DETAILED SYLLABUS

1. Information about the study program

1.1 University	Universitatea Babes-Bolyai
1.2 Faculty	Biology and Geology
1.3 Department	Taxonomy and Ecology
1.4 Field of study	Biology
1.5 Program level (bachelor or master)	Master
1.6 Study program / Qualification	Systems Ecology and Conservation

2. Information about the subject

2.1 Subject title				**PRINCIPILES OF SYSTEMS ECOLOGY**			
2.2 Course activities professor				**Lecturer dr. Cristina Craioveanu**			
2.3 Seminar activities professor				**Lecturer dr. Cristina Craioveanu**			
2.4 Year of study	1	2.5 Semester	1	2.6 Type of assessment	C	2.7 Subject regime	Compulsory

3. Total estimated time (teaching hours per semester)

3.1 Number of hours per week	**2**	out of which: 3.2 course	1	3.3 seminar/laboratory	1
3.4 Total number of hours in the curriculum	**28**	out of which: 3.5 course	14	3.6 seminar/laboratory	14

Time distribution	Hours
Study based on textbook, course support, references and notes	20
Additional documentation in the library, through specialized databases and field activities	40
Preparing seminars/laboratories, essays, portfolios and reports	40
Tutoring	20
Assessment (examinations)	6
Others activities field trips	-

3.7 Total hours for individual study	126
3.8 Total hours per semester	154
3.9 Number of credits	6

4. Preconditions (if necessary)

4.1 Curriculum	• Graduation of general biology (botany and zoology), ecology and biostatistics courses
4.2 Skills	• Capacity to use a PC with the programs Microsoft Excel and Word or equivalent

5. Conditions (if necessary)

5.1. For course development	Logistic support (digital video-projector)
5.2. For seminar / laboratory development	Logistic support: multimedia projector Compulsory attendance of students at minim 80% of the seminars

6. Acquired specific competences

Professional competences	• **Knowledge:** (1) Knowledge, understanding and specific language: students will be introduced to the concept of systems ecology. They will revisit and deepen the knowedge of specific terms from connected fields (Ecosystem: structure and function; hydrobiology, conservation biology etc.) studied at Bachelor level. (2) Explanation and interpretation: Students will be able to explain the principles underpinning the systemic classification of living structures based on the course material. Through the techniques explained and discussed at the seminar they will be able to interpret general principles and scientific information in the field of ecology and will be able to formulate them in specialized scientific essays. • **Skills:** (3) Application, transfer and problem solving: At the planned practical works, students will analyze data and interpret results obtained in ecosystem and population ecology studies (4) Critical and constructive reflection: students are encouraged to discuss the problems presented at the course and to formulate their own conclusions and solutions, and to formulate in writing, through an individual paper, the opinion on certain topics discussed at the seminar. (5) Creativity and Innovation: Creativity in this field materializes in students' ability to find solutions to specific problems, based on the theoretical and practical information received in this discipline. Within this discipline, students will be able to document ecosystem and population ecology studies and practice the restoration of estimates. As a result of these exercises, students will be asked to express a critical view on the effectiveness of the method and any improvements that may be made. (6) Developing a scientific essay: By combining the abilities mentioned above, students will develop the ability to write a scientific essay based on clearly explained and clearly formulated requirements.
Transversal competences	(7) Autonomy and Responsibility: Students will be able to assume responsibility for the interpretation of scientific data specific to the field, based on the theoretical knowledge gained during the course and seminar discussions. In exercises based on the study of literature in the field, students will practice the individual study, taking responsibility for communicating their own conclusions to colleagues. Also by peer evaluation they will develop their ability to evaluate and self-assess and to be able to justify their decisions. (8) Social interaction: analyzing data on working groups and peer reviews will lead to the development of team spirit and effective and diplomatic communication. The course also aims to improve students' oral communication skills through discussions on the issues presented. (9) Personal and Professional Development: By developing critical thinking, logical and argumentative thinking, students will be able to develop a reference system in analyzing environmental issues. They will think independently and will know how to draw their own conclusions according to the experience gained from the bachelor level. Through this exercise they will self-assess their capacity to understand environmental science issues and gain more confidence in their own analytical capability.

7. Subject objectives (arising from the acquired specific competences)

7.1 Subject's general objective	• Study of the principles that form the basis of the systemic ordering of the living world
7.2 Specific objectives	• General principles of systemic theory • Important theories at different levels of organizing the living world • Shifting the principles of organizing the living world from different levels into mathematical models • Analyzing and explaining a theory by making a scientific essay • Peer evaluation and self-evaluation of the scientific essay

8. Contents

8.1 Course	Teaching methods	Observations
Courses 1-2: **Systems theory**: Terms, characteristics of biological systems; Organizational hierarchies	Lecture, dialogue, interrogation use of PPT	
Course 3: **Evolution of supra-individual biological systems**: evolution, organizational and taxonomic classifications, origin of eukaryotes, origins of pluricelularity, origin of sexual process, emerging traits	Lecture, dialogue, interrogation use of PPT	
Course 4: **Organizational evolution of the population**: sexual selection, natural selection, reproductive strategies, intraspecific relationships	Lecture, dialogue, interrogation use of PPT	
Course 5: **Sociality**: social and intra-and inter-specific social and communication systems, beneficial characters at individual and population level	Lecture, dialogue, interrogation use of PPT	
Curs 6-7: **Evoluția populaţiilor**: evoluția intraspecifică, metode specifice de analiza populațiilor, variaţii ale densităţii, dinamica densităţii, reglarea mărimii populaţionale, strategii demografice	Lecture, dialogue, interrogation use of PPT	
Course 8-9: **Evolution of ecosystems**: ecological succession, biodiversity, speciation, coevolution, intermediate disturbance hypothesis, interspecific relations, transect method, square method, parameters used in ecosystem analysis	Lecture, dialogue, interrogation use of PPT	
Course 10: **Ecological niche**: spatial niche, functional niche, competitive exclusion principle, "hipervolume" niche, fundamental niche vs. realized niche, the niche term in the present conception, other theories / concepts about the ecological niche	Lecture, dialogue, interrogation use of PPT	
Course 11-13: **Biomass and Biosphere**: evolution at higher levels of organization, global interactions theories, globalization and global warming, elements of astrobiology	Lecture, dialogue, interrogation use of PPT	
Course 14: **Consultations**: discussions on the themes of the course, how scientific essays are drafted, the bachelor thesis / dissertation in ecology, etc.	Lecture, dialogue, interrogation use of PPT	

