



# UNIVERSITÀ DEGLI STUDI DI PALERMO

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| DEPARTMENT              | Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                 |                  |
| ACADEMIC YEAR           | 2021/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                 |                  |
| 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)       | SARA' GIANLUCA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Professore Ordinario            | Univ. di PALERMO |
| OTHER PROFESSOR(S)      | BOSCH BELMAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ricercatore a tempo determinato | Univ. di PALERMO |
|                         | MARIA DEL MAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                 |                  |
|                         | CALÒ ANTONIO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ricercatore a tempo determinato | Univ. di PALERMO |
|                         | SARA' GIANLUCA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Professore Ordinario            | Univ. di PALERMO |
| CREDITS                 | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |                  |
| PROPAEDEUTICAL SUBJECTS |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                 |                  |
| MUTUALIZATION           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                 |                  |
| YEAR                    | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                 |                  |
| TERM (SEMESTER)         | 1° semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                 |                  |
| ATTENDANCE              | Not mandatory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                 |                  |
| EVALUATION              | Out of 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                 |                  |
| TEACHER OFFICE HOURS    | <p><b>CALÒ ANTONIO</b><br/> Friday 14:00 16:00 Via Archirafi, 20 (DiSTeM) - 90123, Palermo Piano II - Stanza 8</p> <p><b>SARA' GIANLUCA</b><br/> Tuesday 10:00 12:00 Per gli studenti del CdS in Biodiversità 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</p> <p>Thursday 09:00 12:00 Dipartimento di Scienze della Terra e del Mare, Sezione di Ecologia, Plesso Edificio 16, STANZA 1</p> |                                 |                  |

**DOCENTE:** Prof. GIANLUCA SARA' - Lettere A-K, - Lettere L-Z

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| PREREQUISITES      |  |
| LEARNING OUTCOMES  |  |
| ASSESSMENT METHODS |  |
| TEACHING METHODS   |  |

## MODULE ECOLOGY APPLICATIONS WITH PRACTICE

*Prof. ANTONIO CALÒ - Lettere A-K, - Lettere A-K*

### SUGGESTED BIBLIOGRAPHY

Pusceddu A., Sarà G., Viaroli P. 2020. Ecologia. UTET • ISBN: 8860085853  
 Sarà G., in preparazione (2022). Applicazioni di ecologia  
 Ricklefs R. 1999. L'economia della natura. Zanichelli • ISBN: 8808098699  
 Cain L. Bowman W.D. and Hacker S.D. 2017. Ecologia. Piccin • ISBN: 8829928186  
 Levin S. et al. 2012. The Princeton Guide to Ecology ISBN: 9780691156040  
 Townsend C. R. Ecological Applications. Towards a sustainable world. Blackwell Publishing ISBN: 978-1-405-13698-3

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|-------------------------------|----------------------------------------------------|
| <b>AMBIT</b>                  | 50026-Discipline botaniche, zoologiche, ecologiche |
| <b>INDIVIDUAL STUDY (Hrs)</b> | 98                                                 |
| <b>COURSE ACTIVITY (Hrs)</b>  | 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.

## SYLLABUS

| Hrs | Frontal teaching                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4   | What's the meaning of Applied Ecology? The role of ecological principles in managing ecosystems. Millenium Ecosystem Assessment: a context 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) Aichi Biodiversity Targets; 2) the role of ecological systems for human health and welfare; 3) conservation ecology; 4) ecosystems under anthropogenic scenarios. Case studies from terrestrial to wetlands and marine ecosystems. |
| 6   | Ecological altered processes under human disturbance and their 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, phase e regime shifts.                                                                                                                                                                                                                                                               |
| 6   | The ecological niche and biological traits: key concepts to investigate how the disturbance affect ecosystems. Functional traits and Life History theory.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 6   | The population ecology theory: key concepts to investigate how the disturbance affect ecosystems. Conservation of endangered species and biodiversity. Models of population viability analysis. Management of invasive species. Biological control. Harvest management: i) the tragedy of the commons; ii) maximum sustainable yield (MSY) approaches; iii) social and economic implications of sustainable resource management.                                                                                                                                                                         |
| 6   | The community ecology and ecosystem theory: key concepts to investigate how the disturbance affect ecosystems. Diversity analysis, successions, management and conservation. Food web theory for management and conservation. Ecosystem theory: i) managing succession for restoration; ii) invasive species. The key concept of sustainability: the role of ecologists in defining the sustainability. Ecosystem services.                                                                                                                                                                              |
| 6   | Integrated Ecosystem-Based Approach; EBA: ecological principles to address a correct use of marine resources; interaction and coexistence of marine ecosystem human uses; pattern analysis and marine siting; Marine Spatial Planning; EU Marine Strategy Framework Directive (MSFD), Good Environmental Status (GES) tool. Applicative tools: monitoring the human use of seascape and biodiversity management; examples and case studies.                                                                                                                                                              |
| 6   | Some useful tools for Ecological applications. 1) Experimental design principles in Ecology as a tool to study ecological processes under anthropogenic disturbance; 2) Research in Ecology (#1): the role of Literature Systematic Review and Evidence Map as a tools in ecological research; 3) Research in Ecology (#2): the role of bibliometric analysis with examples in defining the scientific value of ecological research; aims and structure of a graduate dissertation in Ecology.                                                                                                           |
| Hrs | Practice                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 12  | Experimental lab session. 1) Biological traits under multiple stressors; 2) the population structure and dynamics with case studies on marine invertebrates and vertebrates; 3) Biodiversity analysis; 4) Diversity data analysis with major emphasis on main indexes with case study data.                                                                                                                                                                                                                                                                                                              |

