COURSE DESCRIPTION

Assessment of Ecosystem Services

Academic year 2026–2027

1. Programme-related data

1.1. Higher Education Institution	Babeș-Bolyai University, Cluj-Napoca
1.2. Faculty	Faculty of Environmental Science and Engineering
1.3. Department	Environmental Engineering
1.4. Field	Environmental Science
1.5. Level of study	Master's degree
1.6. Degree programme / Qualification	Sustainable Development and Environmental Management
1.7. Form of education	Full time

2. Course-related data

2.1. Course title	Assessment of Ecosystem Services			**Course code**	NME4222
2.2. Course coordinator	Assoc. Prof. Dr. HARTEL Rudolf Tiberiu				
2.3. Seminar coordinator	Assoc. Prof. Dr. HARTEL Rudolf Tiberiu				
2.4. Year of study	II	**2.5. Semester**	IV	**2.6. Type of assessment**	Exam
2.7. Course status	Compulsory		**2.8. Course type**		Specialisation Subject (DS)

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	4	**of which: 3.2. course**	2	**3.3. seminar/ laboratory/ project**	2 (1 S + 1 L)
3.4. Total of hours in the curriculum	56	**of which: 3.5. course**	28	**3.6. seminar/ laboratory**	28 (14 S + 14 L)
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					25
Additional research in the library, on subject-specific electronic platforms, and on-site					10
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays (greater than or equal to the total number of hours specified in the course calendar for evaluation tasks)					15
Tutoring (professional guidance)					10

Examinations	4
Other activities [i.e.: two-way communication with the course coordinator/tutor]	5
3.7. Total hours of individual study (IS) and self-taught activities (ST)	**65**
3.8. Total hours per semester	**125**
3.9. Number of credits	**5**

4. Prerequisites (where applicable)

4.1. curriculum-related	It is recommended that students have previously completed coursework or have equivalent knowledge in one or more of the following areas: Environmental Science, Ecology, Geography, Sustainable Development, Natural Resource Management, Environmental Policy, or Environmental Economics. Such foundational knowledge will facilitate a deeper understanding of the concepts and methodologies addressed in this course.
4.2. skills-related	Ability to engage with scientific literature, synthesize information, and critically assess academic sources; basic knowledge of environmental systems, ecosystem processes, and socio-ecological relationships; competence in academic writing, report preparation, and oral communication; critical and integrative thinking, with openness to interdisciplinary approaches and methods. Use of basic software tools (Microsoft Office or open-source equivalents), basic data management and quantitative analysis, active participation in online learning environments, and navigation of scientific databases and reference management tools (Google Scholar, Scopus, Zotero, Mendeley).

5. Specific conditions (where applicable)

5.1. course-related	Delivery of the course requires basic logistical support: a digital video projector for the presentation of course materials; access to a computer with internet connection for multimedia presentations and interactive sessions; availability of an online platform (Microsoft Teams, Google Classroom, or equivalent) for sharing course materials and resources.
5.2. seminar/laboratory-related	Seminars and laboratory sessions require a multimedia projector and audio-visual equipment to support presentations, case studies, and group discussions; access to computers with basic data analysis software (Microsoft Excel, QGIS – optional but recommended for certain exercises); and internet access for online resources, databases, and collaborative learning tools. Compulsory attendance: students must attend at least 80% of seminar and laboratory sessions to be eligible for evaluation. Active participation in discussions, group work, and practical activities is expected and contributes to the final grade. Students are encouraged to bring their personal laptops (if available) for specific seminar tasks and field activities.

6.1. Competencies resulting from the completion of the degree programme (as referred to in the curriculum)

Professional competencies	
Competency code	**Competency**

PC2	Develop environmental policy: Develop an organisational policy on sustainable development and compliance with environmental legislation in line with policy mechanisms used in the field of environmental protection.
PC3	Assess environmental impact: Monitor environmental impacts and carry out assessments in order to identify and to reduce the organisation's environmental risks while taking costs into account.
PC6	Ensure compliance with environmental legislation: Monitor activities and perform tasks ensuring compliance with standards involving environmental protection and sustainability, and amend activities in the case of changes in environmental legislation. Ensure that the processes are compliant with environment regulations and best practices.
PC7	Conduct environmental site assessments: Manage and oversee environmental site prospection and assessments for mining or industrial sites. Designate and demarcate areas for geochemical analysis and scientific research.
PC9	Advise on environmental risk management systems: Evaluate requirements and advise on systems for environmental risk management. Ensure the customer does his part in preventing or limiting adverse environmental impact through the use of technology. Ensure required licenses and permits are obtained.
PC12	Perform scientific research: Gain, correct or improve knowledge about phenomena by using scientific methods and techniques, based on empirical or measurable observations.
Transversal competencies	
Competency code	**Competency**
TC1	Think analytically: Produce thoughts using logic and reasoning in order to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
TC2	Work in teams: Work confidently within a group with each doing their part in the service of the whole.
TC3	Report on environmental issues: Compile environmental reports and communicate on issues. Inform the public or any interested parties in a given context on relevant recent developments in the environment, forecasts on the future of the environment, and any problems and possible solutions.

