MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL UNIVERSITY
"LVIV POLYTECHNIC"

"I APPROVE"
Rector
National University
"Lviv Polytechnic"

_____ /Bobalo Yu.Ya./
"_____" _____ 2022

EDUCATIONAL AND SCIENTIFIC PROGRAM

third (educational and scientific) level of higher education

majoring in *Ecology* 101

fields of knowledge 10 *Natural sciences*

Qualification: Doctor of Philosophy in *Ecology*

Considered and approved
Academic Council of the

University

(protocol №. ___
from "__" _____ 2022)

Lviv 2022

Developed by a working group by speciality **101** ***Ecology*** as part of:

Head of the working group (guarantor):	doctor of technical sciences, prof., Sabadash V.V.
Members:	
Malovanyy M.S.	doctor of technical sciences, prof., head of the Department of Ecology and Sustainable Environmental Management
Gumnytsky J.M.	doctor of technical sciences prof., professor of the Department of Ecology and Sustainable Environmental Management
Dyachok V.V.	doctor of technical sciences, prof., professor of the Department of Ecology and Sustainable Environmental Management
Odnirih Z.S.	PhD, associate professor, associate professor of the Department of Ecology and Sustainable Environmental Management
Luta O.V.	PhD, associate professor, associate professor of the Department of Ecology and Sustainable Environmental Management
Grechanyk R.M.	Director of the Department of Ecology and Natural Resources of the State Administration of Local Government
Vankovich D.M.	director of LMKP "Lvivvodokanal"
Havryshko M.I.	postgraduate student in the 3rd year of study in the speciality 101 "Ecology"
Storoschuk U.Z.	graduate student in the 2nd year of study in the speciality 101 "Ecology"

Guarantor _____ doctor of technical sciences., prof. Sabadash V.V.

Approved and put into effect by order of the Rector of the National University "Lviv Polytechnic" dated "__" _____ 2022 №. _____.

LETTER OF AGREEMENT
the educational and scientific program

Level of higher education	the third (educational and scientific)
Branch of knowledge	10 *Natural sciences*
Speciality	101 *Ecology*
Qualification	doctor of philosophy

APPROVED
Scientific and methodical commission of speciality 101 *Ecology*
Protocol №_ -__
from "__" __ _____-_ 2022

Head of the SMC of the speciality 101 *Ecology*
_____ Drawn by M.S.
"__" _____ 2022

Director of the Institute of Sustainable Development
_____ O.I. Moroz
"__" _____ 2022

AGREED
Head of the educational and methodical department
_____ Sviridov V.M.
"__" _____ 2022

Vice-rector for scientific work
_____ Demidov I.V.
"__" _____ 2022

Vice-rector for scientific and pedagogical work
_____ Davidchak O.R.
"__" _____ 2022

RECOMMENDED
Scientific and methodological council of the University
Protocol No._____
from "__" _____ 2022
Head of SMC
_____ A.H. Zagorodniy

I. EDUCATIONAL COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

Doctor of Philosophy program profile
from the field of knowledge 10 *Natural sciences*
majoring in *Ecology 101*

1 - General information	
Full name of the higher education institution and structural division	**Lviv Polytechnic National University**
The full title of the qualification in the original language	**Doctor of Philosophy in the field of *Natural Sciences* with a speciality in *Ecology*** **Doctor of Philosophy in Natural Sciences by Specialty of Environmental studies**
Educational Qualification	**Doctor of Philosophy in Ecology**
The official name of the educational program	Ecology Environmental studies
Type of diploma and scope of the educational program	Diploma of Doctor of Philosophy, single, 43 ECTS credits, the term of the educational component of the educational-scientific program is 2 years
Cycle/level	NRK of Ukraine – 8th level, FQ-EHEA – third cycle, EQF-LLL – 8th level
Prerequisites	Degree of higher education "master"
Language(s) of instruction	Ukrainian language
Basic concepts and their definitions	The educational and scientific program uses the main concepts and definitions by the Law of Ukraine "On Higher Education" dated 07/01/2014 No. 1556-VII as amended, the Law of Ukraine "On Scientific and Scientific and Technical Activities" dated 11/26/2015 r. No. 848-VIII with amendments and additions, Procedure for the preparation of higher education applicants for the degree of Doctor of Philosophy and doctor of science in higher educational institutions (scientific institutions), approved by the Resolution of the Cabinet of Ministers dated 23.03.2016 No. 261, Provisions on the accreditation of educational programs for the training of higher education applicants, approved by order of the Ministry of Education and Science of Ukraine dated 11.07.2019 No. 977
2 – The purpose of the educational and scientific program	

