# UNIVERSITÀ DEGLI STUDI DI PALERMO

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| **DEPARTMENT** | Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche | | |
| **ACADEMIC YEAR** | 2016/2017 | | |
| **BACHELOR'S DEGREE (BSC)** | BIOLOGICAL SCIENCES | | |
| **INTEGRATED COURSE** | GENERAL AND APPLIED ECOLOGY WITH PRACTICE | | |
| **CODE** | 15958 | | |
| **MODULES** | Yes | | |
| **NUMBER OF MODULES** | 2 | | |
| **SCIENTIFIC SECTOR(S)** | BIO/07 | | |
| **HEAD PROFESSOR(S)** | MAZZOLA ANTONIO | Professore a contratto in quiescenza | Univ. di PALERMO |
| **OTHER PROFESSOR(S)** | SARA' GIANLUCA<br>MAZZOLA ANTONIO | Professore Ordinario<br>Professore a contratto in quiescenza | Univ. di PALERMO<br>Univ. di PALERMO |
| **CREDITS** | 12 | | |
| **PROPAEDEUTICAL SUBJECTS** | | | |
| **MUTUALIZATION** | | | |
| **YEAR** | 3 | | |
| **TERM (SEMESTER)** | 1° semester | | |
| **ATTENDANCE** | Not mandatory | | |
| **EVALUATION** | Out of 30 | | |
| **TEACHER OFFICE HOURS** | **MAZZOLA ANTONIO**<br>Monday 12:00 13:00 DiSTeM, via Archirafi 18, II piano, aula docente<br>**SARA' GIANLUCA**<br>Tuesday 10:00 12:00 Per gli studenti del CdS in Biodiversita e Innovazione Tecnologica, presso le strutture del polo didattico di Trapani o della struttura "Principe di Napoli". I ricevimenti, su richiesta, possono essere svolti anche su piattaforma teams. Ulteriori o differenti incontri possono essere concordati con il docente<br>Thursday 09:00 12:00 Dipartimento di Scienze della Terra e del Mare, Sezione di Ecologia, Plesso Edificio 16, STANZA 1 | | |

**DOCENTE:** Prof. ANTONIO MAZZOLA

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| **PREREQUISITES** | The student is expected to have basic knowledge of Chemistry, Biochemistry, Botany, Zoology. |
| **LEARNING OUTCOMES** | Knowledge and comprehension<br>Acquisition of theoretical and experimental skills related to abiotic and biotic features of ecosystems, interactions between organisms and between organisms and the physical environment, ecosystem functioning. Acquisition of a specialised scientific language.<br>Applying knowledge and comprehension<br>Acquisition of application skills to analyse ecological processes also in anthropically altered ecosystems.<br>Autonomous thinking<br>Acquisition of evaluation skills and competences for interpretation of experimental data, environmental state assessment and the effects of anthropogenic activities.<br>Communication ability<br>Acquisition of adequate skills and tools for communication, with regard to the presentation of the results of ecological studies, communication and dissemination of information on issues concerning the topics of the lessons.<br>Learning ability<br>Acquisition of appropriate skills for the independent achievement of additional competences, with reference to: literature consultation, access to database and other information on the internet, basic cognitive tools for the continuous updating of knowledge. |
| **ASSESSMENT METHODS** | Coursework and final written and/or oral test. The student will be evaluated based on the level of knowledge of the subjects and the ability to link between them, the clarity and the use of a specialised scientific language.<br><br>Assessment criteria<br>-assessment: excellent, grade: 30 - 30 cum laude, excellent knowledge of the topics of the course, excellent use of language, excellent analytical capacity, ability to apply knowledge to problem solving;<br>- assessment: very good, grade: 26-29, good knowledge of the topics of the course, correct use of language, good analytical capacity, ability to apply knowledge to problem solving;<br>- assessment: good, grade: 24-25, good knowledge of the main topics of the course, correct use of language, limited ability to autonomously apply knowledge to problem solving;<br>- assessment: satisfactory, grade: 21-23, partial knowledge of the topics of the course, satisfactory use of language, limited ability to autonomously apply knowledge to problem solving;<br>- assessment: sufficient, grade: 18-20, minimal knowledge of the main topics of the course and of technical language, scarce ability or inability to autonomously apply knowledge to problem solving;<br>- assessment: fail, insufficient knowledge of the topics of the course. |
| **TEACHING METHODS** | Lectures |

**MODULE**
**GENERAL ECOLOGY**

*Prof. ANTONIO MAZZOLA*

**SUGGESTED BIBLIOGRAPHY**

Bullini L., Pignatti S., De Santo V. (1998) Ecologia Generale. UTET
Miller G.T. (1997) Scienze ambientali. EdiSES
Odum E.P. Barrett G.W. (2006) Fondamenti di ecologia. Piccin
Ricklefs R. (1999) L'economia della natura. Zanichelli

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| **AMBIT** | 50026-Discipline botaniche, zoologiche, ecologiche |
| **INDIVIDUAL STUDY (Hrs)** | 102 |
| **COURSE ACTIVITY (Hrs)** | 48 |

**EDUCATIONAL OBJECTIVES OF THE MODULE**

EDUCATIONAL OBJECTIVES - MODULE 1 "Ecology"
The aim of the course is to provide the students with basic information on theoretical and experimental ecology. In particular, we intend to analyse the interactions between species and the environment with particular attention to the effects of anthropogenic activities.

