

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES  
OF UKRAINE**

**Department of Analytical and Bioinorganic Chemistry and Water quality**

**APPROVED**  
**Agrobiological Faculty**  
**“\_18\_”\_June\_2026 p.**

**CURRICULUM OF ACADEMIC DISCIPLINE**  
**AGROECOLOGY**

**Area of knowledge H – Agriculture, forestry, fisheries and veterinary medicine**

**Specialty H1 – Agronomy**

**Academic programme Agronomy**

**Faculty Agrobiological**

**Developed by: Olha KRAVCHENKO Assoc. prof, PhD associated professor of**  
**Department of Analytical and Bioinorganic Chemistry and Water Quality**

**Kyiv – 2026 p.**

### Description of the discipline

Discipline forms students' holistic view of the phenomena and processes in the agricultural sphere, to master new approaches, the best practices, principles, and methods of conducting ecologically balanced agriculture, to get familiar with the means of reproducing the productivity of modern agricultural landscapes, and to ensure the production of ecologically safe products and formation of ecological awareness.

The objective of discipline studies is the provision of knowledge about methods and means of increasing the productivity of agroecosystems and reducing the negative impact on the environment; study of the main properties, structure, and functioning of agrobiogeocenoses as artificial ecosystems; understanding the principles of ecologically balanced agriculture; mastering methods for assessing the ecological state of agroecosystems and its components

<b>Area of knowledge, specialty, academic programme, academic degree</b>		
Academic degree	<i>bachelor's</i>	
Specialty	<i>H1 - Agronomy</i>	
Academic programme	<i>Agronomy</i>	
<b>Characteristics of the discipline</b>		
Type	Compulsory	
Total number of hours	90	
Number of ECTS credits	3	
Number of modules	2	
Course project (work) (if any)		
Form of assessment	<i>exam</i>	
<b>Indicators of the discipline for full-time and part-time forms of university study</b>		
	<b>University study</b>	
	<b>Full-time</b>	<b>Part-time</b>
Year of study		
Term		
Lectures	<i>15 hours</i>	<i>hours</i>
Practical classes and seminars	<i>15 hours</i>	<i>hours</i>
Laboratory classes	<i>hours</i>	<i>hours</i>
Self-study	<i>60 hours</i>	<i>hours</i>
Number of hours per week for full-time students	<i>2 hours</i>	

#### **1. Aim, competences and expected learning outcomes of the discipline**

Aim is to form students a holistic view of the phenomena and processes in the agricultural sphere, to master new approaches, principles and methods of conducting ecologically balanced agriculture, to get familiar with the means of reproducing the

productivity of modern agricultural landscapes and to ensure the production of ecologically safe products and formation of ecological awareness

**List of academic disciplines preceding the study of “Agroecology”:**

- Chemistry (Inorganic and Analytical)

**Competences acquired:**

**Integral competence (IC):** The ability to solve complex specialized tasks and practical problems in agronomy, which involves the application of theories and methods of the relevant science and is characterized by the complexity and uncertainty of conditions.

**General competence (GC):**

GC 7: Ability to apply knowledge in practical situations;

GC 8: Skills for carrying out safe activities;

GC 11: The desire to preserve the environment.

**Special (professional) competence (SC):**

SC 7: The ability to scientifically substantiate the use of fertilizers and plant protection products, considering their chemical and physical properties and impact on the environment;

SC 9: Ability to manage complex activities or projects, responsibility for decision-making in specific production conditions.

**Expected learning outcomes (ELO):**

ELO 9. Possess at the operational level methods of observation, description, identification, classification, as well as cultivation of objects and maintaining the stability of agrocenoses while preserving natural diversity;

ELO 10. Analyze and integrate knowledge from general and special professional training to the extent necessary;

ELO 13. Design and organize activities for growing high-quality agricultural products in accordance with current requirements.