	To deepen theoretical knowledge and practical skills in the field of *natural sciences* in the speciality of *Ecology*, to develop philosophical and linguistic competencies, and to form universal skills of a researcher sufficient for conducting and successfully completing scientific research and further professional and scientific activities.
3 – Characteristics of the educational and scientific program	
Subject area (field of knowledge, speciality)	Field of knowledge 10 *Natural sciences*, speciality 101 *Ecology*
Orientation of the educational program	The educational and scientific program is based on the fundamental postulates of ecology and the results of modern scientific research. It aims to develop the theoretical-methodological and methodological-applied base of ecology with an accentuation on the latest trends in the development of ecology, which deepens the professional, scientific worldview and provides the basis for conducting scientific research and further professional and scientific activities.
The main focus of the educational program and specialization	Acquiring the necessary research skills for a scientific career, teaching particular disciplines in ecology and environmental protection, and commercialization of research activities and technology transfer results. **Keywords:** ecology, environment, environmental protection, balanced nature use, nature protection activities, sustainable development.
	The object of activity: structure and functional components of ecosystems of different levels and origins; anthropogenic impact on the environment and optimization of nature use. *Learning goals*: acquiring the ability to produce new ideas, solve complex problems and carry out scientific research in ecology, environmental protection and rational nature management. *The theoretical content of the subject area*. Concepts, principles of modern ecology and their use for environmental protection, balanced nature use and sustainable development. *Methods, techniques and technologies*. General-scientific, philosophical-ontological and natural-scientific methods of researching the structure and properties of ecological systems of various levels and origins, methods of collecting, processing and interpreting the results of ecological research, in particular, computer modelling methods. *Tools and equipment*: equipment, hardware and software necessary for field, laboratory and remote studies of the structure and properties of ecological systems of various levels and origins.
Features and differences	The educational and scientific program covers a wide range of modern innovative vectors of the development of theory and practice in the field of ecology, which forms an updated theoretical and applied base for conducting scientific research.
Accreditation of the program	Decision IN THE NAME of Protocol No. 22 (39) dated 11/17/2020 Certificate No. 751.

	The validity period of the educational program accreditation certificate is 07/01/2026
4 – Eligibility of graduates of the educational and scientific program to employment and further education	
Employment of graduates	Employment in research institutions, institutions of higher education, other institutions and organizations that carry out research and/or training of specialists in the field of ecology, environmental protection and rational use of nature, as well as develop environmental policy and management.
Academic rights of graduates	Obtaining a doctor's degree and additional qualifications in the adult education system
5 – Teaching and assessment	
Teaching and learning	A combination of lecture, laboratory and practical classes, a pedagogical workshop, consulting with a scientific supervisor, and a scientific and pedagogical community with independent scientific and educational work.
Assessment	Exams, assessments, current control. Defence of the dissertation.
6 – Software competencies	
Integral competence	The ability to produce new ideas, to solve complex problems in the field of ecology, nature protection and rational nature management, which involves a deep rethinking of existing and the creation of new integral knowledge and/or professional practice, to apply modern methodologies of scientific and scientific-pedagogical activities, to carry out own scientific research, the results of which have scientific novelty, theoretical and practical significance.
General competencies (GC)	ZK01. Ability to work in an international context. ZK02. The ability to solve complex problems based on a systematic scientific and general cultural worldview in compliance with the principles of professional ethics and academic integrity.
Special (professional, subject) competences	SKO3. The ability to perform original research, to achieve scientific results that create new knowledge in the field of ecology and interdisciplinary areas related to it, to evaluate and ensure the quality of the performed research. SK04. The ability to initiate, develop and implement complex, innovative projects in ecology and related interdisciplinary projects, and leadership during their implementation. SK05. The ability to use modern tools, electronic information resources, and specialized software in scientific and educational activities, in particular for modelling processes and making optimal decisions in ecology, nature protection and rational nature management. SK06. The ability to carry out scientific and pedagogical activities in higher education.
7 – Program learning outcomes	
PH01. Deeply understand the conceptual principles and methodology of the natural sciences, formulate and test hypotheses, and use appropriate evidence to substantiate conclusions, in	

