Syllabus
for the Educational Component of the Elective Component

Protection and Development of Large-Scale Wetlands

Course Title:	**Protection and Development of Large-Scale Wetlands**
Level of Higher Education:	Second (Master's)
Field of Study:	E Natural Sciences, Mathematics, and Statistics
Major:	E2 Ecology
Educational and Professional (Educational and Research) Program:	ECOLOGICAL SAFETY
Moodle Course Page:	*https://dl2022.khadi-kh.com/course/view.php?id=7455*
Academic Year:	**1**
Semester:	**2**
Course Load	6 credits (180 hours)
Final Assessment Format	Midterm exam
Office Hours:	as scheduled
Department Name:	Department of Ecology
Language of Instruction:	English
Course Instructor:	**Nataliia Vnukova**
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Summary of the educational component:

The objective of the course is to provide higher education students with a comprehensive understanding of the ecological, environmental, and socio-economic significance of large-scale wetlands, as well as modern approaches to their protection, monitoring, restoration, and sustainable management under conditions of increasing anthropogenic pressure and climate change. The course aims to develop students' competencies in assessing the ecological status of wetland ecosystems, analyzing biodiversity and ecosystem functions, evaluating environmental risks, applying modern monitoring technologies, and designing scientifically based conservation and rehabilitation strategies to ensure the sustainable development and resilience of wetland ecosystems.

This course examines the ecological structure and functioning of large-scale wetlands, their role in maintaining biodiversity, water quality regulation, climate adaptation, and flood mitigation, as well as the principles, methods, and tools for wetland conservation, monitoring, restoration, and sustainable management. Particular attention is paid to contemporary environmental challenges, including pollution, microplastic contamination, habitat degradation, climate change impacts, and the implementation of international and European environmental policies and management frameworks.

The main objectives of this course are:

- developing knowledge of the ecological characteristics, classification, distribution, and environmental significance of large-scale wetlands at national, regional, and global levels;
- studying the ecological functions and ecosystem services provided by wetlands and their contribution to biodiversity conservation, water regulation, and climate resilience;
- acquiring knowledge of international agreements, environmental legislation, and policy instruments related to wetland protection and sustainable management;

- mastering methods for assessing biodiversity and ecological integrity of wetland ecosystems using biological, ecological, and environmental indicators;
- developing skills in the assessment of wetland plant and animal communities and their role in maintaining ecosystem stability and environmental quality;
- acquiring practical competencies in water quality assessment and evaluation of environmental pollution in wetland ecosystems using modern ecological indicators and indices;
- studying sources, pathways, impacts, and monitoring methods of pollutants, including microplastics, in aquatic and wetland environments;
- mastering methodologies for ecological assessment of surface water bodies according to the requirements of the EU Water Framework Directive and related environmental standards;
- developing competencies in environmental monitoring of wetlands through field surveys, inventory methods, remote sensing technologies, and geographic information systems;
- acquiring practical skills in the application of satellite imagery and geospatial analysis for assessing vegetation dynamics, hydrological conditions, and ecosystem changes in wetlands;
- studying the impacts of climate change on wetland ecosystems, hydrological regimes, flood frequency, and ecological resilience;
- developing the ability to assess flood risks and design nature-based solutions and sustainable flood protection strategies;
- mastering principles and methods of riparian habitat conservation, restoration ecology, and aquatic ecosystem rehabilitation;
- acquiring knowledge of wetland restoration and rehabilitation measures aimed at mitigating ecosystem degradation and enhancing ecological resilience;
- developing the ability to evaluate ecological sustainability of wetlands and formulate adaptive management strategies within the framework of integrated river basin management and sustainable development.

Prerequisites for studying the educational component:

1. A bachelor's degree in a related field 2. A bachelor's degree in an unrelated field (subject to passing an additional entrance exam)

Competencies acquired by the student:

Integral: The ability to solve complex specialized problems and address practical challenges related to the protection, monitoring, restoration, and sustainable development of large-scale wetlands through the application of ecological theories, environmental assessment methods, geospatial technologies, biodiversity conservation approaches, and ecosystem-based management strategies under conditions of environmental uncertainty and climate change.

General:

Knowledge and understanding of the subject area and professional activities.

Ability to conduct research at the appropriate level.

Ability to make informed decisions and act responsibly while adhering to principles of academic integrity, environmental ethics, and sustainable development.

Professional:

Knowledge and understanding of the theoretical foundations of wetland ecology, environmental protection, biodiversity conservation, and sustainable natural resource management.

