Syllabus
for the Educational Component of the Elective Component

Agriculture and Climate-Adapted Land Use Systems

Course Title:	**Agriculture and Climate-Adapted Land Use Systems**
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=7442*
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**
Phone Number:	**+38050-596-69-11**
Email:	*ecologyknady@gmail.com*

Summary of the educational component:
The objective is to equip higher education students with a systematic understanding of modern approaches to the rational use of land resources in agriculture under conditions of climate change, to help them acquire skills in assessing the condition of soils and agricultural landscapes, analyzing natural, anthropogenic, and technogenic factors affecting land resources, as well as mastering methods for monitoring, reclamation, and the development of adaptive land-use systems aimed at ensuring environmental sustainability, preserving soil fertility, and increasing the efficiency of agricultural production.
This course examines the patterns of functioning and transformation of land resources and agricultural landscapes under the influence of natural, anthropogenic, technogenic, and climatic factors, as well as the principles, methods, and tools for developing adaptive land-use systems, monitoring soil conditions, their protection, restoration, and ensuring the sustainable development of agricultural production under conditions of climate change.
The main objectives of this course are:

- developing knowledge of the natural conditions of soil formation, as well as the structure and state of land resources in Ukraine and worldwide;
- studying current issues related to the use of agricultural land and the impact of climate change on its productivity;
- acquiring skills in assessing soil quality, conducting agroecological analysis, and monitoring land resources;
- mastering methods for applying remote sensing, geographic information systems, and other modern tools to monitor changes in soil cover;
- mastering approaches to assessing anthropogenic and technogenic transformations of agricultural landscapes and their ecological and socio-economic consequences;

- developing the ability to analyze risks of land degradation, erosion processes, soil contamination, and loss of soil fertility;
- acquiring practical skills in developing adaptive land-use systems and measures to enhance the resilience of agricultural production to climate change;
- studying technologies for the reclamation and biological restoration of disturbed lands;
- mastering the principles of designing protective forest belts and other nature conservation measures to minimize climate and environmental risks;
- developing the ability to formulate land-use adaptation plans and evaluate the effectiveness of management decisions in the field of sustainable development of the agricultural sector.

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 issues in the fields of agricultural land use, land resource conservation, soil condition monitoring, and the adaptation of agricultural systems to climate change, which involves the application of modern theories, methods, and technologies for sustainable natural resource management, agroecology, land planning, and land resource management in the context of complex and uncertain external factors.

General:

Knowledge and understanding of the subject area and professional activities.
Ability to conduct research at the appropriate level.
Ability to make decisions and take action while adhering to the principle of zero tolerance for corruption and any form of misconduct.

Professional:

Knowledge and understanding of the theoretical foundations of ecology, environmental protection, and sustainable natural resource management.
Ability to use modern information resources for environmental research.
Ability to assess the condition of land resources and soil cover, identify processes of their degradation, and develop measures to prevent them.
Ability to apply methods of environmental monitoring, remote sensing, and geoinformation technologies to analyze the condition of agricultural landscapes and land resources.
Ability to assess the impact of climate change on the functioning of agroecosystems and the efficiency of agricultural land use.

Learning outcomes in accordance with the curriculum:

Understand the fundamental environmental laws, principles of land resource conservation, and the foundations of sustainable land use in the context of agricultural land management.

Understand contemporary concepts, as well as the theoretical and practical challenges associated with land resource use, soil conservation, and the adaptation of agricultural systems to climate change.

Be able to search for, analyze, and critically evaluate information from scientific, regulatory, and informational sources to make informed decisions in the field of land resource management.

Be able to apply software tools, geographic information systems (GIS), remote sensing technologies, and Internet resources to monitor soil conditions, assess agricultural landscapes, and conduct environmental research.

Be able to present the results of research, analytical assessments, and design solutions regarding adaptive land use to a professional audience and the general public in the form of reports, presentations, and lectures.

Be able to assess the impact of natural, anthropogenic, and climatic factors on the condition of land resources and predict the consequences of their impact on agroecosystems.

Be able to conduct environmental assessments of soil quality, identify risks of land degradation, erosion processes, and soil contamination.

Be able to justify and develop measures for the reclamation, restoration, and protection of land resources, as well as the adaptation of agricultural land use to climate change.

Be able to develop conceptual models of adaptive land use systems and evaluate their environmental and economic effectiveness.

Preserve and enhance society's achievements and values based on an understanding of the role of rational natural resource management and environmentally safe land use in ensuring sustainable development.

Curriculum

Topic No.	Topics (lectures, practical exercises, independent study)	Number of hours	
		full-time	part-time
1	Lec. Concepts of natural systems and classification of soil influencing their formation	2	2
	Prac. Reclamation work technology	2	2
	Indep. Prepare a brief report on key factors influencing soil formation in your region	8	12
2	Lec. Assessment of the global chernozem resource considering their condition, area, and dynamics of changes	2	2
	Prac. Environmental monitoring of soils. Soil degumification	2	2
	Indep. Spatial monitoring of chernozem soil changes using remote sensing and GIS technologies	8	12
3	Lec. Current challenges in the field of global agricultural land use	2	2
	Prac. agroecological assessment of soils	2	2
	Indep. Transformation of agricultural landscapes under the influence of climate change	8	12
4	Lec. Modern challenges of efficient land use in the agricultural sector of Ukraine	2	2
	Prac. Analysis of environmental indicators of efficient land use	2	2
	Indep. The main contemporary approaches to improving the efficiency of land use	8	12
5	Lec. Impact of climate change on the efficiency of agricultural land use in Ukraine	2	2
	Prac. «Assessment of Climate Change Impacts on Agricultural Land Productivity in Different Regions of Ukraine»	2	
	Indep. «Adaptation of Agricultural Land Use Systems in Ukraine to Climate Change: Case Studies and Innovative Practices»	8	12
6	Lec. Assessment of problems of anthropogenic	2	2

