SYLLABUS

Biogeography of Europe and Romania

University year 2025-2026

1. Information regarding the programme

1.1. Higher education institution	University Babes-Bolyai
1.2. Faculty	Biology and Geology
1.3. Department	Hungarian Department of Biology and Ecology
1.4. Field of study	Biology
1.5. Study cycle	Master degree studies/ 4 semesters/with presence
1.6. Study programme/Qualification	Terrestrial and aquatic ecology/Researcher
1.7. Form of education	Daily, with presence

2. Information regarding the discipline

2.1. Name of the discipline	**Biogeography of Europe and Romania**					Discipline code	**BME5203**
2.2. Course coordinator				Associate prof. dr. Keresztes Lujza			
2.3. Seminar coordinator				Associate prof. dr. Keresztes Lujza			
2.4. Year of study	1	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Discipline regime	obligate

3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	**4**	of which: 3.2 course	**2**	3.3 seminar/laboratory	**2**
3.4. Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar/laborator	**28**
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					8
Additional documentation (in libraries, on electronic platforms, field documentation)					8
Preparation for seminars/labs, homework, papers, portfolios and essays					12
Tutorship					14
Evaluations					16
Other activities:					12
3.7. Total individual study hours	**70**				
3.8. Total hours per semester	**126**				
3.9. Number of ECTS credits	**5**				

4. Prerequisites (if necessary)

4.1. curriculum	Not the case
4.2. competencies	Not the case

5. Conditions (if necessary)

5.1. for the course	Classroom equipped with laptop, video, projector, and appropriate software and programs, Power Point, Multimedia, Programmes	
5.2. for the seminar /lab activities	Field work, individual projects, PC	

6.1. Specific competencies acquired [1]

[1] One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

Professional/essential competencies	• Time and space analyses of molecular diversity • The origin and evolution of Europe's biodiversity • The role of molecular biogeography in conservation biology • Integration of interdisciplinary disciplines
Transversal competencies	• Learning advanced methods in the field of Biology • Development of interdisciplinary creative thinking • Application of theoretical knowledge in the practice of biodiversity conservation

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	The general objective of the discipline is the interdisciplinary approach to the spatial projection of biodiversity, with the presentation of the main historical and geological processes that have contributed to the current biodiversity structure. Phylogeography is one of the youngest integrative disciplines that contribute to a better understanding of the evolution and structuring of the present biodiversity, using methods to investigate genealogical lines between populations using different molecular makers. The main role of phylogeography is to establish the links between the historical evolution of populations, such as population expansion, the bottle-neck effect, secular migration phenomena, vicariance with the current spatial structure (biogeography) of species and populations, which we will discuss in detail within the discipline.
7.2 Specific objective of the discipline	The specific objectives of the discipline are to present the most widespread methods in phylogeography, with the approach of current topics. Through an integrative approach, the discipline has two separate but interconnected chapters. In the first part, we present the most important analytical tools used in modern phylogeography, the spatial-temporal distribution of genes, and the most important historical and geological factors that cause these structures. The second part is intended to be a brief introduction to molecular biogeography, with selected case studies that contribute to a better visualization of current genetic structures of the biodiversity of Europe. The ultimate goal of the course will be a better understanding of the speciation process, extinctions, and the effects of continental past events or glaciations on current biodiversity in the face of ongoing major changes in the environment.

8. Content

8.1 Course	Teaching methods	Remarks
1. Premises of the appearance of phylogeography. The past, present, and future of phylogeographic research. Getting started and current concepts. The connection of the discipline with biogeography, paleobiology, or ecology.	Multimedia tools, frontal discussions	Individual work on course-specific problems and questions
2. Molecular evolution. Mutations. Evolutionary models.	idem	idem
3. Methods of highlighting phylogeographic processes: methods based on mitochondrial DNA, data analysis, processes of genetic differentiation of populations, link with current environmental changes	idem	idem

4. Methods for highlighting phylogeographic processes: methods based on mitochondrial or nuclear DNA, detect MRCA, NCPA analysis, phylogenetic reconstructions	idem	idem
5. Genetic structure of populations, genetic variability, bottle- neck effect, historical demographic processes, evolutionary patterns.	idem	idem
6. Coalescence theory and application in phylogeographic research, assessment of divergence time.	idem	idem
7. Comparative phylogeography, repetitive processes. Discussion of case studies.	idem	idem
8. Genetic diversity of populations in the Carpathian area. The emergence and evolution of biodiversity in the Carpathian area.	idem	idem
9. Paradigmatic phylogeographic structuring of populations in the alpine (Carpathian) biogeographic region. Case studies.	idem	idem
10. Paradigmatic phylogeographic structuring of populations in the continental biogeographic region. Case studies.	idem	idem
11. Paradigmatic phylogeographic structuring of populations in the Pannonian biogeographic region. Case studies	idem	idem
12. Paradigmatic phylogeographic structuring of populations in the steppe biogeographic region. Case studies.	idem	idem
13. Paradigmatic phylogeographic structuring of populations in the Pontic biogeographic region. Case studies.	idem	idem
14. Application of phylogeography methods in conservative biology: conservative biogeography.	idem	idem