Ability to use modern information resources, databases, and scientific literature for environmental research and decision-making.

Ability to assess the ecological condition of wetlands and identify factors contributing to ecosystem degradation and biodiversity loss.
Ability to apply methods of environmental monitoring, ecological assessment, remote sensing, and geographic information systems for wetland management.
Ability to evaluate the impacts of environmental pollution, including microplastic contamination, on aquatic and wetland ecosystems.
Ability to assess the effects of climate change on hydrological processes, flood regimes, ecosystem functioning, and wetland resilience.
Ability to develop scientifically justified strategies for wetland conservation, restoration, rehabilitation, and sustainable management.

Learning outcomes in accordance with the curriculum:

Understand the ecological principles governing the structure, functioning, and sustainability of wetland ecosystems and their role in maintaining biodiversity and ecosystem services.

Understand contemporary environmental challenges affecting wetlands, including habitat degradation, pollution, climate change, and increasing anthropogenic pressures.

Be able to search for, analyze, and critically evaluate scientific, environmental, legal, and technical information relevant to wetland protection and management.

Be able to apply ecological assessment methods, biodiversity indicators, environmental indices, and water quality monitoring techniques for evaluating wetland conditions.

Be able to use geographic information systems (GIS), remote sensing technologies, satellite imagery, and environmental databases for wetland monitoring and spatial analysis.

Be able to assess ecological status and environmental quality of wetlands and surface water bodies in accordance with international and European environmental standards.

Be able to identify sources and impacts of environmental pollutants, including microplastics, and evaluate associated ecological risks.

Be able to analyze the effects of climate change on wetland ecosystems, hydrological processes, flood dynamics, and ecosystem resilience.

Be able to develop and justify conservation, restoration, rehabilitation, and adaptive management measures for wetland ecosystems.

Be able to design nature-based solutions for flood protection, biodiversity conservation, and sustainable ecosystem management.

Be able to communicate research findings, environmental assessments, and management recommendations effectively to professional audiences, stakeholders, and the general public.

Preserve and enhance societal achievements and environmental values through the promotion of sustainable wetland management, biodiversity conservation, ecosystem restoration, and climate adaptation practices.

Curriculum

Topic No.	Topics (lectures, practical exercises, independent study)	Number of hours	
		full-time	part-time
1	Lec. Protection of Large-Scale Wetlands	2	2
	Prac. Comparison of the largest wetland systems in Europe and the world.	2	2
	Indep. International agreements, national and regional efforts, and educational activities to protect	8	12

2	Lec. Ecology of Wetlands in Context of Important Functions	2	2
	Prac. The impact of anthropogenic pressure on the ecological functions of wetlands	2	2
	Indep. Research into the role of wetlands in maintaining biodiversity	8	12
3	Lec. Plant Biodiversity as a Keystone for Wetland Ecosystem Stability	2	2
	Prac. Assessment of plant biodiversity of wetlands using species richness indices	2	2
	Indep. Research of plant communities as bioindicators of aquatic environment quality. Methods of studying species biodiversity of wetland plants	8	12
4	Lec. The Role of Wetland Zoos in Biodiversity Education and Conservation	2	2
	Prac. Contribution of wetland fauna to maintaining ecological balance and preserving biodiversity	2	2
	Indep. Study of animal indicators of the ecological state of wetlands	8	12
5	Lec. Pollutants in Water and Wetland Ecosystems	2	2
	Prac. Assessment of Water Quality Based on the Universal Indicator – the Water Pollution Index	2	
	Indep. Methods of Surface Water Quality Assessment	8	12
6	Lec. Microplastics in Aquatic Ecosystem: Sources, Impacts and Solution	2	2
	Prac. Identification of microplastics using Fourier Transform Infrared and Raman spectroscopy	2	
	Indep. Methods of Microplastic Identification in Aquatic Systems and Their Potential Impact on Human Health	8	12
7	Lec. EU-water Directives: Monitoring of water bodies condition	2	
	Prac. Assessment of the Ecological Status of Surface Water Bodies according to the Methodology of the EU Water Framework Directive (WFD, 2000/60/EC))	2	
	Indep. Monitoring and Evaluation of the Ecological Status of Surface Water Bodies in Accordance with the Principles and Requirements of the EU Water Framework Directive (2000/60/EC)	8	12
8	Lec. Monitoring of the Wetland Biological resources State	2	
	Prac. Methods for inventorying the main components of wetland	2	
	Indep. Review of open information sources for monitoring wetland	8	12
9	Lec. Application of Wetland Bioresources Monitoring for Sustainable Management and Resilience	2	
	Prac. Application of geographic information systems and remote sensing technologies for monitoring wetland and adjacent areas	2	
	Indep. Research on the state of vegetation and water cover of wetland and adjacent areas based on satellite images	8	12
10	Lec. Impact of Climate Change on Flood Frequency and Intensity	2	
	Prac. Assessment of the Impact of Climate Change on Flood Frequency and Intensity	2	

