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NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE
Department of Agroecology and Environmental Control

APPROVED
Faculty of Plant Protection,
Biotechnology and Ecology

"21"___05__2025_

CURRICULUM OF ACADEMIC DISCIPLINE
«Ecology »

Area of knowledge 10 Natural Sciences
Specialty 101 Ecology
Academic programme Ecology
Faculty of Plant Protection, Biotechnology and Ecology
Developed by: Associate Professor, PhD in Agricultural Sciences **L. Vagaliuk**

Kyiv – 2025

Description of the discipline «Ecology »

The discipline "**Ecology**" provides students with a foundational understanding of the relationships between organisms and their environment, the structure and function of ecosystems, and the principles governing ecological systems. The course explores key ecological concepts such as ecological factors, population dynamics, community structure (biocenosis), trophic relationships, and ecosystem processes.

Students will study biogeochemical cycles (carbon, nitrogen, phosphorus, sulfur, oxygen, and water), ecological succession, and the biosphere as a global system. The course also addresses how organisms adapt to environmental conditions, ecological laws, and the impacts of human activities such as pollution and habitat destruction.

Special attention is given to current global ecological challenges, including climate change, biodiversity loss, and resource depletion, with an emphasis on sustainability and the role of ecology in solving environmental problems.

Field of knowledge, specialty, educational program, educational degree		
Educational degree	Bachelor	
Specialty	101"Ecology"	
Educational program	Ecology	
Characteristics of the discipline		
Kind of the discipline	Compulsory	
Total number of hours	150	
Credit amount ECTS	5	
Number of content modules	2	
Course project	Course project	
Form of control	Exam	
Indicators of academic discipline for full-time and part-time forms of education		
	Full-time	Part-time
Year of preparation (course)	2	3
Semester	3	5
Lectures	30	2
Practical, seminar classes	-	-
Laboratory classes	45	-
Individual work	75	100
Number of weekly classrooms hours for full-time study	5	

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

The purpose of the course "**Ecology"** is to provide students with a comprehensive understanding of the fundamental ecological principles that govern the interactions between organisms and their environment. The course is designed to develop both theoretical knowledge and practical competencies essential for analyzing ecological systems at the population, community, ecosystem, and biosphere levels.

The main objectives of the course are to:

- Understand the structure and function of ecosystems and the biosphere;
- Explore the influence of abiotic and biotic ecological factors on living organisms;
- Study the dynamics of populations and biological communities;
- Analyze biogeochemical cycles and energy flow in ecosystems;

- Examine ecological laws and models of succession;
- Evaluate the impact of human activities on natural systems and global ecological stability.

Upon successful completion of the course, students will be able to demonstrate knowledge of:

- Core concepts in ecology including population dynamics, community interactions, and ecosystem structure;
- Biogeochemical cycles (carbon, nitrogen, phosphorus, sulfur, oxygen, and water) and their role in ecosystem functioning;
- Mechanisms of adaptation and survival in different environmental conditions;
- Ecological laws and their application in environmental analysis;
- The concept of ecological succession and ecosystem development;
- Causes and consequences of environmental pollution;
- Global environmental problems and their ecological dimensions;
- The biosphere as an integrated system of life and matter circulation.

Students will acquire the following practical skills:

- Applying ecological research methods in field and laboratory conditions;
- Analyzing population and community-level data;
- Evaluating ecological factors and their influence on organisms and ecosystems;
- Identifying stages of ecological succession in various ecosystems;
- Assessing anthropogenic pressures and proposing mitigation measures;
- Using scientific instruments for measuring environmental parameters;
- Interpreting ecological data to support environmental decision-making;
- Communicating ecological findings using scientific terminology and digital tools;
- Following safety protocols during ecological fieldwork and laboratory experiments.

Competences acquired:

Acquisition of Competencies *(According to the approved Educational and Professional Program for the specialty 101 "Ecology")*

1. Integral Competence (IC): The ability to solve complex specialized tasks and address practical problems in the field of ecology, environmental protection, and sustainable nature management, which involves the application of fundamental theories and methods of environmental sciences, characterized by complexity and uncertainty of conditions.

2. General Competencies (GC):

GC01. Knowledge and understanding of the field of study and related professional practice.

GC13. Ability to preserve and enhance moral, cultural, and scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the overall system of knowledge about nature and society, and in the development of society, technology, and engineering; ability to use various types and forms of physical activity for active recreation and maintaining a healthy lifestyle.

GC15. Knowledge and understanding of the theoretical foundations of ecology, environmental protection, and sustainable natural resource use.