Bibliography

1. Avise JC (2000): Phylogeography. Harvard University Press.
2. Avise JC (2004): Molecular Markers, Natural History, and Evolution, Sinauer Associates, Sunderland, Massachusetts.
3. Freeland JR, Molecular Ecology. Chichester (England): John Wiley & Sons, Ltd, 2005
4. Felsenstein, J. (2004): Inferring Phylogenies. Sinauer Associates, Sunderland, Massachusetts.
5. Ladle, R., Whittaker, R. (2011): Conservation Biogeography. Wiley-Blackwell.
6. Lomolino, M., Riddle, B., Brown, J. (2005): Biogeography. Third Edition. Sinauer Associates, Sunderland, Massachusetts.
7. Forró L. (2007): A Kárpát-medence állatvilágának kialakulása. Magyar Természettudományi Múzeum, Budapest.

All books are available in the Zoology Library of the Faculty of Biology and Geology, as well as the personal library of Lujza Keresztes

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Overview of molecular taxonomy and phylogeography methods. DNA isolation techniques, PCR, RFLP, sequencing. Practice of DNA isolation, methods, kits used	Seminary work will be organized using laptops and phylogeography programs, multimedia tools	Individual project in a molecular laboratory and field work
2. PCR and choice of primers, loci used in phylogeography.	idem	idem
3. Electrophoresis and cloning, discussion of sequencing methods, control of PCR products by gelatin electrophoresis.	idem	idem
4. Molecular analysis. Correction and control of sequencing chromatograms received from analysis laboratories, using specific programs.	idem	idem

5. Analysis of sequences received or downloaded from the international database based on specific programs, maintenance and correction of genetic bases, building the library of DNA sequences.	idem	idem
6. Use of international genetic banks (NCBI, BOLD, etc.). Application of the BLAST program. Data collection for taxonomic or phylogenetic analysis.	idem	idem
7. Basic principles applied in the proper joining of sequences, recommended programs. Verification, attachment and correction of sequences downloaded from international genetic bases.	idem	idem
8. Phylogeographic methods: methods based on the analysis of genetic distance, methods based on the analysis of sequences. Substitution models in the case of nucleotide sequences, the issue of evaluation of genetic distances. Presentation of statistical analysis programs (eg MEGA), using different evolution models or different parameters. The issue of the gap.	idem	idem
9. Building a tree based on genetic distances: neighbor-joining by using programs (eg MEGA). Editing phylogenetic trees, ordering.	idem	idem
10. Methods based on the principle of parsimony, basic principles, possibilities and restrictions in genetic analysis. Calculations based on parsimony and the effects of adjusting the selected parameters.	idem	idem
11. Maximum-Likelihood methods: principles of use in phylogenetic evaluations, evaluation and selection of parameters (based on the ModelTest program).	idem	idem
12. Maximum-Likelihood methods: principles of use in phylogenetic evaluations (application of the PhylML program). Comparison of phylogeographic hypotheses with the results obtained with the ML method.	idem	idem
13. Bayesian methods, statistical programs, applicability.	idem	idem
14. Presentation and discussion of selected case studies using nucleotide sequences downloaded from international databases, presentation the phylogeography analyses results, commets.	idem	idem

Bibliography

1. Avise JC (2000): Phylogeography. Harvard University Press.
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9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The content of the discipline is by other national university curricula and abroad.
- Graduates of this course can use their knowledge gained in laboratory work, in education, in the environmental departments of public institutions (profile ministries) and local (county and municipal councils), Environmental Agencies, Administration of the Romanian Waters, Environmental Guard, National and Natural Parks Administrations or other types of protected areas, various biological laboratories (ecotoxicology laboratories, clinical laboratories), etc. They can be integrated into private companies / NGOs or NGOs that offer environmental consulting services or biotechnology services. At the same time, the notions specific to the course constitute a starting point towards the higher level of training, wx. bioinformatics

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Creativity in accruing new knowledge	Oral examination	50%
	Active participation to the course (80%)		
10.5 Seminar/laboratory	Presentation of the result of individual projects	Oral examination	50%
	Participation in 100% to seminary discussions		
10.6 Minimum standard of performance			
• Presentation at the final exam is possible only after an 80% attendance at the course and 100% at the seminary activities. Only those who have passed all the partial exams participate in the final exam, and the final mark for the practical exam is higher than five. • In case of motivated absences, it is possible to visit the material outside the mandatory hours every week on Friday, between 10 am and 1 pm. Plagiarism during practical and theoretical exams entails the exclusion of the student from the exam Final note – 50% theory + 50% seminary work			

11. Labels ODD (Sustainable Development Goals)[2]

	General label for Sustainable Development							
								
								

[2] Keep only the labels that, according to the *Procedure for applying ODD labels in the academic process*, suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable.*”.

Date:
January 15th, 2025

Signature of course coordinator

Associate prof. dr. Keresztes Lujza

Signature of seminar coordinator

Associate prof. dr. Keresztes Lujza

Date of approval:
January 20th, 2025

Signature of the head of department

Associate prof. dr. Keresztes Lujza