particular, the results of theoretical analysis, experimental studies and mathematical and/or computer modelling in order to solve significant scientific and applied scientific problems ecology PH02. Plan and carry out experimental and/or theoretical research on ecology, environmental protection and optimization of nature use using modern tools, critically analyze the results of own research and the results of other researchers in the context of the entire complex of modern knowledge regarding the problem under study. RNOZ Freely present and discuss research results, scientific and applied problems in ecology, environmental protection and optimization of natural resources in national and foreign languages in compliance with the norms of academic ethics, competently reflecting the results of research in scientific publications in leading domestic and international scientific publications. PH04. Develop and teach special educational disciplines related to the subject area of ecology in institutions of higher education. PH05. Develop and implement scientific and/or innovative engineering projects that provide an opportunity to rethink existing and create new holistic knowledge and/or professional practice, taking into account social, ethical, economic, environmental and legal aspects. PH06. Apply modern search tools and technologies for processing and analyzing information on environmental problems and related issues, in particular, statistical methods for analyzing data of a large volume and/or complex structure, specialized databases and information systems. PH07. Have up-to-date conceptual knowledge and a high methodological level in the field of ecology and at the border of subject areas, as well as research skills sufficient to conduct scientific and applied research at the level of the latest world achievements.

8 – Resource support for program implementation	
Specific characteristics of personnel support	100% of the teaching staff involved in teaching professionally oriented disciplines have scientific degrees in their speciality. In order to improve their professional level, all scientific and pedagogical workers undergo an internship once every five years.
Specific characteristics of material and technical support	Use of modern measuring equipment and methods of soil, water and gas analysis. Use of modern software: "Maple", "MS Office", "Math lab ", " Comsol Multiphysics ", " SimaPro 9"
Specific characteristics of informational and methodological support	The use of the virtual learning environment of the National University "Lviv Polytechnic" and the author's developments of the teaching staff.
10 – Academic mobility (regulated by CMU Resolution No. 579, "On Approval of the Regulation on the Procedure for Realizing the Right to Academic Mobility," dated August 12, 2015)	
National credit mobility	On the basis of bilateral agreements between the National University "Lviv Polytechnic" and the technical universities of Ukraine.
International credit mobility	As part of the EU Erasmus+ program on the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries
Education of foreign students of higher education	It is possible, after studying the Ukrainian language course.

2. Distribution of content of the educational component of the educational and scientific program by component groups and training cycles

No s/p	Training cycles	The amount of study load of a graduate student (credits / %)		
		Mandatory components of the educational component	Elective components of the educational component	In total for the entire term teaching
1.	The cycle of disciplines that form general scientific competencies and universal skills of the researcher	21 / 49	3 / 7	24 / 56
2.	The cycle of disciplines forming professional competences	10/23	6 / 14	16 / 37
3.	The cycle of subjects of free choice of a graduate student	-	3 / 7	3 / 7
Total for the entire period of study		31 / 72	12 / 28	43 / 100

