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Professional Training of Future Ecologists: The Experience of Ukraine and the Czech Republic

Abstract: The article focuses on the problem of ecological education and, in particular, on the professional training of future ecologists in the Czech Republic and Ukraine. The relevance of the study is determined by the growing urgency of environmental issues in the twenty-first century, including climate change, biodiversity loss, pollution, ecosystem degradation, and the need for sustainable development. In this context, ecologists are essential professionals for the modern world, as they study the interaction between living organisms and their physical environments and contribute to the protection of natural systems that support human life, public health, and the economy. The object of the study is the process of professional training of future ecologists in higher education institutions in Ukraine and the Czech Republic. The aim of the article is to analyse the conceptual foundations of the environmental sphere, clarify the role of ecologists in contemporary society, and compare the specific features of professional training in ecology in the two countries. The scientific novelty of the study lies in the comparative analysis of Ukrainian and Czech approaches to ecological education, with particular attention to curriculum structure, fieldwork, laboratory and data-based training, internationalisation, EU policy alignment, and the response of educational programmes to national environmental challenges. Training environmental professionals typically includes degrees in environmental science, ecology, or sustainability, complemented by international certifications and specialised professional courses. These qualifications allow graduates to engage in academic research, fieldwork, environmental management, conservation, or corporate sustainability in global and local contexts. The article shows that the professional training of ecologists in the Czech Republic is thorough and combines intensive fieldwork, data analysis, laboratory research, applied landscape ecology, conservation biology, and ecological monitoring. In Ukraine, the training of ecologists focuses on green recovery, European integration, sustainable development, environmental protection, and the restoration of territories affected by contemporary socio-ecological challenges. The article compares and summarises the common and distinctive features of professional training of ecologists in the Czech Republic and Ukraine, emphasising the specific needs, priorities, and educational strategies of each country.

Keywords: ecological education, environment, environmental professionals, ecologists, international certification, international certification, professional training.

Introduction

The 21st century is characterised by the rapid development of information and communication technologies, which are widely used in various areas of modern society. At the same time, the twenty-first century is also marked by a number of global problems and challenges. One of the most widely discussed problems of contemporary global society is the environment and the growing complexity of ecological issues. Human activities have significantly transformed natural landscapes, climate systems and the balance of ecosystems. These disturbances threaten not only wildlife, but also human health, food security and economic stability throughout the world. Understanding the causes and consequences of environmental problems is therefore the first step towards finding effective and sustainable solutions (*Academia Brasileira do Sono, 2026*).

If ecology is considered as a concept or term, it refers to the scientific study of the relationships between living organisms and their environment, as well as to broader applied concepts related to environmental protection and human interaction with nature (*Encyclopaedia Britannica, n.d.*). Ecology is also regarded as a scientific discipline, namely as a branch of biology that studies how living organisms, or biotic factors, interact with one another and with their physical environment, or abiotic factors. These interactions are examined at different levels and scales, from individual organisms and populations to communities, ecosystems and the biosphere (Maurya, 2024). Ecology may also be considered in its applied dimension, where scientific principles are used to solve real-world environmental problems and to support the sustainable management of natural resources. In public discourse, the concepts of human ecology and environmental ecology are often closely connected with environmental protection and the environmental movement (*Michigan Technological University, n.d.*).

Thus, at the present stage of social development, ecology is understood as a complex interdisciplinary science concerned with the relationships between organisms, society and the environment. It studies the laws governing the life of organisms in their natural habitat and analyses the changes occurring in this environment as a result of human activity. In recent years, ecology and environmental problems caused by anthropogenic activity have become constant subjects of academic, public and media discussion (*Vasileva-Tcankova, 2022*). This has strengthened the social demand for specialists capable of analysing environmental risks, interpreting ecological data, participating in conservation activities, and designing strategies for sustainable development.

Accordingly, professionals engaged in this field, namely ecologists, study the relationships between living organisms and their environment. They investigate ecosystems, biodiversity and environmental change in order to understand how plants, animals and natural systems interact. Ecologists collect and analyse data, conduct field and laboratory research, and contribute to studies that support conservation, land management and environmental policy. A career as an ecologist may involve work in natural environments, as well as in offices, laboratories, research institutions, universities, government agencies, environmental consulting firms and conservation organisations (*University of Southern Queensland, 2026*).