**2. Programme and structure of the discipline**

Modules and topics	Number of hours						
	full-time						
	weeks	total	including				
1			p	lab	ind.	s.st.	
<b>Module №1. Agroecosystems and their natural-resource potential</b>							
Topic #1. Scientific bases of agroecology. The purpose and tasks of discipline studying	2	11	2	1			30
Topic #2. “Agroecosystems: Structural and Functional Organization and the Role of Abiotic Factors in Their Functioning”	2	15	2	3			
Topic #3-4. “Biotic Components and Their Interactions in Agroecosystem”	3	18	3	3			
<b>Total for module 1</b>	<b>7</b>	<b>44</b>	<b>7</b>	<b>7</b>			<b>30</b>
<b>Module №2. Theoretical and methodological principles of agroecological monitoring</b>							
Topic #5. Ecological Aspects of Pesticide and Agrochemical Use	2	13	2	1			
Topic #6. The Biological Approach to Environmental Assessment. Biomonitoring and	2	9	2	1			

bioindication							
Topic #7. Bioassay: an important tool for evaluating ecological safety	2	14	2	4			30
Topic #8. Ecological certification and labeling of agricultural production	2	10	2	2			
<b>Total for module 2</b>	<b>8</b>	<b>46</b>	<b>8</b>	<b>8</b>			<b>30</b>
<b>Total hours</b>	<b>90</b>		<b>15</b>	<b>15</b>			<b>60</b>

### 3. Topics of lectures

No.	Topic	Hours
<b>Module №1. Agroecosystems and their natural-resource potential</b>		
1	Scientific bases of agroecology. The purpose and tasks of disciplin	2
2	Agroecosystems: Structural and Functional Organization and the Role of Abiotic Factors in Their Functioning	2
3-4	Agroecosystems: Structural and Functional Organization and the Role of Abiotic Factors in Their Functioning	3
<b>Module №2. Theoretical and methodological principles of agroecological monitoring</b>		
5	Ecological Aspects of Pesticide and Agrochemical Use	2
6	The Biological Approach to Environmental Assessment. Biomonitoring and bioindication	2
7	Bioassay: an important tool for evaluating ecological safety	2
8	Ecological certification and labeling of agricultural production	2
<b>Total</b>		<b>15</b>

### 4. Topic of practical classes

No.	Topic	Hours
<b>Module №1. Agroecosystems and their natural-resource potential</b>		
1.1	The influence of abiotic factors on the growth and development of plants. Agroecological characteristics of agricultural crops	2
1.2	Ecological bases of Crop rotation	1
1.3	Modeling of agroecosystems contamination by radionuclides	2
1.4	Response and adaptation of crops to Air pollution	2
<b>Module №2. Theoretical and methodological principles of agroecological monitoring</b>		
2.1.1	Determination of total water hardness, concentration of Calcium and Magnesium in irrigation water	1
2.1.2	Determination of water mineralization (TDS) in irrigation water	1
2.2	Assessment of Water Quality for Irrigation	2
2.3	Determination of nitrate content in vegetables, fruits and water	2
2.4	Assessment of Pesticides Toxicity Using the Allium-Test	2
<b>Total</b>		<b>15</b>

## 5. Topics of self-study

No.	Topic	Hours
<b>Module №1. Agroecosystems and their natural-resource potential</b>		
1	Biogeochemistry of trace elements in Agroecosystems (Academic search)	30
<b>Module №2. Theoretical and methodological principles of agroecological monitoring</b>		
2	Assessment of the effectiveness and ecological safety of pesticides	30
<b>Total</b>		<b>60</b>

## 6. Methods of assessing expected learning outcomes:

- oral or written survey;
- interview;
- test;
- defending laboratory/practical, design/graphical works, projects;
- poster defending
- peer-to-peer assessment, self-assessment.

## 7. Teaching methods:

- problem-based method;
- practice oriented studying method;
- case method;
- project education method;
- flipped classroom, mixed education method;
- research based method;
- learning discussions and debates method;
- team work, brainstorm method
- gamification studying method.