3. List of components of the educational component the educational and scientific program

Code n/a	Components of the educational component	Number of credits	Form summary control	Competences provided for by Resolution 261 dated 03.23.2016 (as amended from 04.03.2019)
1	2	3	4	5
1. **Mandatory components educational component**				
The cycle of disciplines that form general scientific competencies and universal skills of the researcher				
OK1.1.	Philosophy and methodology of science	3	examination	Mastering general scientific (philosophical) competencies aimed at forming a systematic scientific outlook, professional ethics and a general cultural outlook; application of modern information technologies in scientific activities (work with NMBD, automatic formation of links to literary sources, etc.)
OK1.2.	A foreign language for academic purposes, part 1	4	test	Acquisition of linguistic competencies sufficient to present and discuss the results of one's scientific work in a foreign language in oral and written form, as well as to fully understand foreign language scientific texts in the relevant speciality, use of modern information technologies (presentation of scientific results).
OK1.3.	A foreign language for academic purposes, part 2	4	examination	
OK1.4.	Professional pedagogy	3	test	Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (work with VNS, Microsoft Teams, Zoom, etc.)
OK1.5.	Academic entrepreneurship	4	test	Acquisition of universal skills of a researcher, in particular, oral and written presentation of the results of one's own research in Ukrainian, management of scientific projects and/or preparation of proposals for financing scientific research, registration of intellectual property rights, application of modern information technologies.
OK1.6.	Pedagogical practice	3	test	Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (working with VNS, Microsoft Teams, Zoom, etc.).
Total per cycle:		**21**		

1	2	3	4	5
The cycle of disciplines forming professional competences				
OK2.1.*	Scientific bases for modelling and forecasting the state of the environment	4	examination	Acquiring in-depth knowledge of the speciality in which the graduate student conducts research, in particular, mastering the main concepts, understanding theoretical and practical problems, the history of development and the current state of scientific knowledge in the chosen speciality, mastering the terminology of the researched scientific direction in the amount of ECTS credits in accordance with the standard of higher education
OK2.2.*	Research seminar in the field of ecology	3	hall _	
OK2.3.*	Research methods in environmental protection technologies	3	test	
Total per cycle:		**10 (3+3+4)**		
Selective components educational component				
The cycle of disciplines that form general scientific competencies and universal skills of the researcher				
VB1.1	Business Foreign Language	3	test	Acquisition of universal skills of a researcher, in particular, oral and written presentation of the results of one's own research in Ukrainian, management of scientific projects and/or preparation of proposals for financing scientific research, registration of intellectual property rights, application of modern information technologies. Acquisition of linguistic competencies sufficient to present and discuss the results of one's scientific work in a foreign language in oral and written form, as well as to fully understand foreign language scientific texts in the relevant speciality, use of modern information technologies (presentation of scientific results). Mastering general scientific (philosophical) competencies aimed at forming a systematic scientific outlook, professional ethics and a general cultural outlook; application of modern information technologies in scientific activities (work with NMBD, automatic formation of links to literary sources) Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (working with VNS, Microsoft Teams, Zoom, etc.).
VB1.2	Psychology of creativity and invention	3	test	
VB1.3	Management of scientific projects	3	test	
VB1.4	The technology of registration of grant applications and patent rights	3	test	
VB1.5	Rhetoric	3	test	
VB1.6	Modern inventions in research activities	3	test	
VB1.7	Open scientific practices	3	test	
VB1.8	Academic integrity and quality of education	3	test	
VB1.9	Methodology of preparation of scientific publications	3	test	
VB1.10	Quality of higher education (formation of internal quality assurance systems)	3	test	
Total per cycle:		**3**		