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
PC2, PC3, PC6, PC7, PC9, PC12, TC1, TC3	The student/graduate identifies and describes the international environmental legislative and policy framework, the assessment and analysis procedures used in ecological management, and the principles of ecosystem services evaluation.	The student/graduate applies environmental legislation and policies in concrete situations; uses assessment and analysis procedures for ecological management; evaluates ecosystem services and integrates them into environmental decisions.
PC3, PC7, PC12, TC1	The student/graduate knows and understands the fundamental principles of social-ecological systems, the typologies of ecosystem services and their role in	The student/graduate analyses social-ecological systems, identifies vulnerability factors and proposes solutions for the sustainable management of ecosystem services.

	maintaining the resilience of human-modified landscapes.	
PC2, PC6, PC9, TC2, TC3	The student/graduate knows and understands governance mechanisms, the role of stakeholders involved, and the importance of interdisciplinary collaboration in managing ecosystem services.	The student/graduate contributes to the development of management strategies and scenarios, drafts recommendations for authorities and communities, and communicates the results of environmental assessments effectively.

7. Subject-specific learning outcomes (referred to by each subject coordinator across the range of competencies and learning outcomes at the level of the degree programme)

Knowledge and comprehension
1. The student knows and understands the fundamental principles of ecosystem services and their role in maintaining the resilience of social-ecological systems.
2. The student knows and understands concepts and theoretical frameworks for assessing human-nature interactions, including the valuation of ecosystem services.
3. The student knows and understands the typologies of ecosystem services (provisioning, regulating, cultural, supporting) and their relevance for sustainable development strategies.
4. The student knows and understands methods for integrating ecosystem services into environmental planning, management, and public policy-making.
5. The student knows and understands the links between biodiversity conservation, ecosystem services, and human well-being.
6. The student knows and understands the concepts of resilience, transformability, and biocultural refugia and their application to the analysis of human-modified landscapes.
7. The student knows and understands the international conventions and regulations relevant to ecosystem services (e.g., CBD, IPBES, EU Biodiversity Strategy).
Specific academic skills
1. The student will be able to critically analyse and evaluate case studies on the assessment and management of ecosystem services.
2. The student will be able to collect, process, and interpret environmental, social, and economic data relevant to ecosystem service evaluations.
3. The student will be able to develop strategic recommendations for improving the supply of ecosystem services in different landscape contexts (urban, rural, protected areas).
4. The student will be able to create graphical and analytical materials (maps, infographics, conceptual models) to represent ecosystem service dynamics.
5. The student will be able to collaborate in interdisciplinary teams to design sustainable management plans based on ecosystem service assessments.
6. The student will be able to identify and critically assess conflicts related to the supply, access, and distribution of ecosystem services in human-dominated landscapes.
7. The student will be able to develop and argue for alternative governance and management scenarios for human-modified landscapes.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks**