## 8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

### 8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
<b>Module №1. Agroecosystems and their natural-resource potential</b>		
Practical training 1.3 "The influence of abiotic factors on the growth and development of plants. Agroecological characteristics of agricultural crops"	<b>To be able to give</b> the agroecological characteristics of crops. <b>To explain</b> what abiotic factors are and describe their role in plant growth and development	<b>10</b>
Practical training 1.2 "Ecological bases of Crop rotation"	<b>To define</b> crop rotation and explain its role in sustainable agriculture. <b>To analyze</b>	<b>10</b>

	examples of crop rotation schemes and evaluate their ecological effectiveness.	
Practical Training 1.3 "Modeling of agroecosystems contamination by radionuclides"	<b>To evaluate</b> potential health and ecological risks from radionuclide transfer through the food chain.	<b>20</b>
Self-study 1 "Biogeochemistry of trace elements in Agroecosystems (Academic search)"	<b>To conduct</b> academic searches using scientific databases (e.g., Scopus, Web of Science, Google Scholar) to find relevant peer-reviewed articles. <b>To analyze</b> biogeochemical cycles of elements and their most important compounds	<b>20</b>
Practical training 1.4 "Response and adaptation of crops to Air pollution"	<b>To understand</b> the influence of various abiotic factor on the stability of agroecosystems. <b>To conduct</b> observational or laboratory-based experiments to assess plant stress indicators.	<b>20</b>
Module control test 1.		<b>20</b>
<b>Total for module 1</b>		<b>100</b>
<b>Module №2. Theoretical and methodological principles of agroecological monitoring</b>		
Self-Study 2 "Assessment of the effectiveness and ecological safety of pesticides"	<b>To compare</b> different classes of pesticides based on their mode of action, persistence, and bioaccumulation potential.	<b>15</b>
Practical training 2.1.1 "Determination of total water hardness, concentration of Calcium and Magnesium in irrigation water"	<b>To perform</b> titrimetric analysis to determine the total hardness of irrigation water samples. <b>To calculate</b> the concentrations of calcium and magnesium ions in irrigation water, based on titration results.	<b>12</b>
Practical training 2.1.2 "Determination of water mineralization (TDS) in irrigation water"	<b>To define</b> water mineralization (TDS) and their role in assessing water quality. <b>To measure</b> water mineralization using gravimetric methods.	<b>3</b>
Practical Training 2.2 "Assessment of Water Quality for Irrigation"	<b>To evaluate</b> irrigation water quality with Ukrainian and international water quality standards.	<b>20</b>
Practical Training 2.3 Determination of nitrate content in vegetables, fruits and water	<b>to determine</b> the nitrate content in plant products and assess their suitability for consumption according to this indicator.	<b>10</b>
Practical Training 2.4 "Assessment of Pesticides Toxicity Using the Allium-Test"	To <b>prepare</b> test setups using onion bulbs exposed to pesticide solutions. <b>To be able to evaluate</b> the toxicity of agrochemicals to biota using biological methods	<b>20</b>
Module control test 2.		<b>20</b>
<b>Total for module 2</b>		<b>100</b>
<b>Class work</b>	<b>(M1 + M2)/2*0,7 ≤ 70</b>	
<b>Exam</b>	<b>30</b>	
<b>Total for discipline</b>	<b>(Class work + exam) ≤ 100</b>	

## 8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

## 8.3. Assessment policy

<b>Deadlines and exam retaking rules</b>	Works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
<b>Academic integrity rules</b>	Cheating during tests and exams is prohibited (including using mobile devices). Plagiarism and unauthorized use of AI are strictly prohibited. All work must be completed independently. Violations may result in a failing grade or further disciplinary measures. Term papers and essays must have correct references to the literature used
<b>Attendance rules</b>	Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

## 9. Teaching and learning aids:

- e-learning course of the discipline (<https://elearn.nubip.edu.ua/course/view.php?id=2610>);
- Kravchenko, O., Tonkha, O., & Ushchapivska, T. (2026). Agroecology: Workbook for practical and independent study for students' specialty H1 – "Agronomy" [Methodological workbook]. Expo-druk. 112 p.
- abstracts of lectures and their presentations (in electronic form);