1	2	3	4	5
*The cycle of disciplines forming professional Competencies***				
VB2.1	Fundamentals of ecological biotechnology	3	examination	Acquiring in-depth knowledge of the speciality in which the graduate student conducts research, in particular, mastering the main concepts, understanding theoretical and practical problems, the history of development and the current state of scientific knowledge in the chosen speciality, mastering the terminology of the researched scientific direction
VB2.2	Innovative technologies for the utilization of industrial and household waste	3	examination	
VB2.3	Modern technologies of atmospheric air protection in the context of climate change	3	examination	
VB2.4	Conceptual principles of protection and rational use of water resources	3	examination	
VB2.5	Ecological strategies for the protection and preservation of landscapes	3	examination	
VB2.6	Methodological principles of environmental impact assessment	3	examination	
VB2.7	Environmental audit of territories and productions	3	examination	
VB2.8	Environmental control: inspection, monitoring and certification of natural and man-made objects	3	examination	
VB2.9	Measurement and information technologies in environmental management	3	examination	
VB2.10	Life cycle management	3	examination	
Total per cycle:		**6 (3+3)**		
Disciplines of the graduate student's free choice * **				
VB3.1	The discipline of the graduate student's free choice	3	test	Acquisition of skills in critical analysis, evaluation and synthesis of new and complex ideas
Total per cycle:		**3**		
TOGETHER		**43**		

4. **Matrix of correspondence of program competencies educational components**

	OK 1.1.	**OK 1.2.**	**OK 1.3.**	**OK 1.4.**	**OK 1.5.**	**OK 1.6.**	**OK 2.1.**	**OK 2.2.**	**OK 2.3.**	**VB 1.1. - VB 1.10**	**VB 2.1.**	**VB 2.2.**	**VB 2.3.**	**VB 2.4.**	**VB 2.5.**	**VB 2.6.**	**VB 2.7.**	**VB 2.8.**	**VB 2.9.**	**VB 2.10.**	**VB 3.1.**
INT	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
ZK01	•	•	•	•						•	•	•	•	•	•	•	•	•	•	•	•
ZK02					•	•				•	•	•	•	•	•	•	•	•	•	•	•
SK03							•														•
SK04								•													
SK05									•		•										
SK06							•	•				•	•	•	•	•	•	•	•	•	•

Conventional designations: Oki – mandatory discipline, ВБи – selective discipline, и – discipline number in the list of components of the educational component, INT – integral competence, ZKj – general competence, SKj – professional competence of the speciality, j – competence number in the list of competencies of the educational component.

5 **. Matrix of provision of program learning outcomes relevant components of the educational component**

	OK 1.1.	**OK 1.2.**	**OK 1.3.**	**OK 1.4.**	**OK 1.5.**	**OK 1.6.**	**OK 2.1.**	**OK 2.2.**	**OK 2.3.**	**VB 1.1. - VB 1.10.**	**VB 2.1.**	**VB 2.2.**	**VB 2.3.**	**VB 2.4.**	**VB 2.5.**	**VB 2.6.**	**VB 2.7.**	**VB 2.8.**	**VB 2.9.**	**VB 2.10.**	**VB 3.1**
PH01	•						•	•	•		•	•	•	•	•	•	•	•	•	•	•
PH02		•	•							•											
PH03				•		•															
PH04					•																
PH05				•		•															
PH06							•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
PH07	•	•	•					•				•	•	•	•						

Notations: ОКn – mandatory discipline, ВБn – optional discipline, n – number of the discipline in the list of components of the educational component, РНm – program results (knowledge and skills), m – number of the program result in the list of program results of the educational component.

II. THE SCIENTIFIC COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

The scientific component of the educational-scientific program involves the postgraduate student conducting his own scientific research under the supervision of a scientific supervisor and the preparation of his results in the form of a dissertation.

The dissertation for obtaining the degree of Doctor of Philosophy is an independent detailed study that offers a solution to an actual scientific and applied task in the speciality 101 " Ecology", the results of which are characterized by scientific novelty and practical value and are published in relevant publications.

The scientific component of the educational-scientific program is drawn up in the form of an individual plan of scientific work of a postgraduate student and is an integral part of the postgraduate curriculum.

Preparation and publication of scientific articles, speeches at scientific conferences, professional scientific seminars, round tables, and symposia are integral parts of the scientific component of the postgraduate educational and scientific program.