Considering the challenges of the twenty-first century, ecologists are essential professionals for the modern world because they protect the natural systems that support human life and the economy. They act as important specialists in addressing urgent environmental crises such as climate change, pollution, deforestation and biodiversity loss. Their professional activity is closely

connected with shaping public policy, promoting sustainable development, supporting corporate responsibility and informing society about the consequences of environmental degradation (*Foley, 2026*).

The training of environmental professionals and ecologists typically includes degrees in environmental science, ecology or sustainable development, complemented by international certifications and specialised professional courses. These qualifications allow specialists to engage in academic research, fieldwork, environmental monitoring, conservation, ecological consulting, public administration or corporate sustainability in both global and local contexts (*Bouchrika, 2026*). Environmental scientists apply scientific principles to protect the environment and human health. They investigate environmental problems by collecting and analysing data from various sources, including soil, water and air. Their work includes assessing pollution levels, studying ecosystems and developing strategies for sustainable development. They also disseminate their findings to inform policy decisions, guide business practices and educate the public. By specialising in areas such as climate change, waste management or ecosystem restoration, they contribute to building a healthier and more sustainable future (*Bouchrika, 2026*).

The training of ecologists differs across countries and is shaped by regional environmental challenges, cultural values, educational traditions and economic priorities. Some countries place greater emphasis on fundamental scientific research, ecological modelling and environmental policy, whereas others focus on community-based conservation, environmental education, applied fieldwork or grassroots environmental activism. These differences demonstrate that professional training in ecology cannot be considered as a universal and identical process in all national contexts; rather, it reflects the interaction between global environmental priorities and the specific needs of each country (*Springer Nature Link, 2023*).

The relevance of the present study is determined by the growing importance of environmental problems for contemporary society, the need to train highly qualified specialists in ecology, and the necessity of comparing environmental education programmes and their specific features in higher education. This issue is especially important in the context of European integration, sustainable development, climate policy, biodiversity protection, green recovery and the increasing demand for specialists who are able to combine theoretical knowledge with field practice, laboratory research, data analysis and environmental management.

The research problem lies in the fact that, despite the global relevance of ecological education, the professional training of future ecologists remains strongly dependent on national educational systems, institutional traditions and regional environmental priorities. In this regard, the experience of Ukraine and the Czech Republic is particularly significant. The Czech Republic has developed a structured and internationally oriented system of ecological education, closely connected with European environmental policy, field research, ecological monitoring and specialised academic institutions. Ukraine, in turn, is modernising its ecological education in the context of European integration, sustainable development, environmental protection, green recovery and the need to restore ecosystems affected by contemporary socio-ecological challenges. Therefore, a comparative analysis of these two systems makes it possible to identify both common tendencies and nationally specific features of professional training in ecology.

The scientific novelty of the study lies in the comparative analysis of the professional training of future ecologists in Ukraine and the Czech Republic, with attention to curriculum structure,

educational levels, practical training, fieldwork methodologies, internationalisation, EU policy integration, institutional experience and the adaptability of educational programmes to contemporary environmental challenges. The study also clarifies how national priorities influence the content and organisation of ecological education and how higher education institutions prepare future specialists for work in research, environmental management, conservation, public administration and sustainable development.

The object of the study is the process of professional training of future ecologists in higher education institutions in Ukraine and the Czech Republic.

The subject of the study is the common and distinctive features of educational programmes, curricula, practical training and institutional approaches to the professional preparation of ecologists in the two countries.

The study aims to analyse the conceptual foundations of the environmental sphere, clarify the role of ecology and ecologists in the modern world, examine the peculiarities of professional training in ecology, and compare the features of educational programmes in ecology in Ukraine and the Czech Republic.

To achieve this aim, the following objectives have been identified:

- to analyse scholarly and informational sources defining ecology as a scientific and applied field;
- to clarify the role of ecologists and environmental professionals in addressing contemporary environmental challenges;
- to characterise the main components of professional training in ecology, including theoretical, practical, field, laboratory and research-oriented elements;
- to examine the specific features of professional training of future ecologists in the Czech Republic;
- to analyse the main characteristics of ecological education and professional training of ecologists in Ukraine;
- to compare Ukrainian and Czech educational programmes in ecology according to their curriculum structure, flexibility, practical orientation, internationalisation and relation to national environmental priorities;
- to identify common and distinctive features in the training of future ecologists in the two countries;
- to determine the theoretical and practical significance of comparative analysis for improving ecological education in higher education institutions.

