicomiso de Conservación de Puerto Rico.

<http://.www.paralanaturaleza.org/>

For more information resources related to the course's topics, access the library's webpage <http://biblioteca.sagrado.edu/>

## REASONABLE ACCOMMODATION

For detailed information on the process and required documentation you should visit the corresponding office. To ensure equal conditions, in compliance with the ADA Act (1990) and the Rehabilitation Act (1973), as amended, any student in need of reasonable accommodation or special assistance must complete the process established by the Vice Presidency for Academic Affairs.

## ACADEMIC INTEGRITY

This policy applies to all students enrolled at Universidad del Sagrado Corazón to take courses with or without academic credit. A lack of academic integrity is any act or omission that does not demonstrate the honesty, transparency, and responsibility that should characterize all academic activity. Any student who fails to comply with the Honesty, Fraud, and Plagiarism Policy is exposed to the following sanctions: receive a grade of zero in the evaluation and / or repetition of the assignment in the seminar, a grade of F (\*) in the seminar, suspension, or expulsion as established in the Academic Integrity Policy effective in November 2022.

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