# Ecology

## Prof. Giacomo Al. Gerosa

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to provide students with a broad conceptual basis for understanding the structure and functioning of ecosystems. Specific objectives are the study of biotic factors (population-level and community) and abiotic factors (physical and chemical) of different ecosystems, their interaction and the fluxes of matter and energy that characterize them.

The wide-spectrum instruction aims the student to raise his/her awareness about the role of the human species on the planet.

The high interdisciplinarity opens to multiple applications of the acquired knowledge in the fields of the management and conservation of the natural environment, demography, contamination control and urban management.

This knowledge is essential for those who wish to give their preparation a biological and environmental curvature or for those who aspire to teach mathematics and science in the secondary schools of first grade.

At the end of the course, students will be able to understand the constituent elements of each ecosystem and what governs their functioning and evolution. They will know the characterising elements of the different environmental matrices, the dynamics of population growth, the dynamics of competition, energy processes, and the cycles of different elements.

Students will be able to recognise and delimit the ain terrestrial ecosystems, predict their evolution based on a simple knowledge of the energy balance, identify situations of imbalance and suggest corrective solutions. They will also be able to use the main measuring techniques used in ecological surveys and data analysis.

***COURSE CONTENT***

1. Introduction to ecology.

Organism-environment interactions. The concept of ecosystem: matter, energy, trophic organisation, evolution. Definition of pollutant and alteration of ecosystems, biomagnification.

2. Environmental compartments.

Characteristics of pedosphere, hydrosphere, atmosphere. Terrestrial climates and biomes.

3. Biosphere.

Populations: growth factors, limiting factors, dynamics.
Community: interactions between populations, competition, diversity, niches and habitat.

4. Functioning of ecosystems.

Energy in biological systems: photosynthesis and photosynthetic strategies, aerobic and anaerobic respiration. Phototrophic and chemotrophic, autotrophic and heterotrophic organisms.

Energy in ecological systems: productivity, food networks, energy flow.

Materials in ecological systems: biogeochemical cycles of water, carbon, nitrogen, phosphorus, sulfur and associated processes.

Evolution of ecosystems: successions and climax.

Factors affecting ecosystems: perturbations, responses, stability.

1. Methods of ecological survey. Productivity measurements in aquatic and terrestrial ecosystems. Biodiversity monitoring: IBE and IBL.

*Practical activitiies*

IRGA measurements of photosynthetic assimilation. Fluorimetric measurements of photosystems efficiency. Measurements of stomatal conductance. Phisics’ tools and technologies for the evaluation of net primary productivity of aquatic and terrestrial ecosystems. Monitoring of the environmental quality through ecological indexes: index of lichen biodiversity (IBL) and extended biotic index (EBI) for water quality and river functionality (RFI). One or two field trips and/or visits.

***READING LIST***

*Basic texts on ecology (one choice, in order of preference)*

* Townsend, Harper, Begon, 2005. *“L’essenziale di ecologia”*, Zanichelli (there is also an English edition: Townsend, Begon, Harper *“Essential of Ecology”,* Wiley, 2008)
* Odum E.P., Barrett G.W. *"Fondamenti di ecologia "*, Piccin, 2006 (there is also an English edition: Odum E.P., Barrett G.W*. “Fundamentals of Ecology”*, Brooks Cole publisher, 2004)

*Basic texts on biology* (one choice, in order of preference)

* Luria S.E., Gould S.J., Singer S., 1996. "Una visione della vita. Introduzione alla biologia", Zanichelli
* Neil A Campbell , Jane B Reece , Martha R Taylor , Eric J Simon, 2006. “Immagini della biologia A-la cellula”, Zanichelli

In-depth studies

* Begon M., Harper J.L., Townsend C.R.., 1989. *“Ecologia. Individui, popolazioni, comunità”*, Zanichelli
* Provini, Galassi S., Marchetti *"Ecologia Applicata"*, Città Studi

And

* Class slides
* Further material provided in class

***TEACHING METHOD***

Lectures, seminars, demonstrations, exercitations, field trips.

***ASSESSMENT METHOD AND CRITERIA***

The course examination consists in an oral exam to ascertain the degree of assimilation of the concepts, results and procedures shown during the lessons, through the exposure and discussion of some points of the syllabus, not excluding reference to the prerequisites or links between parts of the syllabus.

Students will be asked to start with the presentation and discussion of a topic of their choice. Three questions will follow on topics that have not been covered in the chosen presentation.

During the interview, students may be asked to interpret diagrams or maps related to the phenomena discussed on the course. Assessment will take into account accuracy of explanation of the concepts, logical and methodological rigour, and effectiveness and fairness of the presentation, emphasizing the assimilation of the concepts and personal elaboration by students.

In the formulation of the final mark, 40% will be assigned to the presentation and discussion of the chosen topic (up to 12/30). The subsequent three questions will each be assigned 20% of the mark (up to 6/30 per question). A distinction will be awarded according to the effectiveness and confidence of students' presentations.

***NOTES AND PREREQUISITES***

There are no prerequisites for attending the course.

The course is strongly recommended for those who wish to take the environmental physics course.

Finally, it is recommended for those who aim to acquire BIO ECTS for the teaching of Mathematics and Sciences at secondary school level. In fact, ecology provides a broad spectrum and more multidisciplinary preparation than basic biology alone. It therefore appears more appropriate to the cultural background of the future middle-school teacher, who will have to know how to blend interdisciplinary skills in biology, geology, chemistry, physics and mathematics.

*Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.*