GC21. Ability to conduct environmental monitoring and assess the current state of the environment.

Program Learning Outcomes (PLO):

PLO02. To understand the basic ecological laws, regulations, and principles of environmental protection.

PLO18. To combine skills of independent and teamwork to achieve results, with an emphasis on professional integrity and responsibility in decision-making.

PLO22. To participate in the development of projects and practical recommendations for environmental conservation."

2. Programme and structure of the discipline

Names of content modules and topics	Number of hours									
	full-time					part-time				
	total	including				total	including			
		l.	p.	lab.	ind.		l.	p.	lab.	ind.
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Module 1. Fundamentals of Ecology and Population Dynamics										
Lecture 1. Introduction to General Ecology	10	2	-	3	5	14	2	-	2	10
Lecture 2. Ecological Factors	10	2	-	3	5	10		-	-	10
Lecture 3. Population as a Unit of Evolution	10	2	-	3	5	10	-	-	-	10
Lecture 4. Biocenosis: Structure and Interactions	10	2	-	3	5	10	-	-	-	10
Lecture 5. Ecosystem	10	2	-	3	5	5	-	-		5
Lecture 6. Trophic Structure	10	2	-	3	5	5	-			5
Total for the module 1	60	12	-	18	30	54	2	-	2	50
Module 2. Ecosystem Processes, Biogeochemical Cycles, and Environmental Challenges										
Lecture 7. Biogeochemical Cycles: General Principles	10	2		3	5	14	2	-	2	10
Lecture 8. Carbon, Oxygen, and Water Cycles	10	2		3	5	12		-	2	10
Lecture 9. Nitrogen, Phosphorus, and Sulfur Cycles	10	2		3	5	10	-	-	-	10
Lecture 10. Biosphere	10	2		3	5	10	-	-	-	10
Lecture 11. Adaptations of Organisms to the Environment	10	2		3	5	10	-	-	-	10
Lecture 12. Ecological Laws	10	2		3	5	-	-	-	-	-
Lecture 13. Succession and Ecosystem Development	10	2		3	5	-	-	-	-	-
Lecture 14. Environmental Pollution	10	2		3	5	-	-	-	-	-
Lecture15.Global Environmental Issues	10	2		3	5	-	-	-	-	
Total for the module 2	90	18		27	45	56	2	-	4	50
Total	150	30		45	60	110	4	-	6	100

3. Topics of lectures

No.	Topic	Hours
1	Introduction to General Ecology	2
2	Ecological Factors	2
3	Population as a Unit of Evolution	2
4	Biocenosis: Structure and Interactions	2
5	Ecosystem	2

8	Trophic Structure	2
9	Biogeochemical Cycles: General Principles	2
10	Carbon, Oxygen, and Water Cycles	2
11	Nitrogen, Phosphorus, and Sulfur Cycles	2
12	Biosphere	2
13	Adaptations of Organisms to the Environment	2
14	Ecological Laws	2
15	Succession and Ecosystem Development	2
	Total	30

4. Topic of laboratory (practical, seminars) classes

№	Topics	Number hours
	Module 1. Fundamentals of Ecology and Population Dynamics	
1	Ecological Research Methods: Fieldwork and Data Collection Techniques	3
2	Impact of Environmental Factors on Organismal Tolerance and Responses	3
3	Study of Organismal Adaptations to Diverse Environmental Conditions	3
4	Analysis of Population Structure, Density, and Dynamics	3
5	Assessment of Community Composition and Biodiversity Indices	3
6	Construction and Analysis of Food Chains, Food Webs, and Ecological Pyramids	3
	Module 2. Ecosystem Processes, Biogeochemical Cycles, and Environmental Challenges	
7	Study and analysis of biogeochemical cycles and their ecological significance.	3
8	Investigation of the processes and environmental impacts of carbon, oxygen, and water cycles.	3
9	Examination of nutrient cycles, microbial involvement, and anthropogenic effects.	3
10	Analysis of biosphere structure, functions, and human influence on global systems.	3
11	Practical study of physiological, morphological, and behavioral adaptations.	3
12	Experimental verification and discussion of key ecological principles and laws.	3
13	Observation and analysis of primary and secondary successions in ecosystems.	3
14	Identification, classification, and monitoring of various types of pollution.	3
15	Study of major global issues such as climate change, urbanization, and land degradation.	3
	Total	45

