UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche		
ACADEMIC YEAR	2022/2023		
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 MARIA DEL MAR	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	**SARA' GIANLUCA**		
	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	
	Thursday 09:00 12:00	Dipartimento di Scienze della Terra e del Mare, Sezione di Ecologia, Plesso Edificio 16, STANZA 1	

DOCENTE: - *Lettere L-Z*

PREREQUISITES	The student is expected to have basic knowledge of Chemistry, Biochemistry, Botany, Zoology
LEARNING OUTCOMES	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. Gaining basic knowledge at undergraduate level on ecological principles useful to investigate the ecosystem's response under anthropogenic pressure in order to increase skills when proposing impact analyses, multiscale monitoring protocols, mitigation and adaptation solutions in a context of global change and multiple stressors. Acquisition of a specialised scientific language. Applying knowledge and comprehension Acquisition of application skills to analyse ecological processes also in anthropogenic altered ecosystems. Autonomous thinking Acquisition of evaluation skills and competences for interpretation of experimental data, environmental state assessment and the effects of anthropogenic activities. Communication ability 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. Learning ability 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 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. Assessment criteria -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; - 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; - 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; - 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; - 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; - assessment: fail, insufficient knowledge of the topics of the course
TEACHING METHODS	Lectures, invited talks, and lab and classroom practice exercises

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

PREREQUISITES	The student is expected to have basic knowledge of Chemistry, Biochemistry, Botany, Zoology.
LEARNING OUTCOMES	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. Gaining basic knowledge at undergraduate level on ecological principles useful to investigate the ecosystem's response under anthropogenic pressure in order to increase skills when proposing impact analyses, multiscale monitoring protocols, mitigation and adaptation solutions in a context of global change and multiple stressors. Acquisition of a specialised scientific language. Applying knowledge and comprehension Acquisition of application skills to analyse ecological processes also in anthropogenic altered ecosystems. Autonomous thinking Acquisition of evaluation skills and competences for interpretation of experimental data, environmental state assessment and the effects of anthropogenic activities. Communication ability 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. Learning ability 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 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. Assessment criteria -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; - 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; - 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; - 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; - 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; - assessment: fail, insufficient knowledge of the topics of the course.
TEACHING METHODS	Lectures, invited talks, and lab and classroom practice exercises

MODULE
ECOLOGY APPLICATIONS WITH PRACTICE

- 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

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.

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

EDUCATIONAL OBJECTIVES OF THE MODULE

MODULE 1 - General 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 and particular emphasis implications for applied solutions.

SYLLABUS

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

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

MODULE
ECOLOGY APPLICATIONS WITH PRACTICE

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

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AMBIT	50026-Discipline botaniche, zoologiche, ecologiche
INDIVIDUAL STUDY (Hrs)	98
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