	Indep. Assessment of Climate Change Impacts on Flood Regimes and Risk Management Strategies	8	12
11	Lec. Strategies for Sustainable Flood Protection and Risk Management	2	
	Prac. Development of a nature-based flood protection strategy for a local community	2	
	Indep. Comparative analysis of European and National approaches to sustainable flood risk management	8	12
12	Lec. Riparian Landscape Restoration	2	
	Prac. Riparian Habitat Identification and Typology Mapping	2	
	Indep. Critical Review of Riparian Restoration Failures	8	12
13	Lec. Conservation and Restoration of Aquatic Ecosystem	2	
	Prac. Methods of Aquatic Ecosystem Restoration: Modern Approaches and Technologies	2	
	Indep. The Impact of Climate Change on the Condition of Aquatic Ecosystems	8	6
14	Lec. Measures of Wetland Restoration and Rehabilitation	2	
	Prac. Identification of causes of pollution and consequences of degradation of wetland areas with a view to developing adaptive rehabilitation measures	2	
	Indep. Review of successful practices in wetland restoration and rehabilitation	8	6
15	Lec. Wetlands in the Context of Climate Change Adaptation and Sustainable Development	2	
	Prac. Research on climate change and determination of bioclimatic stability of wetland in the context of sustainable development and basin management	2	
	Indep. Assessment of the overall ecological sustainability of wetland based on the indicator of anthropogenic pressure on the river basin	8	4
In total	Lec.	**30**	**12**
	Prac	**30**	**8**
	Indep.	**120**	**160**

Individual Research Assignment (if applicable): -

Students, as part of the assignment of research work among faculty members of the Department of Ecology, select a research area in consultation with their advisor, formulate the topic and objectives of their research-which are documented in the research assignment letter-and work on the chosen topic throughout the semester.

Teaching methods:

1) verbal: 1.1 traditional: lectures, explanations, storytelling, etc.;
2) visual: use of illustrations, demonstrations;
3) practical: 3.1 traditional: practical exercises.

Grading system and requirements – spring semester; form of final assessment – credit.

Students current academic performance, based on their performance on in-class assignments and independent work, is evaluated on a 100-point scale in accordance with the “Regulations on the Assessment of Student Learning Outcomes at Higher Education Institutions of the Kharkiv National Automobile and Highway University. The results of the

assessment of the current academic performance of higher education students are recorded in the academic performance log. All types of work specified in the curriculum are taken into account when assessing current academic performance.

1.1. Lectures are assessed through oral questioning or by means of testing.

1.2. Practical classes are assessed based on the quality of the practical work's execution and presentation, as well as the report on the completion of practical work.

2. The final grade for ongoing performance is calculated as the sum of points for:

- standardized tests, oral examinations, class attendance, and active participation in class;
- completion of assignments required for practical classes.

The distribution of points awarded to students based on the results of ongoing assessment is presented in Table 1.

Table 1 – Breakdown of scores by topic for determining the final grade for ongoing work

Ongoing monitoring															Together for discipline
topic 1	topic 2	topic 3	topic 4	topic 5	topic 6	topic 7	topic 8	topic 9	topic 10	Topic 11	topic 12	topic 13	topic 14	topic 15	100
7	7	7	7		7	7	7	7	7	6	6	6	6	6	

Final assessment in the form of a test (2nd semester):

1. A student receives a passing grade in the final class of a course based on the results of the ongoing assessment. To receive a passing grade, the student's current grade in the course must be at least 60 points.

2. Students with an average current grade in the course below 60 points may improve their current grade during the final class by taking a combined (written and oral) exam, which consists of standardized tests. Students who have completed the assignments required for the practical sessions are eligible to take the final assessment.