The theoretical significance of the study lies in expanding the understanding of ecological education as an interdisciplinary and comparative research field. The article contributes to the analysis of how professional training in ecology is shaped by environmental challenges, higher education policy, European integration, institutional traditions and labour market demands. It also provides a basis for further comparative studies of environmental education in different national contexts.

The practical significance of the study lies in the possibility of using its results to improve educational programmes in ecology, strengthen the practical component of professional training, develop flexible learning trajectories, enhance international cooperation and adapt curricula to

current environmental challenges. The findings may be useful for higher education institutions, curriculum developers, lecturers, educational policymakers and specialists involved in the training of future ecologists. They may also support the modernisation of ecological education in Ukraine by taking into account relevant European experience, including the Czech model of combining fieldwork, laboratory research, data analysis, conservation biology and environmental policy training.

Thus, the professional training of future ecologists is a strategically important task for higher education in the 21st century. It determines the capacity of societies to respond to environmental crises, implement sustainable development strategies, protect ecosystems and train specialists who are able to operate effectively in scientific, applied, administrative and international contexts.

Methods

The methodological framework of this study is based on a qualitative comparative research design combined with structural-functional analysis and content analysis of higher education programmes in ecology. This approach was selected because the professional training of future ecologists cannot be adequately examined through a single institutional case or a purely descriptive overview. It requires a comparative analysis of educational aims, curriculum structure, practical training, research orientation, internationalisation, and the capacity of higher education systems to respond to contemporary environmental challenges.

The study was conducted within the framework of comparative education, with a focus on identifying common and distinctive features in the professional training of future ecologists in Ukraine and the Czech Republic. The comparison was based on the assumption that ecological education is shaped by both global environmental priorities and nationally specific factors, including environmental policy, labour market needs, institutional traditions, European integration processes, and regional socio-ecological challenges.

The primary data sources included official educational programmes, university curricula, publicly available descriptions of academic departments, state and institutional regulations, and academic profiles of leading higher education institutions that provide training in ecology, environmental science, environmental protection, and related fields. The study also used informational and analytical sources concerning ecology as a scientific discipline, the professional role of ecologists, environmental education, and sustainability-oriented training.

The Czech case was represented by leading academic centres that provide ecology-related education and research, including Charles University, the Czech University of Life Sciences in Prague, Palacký University Olomouc, Masaryk University, and other institutions involved in ecological and environmental training. Particular attention was paid to programmes associated with applied and landscape ecology, conservation biology, ecological monitoring, hydrobiology, environmental protection, and environmental education. The analysis also considered the role of international cooperation, European environmental policy, field-based learning, laboratory research, and research infrastructure in the Czech model of ecological education (*Czech Universities, 2020*; *Czech Society for Ecology, n.d.*; *Palacký University Olomouc, n.d.*).

The Ukrainian case was analysed through the professional training of ecologists in higher education institutions offering the "Ecology" speciality and related educational programmes. The study considered the general structure of ecology education in Ukraine, where training is provided

at bachelor's, master's and doctoral levels in more than 90 higher education institutions. Particular attention was paid to universities that play an important role in environmental education, including Taras Shevchenko National University of Kyiv, the National University of Life and Environmental Sciences of Ukraine, the National University of Kyiv-Mohyla Academy, Ivan Franko National University of Lviv, the Ukrainian National Forestry University, V. N. Karazin Kharkiv National University, Odesa State Environmental University, and Bohdan Khmelnytsky National University of Cherkasy. The analysis focused on the integration of classical ecology, environmental protection, sustainable development, ecological audit, ecomanagement, green recovery, and restoration of ecosystems affected by contemporary environmental and socio-political challenges (*Cherkasy National University, n.d.*; *National University of Kyiv-Mohyla Academy, n.d.*; *National University of Food Technologies, 2026*).

The units of analysis were educational programmes, curriculum components, forms of practical training, institutional profiles, and declared learning outcomes. At the bachelor's level, attention was paid to the formation of basic ecological, biological, environmental, and methodological competencies. At the master's level, the analysis focused on specialisation, applied research, professional orientation, field practice, and the ability to solve complex environmental problems. At the doctoral level, the study considered the development of research competence, participation in scientific projects, and integration into national and international academic networks.

