

Ministry of Education and Science of Ukraine  
National University of Water and Environmental Engineering  
Institute of Agroecology and Land Management  
Water Bioresources Department

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"APPROVED"  
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Pedagogical, Methodical and  
Educational Work  
\_\_\_\_\_  
O.A. Lahodniuk  
“ \_\_\_\_ ” \_\_\_\_\_ 2020

**Program of the Educational Component**  
**FUNDAMENTALS OF ECOLOGY**  
**for foreign students (language of instruction – English)**

Specialty: **all specialties**

Specialization: **all specializations**

Program of the educational component "Fundamentals of ecology" for foreign students studying at all specialties NUWEE (language of instruction – English). – Rivne: NUWEE, 2020. – 12 p.

Developed by; Y.R. Grokhovska, Doctor of Agricultural Sciences, Professor of Water Bioresources Department

Program was approved at the meeting of Water Bioresources Department

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Head of Water Bioresources Department

V.V. Sondak

Considered and approved

Scientific and Methodical commission on the quality of the Scientific Research Institute of Agroecology and Land Management

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Head of SMC on the quality of the Scientific Research Institute of Agroecology and Land Management

A.M. Pryshchepa

Considered and approved

Scientific and Methodical Council of the NUWEE

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Scientific secretary of the Scientific and Methodological Council

T.A. Kostyukova

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## INTRODUCTION

Ecology is the scientific discipline, that is concerned with the relationship between organisms and their past, present and future environments, both living and non-living. Environmental science is the interdisciplinary study of how humanity interacts with other organisms and the nonliving physical environment. The objects of ecology and environmental research are mainly systems above the level of individual organisms: populations, biocenoses, ecosystems, as well as the entire biosphere. The subject of research is the organization and functioning of such systems under the human impact.

The main goal of the course is to form knowledge about ecology as a science, its main concepts; to study the diversity of environmental problems, their occurrence, consequences and solutions. It is a part of ecological literacy, which is a powerful concept as it creates a foundation for an integrated approach to environmental problems.

The discipline combines information about the levels of hierarchy of organisms according to the current ecological and environmental research in those fields. This is the basis for the professional training of students.

### Abstract

The program of the compulsory (normative) educational component “Fundamentals of ecology” is compiled according to the bachelor’s training programs of different specialties. The course is developed for foreign students of full-time and part-time study that are taught in English. The course aims at acquiring by the students of the necessary minimum knowledge about ecology as a science and its main concepts; the diversity of environmental problems, their occurrence, consequences and solutions. From the solution of the problems are depended humans’ health and wellbeing, as well as humankind’ surviving in the future. Thus the course prepares the foundation for the study of other key natural, economic and technical courses.

**Key words:** biodiversity, ecology, ecosystem, environmental problems, ecological factors, pollution, resource depletion.

## Анотація

Програма обов'язкової (нормативної) дисципліни «Основи екології» складена відповідно до навчальних планів підготовки бакалаврів різних спеціальностей. Курс розроблено для іноземних студентів денної та заочної форм навчання, які навчаються на англійській мові. Він спрямований на здобуття студентами необхідного мінімуму знань про екологію як науку та її основні поняття, різноманітність екологічних проблем, причини їх виникнення, наслідки і способи вирішення. Від вирішення цих проблем залежить здоров'я і добробут людей, а також виживання людства в майбутньому. Тому ця дисципліна забезпечує основу для подальшого вивчення ключових природничих, економічних та технічних курсів.

**Ключові слова:** біорізноманіття, екологія, екосистема, екологічні проблеми, екологічні фактори, забруднення, виснаження ресурсів.

### 1. Description of the educational component

Name indicators	Branch of knowledge, specialty, level of higher education	Characteristics of the educational component	
		full-time education	part-time education
Established ECTS Credits – 3	<i>All specialties</i>	Normative	
Modules – 1		Year of preparation:	
Content modules – 2		1	1
Total hours – 90		Lectures	
		16 hours	2 hours
Weekly hours for full-time study: classroom – 2 independent work of the student – 4	Educational level <i>Bachelor</i>	Practical classes	
		-	-
		Laboratory classes	
		14 hours	6 hours
		Independent work	
	60 hours	82 hours	
	Type of Control: test		

**Note.** The ratio of the number of classes to independent and individual work of students: for full-time education - 35% to 65%; for part-time education - 10% to 90%.