5. Topics of self-study

No.	Topic	Number hours
1.	Analysis of Abiotic and Biotic Factors in Local Ecosystems	6
2.	Population Dynamics: Case Study of a Selected Species	6
3.	Structure and Interactions within Biocenoses	5
4.	Ecosystem Functions and Energy Flow	5
5.	Investigation of Trophic Relationships and Food Webs	5
6.	Role and Impact of Biogeochemical Cycles in Ecosystem Stability	5
7.	Adaptations of Organisms to Different Environmental Conditions	5
8.	Study of Ecological Laws and Their Application in Environmental Management	4
9.	Analysis of Ecosystem Succession and Development	5

10.	Assessment of Environmental Pollution and Its Effects on Ecosystems	5
11.	Human Ecological Footprint and Sustainable Resource Use	4
12.	Methods of Ecological Monitoring and Data Collection	4
13.	Bioindication and Environmental Quality Assessment	4
14.	Climate Change Impacts on Ecosystems	4
15.	Global Environmental Problems and International Environmental Policy	4
	Total	60

6. Methods of assessing expected learning outcomes:

- Oral or written questioning
- Exam
- Module tests
- Essays, presentations
- Calculations (individual assignments**)**
- Defense of practical works

7. Teaching methods*:*

- Verbal method (lecture, discussion, interview, etc.)
- Practical method (laboratory and practical classes)
- Visual method (illustration method, demonstration method)
- Working with educational and methodological literature (note-taking, summarizing, annotating, reviewing, writing essays)
- Video method (distance learning, multimedia, web-based formats, etc.)
- Independent work (completion of assignments)
- Individual research work of higher education students

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
Module 1. Fundamentals of Ecology and Population Dynamics		
Laboratory Work 1. Ecological Research Methods: Fieldwork and Data Collection Techniques	To become familiar with the fundamental methods of ecological research, including fieldwork and desk-based techniques for collecting, recording, and analyzing environmental data. To understand the importance of accurate data collection for assessing ecosystem conditions and dynamics.	10
Laboratory Work 2. Impact of Environmental Factors on Organismal Tolerance and Responses	To understand how various environmental factors influence the tolerance limits and physiological, behavioral, and morphological responses of organisms. To study the concept of tolerance zones and critical thresholds that determine organism survival and adaptation in changing environments.	10
Laboratory Work 3. Study of Organismal Adaptations to Diverse Environmental Conditions	To explore the variety of physiological, morphological, and behavioral adaptations that organisms develop in response to different environmental conditions. To understand how these adaptations enhance survival, reproduction, and ecological success in various habitats.	10
Laboratory Work 4. Analysis of Population Structure, Density, and Dynamics	To understand the fundamental concepts and methods used to analyze population structure,	10

	density, and dynamics. To learn how population characteristics influence ecological interactions and evolutionary processes.	
Laboratory Work 5.Assessment of Community Composition and Biodiversity Indices	To study the structure and composition of biological communities and to learn methods for quantifying biodiversity using various ecological indices. To understand the importance of biodiversity metrics in ecosystem assessment and conservation.	10
Laboratory Work 6. Construction and Analysis of Food Chains, Food Webs, and Ecological Pyramids	To understand the organization of trophic relationships within ecosystems by constructing and analyzing food chains, food webs, and ecological pyramids. To explore energy flow and matter cycling through different trophic levels.	10
Self-study 1. Calculation of Population Growth Parameters and Ecological Impact Assessment	To acquire skills in calculating key population growth parameters and evaluating their implications for ecosystem dynamics and environmental management. To assess the ecological impacts of population changes on habitats and community stability.	10
Module control work 1.		**30**
Total for module 1	PLO 02, PLO 018.	**100**
Module 2. Ecosystem Processes, Biogeochemical Cycles, and Environmental Challenges		
Laboratory Work 7. Study and analysis of biogeochemical cycles and their ecological significance.	To explore the structure, components, and functioning of major biogeochemical cycles and understand their role in maintaining ecosystem stability. To analyze the impact of human activities on these cycles and associated ecological consequences.	10
Laboratory Work 8. Investigation of the processes and environmental impacts of carbon, oxygen, and water cycles.	To study the pathways and processes of the carbon, oxygen, and water cycles, their interconnection within ecosystems, and the consequences of their disruption due to natural and anthropogenic influences.	10
Laboratory Work 9. Examination of nutrient cycles, microbial involvement, and anthropogenic effects.	To examine the structure and functioning of nutrient cycles (nitrogen, phosphorus, sulfur), the role of microorganisms in these processes, and the consequences of human impact on nutrient balance in ecosystems.	10
Laboratory Work 10. Analysis of biosphere structure, functions, and human influence on global systems.	To develop an understanding of the biosphere as a global ecological system, its structural and functional organization, and the effects of human activities on its stability and resilience.	10
Laboratory Work 11. Practical study of physiological, morphological, and behavioral adaptations.	To explore the mechanisms by which organisms adapt to different environmental conditions through physiological, morphological, and behavioral traits, and to understand how these adaptations enhance survival and reproductive success.	10
Laboratory Work 12. Experimental verification and discussion of key ecological principles and laws.	To experimentally verify fundamental ecological laws and principles (e.g., Liebig's Law of the Minimum, Shelford's Law of Tolerance), and to understand their relevance in explaining organism-environment interactions.	10