The criteria for comparison included:

- the structure of educational programmes at bachelor's, master's and doctoral levels;
- the balance between theoretical, practical, field, laboratory and research components;
- the degree of curriculum flexibility and the possibility of forming individual learning trajectories;
- the presence of specialised subjects and professional modules;
- the integration of European and international environmental policy;
- the role of fieldwork, ecological monitoring and laboratory training;
- the use of data analysis, modelling and modern research methods;
- the connection between educational programmes and labour market needs;
- the adaptability of training to national environmental priorities;
- the orientation of programmes towards sustainable development, green recovery, conservation and environmental management.

The structural-functional method was used to determine how different components of professional training function within each national educational system. This method made it possible to analyse how theoretical disciplines, fieldwork, laboratory classes, internships, research projects and professional practice are connected with the declared aim of training future ecologists. It also helped identify the role of universities as institutions that combine academic education, applied ecological training, environmental research and preparation for professional activity.

Content analysis was applied to educational programme descriptions, curricula, departmental materials and institutional information. This method made it possible to identify repeated thematic components, including ecology, environmental protection, landscape ecology, conservation biology, sustainable development, environmental monitoring, ecological audit, climate policy,

ecosystem restoration, and environmental education. The analysis also allowed the study to determine the extent to which these components are integrated into the training of future ecologists in both countries.

The comparative method was used to identify similarities and differences between the Ukrainian and Czech systems of ecological education. The comparison was not limited to listing educational programmes, but focused on the logic of professional training, including institutional priorities, curriculum flexibility, practical orientation, research opportunities, international cooperation and responsiveness to environmental challenges. This made it possible to distinguish both shared European tendencies and nationally specific approaches.

The generalisation method was used to summarise the obtained results and formulate conclusions concerning the common and distinctive features of professional training of future ecologists in Ukraine and the Czech Republic. The study also used elements of interpretative analysis in order to explain why certain features of ecological education are more pronounced in one national context than in another. For example, the Czech system demonstrates stronger integration with EU environmental policy, international research cooperation and flexible specialisation, whereas the Ukrainian system places increasing emphasis on green recovery, environmental protection, ecological audit, sustainable development and the restoration of territories affected by contemporary socio-ecological challenges.

The research procedure consisted of several stages. At the first stage, scholarly and informational sources concerning ecology, ecological education, the role of ecologists, and environmental challenges were analysed. At the second stage, official and publicly available materials on ecology-related educational programmes in Ukraine and the Czech Republic were collected and systematised. At the third stage, the selected programmes and institutional profiles were examined according to the defined comparison criteria. At the fourth stage, the common and distinctive features of professional training in the two countries were identified. At the fifth stage, the results were interpreted in relation to the needs of modern environmental education, sustainable development, European integration and the professional preparation of future ecologists.

The validity of the study was supported by the use of multiple types of sources, including university programme descriptions, institutional materials, professional information resources and academic literature. Cross-comparison of several institutions in both countries made it possible to avoid reducing the analysis to a single university case. At the same time, the study is limited by its reliance on publicly available documents and programme descriptions. It does not include interviews with lecturers, students or employers, nor does it provide statistical measurement of learning outcomes. Therefore, the findings should be interpreted as a qualitative comparative analysis of educational models and institutional approaches rather than as an empirical assessment of programme effectiveness.

Despite these limitations, the selected methodology makes it possible to provide a structured and academically grounded comparison of professional training of future ecologists in Ukraine and the Czech Republic. The combination of comparative, structural-functional, content and interpretative analysis allows the study to reveal how ecological education is organised in different national contexts and how it responds to contemporary environmental, educational and socio-economic challenges.

Literature Review

Contemporary research on ecological education is developing in the context of increasing global environmental instability. Climate change, biodiversity loss, pollution, degradation of ecosystems, depletion of natural resources and the growing anthropogenic pressure on landscapes require not only technological and political responses, but also a transformation of professional training in higher education. Environmental problems in the modern world are increasingly interpreted as complex interdisciplinary challenges that connect natural sciences, social sciences, public policy, economics, public health and sustainable development (*Academia Brasileira do Sono, 2026*; *Vasileva-Tcankova, 2022*). Therefore, the training of future ecologists is no longer limited to the acquisition of biological or environmental knowledge. It must also include practical research skills, fieldwork, data analysis, laboratory methods, ecological monitoring, environmental management, communication with stakeholders and the ability to operate within national and international policy frameworks.

