UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Ecology

2223-2-E1301Q087

Aims

This course is subdivided in two parts: Lectures (6 credits) and activities lab (1 credit COMPULSARY)

This course is a comprehensive introduction to ecology. Students will be introduced to the types of questions asked by ecologists and the methods that are used to answer ecological questions. Particular emphasis will be paid to population, community, and ecosystem level processes. Both terrestrial and aquatic systems will be considered.

Applying Knowledge and understanding: the course will deepen the principal concepts and theories that guide ecological inquiry.

Making judgments: Collect and interpret the relevant ecological data.

Communication skills: the course aims to provide the skills to communicate effectively, appropriately and with specific language, the concepts learned during the course.

Learning skills: At the end of the course the student must be able to study in depth the topics covered in the course, also by consulting specific bibliography texts.

Contents

Definitions of ecology, Autoecology-synecology, Unitary organisms, Modular organisms, populations, metapopulation, Community, ecosystems, biomes, Biosphere, Ecological factors: condition and resources, Population dynamics, Predation, Symbiosis and mutualism, coprophagous, Parasitism, Intraspecific competition, Demography, Community, Primary and secondary succession, Climax, Energy flows in ecosystems, Biogeochemical cycles, Theory of insular biogeography, Conservation of nature, Climate, biomes, Gaia hypothesis of Lovelock

Detailed program

Definitions of ecology (Haeckel, Krebs, Begon, Odum), Autoecology and synecology, Unitary organisms, Modular organisms (free-forming, rhizomatous and stoloniferous, bush-forming, persistent multi-ramified, Modular organisms: ramet and genet, populations, metapopulation, Community, ecosystems, biomes, Biosphere, Biosphere 2, Ecological factors: abiotic and biotic, Ecological factors: condition and resource, Definition of limiting factor, Biological success in function of the ecological factor (three different models, temperature, pH, poisons, trace elements such as copper and sodium chloride). Consumable and exhaustible resources: Essential resources, Perfectly replaceable resources, Complementary resources, Antagonistic resources, Q10 temperature coefficient, Physiological time (example with grasshopper), Acclimatization: example with Cryptopygius antarticus, importance of glycerol in butterflies, South Pole Fish, Allen's Rule, Bergmann's Rule, lethargy, Hibernation, Living at high temperatures: estivation, transpiration plants, behavior modification (desert iguana), interruption of homeostatic processes for short periods (earth squirrel body temperature variation), Alvinella pompeiana hydrothermal fireplaces, Vestimentiferi, Use of pedicled eyes as heat receptors, Importance of whale skeletons for hydrothermal chimney organisms, Different modality of nitrogen excretion: ammonia, urea and uric acid, Evolutionary adaptations, Role of temperature in the winning of a competition between two species, the pH, Documentary vision an inconvenient truth and the president's island, Strategies implemented by organisms to survive adverse events, cryptobiosis, diapause, Cyclical migration, One-time migration (eels, sturgeons), Migration involving birth and death of organisms in the same place (case of the butterfly Vanessa atalanta), Raunkiaer classification: adaptation of plants to the unfavorable season), Biological forms of plants: fanerophytes, camephites, hemicriptophytes, geophytes, therophytes, Definition of ecological niche, Fundamental niche and realized niche, (Example with Planaria gonocephala and Planaria montenegrina), Principle of exclusion of Gauss, Guild, Ecological equivalents, Ecological niche determined by both biotic and abiotic factors (example with barnacles, Population dynamics, Method of capture and recapture of Peterson (estimation of population density), Populations Density (N), Births (B), Mortality (D), b average birth rate per capita, average per-capita mortality, dN / dt = rN, Curve j of the strategic r organisms (theoretical and real), Constant r, dN / dt = rN ((K-N) / k) growth curve organisms k strategists, Constant k, dN / dt = rN ((K-N) / k) ((N-M) / N), Constant M (minimum number of individuals), Example with ibex, Competition from the use of common and limited resources (alpha and beta coefficient, alpha coefficient calculation), Example with Asterionella and synedra, Example competition between two diatoms, Isocline zero growth (stable and unstable equilibrium points), Predation, Prey equation, predatory equation, Isocline zero growth for prey and predator, Symbiosis and mutualism, Example cleaner fish, Example clownfish and anemone, Proterandria proteroginia, Mutualism between plants and ants, Mutualism between plants and cockroaches, Mutualism within the digestive tract, Mutualism corals and algae, Saprophytes (decomposers and detritivores), coprophagous, Beetles burials, Parasitism, Definitions of parasitism (Leukart, Crofton), Aggregate distribution of pests, Parasites classification based on their size, Classification of pests based on the area of ??contact with the host, Monoxene and eteroxeno cycle, Strategies implemented by parasites with eteroxeno cycle to facilitate pests with hosts, Origin of life pests, Parasites: infrapopulation, metapopulation, overpopulation, infragroup, community component, compound community, Intraspecific competition, Overcrowding effect on deer survival, Competition and unpredictability of environmental variations, Hypothesis of the intermediate disorder, Fugitive and highly competitive species (annual C fertility and E * balance), Example brown alga and bivalve mollusk, Arrival time effect on competition, Paradox of plankton, Ghost competition of the past, Preference for food, Theory of optimal foraging, Functional response of type 1, Functional response of type 2, Functional response of type 3, Demography, Lx (Longevity), Mx (Maternity), R0 net reproduction rate, Age distance in a constant environment, Community, Chain of grassland and debris, Attributes that define biological community structure, Indices of Monk, Menhinick, Margalef, Relative abundance, abundance rank diagram, Indices of dominance of Simpson, Shannon diversity index (HI), Evenness Index (J), Keystone species, Interactions between species in a community, Indices similarity (by Sorensen), Percentage similarity (SP), Succession (pioneer and late species), Primary and secondary succession, Study of primary succession, Climax (monoclimax and policlimax), Energy flows in ecosystems, First thermodynamic law, Second thermodynamic law, Gross primary productivity and net primary productivity, Net productivity of the community, Secondary productivity, Measure primary gross, net and respiration productivity by using light and dark bottle methods (with numerical examples, Respiration variation and net production in sea depth function, Ecological pyramids of number, biomass and energy, Reverse pyramids of number and biomass, Biogeochemical cycles, Carbon cycle, Phosphorus cycle, The phenomenon of eutrophication, Nitrogen cycle,