1. Social-ecological systems – introduction to systemic thinking, the importance of mental models in how complex systems are conceptualised, comparisons between social systems and ecosystems, and the challenges arising from these differences for the sustainable harmonisation of both systems.	Lecture, dialogue, interrogation	Emphasis on interactive discussion to explore students' mental models and biases regarding complex systems.
2. Human-modified landscapes – evolution, definitions, history, conceptualisations.	Lecture, dialogue, interrogation	Use of case studies from different cultural and geographic contexts to illustrate human impacts on landscapes.
3. Resilience and transformability of social-ecological systems – the concept of resilience, panarchy, ecological, biological and cultural memory, social-ecological traps, the decoupling and re-integration of social-ecological systems, and the challenges induced by globalisation.	Lecture, dialogue, interrogation	Reflection on real-world examples of resilience and collapse (e.g., agricultural systems, urban resilience).
4. Value domains that link human society to ecosystems (human-nature ties): cognitive, experiential, spiritual, material, and emotional values. Three domains of values: instrumental values (ecosystem services), intrinsic values, relational values. Examples for human-modified landscapes at European and global levels.	Lecture, dialogue, interrogation	Analysis of students' cultural influences to enrich understanding of diverse value systems.
5. Forms of capital used for the co-production of ecosystem services and disservices: human, social, financial, manufactured, and natural capital. How these capitals interact for ecosystem service co-production, the development path dependencies they imply, and the vulnerabilities they impose on the resilience of social-ecological systems.	Lecture, dialogue, interrogation	Real-world examples to explore capital interactions; short exercises to map capital flows.
6. Integration of ecosystem service co-production and biodiversity conservation in human-modified landscapes. The concepts of land-sparing, land-sharing, high natural and cultural value landscapes, and sustainable intensification. Application of these concepts to cultural, urban, and rewilded landscapes.	Lecture, dialogue, interrogation	Comparative analysis of land-sparing and land-sharing scenarios through group discussion.
7. Strategies and policies for governing ecosystem service co-production – the importance of pluralistic leadership, holistic vision, contextualisation, community-based resource management, and social capital.	Lecture, dialogue, interrogation	Group debates to foster critical thinking on leadership models and governance approaches.
8. Scenarios for ecosystem service supply in human-modified landscapes – the importance of scenarios, scenarios based on statistical models, participatory scenarios, and the importance of proactive attitudes.	Lecture, dialogue, interrogation	Introduction to participatory scenario-building techniques; possibility of mini-simulation exercises.
9. The concept of biocultural refugia and its applicability to the sustainability of cultural landscapes – parallels between glacial refugia and biocultural refugia, and the contribution of biocultural refugia to	Lecture, dialogue, interrogation	Field study examples (where possible); regional analyses delivered by

the social-ecological resilience of European landscapes. Examples through knowledge transfer, genetic resources, recolonisation by large carnivores, etc.		students through short presentations.
10. Social-ecological archetypes and typologies of human-modified landscapes – ecosystem services, socio-economic and ecological vulnerability, and the importance of research for understanding social-ecological and historical contexts.	Lecture, dialogue, interrogation	Students are encouraged to link archetypes with ecosystem service provision in their countries of origin.
11. International conventions and legislation relevant to ecosystem services – a critical approach.	Lecture, dialogue, interrogation	Critical reading and discussion of selected international treaties (e.g., CBD, IPBES, EU Biodiversity Strategy).
12. The importance of disciplinary, interdisciplinary, and transdisciplinary research for the holistic, solution-oriented understanding of human-modified landscapes in Europe and globally. The importance of a cross-sector perspective for the sustainable governance of ecosystem services.	Lecture, dialogue, interrogation	Case-based learning; examples of successful cross-sector collaborations.
13. The role of universities and the academic sphere in shaping and guiding the transformation of values at the societal level, for sustainability.	Lecture, dialogue, interrogation	Reflection on personal academic contributions to value transformation and sustainability advocacy.
14. Species and habitats of Community interest requiring extensive, multifunctional management.	Lecture, dialogue, interrogation	Use of maps and species profiles; analysis of management practices that promote multifunctionality.

Bibliography

Berkes, F., Colding, J., Folke, C. (2008). Navigating Social-Ecological Systems: Building Resilience for Complexity and Change. Cambridge University Press.

Chan, K. M. A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S. (2016). Why protect nature? Rethinking values and the environment. Proceedings of the National Academy of Sciences, 113: 1462–1465.

Hartel, T., Plieninger, T. (2014). European wood-pastures in transition: a social-ecological approach. Earthscan/Routledge.

Ives, C.D., Giusti, M., Fischer, J., et al. (2017). Human–nature connection: a multidisciplinary review. Current Opinion in Environmental Sustainability, 26–27: 106–113.

Piccolo, J. J. (2017). Intrinsic values in nature: Objective good or simply half of an unhelpful dichotomy? Journal for Nature Conservation, 37: 8–11.

Plieninger, T., Bieling, C. (2012). Resilience and the cultural landscape. Cambridge University Press.

Plieninger, T., Bieling, C. (2017). The Science and Practice of Landscape Stewardship. Cambridge University Press.

Loos, J., Abson, D., Dorresteijn, I., Hanspach, J., Hartel, T., Horcea-Milcu, A.I., Mikulcak, F., Fischer, J. (2017). Sustainable Landscapes in Central Romania: A social-ecological study on the future of Southern Transylvania. Pensoft.