The concept of ecology itself has undergone considerable expansion. In its classical scientific meaning, ecology is understood as the study of interactions between organisms and their environment (*Encyclopaedia Britannica, n.d.*). At the same time, contemporary ecological knowledge is increasingly applied to the solution of real-world environmental problems, including conservation, sustainable resource use, climate adaptation, pollution control and ecosystem restoration. Maurya (*2024*) emphasises that ecology examines the dynamics of life and the environment at different levels, from organisms and populations to ecosystems and global ecological systems. In this regard, ecological education must combine fundamental theoretical knowledge with applied competencies that allow future specialists to assess, predict and manage environmental change.

The applied dimension of ecology is particularly important for higher education because it determines the practical orientation of professional training. Educational programmes in ecology should prepare graduates not only for academic research, but also for work in environmental consulting, public administration, conservation organisations, research laboratories, national parks, industrial enterprises, environmental monitoring agencies and international projects. This corresponds to the broader understanding of ecology as a science that uses biological, geographical, chemical, technological and socio-economic knowledge to support environmental protection and sustainable development (*Michigan Technological University, n.d.*; *University of Southern Queensland, 2026*).

A significant part of the literature focuses on the professional role of ecologists in contemporary society. Ecologists study ecosystems, biodiversity, species interactions, environmental change and the consequences of human activity. Their work includes the collection and interpretation of field and laboratory data, ecological modelling, assessment of pollution levels, monitoring of natural systems, participation in environmental impact assessment, and development of recommendations for policy and practice. In this sense, ecologists act as specialists who connect science, public administration and practical environmental protection. Foley (*2026*) stresses that ecologists and environmental professionals are essential in responding to urgent environmental crises such as climate change, deforestation, pollution and biodiversity loss. Thus,

the training of ecologists is directly linked to the capacity of societies to protect natural systems and maintain long-term ecological security.

Studies on professional pathways in environmental science indicate that ecological training usually includes university degrees in ecology, environmental science, sustainability or related fields, supplemented by specialised courses, certifications, field experience and professional practice. Bouchrika (*2026*) notes that environmental scientists apply scientific principles to protect ecosystems and human health, investigate environmental problems by analysing soil, water and air, and develop strategies for sustainable development. This implies that professional ecological education must be interdisciplinary, practice-oriented and responsive to labour market needs. Graduates should be able to combine scientific analysis with practical decision-making in complex and uncertain environmental contexts.

The literature also demonstrates that the training of ecologists varies significantly between countries. These differences are shaped by environmental priorities, cultural values, economic conditions, educational traditions, national legislation and international commitments. Some countries place greater emphasis on fundamental research, ecological modelling and environmental policy, whereas others prioritise community-based conservation, environmental education, regional monitoring or grassroots environmental activity. Studies devoted to sustainability education also show that barriers to learning for sustainability may arise from insufficient institutional support, limited curriculum flexibility, lack of teacher preparedness, weak integration between theory and practice, or the absence of a coherent educational strategy (*Springer Nature Link, 2023*). Consequently, the comparative study of national models of ecological education is necessary for identifying effective approaches to curriculum design and professional training.

Within the field of comparative education, the analysis of ecological training programmes makes it possible to identify how higher education systems respond to shared global challenges through nationally specific educational models. Comparative research is particularly relevant when educational programmes operate under different socio-economic and environmental conditions but aim to prepare specialists for similar professional tasks. In this context, the comparison between Ukraine and the Czech Republic is methodologically justified because both countries are located within the broader European educational and environmental space, yet their ecological education systems have developed under different historical, institutional and socio-political conditions.

The Czech model of ecological education is frequently characterised by strong integration of fundamental ecological theory, applied environmental training, field practice and international cooperation. According to Czech Universities (*2020*), ecology-related programmes in the Czech Republic often combine theoretical preparation with field research, laboratory work, conservation biology, applied landscape ecology and environmental monitoring. Czech higher education institutions benefit from close links with European environmental policy, international research projects and protected natural areas, including Natura 2000 sites and biosphere reserves. This creates favourable conditions for combining academic training with real field-based ecological research.