Theory of insular biogeography, Immigration rate according to the number of resident species, Rate of extinction depending on the number of resident species, Experimental data supporting biogeographic theory, Parks like ecological islands, Conservation of nature, Extinction of the Dodo and its influence on the plant Calvaria major, Management of animal and plant resources, Production Optimum (Maximum Sustainable Production), System of fixed quotas in the unit of time, Variable quote system, Withdrawal effort, Regulated escape, Climate, Solar radiation, motions of the planet, shape and structure of the earth's surface, Solar and thermal radiation, Maritime and altitudinal effect, Continental bioclimate and maritime bioclimate, Climogramma, biomes, Arctic tundra, Alpine tundra, Forests of conifers (taiga, mountain forests), Temperate forests, Prairies (steppe), Savana (biomass variation in relation to fire, animal biomass in relation to water availability), Deserts, Tropical rainforests, Gaia hypothesis of Lovelock

Prerequisites

general knowledge of zoology, it is recommended to have given the zoology exam before following the ecology course

Teaching form

lectures supported by powerpoint and videos

Textbook and teaching resource

Teaching material consists of:

powerpoint in PDF format available from the e-learning platform

Recommended textbooks:

ELEMENTS OF ECOLOGY, THOMAS SMITH, ROBERT SMITH, NINTH EDITION, PEARSON PUBLISHER

each page of the slides is accompanied by a code and a page that refer to the textbooks of ecology that can be also consulted

Slides available on the e-learning platform

videos available on the e-learning platform

Semester

First semester

Assessment method

Written:

questionnaire of 30 multiple choice questions,

5 possible answers of which only one correct (1 point for each correct answer, 0 points for each wrong answer,= point for each no answer)

Office hours

by appointment, please write an email to: paolo.galli@unimib.it

Sustainable Development Goals

SUSTAINABLE CITIES AND COMMUNITIES