References:

1) Pásztor, L., Botta-Dukát, Z., Magyar, G., Czárán, T., Meszéna, G., 2016, Theory-Based Ecology: A Darwinian Approach, Oxford University press, 301 pp.
2) Ovaskainen, O., de Knegt, H.J., del Mar Delgado, M., 2016, Quantitative Ecology and Evolutionary Biology, Oxford University press, 285 pp.
3) Begon, M., Townsend, C.R., Harper, J.L., 2006, Ecology, from individuals to ecosystems, (4th Ed.), Blackwell Publishing, Malden, 1-738
4) Botnariuc, N., 1999, Evoluţia sistemelor biologice supraindividuale, Edit. Universităţii din Bucureşti, Bucureşti
5) Botnariuc, N., Vădineanu, A., 1982, Ecologie, Edit. Didact. şi Pedag., București
6) Meffe, G.K., Carroll C.R. and contributors, 1997, Principles of Conservation Biology, (2nd Ed.), Sinauer Associates Inc. Publishers, Sunderland, Massachusetts

8.2 Seminar / laboratory	Teaching methods	Observations
1. Debate on organisation of living systems: organizational hierarchy vs. taxonomic hierarchy	Lecture, dialogue,	

	interrogation use of PPT	
2. Watching and discussing „Charles Darwin and the Tree of Life”	Lecture, dialogue, interrogation use of PPT	
3. Watching documentary films on the evolution of pluricelularity, eukaryotes, sexual reproduction, and discussing arguments	Lecture, dialogue, interrogation use of PPT	
4. Methods of analysis of intraspecific relations and their quantification. Interpretation of results.	Fieldwork, practice	
5. Methods of analysis in studies of social organisms and interpretation of data.	Lecture, dialogue, interrogation use of PPT, practice	
6. The square method and mark-recapture method in population analysis. Presumptions of mathematical models of population estimation. Interpretation of population data.	Lecture, dialogue, interrogation use of PPT, practice	
7. Population density estimation: transect method: suitable populations, calculation mode, interpretation	Lecture, dialogue, interrogation use of PPT, practice	
8.- 9. Ecological succession studies, estimation of diversity, indices of diversity and equitability, similarities of biotic communities. Analyzing a data set and interpreting and discussing the results.	Lecture, dialogue, interrogation use of PPT, practice	
10-11. Ecological niche modelling. Programs, techniques and methods for mathematical niche modelling. Critical analysis of several studies.	use of PPT, practice on PC	
12.-13. Methods of theoretical ecology in modeling of ecosystems and biomes.	Lecture, dialogue, interrogation use of PPT, practice	
14. Colocviu	-	

References:

1) Ovaskainen, O., de Knegt, H.J., del Mar Delgado, M., 2016, Quantitative Ecology and Evolutionary Biology, Oxford University press, 285 pp.
2) Battes, K.P., 2012, Ecologie generală, ghid de lucrări practice, Presa Universitară Clujeană, Cluj-Napoca, 1-152
3) Henderson, P.A., 2003, Practical methods in ecology, Blackwell Publishing, 1-163
4) Krebs, C.J., 1999, Ecological Methodology, Wesley Longman Inc.
5) Rîşnoveanu, G. (ed.), 2010, Caracterizarea sistemelor populaţionale, Ars Docendi, Universitatea din Bucureşti, 1-392
6) Van Emden, H.F., 2008, Statistics for terrified biologists, Blackwell Publishing, 1-343

9. Corroboration / validation of the subject's content in relation to the expectations coming from representatives of the epistemic community, of the professional associations and of the representative employers in the program's field.

Graduates of this discipline will deepen their knowledge of ecology acquired at the Bachelor's level and will use them later if they choose to pursue a PhD in Ecology.

The professional and transversal competencies of this discipline are indispensable for any applicant in the field of ecology (both theoretical and applied): for protected area keepers, employees of environment advisory firms, employees of environmental agencies (Environmental Protection Agencies, The

Romanian Waters Administration, Garda de Mediu), for the pre-university teachers and the teaching staff in the university education, for the volunteers of the environmental NGOs, even for the civil servants from the respective ministries.

10. Assessment (examination)

Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Knowledge of the information content	Colloquium	60%
	Understanding and interpretation of ecological data		
10.5 Seminar/laboratory	Evaluation of practical skills	Scientific essay and peer evaluation	40 %
10.6 Minimum performance standard			
• Knowledge of at least 50% of the information that pertains to the course • Acquiring the skills (in proportion of at least 50%) practiced during seminars			

Date of filling
14.09.2019

Signature of the course professor

Signature of the seminar professor

Date of approval by the department
14.09.2019

Head of department's signature
Prof. Dr. László Rákosy