3. The learning outcome is assessed on a two-point scale (pass/fail) according to Table 2.

Table 2 – Conversion Scale for Scores to the National Grading System

On a 100-point scale	**On the national scale**
60 to 100 points	passed
less than 60 points	failed

On a 100-point scale (for a graded assessment) as shown in Table 3.

Table 3 – Grading Scale for Students Based on the Results of the Final Exam in the Course

Score	national grading scale		Grading on the ECTS scale	
			Assessment	Criteria
	examination	credit test		

Score	national grading scale		Grading on the ECTS scale	
	examination	credit test	Assessment	Criteria
90-100	**great**	**credited**	**A**	The theoretical content of the course has been fully mastered with no gaps; the necessary practical skills for working with the material have been acquired; all learning objectives specified in the curriculum have been met; and the quality of their completion has been assessed with a grade close to the maximum
80–89	**good**	**credited**	**B**	The theoretical content of the course has been fully mastered, with no gaps; the necessary practical skills for working with the material have been largely developed; all learning objectives specified in the curriculum have been met; and the quality of most of these tasks has been graded with a score close to the maximum.
75-79			**C**	The theoretical content of the course has been fully mastered, with no gaps; however, some practical skills related to the material covered have not been sufficiently developed. All learning tasks specified in the curriculum have been completed, and none received a grade below the minimum passing score; some types of tasks were completed with errors.
67-74	**satisfactory**		**D**	The theoretical content of the course has been partially mastered, but the gaps are not significant; the necessary practical skills for working with the material covered have largely been developed; most of the learning tasks specified in the curriculum have been completed; some of the completed tasks may contain errors
60–66			**E**	The theoretical content of the course has been partially mastered; some practical skills have not been developed; many of the learning tasks specified in the curriculum have not been completed; and the quality of some of the completed tasks has been graded with a score close to the minimum.

Score	national grading scale		Grading on the ECTS scale	
			Assessment	Criteria
	examination	credit test		
35–59	**unsatisfactory**	**unsatisfactory**	**FX**	The theoretical content of the course has been partially mastered; the necessary practical skills have not been developed; most of the learning tasks specified in the curriculum have not been completed, or the quality of their completion has been rated with a score close to the minimum; with additional independent study of the course material, it is possible to improve the quality of the learning tasks (with the possibility of retaking the course)
0–34	**unsatisfactory**		**F**	The theoretical content of the course has not been mastered, the necessary practical skills have not been developed, all completed assignments contain serious errors, and additional independent study of the course material will not lead to any significant improvement in the quality of the assignments (with a mandatory repeat of the course)

Recognition of Non-Formal and Informal Learning Outcomes

The recognition of an applicant's non-formal and/or informal learning outcomes involves the following procedures: submission by the applicant of an application for recognition (no later than within the first 10 business days of the start of the semester in which the course is taken); verification of the results of non-formal and/or informal learning declared by the applicant in writing; evaluation of the applicant's declared learning outcomes; and a decision to recognize and credit the applicant with all or part of the learning outcomes for the course, or to deny recognition. The procedure for implementing these procedures is regulated by STVNH 83.1-02:2022 "Recognition of Learning Outcomes Obtained Through Non-formal and Informal Education"

Course Policy:

– The course involves group work; the classroom environment is friendly, creative, and open to constructive criticism;

– Successful completion of the course requires mandatory attendance at lectures and practical sessions, as well as independent study;

– Independent study involves studying specific topics of the course that are designated in the syllabus for self-study or were covered briefly;

– All assignments specified in the syllabus must be completed by the deadline;

– If a student is absent from class for a valid reason, they must present the completed assignments during independent study and consultation with the instructor;

– The term paper must be defended no later than one week before the start of the exam period **(if applicable)**;

– While taking this course, students must adhere to the rules of academic integrity set forth in the following documents: "Rules of Academic Integrity for Participants in the Educational Process at Kharkiv National Automobile and Highway University"

(https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "Academic Integrity. Checking academic, scientific, and qualification papers for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85.1-02.pdf), "Code of Ethics for Participants in the Educational Process at Kharkiv National Automobile and Highway University" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
– If plagiarism is detected, the student will receive a score of 0 for the assignment and must retake the assignments specified in the syllabus;
– Cheating during quizzes and exams is prohibited (including the use of mobile devices). Mobile devices may only be used during online testing.