## MODULE GENERAL ECOLOGY

*Prof. GIANLUCA SARA' - Lettere A-K, - Lettere A-K, - Lettere L-Z, - Lettere L-Z*

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| <b>AMBIT</b>                  | 50026-Discipline botaniche, zoologiche, ecologiche |
| <b>INDIVIDUAL STUDY (Hrs)</b> | 102                                                |
| <b>COURSE ACTIVITY (Hrs)</b>  | 48                                                 |

### EDUCATIONAL OBJECTIVES OF THE MODULE

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 and particular emphasis implications for applied solutions.

## SYLLABUS

| Hrs | Frontal teaching                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| 4   | PRESENTATION OF THE COURSE<br>Who we are, the objectives of our work, the scientific article<br>Ecology as a scientific discipline<br>Purpose of Ecology & historical notes: milestones in Ecology<br>The observation stairs<br>The concept of Variability.                                                                                                                                                                                                                                |
| 6   | THE ECOSYSTEM: STRUCTURE AND PROCESSES<br>The concept of ecosystem<br>Structure and functioning of an ecosystem<br>Thermodynamic properties of ecosystems<br>Trophodynamic properties of ecosystems, food webs and microbial circuit<br>Emerging properties of ecosystems                                                                                                                                                                                                                  |
| 3   | THE ABIOTIC COMPONENTS OF THE ECOSYSTEM: MATTER AND ENERGY<br>Elements of chemistry for ecological analysis: chemical conditions in the environment and limiting factors<br>Water and ecosystem properties<br>Energy in the ecosystem<br>Atmosphere, weather and climate                                                                                                                                                                                                                   |
| 4   | THE CYCLE OF MATTER IN ECOSYSTEMS<br>Biogeochemical cycles: definitions and general characteristics<br>The water cycle<br>The carbon cycle<br>The nitrogen cycle<br>FOCUS:<br>Global warming<br>Oceanic acidification<br>Eutrophication                                                                                                                                                                                                                                                    |
| 4   | THE ECOLOGICAL NICHE<br>Ecological responses at the level of a single organism<br>What are functional traits?<br>The traits of vital stories and the concept of trade-offs<br>FOCUS:<br>Fitness<br>The hypervolume niche and the concept of persistence of a population<br>The concept of scale in ecology<br>Importance of body size                                                                                                                                                      |
| 4   | ACQUISITION OF ENERGY IN THE ORGANISMS<br>Ecological-functional aspects of energy acquisition in organisms<br>The acquisition of energy in photosynthetic autotrophs<br>Control factors of photosynthetic primary production<br>Resource allocation and plant growth<br>Responses to the environmental conditions of plants<br>Energy acquisition in heterotrophs<br>Acquisition of food in heterotrophs<br>The use of inorganic matter<br>The functional traits in maximizing energy gain |

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| 4 | <p>THE ECOLOGICAL SIGNIFICANCE OF THE DISTURBANCE</p> <p>Why study the disturbance before populations?</p> <p>What is the disturbance</p> <p>How the disturbance works</p> <p>The characteristics of the disturbance</p> <p>Multiple stressors</p>                                                                                                                                                                                                                                                                                                                                      |
| 5 | <p>POPULATIONS</p> <p>Populations and demographic traits</p> <p>Population Growth Models: Why Use Models?</p> <p>Unlimited resources, closed populations and identical individuals</p> <p>Growth of a population in a limited environment</p> <p>Growth of populations with age structure</p> <p>The Metapopulations</p>                                                                                                                                                                                                                                                                |
| 4 | <p>BIOLOGICAL INTERACTIONS</p> <p>Generality</p> <p>Mutualism and symbiosis</p> <p>Commensalism</p> <p>Competition</p> <p>Predation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 6 | <p>ECOLOGICAL COMMUNITIES AND BIODIVERSITY</p> <p>Definition, structure and composition</p> <p>Factors influencing the structure and composition of communities</p> <p>Ecological successions</p> <p>Distribution and dispersion of species</p> <p>Definitions of biodiversity</p> <p>Diversity of species</p> <p>Methods for measuring species diversity (please refer to the Applied Ecology Course for more details)</p> <p>Factors affecting the biodiversity</p> <p>Relations between biodiversity and ecosystem functioning</p> <p>Biodiversity, ecosystem goods and services</p> |
| 4 | <p>Testing Activities</p> <p>Test in progress - development</p> <p>Test in progress – correction altogether</p> <p>Closing the course and final considerations</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |

## MODULE ECOLOGY APPLICATIONS WITH PRACTICE

*Prof.ssa MARIA DEL MAR BOSCH BELMAR - Lettere L-Z, - Lettere L-Z*

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| Hrs | Practice                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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