## 2. Aims and tasks of the course

The main **aim** of the course is to develop the understanding by students the principles of organization of ecological communities (i.e. ecosystems) and using those principles for creating sustainable human communities.

The course is aimed at communities, populations and organisms in nature, as well as with manmade or human influenced environments (plantation forests, wheat fields, grain stores, nature reserves and so on), and with the consequences of human influence on nature (pollution, overharvesting, global climate change etc).

The main **tasks** of the course:

- learning the interactions among organisms and their environment, this includes both biotic and abiotic components;
- learning the systems above the level of individual organisms their organization and functioning: populations, biocenoses, ecosystems, and biosphere.
- learning the main environmental problems, that appeared due to the human impact and their mitigation.

As a result of studying students should **know**:

- three levels which ecology deals with: the individual organism, the population and the community;
- different biotic and abiotic factors, as well as their influence on organisms and ecosystems;
- main causes of environmental degradation and pollution;
- mitigation measures for solution the environmental problems.

**To be able to:**

- investigate the interactions between organisms and their environment and make conclusions about it;
- investigate the relationship between a population of organisms and some physical characteristic of their environment, such as concentration of a chemical;
- investigate the interaction between two populations of different organisms through some symbiotic or competitive relationship;
- understand the principles of organization of ecosystems and their potential application for building a sustainable human society;

- use their knowledge for an individual scientific work for obtaining qualification level.

The course gives students extra theoretical knowledge and practical skills, aiming to help them to understand complex interdependence of ecological and social systems in their motherhood country.

### **3. Content of the educational component**

#### **Content Module 1. Ecology: from individuals to ecosystems**

##### **1. Introduction to Ecology and Environmental Science**

Ecology and Environmental Science. Brief history of Ecology. Ecology as a multi-disciplinary science. Pure and applied ecology.

##### **2. Organism and its habitat**

Habitats. Aquatic habitat. The main characteristics of aquatic habitat. Major threats to the ocean. Terrestrial habitat. Major threats to the terrestrial ecosystems. Soil as a habitat. The major threat to the soil. Living organisms as a habitat.

##### **3. Primary abiotic factors and adaptations of organisms**

Environmental factors and their classification. Adaptations of organisms. General laws of environmental factors effect on organisms. Limiting factors. Minimum law of Liebig, tolerance law of Shelford. Primary abiotic factors and adaptations of organisms

##### **4. Populations and Communities**

Concept of “population”. Main characteristics of the population. Biological structure of populations. Ethological structure of populations. Population dynamics: fertility, mortality, immigration and emigration of species. Life history strategies and natural selection. Structure of the biocenosis. Species wealth. Species diversity. Species interactions. Biological diversity.

##### **5. Ecosystems and Biosphere**

The concept of the ecosystem and biogeocoenosis. Food web structure. Succession and stability. Agroecosystems. The concept of the Biosphere. Geochemical cycle in the biosphere. The evolution of the biosphere.

#### **Content Module 2. Environmental problems**

##### **6. Overpopulation, global climate change and environmental degradation**

Overpopulation. Urbanization. Global warming. Fossil fuels. Sea

level rise. Greenhouse gas. Flooding. Habitat destruction. Deforestation. Desertification. Biodiversity loss. Invasive species. Water degradation.

### 7. Pollution and resource depletion

Water pollution: nonpoint source pollution, point source pollution. Air pollution. Health effects. Consumerism. Fishing. Logging. Mining.

### 8. Mitigation measures

Sustainable development. Nature conservation. Environmental technology. Renewable energy. Water purification. Air purification. Sewage treatment. Environmental remediation. Solid waste management.