Suggested reading:

1. Mitsch W. J., Gosselink J. G. Wetlands. 6th ed. Hoboken : John Wiley & Sons, 2024.
2. Tiner R. W. Wetland Indicators: A Guide to Wetland Identification, Delineation, Classification and Mapping. 3rd ed. Boca Raton : CRC Press, 2022.
3. Adam E., Mutanga O., Cho M. A. (eds.). Remote Sensing of Wetlands: Applications and Advances. Amsterdam : Elsevier, 2022.
4. Brix H., Vymazal J., Mander Ü. (eds.). Nature-Based Solutions in Wetland Restoration and Water Management. London : IWA Publishing, 2023.
5. Hester E. T., Doyle M. W. River and Wetland Restoration: Processes, Assessment and Management. 2nd ed. Hoboken : Wiley, 2023.
6. Wagner M., Lambert S. (eds.). Freshwater Microplastics: Emerging Environmental Contaminants. Amsterdam : Elsevier, 2022.
7. Campbell J. B., Wynne R. H. Introduction to Remote Sensing. 6th ed. New York : Guilford Press, 2022.
8. Waltham N., Searle R. Environmental Monitoring and Assessment. Hoboken : Wiley, 2022.
9. Keddy P. A. Wetland Ecology: Principles and Conservation. 3rd ed. Cambridge : Cambridge University Press, 2024.
10. Finlayson C. M., Davidson N. C., Milton G. R., Prentice R. C. (eds.). The Wetland Book. Cham : Springer Nature (Living Reference Work, continuously updated edition).

Additional sources:

1. Convention on Wetlands. Global Wetland Outlook 2025: Valuing, Conserving, Restoring and Financing Wetlands. Gland : Secretariat of the Convention on Wetlands, 2025.
2. Convention on Wetlands. Global Wetland Outlook: Special Edition 2021. Gland : Ramsar Convention Secretariat, 2021.
3. Intergovernmental Panel on Climate Change (IPCC). Climate Change 2023: Synthesis Report. Geneva : IPCC, 2023.
4. United Nations Environment Programme. Adaptation Gap Report 2024. Nairobi : UNEP, 2024.
5. UNESCO. United Nations World Water Development Report 2024: Water for Prosperity and Peace. Paris : UNESCO, 2024.
6. European Environment Agency. Europe's Water Resources under Pressure: State of Water Assessment 2024. Copenhagen : EEA, 2024.
7. European Commission. EU Biodiversity Strategy for 2030. Brussels : European Commission, updated implementation reports, 2024–2025.
8. European Parliament and Council. Water Framework Directive 2000/60/EC. Consolidated version, 2024.

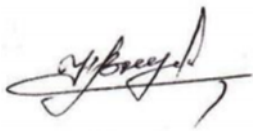
9. European Parliament and Council. Floods Directive 2007/60/EC. Consolidated version, 2024.
10. Food and Agriculture Organization of the United Nations. The Status of the World's Land and Water Resources for Food and Agriculture (SOLAW 2024). Rome : FAO, 2024.

Ukrainian sources:

1. Ministry of Environmental Protection and Natural Resources of Ukraine. National Biodiversity Conservation Strategy of Ukraine until 2030. Kyiv, 2023.
2. Ministry of Environmental Protection and Natural Resources of Ukraine. National Report on the State of the Environment in Ukraine in 2024. Kyiv, 2025.
3. Institute of Hydrobiology of the National Academy of Sciences of Ukraine. Current State of Aquatic Ecosystems of Ukraine and Approaches to Their Restoration. Kyiv, 2024.
4. National Academy of Sciences of Ukraine. Assessment of Climate Change Impacts on Water Resources and Aquatic Ecosystems of Ukraine. Kyiv, 2024.
5. Grebin V. V., Obodovskyi O. H., Yatsyk A. V. et al. Recent publications on integrated water resources management, river basin monitoring and ecological assessment of surface waters of Ukraine. Kyiv : Taras Shevchenko National University of Kyiv, 2021–2025.
6. Scientific papers of the Institute of Hydrobiology NAS of Ukraine (2020–2025).
7. Scientific papers of the Ukrainian Hydrometeorological Institute of the State Emergency Service of Ukraine and NAS of Ukraine (2020–2025).
8. Articles published in the journals Hydrobiological Journal, Environmental Safety and Natural Resources, Agroecological Journal, and Balanced Nature Management (2020–2025).

https://dl2022.khadi-kh.com/course/view.php?id=7455 Online course in the subject « **Protection and Development of Large-Scale Wetlands** ».

Syllabus developer
for the course
Doctor of Engineering,



Professor signature Nataliia VNUKOVA
Last name and first name