8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**

1. Building complex virtual systems based on a large number of given elements. Group exercises. Debating the results.	Individual and group practical exercises	Develops systemic thinking and visualisation of complex social-ecological relationships.
2. Presentation of the history of a landscape selected by each student, according to the student's origin/experience.	Individual and group practical exercises	Encourages personal connection, intercultural learning, and appreciation of landscape diversity.
3. Carrying out social trap experiments and finding solutions to escape the trap.	Individual and group practical exercises	Reinforces understanding of common-pool resource dilemmas and cooperation strategies.
4. Estimating ecosystem services and disservices for a virtual landscape and developing a strategy to maximise diversity in the supply of ecosystem services. Synergies and trade-offs.	Individual and group practical exercises	Trains the ability to recognise synergies and trade-offs in ecosystem service management.
5. Exercises on food-production strategies and biodiversity conservation along an urban-rural gradient. The importance of the social context.	Individual and group practical exercises	Highlights the socio-economic context in shaping ecological strategies and land-use decisions.
6. Case study: developing a coexistence strategy between humans and large carnivores at the landscape level, in human-modified landscapes. Students are divided into interest groups and play the roles assigned by the teacher.	Individual and group practical exercises	Enhances negotiation skills, stakeholder analysis, and conflict resolution capacity.
7–8–9. Developing scenarios for the future of three distinct human-modified landscapes in Europe. These landscapes are chosen by the groups that are formed. Selection of landscapes from distinct regions of Europe and the world is encouraged.	Individual and group practical exercises	Promotes strategic planning, creativity, and interdisciplinary collaboration across regions.
10. Developing social-ecological archetypes and estimating ecosystem service production for the cultural landscapes addressed in exercises 7–8–9.	Individual and group practical exercises	Strengthens skills in pattern recognition and generalisation across diverse contexts.
11. Developing institutional governance networks for the landscapes addressed in exercises 7–8–9–10.	Individual and group practical exercises	Improves understanding of institutional arrangements, power relations, and governance challenges.
12. Developing virtual transdisciplinary research projects for the landscapes addressed in points 7–10.	Individual and group practical exercises	Fosters skills in research design, integration of disciplines, and practical problem-solving.
13. Developing model sustainable-development strategies for the universities from which students come – how can the university become the avant-garde of societal value change?	Individual and group practical exercises	Encourages leadership thinking and the proactive role of academia in societal transformation.

14. Field trip to Fânațele Clujului.	Field trip	Direct observation and analysis of biodiversity conservation challenges in multifunctional landscapes.

Bibliography

Hartel, T., Reti, K.O., Craioveanu, C. (2017). Valuing scattered trees from wood-pastures by farmers in a traditional rural region of Eastern Europe. Agriculture, Ecosystems & Environment, 236: 304–311.
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9. Evaluation

Type of activity	9.1 Evaluation criteria	9.2 Evaluation methods	9.3 Percentage in the final grade
9.4. Course	Level of understanding of the fundamental concepts of ecosystem services	Written examination	**50%**
	Capacity for analysis and synthesis of social-ecological systems		
	Integration of the ecosystem services conceptual framework into applied contexts		
	Quality of argumentation and critical thinking		
9.5. Seminar/ laboratory	Application of knowledge in practical contexts (case studies, exercises, field applications)	Case studies, portfolio	**30%**
	Quality of argumentation, collaboration, and active participation	Seminar participation	**20%**

9.6 Minimum standard for passing

Obtaining a minimum grade of 5 in each major component (written examination and seminar/laboratory activity).
Demonstrating understanding of at least 50% of the concepts, theories, and frameworks presented in the course (social-ecological systems, typologies of ecosystem services, value domains, governance strategies).
Applying at least 50% of the methods, tools, and techniques practised during seminars and laboratories (ecosystem services evaluation, analysis of social-ecological systems, scenario development).
Attending at least 80% of seminar and laboratory sessions.
Complying with ethical norms related to environmental management and interaction with human communities.

10. SDG labels (Sustainable Development Goals)

All Sustainable Development Goals are relevant to this course, given the integrative nature of ecosystem services assessment and sustainable development.

	x	Eticheta generală pentru Dezvoltare durabilă

								
○	○	○	○	○	○	○	○	○
								Nu se aplică nici o etichetă
○	○	○	○	○	○	○	○	○

Date of entry: 21.04.2026	**Signature of course coordinator:**	**Signature of seminar coordinator:**
	Assoc. Prof. Dr. HARTEL Rudolf Tiberiu 	Assoc. Prof. Dr. HARTEL Rudolf Tiberiu 

Date of approval in the department:	**Signature of the head of department:**