## 4. The structure of the educational component

Titles of modules and topics	Number of hours			
	Total hours	lectures	Laboratory classes	Independent work
1	2	3	4	5
<b>Module 1</b>				
<b>Content module 1. Ecology: from individuals to ecosystems</b>				
Topic 1. Introduction to Ecology and Environmental Science	6	2	-	4
Topic 2. Organism and its habitat	12	2	2	8
Topic 3. Primary abiotic factors and adaptations of organisms	12	2	2	8
Topic 4. Populations and Communities	12	2	2	8
Topic 5. Ecosystems and Biosphere	12	2	2	8
<i>Total of content module 1</i>	<i>54</i>	<i>10</i>	<i>8</i>	<i>36</i>
<b>Content module 2. Environmental problems</b>				
Topic 6. Overpopulation, global climate change and environmental	12	2	2	8

Titles of modules and topics	Number of hours			
	Total hours	lectures	Laboratory classes	Independent work
1	2	3	4	5
degradation				
Topic 7. Pollution and resource depletion	12	2	2	8
Topic 8. Mitigation measures	12	2	2	8
<i>Total of content module 2</i>	<i>36</i>	<i>6</i>	<i>6</i>	<i>24</i>
<b>Total number of hours</b>	<b>90</b>	<b>16</b>	<b>14</b>	<b>60</b>
<b>Module 2</b>				
Individual scientific task	-	-	-	-

### 5. Seminars

*Seminars are not provided for by the curriculum*

### 6. Practical classes

*Practical classes are not provided for by the curriculum*

### 7. Laboratory classes

№	Titles of topics	Number of hours
1	Exploration of species	2
2	Exploration of habitats	2
3	Exploration of primary abiotic factors and adaptations of organisms	2
4	Exploration of life history strategies	2
5	Exploration of species interactions	2
6	Exploration of pollution and its influence on species	4
	Total number	14

### 8. Self-study

The distribution of hours of self-study for students of **full-time education**:

- preparation for learning in the auditory – 0,5 h/1.0 h in class (15 h);



- preparation for control measures – 6 h per 1 credit (18 h).
- study of the individual topics of the program or their parts which are not taught in lectures (27 h).

### 8.1. Tasks for the independent work

№	Titles of issues within general topics	Number of hours
1	Brief history of Ecology	2
2	Ecological factors of aquatic environment	2
3	Plant ecology	2
4	The most harmful invasive species in the world	2
5	Ecological pyramids	2
6	Ecosystem services	2
7	Define predation, and describe the effects of natural selection on predator-prey relationships	2
8	Genetically modified organisms	2
9	Pesticides and their influence on the environment	2
10	Ozone layer destruction	2
11	Indigenous biodiversity and ecological problems (relate to the countries, which students come from)	7
Total number of hours		27

### 9. Individual scientific task

*Individual scientific task is not provided for by the curriculum*

### 10. Teaching methods

1. The study of discipline is achieved through informational, illustrative and problem-based teaching methods. Lectures are accompanied by demonstration of schemes, tables with multimedia support. At practical lessons, tasks that are close to real situations are considered and solved:

- handout material is used to form students in systems thinking, memory development;
- discussion of problem issues;
- provocative questions are asked.

Some problem issues are used for discussion, for instance: “Do you know advantages and disadvantages of intensive methods in agriculture and animal husbandry?”, “Hunting and fishery at current level: how these activities are necessary or harmful?” “What is the population size

of your community? In terms of environmental issues, how does your community compare to Rivne?”, etc.

Training is accompanied by the development of normative, educational literature, as well as periodicals.

2. Laboratory classes are provided in the special laboratory of the department of water bioresources. Special equipments are used: microscopes, water supplying facilities, laboratory glassware, cultivation tanks etc. Plants and animals are used for cultivation in the laboratory.

3. Consultation on the course conducted for supporting the independent work of students.

4. Registration of results of laboratory works and their defense by students.

5. Students participate in research activities of the department of water bioresources.

6. Students participate in scientific conferences on the field of ecology and environmental problems.

### **11. Methods of control**

The control of students' knowledge and skills is executed by writing tasks, or by computer testing at the Independent Assessment Center of the university. The test of a topic consists of sections, which include 10-20 questions and 5 corresponding options to choose the correct one.