	transformations in the agricultural sector of Ukraine		
	Prac. Calculation of the regulatory monetary valuation of agricultural land	2	
	Indep. Socio-economic consequences of anthropogenic pressure on agricultural landscapes of Ukraine	8	12
7	Lec. Assessment of technogenic transformations in the agricultural sector of Ukraine: problems and consequences (technogenic risks)	2	
	Prac. Assessment of anthropogenic pollution of agricultural soils	2	
	Indep. Modernisation of mechanisms to reduce anthropogenic impact on agricultural land	8	12
8	Lec. Concept of adaptive land use systems in the agricultural sector	2	
	Prac. Develop a conceptual scheme of an adaptive land use system for a selected region	2	
	Indep. Summarize key elements of adaptive management in agriculture	8	12
9	Lec. Recultivation processes as a key tool for land restoration	2	
	Prac. Methods of biological reclamation: assessment of plant indicators of restoration	2	
	Indep. Monitoring the effectiveness of reclamation measures	8	12
10	Lec. Measures to minimize risks: Windbreak plantings and other barriers	2	
	Prac. Design a scheme of windbreak placement for a specific landscape	2	
	Indep. Study best practices of protective afforestation in dry regions	8	12
11	Lec. Features of adaptation of agricultural land use in Ukraine to climate change	2	
	Prac. Assessment of Climate Change Impacts on Agricultural Land Productivity in Different Regions of Ukraine	2	
	Indep. Adaptation of Agricultural Land Use Systems in Ukraine to Climate Change: Case Studies and Innovative Practices	8	12
12	Lec. Methodology and tools for monitoring soil quality in the agricultural sector	2	
	Prac. Practical application of soil quality assessment methods: sampling and laboratory analysis	2	
	Indep. Comparative analysis of modern soil monitoring tools (field sensors, remote sensing, GIS)	8	12
13	Lec. Assessment of the dynamics of changes in soil properties under the influence of agricultural activities and climatic factors	2	
	Prac. Assessment of the intensity of erosion processes on agricultural lands	2	
	Indep. Using climate models and scenarios to predict changes in soil properties	8	6
14	Lec. Political and socio-economic aspects of adaptation of the agricultural sector to climate change	2	
	Prac. Analysis of policy instruments and management	2	

	decisions for agricultural sector sdaptation to climate change		
	Indep. Socio-economic barriers and incentives for the adoption of climate-adaptive practices by farmers	8	6
15	Lec. Prospects for the development of climate-adapted land use systems in Ukraine	2	
	Prac. Designing a Climate-Adaptation Plan for a Farm in Southern Ukraine	2	
	Indep. Policy and Economic Incentives for Agroforestry Implementation in Ukraine	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		
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.

Score	national grading scale		Grading on the ECTS scale	
			Assessment	Criteria
	examination	credit test		
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.
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. Campbell J. B., Wynne R. H. *Introduction to Remote Sensing*. 6th ed. New York : Guilford Press, 2022. 672 p.
2. Brady N. C., Weil R. R. *The Nature and Properties of Soils*. 16th ed. Harlow : Pearson Education, 2022. 992 p.
3. Vadrevu K. P., et al. *Remote Sensing of Agriculture and Land Cover/Land Use Changes*. Cham : Springer, 2022. 617 p.
4. Triantakonstantis D., Tziachris P. (eds.). *Integrating GIS and Remote Sensing in Soil Mapping and Modeling*. Basel : MDPI, 2022. 320 p.
5. Dharumarajan S., et al. *Remote Sensing of Soils: Mapping, Monitoring and Measurement*. Amsterdam : Elsevier, 2023. 740 p.
6. Ahamed T. (ed.). *Remote Sensing Applications II: A Climate Change Perspective in Agriculture*. Cham: Springer, 2024. 550 p.
7. Kumar P., Aishwarya. *Technological Approaches for Climate-Smart Agriculture*. Cham : Springer Nature, 2024. 411 p.

8. Waltham N., Searle R. *Environmental Monitoring and Assessment*. Hoboken : Wiley, 2022. 350 p.
9. Eswaran H., Lal R., Reich P. F. *Land Degradation: An Overview*. Boca Raton : CRC Press, 2022. 280 p.
10. Montgomery D. R. *Growing a Revolution: Bringing Soil Back to Life*. New York : W. W. Norton & Company, 2022. 320 p.

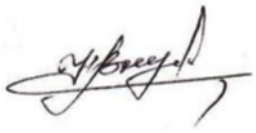
Additional sources:

1. Food and Agriculture Organization of the United Nations. *Climate-Smart Agriculture Sourcebook*. Rome : FAO, 2022.
2. Food and Agriculture Organization of the United Nations, Intergovernmental Technical Panel on Soils. *State of Knowledge of Soil Biodiversity*. Rome : FAO, 2021–2022.
3. Intergovernmental Panel on Climate Change. *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Cambridge : Cambridge University Press, 2022.
4. Intergovernmental Panel on Climate Change. *Climate Change 2023: Synthesis Report*. Geneva : IPCC, 2023.
5. European Environment Agency. *Climate Change Adaptation and Agriculture in Europe*. Copenhagen : EEA, 2023.
6. United Nations Environment Programme. *Global Environment Outlook 7 (draft/preparatory reports)*. Nairobi : UNEP, 2024.

https://dl2022.khadi-kh.com/course/view.php?id=7442 Online course in the subject «**Agriculture and Climate-Adapted Land Use Systems**».

Syllabus developer
for the course
Doctor of Engineering,

Professor



signature

Nataliia VNUKOVA
Last name and first name