## SYLLABUS

| Hrs | Frontal teaching |
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| 4 | Introduction to ecological studies – Holistic and reductionistic approaches – Autoecology and synecology – Functional levels of ecological hierarchy – Spatial and temporal scales – Ecological systems. |
| 4 | Climate – Factors affecting climate – Effects of climate – Atmosphere and mechanisms controlling global temperature - Climate change - Air pollution. Soil composition – Horizons – Pedogenesis – Erosion. Abiotic factors and effects on ecosystems – Liebig's law of the minimum – Shelford's law of tolerance – Adaptations – Fire as an ecological factor. |
| 12 | Organisms – Populations – Structure, dimension, dispersion and distribution – Population growth models – Factors controlling population growth – Logistic equation – Population dynamics – Age pyramids – Metapopulations – r and k strategies – Carrying capacity – Interactions between organisms – Lotka-Volterra model. |
| 12 | Mechanisms controlling ecosystems – Ecological stability: resistance and resilience – Ecosystem trophic structure – Thermodynamic concept of ecosystems – Primary production and limiting factors – Energy fluxes in ecosystems – Food chains and food webs – Ecological pyramids – Biological magnification. Nutrient cycling – Basic principles of biogeochemical cycles. The water cycle. |
| 12 | Community – Holistic and individualistic approaches – Closed and open communities – The continuum concept – Ecotones – Species interactions – Ecological niche. Biodiversity - Geographical variations and species diversity – Biodiversity indices – Dominance-diversity curves – The value of biodiversity – Biodiversity conservation – Autochthonous and allochthonous species.<br>Ecological successions – Autotrophic and heterotrophic successions – Primary and secondary successions – The concept of sere – Fire and ecological successions – Pioneer and climax communities - Mosaic of patches and landscape. |
| 4 | The biosphere – Biosphere evolution – Gaia hypothesis. Environmental sustainability. |

## MODULE
## ECOLOGY APPLICATIONS WITH PRACTICE

*Prof. GIANLUCA SARA'*

**SUGGESTED BIBLIOGRAPHY**

Cunningham et al. (2004) Ecologia applicata. McGraw-Hill
Galassi et al. Introduzione all'ecologia applicata. Dalla teoria alla pratica della sostenibilita. 2014 CittaStudi
Ricklefs R. (1999) L'economia della natura. Zanichelli
Materiale didattico fornito dal docente
Appunti delle lezioni

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| **AMBIT** | 50026-Discipline botaniche, zoologiche, ecologiche |
| **INDIVIDUAL STUDY (Hrs)** | 98 |
| **COURSE ACTIVITY (Hrs)** | 52 |

**EDUCATIONAL OBJECTIVES OF THE MODULE**

The course of Applied Ecology will offer both basic ecological principles to increase undergraduate student's skills in analyzing the complexity of ecological issues involved in the assessment and management of ecosystems both natural and under anthropogenic pressure. Throughout 52 h of lectures and lab practice, students will learn 1) how to analyze ecological implications of human effects on ecosystems paying attention on how to contextualize ecological processes within the Millenium Ecosystem Assessment framework and UN Sustainable Development Goals; 2) ecological processes supporting the provision of goods and services by ecosystems and the relationship biodiversity-functioning; 3) how to use case studies from local to regional and global to get insights on relevant ecological processes involved in the human action on ecosystems.

## SYLLABUS

| Hrs | Frontal teaching |
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| 8 | Ecology to study anthropogenic effects on ecosystems and goods and services. The ecological hierarchy, Ecosystem as the fundamental functional unit in Ecology; relationship between biodiversity and functioning. Main topics: 1) the role of ecological systems for human health and welfare; 2) conservation ecology; 3) ecosystems under anthropogenic scenarios. Case studies from: terrestrial, shallow and marine ecosystems. |
| 12 | Functional traits and the role in the quantification of disturbance's effect. Functional and life history traits. Physiological functional traits: i) effect of temperature; ii) hypossia response. Behavioural traits: a) feeding behaviour, b) social behavior. Morphological functional traits: aa) growth rate bb) organismal shape. |
| 12 | Disturbance, ecological altered processes and ecosystem management. Multiple scale change and anthropogenic change drivers. Disturbance theory: the main ecological door and how it propagates through the ecological hierarchy. Single and multiple stressors. Stability, resistance, resilience, adaptability, sustainability, phase e regime shifts. Ecological impact analysis: effects of human activities on terrestrial ecosystems (e.g. agriculture); the role of fire on terrestrial ecosystems; ocean acidification, increasing temperature on terrestrial and aquatic ecosystems; eutrophication; hypoxia and anoxia. Case studies: terrestrial ecosystems; regime shift with sea urchins, kelp forest and turf; fishery and aquaculture; lagoons; Posidonia oceanica habitats, the coralligenous in the Mediterranean Sea, vermetid and coral reefs. |
| 8 | Integrated Ecosystem-Based Approach (EBA): ecological principles to address the view of a correct spatial planning within the UN SDGs framework. Management of environmental issues. Contamination; mitigation in terrestrial and ecosystems; ecosystem management tools. |

| Hrs | Practice |
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| 12 | 1) Experimental design in Ecology as a tool to study ecological processes under anthropogenic disturbance; 2) Defining the tolerance limits of organisms; 3) studying the population structure and dynamics with case studies on terrestrial and marine invertebrates (e.g. gastropods and bivalves) and vertebrates (e.g. birds and fish); 5) Diversity models, indexes and case studies; 5) Research in Ecology: the role of bibliometric analysis with examples in defining the scientific value of ecological research; aims and structure of a dissertation in Ecology. |