The control of students' work is executed by lecture notes checking and laboratory classes – by verification of completed tasks and answer the questions.

Assessment of the results of the current work (tasks that are executed in laboratory classes as well as results of students' independent work) is carried out according to the following criteria: tasks and practical work (in% of the number of points allocated to the task with rounding to the nearest whole number):

0% - the task is not completed;

40% - the task is partially completed but contains significant errors of a methodological or calculated nature;

60% - the task is fully completed, but contains significant mistakes in the calculations or in the methodology;

80% - the task is fully completed on time, however, it contains some minor mistakes (conclusions, design, etc.);

100% - the task is completed correctly, on time and without comments.

### 12. The division of points by topics

Current testing and independent work							Total amount
Content module 1				Content module 2			
T1	T2	T3	T4	T5	T6	T7	T8
12	12	12	12	14	12	12	14
							100

T1, T2, ... T7 – topics of content modules.

### Estimation scale

The sum of points for all types of educational activities	Estimation according to the national scale	
	for exam and term paper	for course credit
100 – 90	great	The course is completed
82 – 89	good	
74 – 81		
64 – 73	satisfactory	
60 – 63		
35–59	The course is not completed, with the possibility of re-passing the course	
0–34	The course is not completed, course is required re-learning by the student	

### 13. Methodological support

1. Information resources in the Digital Repository of National university of water and environmental engineering. – URL: <http://ep3.nuwm.edu.ua/>.
2. Reference summary of lectures (on electronic and paper media) on all topics of the course, visual supporting materials (tables, models).
3. Packages of test tasks for each topic and for the whole course of the discipline.

## 14. Recommended books

### Basic

1. Michael Begon, Colin R. Townsend, John L. Harper. Ecology: from individuals to ecosystems. 4th ed. Blackwell Publishing Ltd, 2006. 714 p.
2. Bobrenko M. A., Balzhanova A. M. A course of lectures on ecology and life safety basics: textbook. Kostanay: KSPU, 2018. 139 p.
3. Environment / Raven P. et all. 9<sup>th</sup> edition. John Wiley & Sons, Inc., 2015. 520 p.

### Additional

1. WWF (2018). Living Planet Report - 2018: Aiming Higher. Grooten, M., Almond, R.E.A.(Eds). Switzerland: WWF, 2018. 75 p.
2. Colin P.N. Dictionary of environment & ecology. Fifth edition. Bloomsbury Publishing, 2004. 265 p.
3. Dictionary of environmental science. The McGraw-Hill Companies, Inc., 2003. 496 p.
4. Encyclopedia of ecology / Editor-in-chief Sven Erik Jorgensen. First edition. Elsevier. 2008. 4156 p.
5. May R., McLean A. Theoretical Ecology Principles and Applications. Oxford University Press, 2008. 257 p.

### 15. Web resources

1. Kucherova A. V., Volodymyrets V. A. Biology and ecology of living organisms. Practical manual. Rivne : NUWM, 2013.121 p. – URL: <http://ep3.nuwm.edu.ua/id/eprint/1732>.
2. Гідроекологія : підруч. для студ. вищ. навч. закл. / М. О. Клименко, Ю. В. Пилипенко, Ю. Р. Гроховська, О. В. Лянзберг, О. О. Бедункова. Херсон: ОЛДІ-ПЛЮС, 2015. 379 с. – URL: <http://ep3.nuwm.edu.ua/id/eprint/7515>.
3. Biology Dictionary. – URL: <https://www.biology-online.org/dictionary/Ecology>.
4. National Geographic. URL: <https://www.nationalgeographic.com/science/>.
5. The IUCN red list of threatened species. – URL: <https://www.iucnredlist.org/>.
6. Vernadsky National Library of Ukraine. – URL: <http://nbuv.gov.ua/>.

Developed by:

Doctor of Agricultural Sciences,

Professor of Water Bioresources Department

Y.R. Grokhovska