Observance of academic integrity by the recipient of the degree of Doctor of Philosophy involves compliance with the requirements of scientific integrity in all types of scientific and educational activities; use of only proven and reliable sources of information in research activities and direct reference to them; avoiding falsification or fabrication of information, scientific results with their further use in the dissertation work.

Topics of scientific research in speciality 101 "Ecology."

1. Environmental risk assessment of environmental pollution.
2. Environmental impact assessment of mining and chemical industries.
3. Assessment of the impact of mineral fertilizers on the natural environment.
4. Environmental safety of food production (wastewater treatment, waste disposal).
5. Encapsulation of mineral fertilizers with films based on polymer materials and naturally dispersed sorbents for ecological safety of agricultural systems.
6. Use of naturally dispersed sorbents in environmental protection.
7. Theoretical basics of purification of gas and liquid media by adsorption methods.
8. Cleaning of surface waters from oil pollution by adsorption methods.
9. Adsorption processes of wastewater treatment from organic solvents.
10. Environmental safety of waste-free technologies for the processing of multicomponent salt-containing materials.
11. Cleaning of drainage waters of solid waste landfills.
12. Theoretical bases of plant waste utilization.
13. Cleaning of gas environments from chemical and mechanical pollution.

III. ATTESTATION OF A THIRD-LEVEL GRADUATE OF HIGHER EDUCATION

State attestation of the educational component of the educational and scientific program is carried out by passing qualifying exams in the disciplines of general and professional training before the commission, the composition of which is approved by the rector of the University.

Attestation of persons who obtain the degree of doctor of philosophy is carried out by a permanent or one-time specialized academic council of a higher educational institution or a scientific institution accredited by the National Agency for Quality Assurance of Higher Education in the form of a public defence of a dissertation. The recipient of the Doctor of Philosophy degree has the right to choose a specialized academic council.

The dissertation for obtaining the degree of Doctor of Philosophy is an independent, comprehensive study that offers a solution to a specific scientific problem in the field of ecology or on its border with other specialities, the results of which constitute an original contribution to the development of ecology and are published in scientific publications in peer-reviewed scientific publications. The dissertation should not contain academic plagiarism, falsification, or fabrication.

The dissertation must be published on the official website of the institution of higher education or its division or in the repository of the institution of higher education (scientific institution).

To prevent non-compliance with the norms and rules of academic integrity, the University uses a set of preventive measures, in particular, expert assessment and (or) technical verification (with the help of specialized software tools) regarding signs of academic plagiarism in dissertation studies prepared for defence, monographs, scientific articles, etc.

IV. CHARACTERISTICS OF THE SYSTEM OF INTERNAL QUALITY ASSURANCE OF THE APPLICANT'S TRAINING OF THE THIRD LEVEL OF HIGHER EDUCATION

The system of internal assurance of the quality of higher education by a higher educational institution consists of the following procedures and measures provided for by the Law of Ukraine "On Higher Education":

1) determination of the principles and procedures for ensuring the quality of higher education;
2) implementation of monitoring and periodic review of educational programs;
3) annual assessment of candidates for the level of Doctor of Philosophy, scientific and pedagogical workers of a higher educational institution and regular publication of the results of such assessments on the official website of the higher educational institution, on information stands, etc.;
4) ensuring advanced training of scientific and pedagogical workers;

5) ensuring the availability of the necessary resources for the organization of the educational process, including the independent work of applicants of the third level of higher education, for each educational program;
6) ensuring the availability of information systems for effective management of the educational process;
7) ensuring publicity of information about educational programs, degrees of education and qualifications;
8) ensuring an effective system of prevention and detection of academic plagiarism in the scientific works of employees of higher educational institutions and PhD candidates.

Head of the project team,
Professor of the Department of Ecology and Sustainable Environmental Management,
doctor of technical scienses, prof. V.V. Sabadash

Structural and logical scheme of the educational and scientific program of the Doctor of Philosophy in the speciality 101 "Ecology"