UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche		
ACADEMIC YEAR	2019/2020		
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
	MAZZOLA ANTONIO	Professore a contratto in quiescenza	Univ. di PALERMO
OTHER PROFESSOR(S)	CALÒ ANTONIO	Ricercatore a tempo determinato	Univ. di PALERMO
	SARA' GIANLUCA	Professore Ordinario	Univ. di PALERMO
	MAZZOLA ANTONIO	Professore a contratto in quiescenza	Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	3		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**CALÒ ANTONIO** Friday 14:00 16:00 Via Archirafi, 20 (DiSTeM) - 90123, PalermoPiano II - Stanza 8 **MAZZOLA ANTONIO** Monday 12:00 13:00 DiSTeM, via Archirafi 18, II piano, aula docente **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: Prof. ANTONIO MAZZOLA- *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	Student's final evaluation will be carried out by a 90 minutes written test based on 20 questions, 10 will deal with the General Ecology and 10 the Applied Ecology module. Question will be composed by a multi choice component followed by a synthetic discussion about the adopted choice (max 50 words). If the answers to all 16 questions will be judged excellent by teachers (i.e. both multi choice answer is correct and the comment is consistent), the student may strive for the maximum grade (30/30) cum laude. Comments will be judged excellent only if they will meet the conceptual accuracy in terms of skills, learning abilities and comprehension levels (50%), if they will be easily legible (15%), will be clear (20%) and synthetic (15%). The comment should not be a mere repetition of the multi-choice question. Answer will be judged correct only if both components (multi-choice and comment) will be present; as an alternative, they will be considered invalid. A mid-course ongoing test (90 minutes) will deal with the first part of the course (about 50%) and will be carried out using the kind of written test as that adopted at the end of the course (see above for details). This mid-course will give the student the opportunity to be evaluated on the second part of course contents during the final test. The student's final evaluation grade will be the average of the mid-term and the end-term tests. In case the student will not accept the grade of the mid-term test, the end-term test will deal with all the topics of the course. 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 L-Z*

PREREQUISITES	The student is expected to have basic knowledge of Chemistry, Biochemistry, Botany, Zoology.
LEARNING OUTCOMES	Knowledge and comprehension 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.
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TEACHING METHODS	Lectures, invited talks, and lab and classroom practice exercises

MODULE
ECOLOGY APPLICATIONS WITH PRACTICE

Prof. ANTONIO CALÒ - Lettere L-Z, - Lettere L-Z

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
Pusceddu, Viaroli & Sara. Manuale di Ecologia. CittaStudi (in stampa 2018)
Sara. Applicazioni di Ecologia. Piccin (in preparazione 2019)
Ricklefs R. (1999) L'economia della natura. Zanichelli
Townsend C. R. Ecological Applications. Towards a sustainable world. Blackwell Publishing.
Materiale didattico fornito dal docente

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. Ecological impact analysis and ecosystem's parallelisms: effects of human activities on terrestrial ecosystems (e.g. agriculture) and repercussions on contiguous marine habitats; ocean acidification, increasing temperature and the IPCC (2014) scenario analysis of global climate change; eutrophication; hypoxia and anoxia, nitrogen driven change.
6	The ecological niche and biological traits: key concepts to investigate how the disturbance affect ecosystems. Functional traits and Life History theory i) as predictors for effective restoration; ii) as predictors of invasion success; iii) as predictors of extinction risk. Dispersal, migration and management: why species mobility matters for conservation, restoration and invasive dynamics purposes. Case studies.
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. Predicting models to investigate the global effects on ecosystems, socio-economic implications. Case studies: regime shift with sea urchins, kelp forest and turf, fishery, lagoons, rocky intertidal, Posidonia oceanica habitats, the coralligenous in the Mediterranean Sea, vermetus and coral reefs.
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. ANTONIO MAZZOLA - Lettere A-K, - Lettere A-K

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
Cain L. Bowman W.D. and Hacker S.D. (2017) Ecologia. Piccin

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

SYLLABUS

Hrs	Frontal teaching
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.
10	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. 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.
6	The biosphere – Biosphere evolution – Gaia hypothesis. Environmental sustainability.

MODULE
ECOLOGY APPLICATIONS WITH PRACTICE

Prof. GIANLUCA SARA' - Lettere A-K, - Lettere A-K

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