Laboratory Work 13. Observation and analysis of primary and secondary successions in ecosystems.	To observe and analyze the patterns, processes, and stages of primary and secondary successions in natural or simulated ecosystems, and to understand their role in ecosystem development and stability.	5
Laboratory Work 14. Identification, classification, and monitoring of various types of pollution.	To gain knowledge and practical skills in identifying different types of environmental pollution, classifying their sources and effects, and applying methods for pollution monitoring and assessment.	2
Laboratory Work 15. Study of major global issues such as climate change, urbanization, and land degradation.	To explore the causes, processes, and consequences of key global environmental challenges, including climate change, urbanization, and land degradation, and to evaluate their ecological, economic, and social implications.	3
Module control work 2.		**30**
Total for module 2	PLO 02, PLO 22	**100**
Class work		**(M1 + M2)/2*0,7 ≤ 70**
Exam/credit		**30**
Total for year		**(Class work + exam) ≤ 100**

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

Deadlines and exam retaking rules	*EXAMPLE:* 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).
Academic integrity rules	*EXAMPLE:* cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
Attendance rules	*EXAMPLE:* 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=2431
- *https://elearn.nubip.edu.ua/course/view.php?id=843)*;
- references to digital educational resources;
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time and part-time students;
- internship programmes of the discipline (if included in the curriculum)

1. Vagaluk, L.V. General Ecology and Neoecology*:* Methodical Guidelines for Practical Classes and Independent Work for Students Majoring in 101 "Ecology" (Full-time and Part-time Forms of Study). Kyiv: Komprint, 2017. – 62 p.

2. Rubezhnyak I., Vagaluk L. Ecology and Neoecology: Textbook / I.H. Rubezhnyak, L.V. Vagaluk. — Kyiv: Komprint, 2017. — 232 p.

10. Recommended sources of information

1. Molles, M. C., & Sher, A. A. (2021). *Ecology: Concepts and Applications* (9th ed.). McGraw-Hill Education. – 608 p.

2. Hui, C., & Richardson, D. M. (2022). *Invading Ecological Networks*. Cambridge University Press. – 356 p.

3. Newton, A. C. (2021). *Ecosystem Collapse and Recovery*. Cambridge University Press. – 384 p.

4. Matthews, T. J., Triantis, K. A., & Whittaker, R. J. (2021). *The Species–Area Relationship: Theory and Application*. Cambridge University Press. – 270 p.

5. Ovaskainen, O., & Abrego, N. (2020). *Joint Species Distribution Modelling: With Applications in R*. Cambridge University Press. – 368 p.

6. Prach, K., & Walker, L. R. (2020). *Comparative Plant Succession among Terrestrial Biomes of the World*. Cambridge University Press. – 320 p.

7. Dudgeon, D. (2020). *Freshwater Biodiversity: Status, Threats and Conservation*. Cambridge University Press. – 472 p.

8. Woodmansee, R. G., Moore, J. C., & Ojima, D. S. (2021). *Natural Resource Management Reimagined: Using the Systems Ecology Paradigm*. Cambridge University Press. – 320 p.

List of International Regulatory Documents in Ecology

1. Convention on Biological Diversity, 1992. United Nations.

2. Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997. United Nations.

3. Paris Agreement under the United Nations Framework Convention on Climate Change, 2015. United Nations.

4. Montreal Protocol on Substances that Deplete the Ozone Layer, 1987. United Nations Environment Programme.

5. Vienna Convention for the Protection of the Ozone Layer, 1985. United Nations Environment Programme.

6. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989. United Nations Environment Programme.

7. Stockholm Convention on Persistent Organic Pollutants, 2001. United Nations Environment Programme.

8. United Nations Convention on the Law of the Sea (UNCLOS), 1982. United Nations.

9. Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, 1998. United Nations Economic Commission for Europe.

10. Bern Convention on the Conservation of European Wildlife and Natural Habitats, 1979. Council of Europe.