## 10. Recommended sources of information

1. Gliessman, S. R. (2021). Package price agroecology: The ecology of sustainable food systems. CRC press
2. Voitenko L. Chemistry with the foundations of biogeochemistry: manual. Kyiv: Naukova stolytsa, 2019. 400 p. (In Ukrainian).
3. Gliessman, S. R., Méndez, V. E., Izzo, V. M., & Engles, E. W. (2022). Agroecology: Leading the transformation to a just and sustainable food system. CRC Press.
4. Ecology of agrosphere (handbook): [https://www.agroeco.org.ua/wp-content/uploads/Publications/ecology\\_agrosphere.pdf](https://www.agroeco.org.ua/wp-content/uploads/Publications/ecology_agrosphere.pdf)
5. SEGAE: a serious game to learn agroecology <https://www.segae.org/game/>

6. Chobotar, V. V., Kopilevich, V. A., & Kravchenko, O. O. (2024). Analysis of Natural Water Quality in the Dniester River Basin for Economic Utilization. *Journal of Water Chemistry and Technology*, 46(6), 636-644. <https://doi.org/10.3103/S1063455X24060031>
7. Chobotar, V., Kravchenko, O., & Tkalenko, H. (2024). Effectiveness of nanoaqua-chelates of transition metals against scab in industrial apple plantations. *Quarantine and plant protection*, (4), 29-35. <https://doi.org/10.36495/2312-0614.2024.4.29-35>
8. Hnatiuk, T., Kravchenko, O., Abarbarchuk, L., Churilov, A., & Chobotar, V. (2023). Influence of drugs produced by electropulse ablation methods on the development of soybean phytopathogenic bacteria. *Plant and Soil Science*, 14(3), 22-34. <https://doi.org/10.31548/plant3.2023.22>
9. Antraptseva, N. M., Kochkodan, O. D., Solod, N. V., & Kravchenko, O. O. (2023). The behavior of  $\text{Co}_{3-x}\text{M}^{\text{II}}_x(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$  ( $\text{M}^{\text{II}} = \text{Mg}, \text{Mn}, \text{Zn}$ ) solid solutions at elevated temperatures. *Functional materials*, 30(4), 519-525. <https://doi.org/10.15407/fm30.04.519>
10. Antraptseva N., Solod N., Kochkodan O., Kravchenko O. (2022), Co-precipitation of cations of zinc and divalent metals from phosphoric acid solutions, *Functional Materials*, 29(4), pp. 597–604, <https://doi.org/10.15407/fm29.04.597>
11. Kravchenko, O. O., et al. "Sensitivity of phytopathogenic and nodule bacteria of soybeans to microelements preparations obtained by electropulse ablation." *Науковий журнал «Біологічні системи: теорія та інновації»* 12.1 (2021): 36-43. <http://dx.doi.org/10.31548/biologiya2021.01.004>
12. Antraptseva, N., Solod, N., & Kravchenko, O. (2021). Features of the synthesis of solid solutions of divalent metal phosphates with a newberyite structure. *Functional Materials*, 28(3), 573-579. <https://doi.org/10.15407/fm28.03.573>
13. Antraptseva, N., Solod, N., & Kravchenko, O. (2020). Influence of crystal hydrate water on the process and products of heat treatment of magnesium-manganese (II) of dihydrogen phosphates. *Functional Materials*, 27(4), 820-826. <https://doi.org/10.15408/fm.27.04.820>
14. Kravchenko, O et al. Порівняльна оцінка якості питної води окремих населених пунктів Могилів Подільського району Вінницької області. *Науковий журнал «Біологічні системи: теорія та інновації»*, (2020): v. 11, n. 3, p. 63-73, <http://dx.doi.org/10.31548/biologiya2020.03.007>.

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