A number of Czech institutions play a central role in the training of future ecologists. The Czech University of Life Sciences in Prague, Charles University, Masaryk University and Palacký University Olomouc provide ecology-related programmes at different levels of higher education

and offer specialised courses in areas such as landscape ecology, conservation biology, hydrobiology, environmental protection, biodiversity research, ecological monitoring and environmental education. The Czech Society for Ecology (*n.d.*) also contributes to the professional and academic development of ecology as a scientific field by supporting ecological research and cooperation among specialists.

Particular attention in the Czech context is given to Palacký University Olomouc, whose Department of Ecology and Environmental Sciences is one of the oldest ecological departments in the country. Its educational and research profile demonstrates the connection between fundamental ecology and applied environmental problem-solving. The department offers bachelor's, master's and doctoral programmes in ecology, environmental protection, landscape conservation, hydrobiology and environmental education. Its curriculum combines biological disciplines, Earth sciences, theoretical ecology, field excursions, practical training and courses related to nature and landscape conservation. Such a structure illustrates the Czech tendency to integrate research, field practice, interdisciplinary training and public engagement in ecological education (*Palacký University Olomouc, n.d.*).

The literature and institutional sources indicate that Czech ecological education is strongly aligned with European environmental policy. This alignment influences curriculum content, learning outcomes, research priorities and graduate employability. Students are prepared for participation in international research grants, cross-border conservation projects, EU-level environmental programmes and professional activity in environmental protection agencies, research institutions, state administration, non-governmental organisations and private environmental consulting. The flexibility of Czech study programmes is also important. Students may often shape individual learning trajectories by choosing specialised subjects and focusing on areas such as tropical ecology, behavioural ecology, ecogeography, microbial ecology or ecosystem services. This flexibility supports the formation of differentiated professional profiles.

The Ukrainian model of ecological education has its own specific features. Training in the speciality "Ecology" is offered by a large number of higher education institutions across the country. Ukrainian educational programmes traditionally combine classical ecology, environmental protection, nature management, ecological audit, environmental safety and sustainable development. At the same time, recent socio-political and environmental challenges have strengthened the relevance of green recovery, ecosystem restoration, military ecology, environmental consequences of war, environmental epidemiology and European integration. The National University of Kyiv-Mohyla Academy, for example, presents environmental studies as an area connected with natural sciences, environmental policy and sustainable development (*National University of Kyiv-Mohyla Academy, n.d.*).

Ukrainian ecological education is influenced by the Bologna Process and the broader movement towards integration into the European Higher Education Area. However, it also retains strong national regulatory features and a relatively standardised structure of educational programmes. Compared with the Czech model, Ukrainian programmes are often less flexible in terms of individual learning trajectories, although they provide broad interdisciplinary training in ecology and environmental protection. A typical Ukrainian programme prepares students for work in environmental departments of enterprises, state authorities, research institutions, laboratories, environmental inspections, protected areas and educational institutions. This reflects the practical

orientation of Ukrainian ecological education and its connection with national environmental governance.

The experience of Bohdan Khmelnytsky National University of Cherkasy is illustrative in this regard. Its "Ecology" educational programme at bachelor's and master's levels is aimed at forming general and professional competencies for practical, scientific, innovative and educational activity in the field of ecology, environmental protection and balanced nature management. The programme combines theoretical learning, practical training, internships and scientific project work. It is designed to prepare graduates for professional tasks in institutions, organisations, higher education establishments, public authorities and civil associations. According to institutional materials, the programme emphasises the ability to assess the state of natural systems, apply scientific methods to solve complex environmental problems and operate under conditions of uncertainty (*Cherkasy National University, n.d.*).

Another important direction in Ukrainian ecological education is the orientation towards sustainable development and green recovery. The National University of Food Technologies (*2026*), for instance, represents environmental safety and health as areas connected with sustainable development, environmental protection and applied ecological competencies. In the current Ukrainian context, such an orientation has particular importance because environmental training must respond not only to general global challenges, but also to the consequences of war-related damage, industrial risks, contamination, destruction of infrastructure and the need for post-war restoration of ecosystems and territories.

The review of institutional and academic sources shows that both Ukraine and the Czech Republic train ecologists at bachelor's, master's and doctoral levels and recognise ecology as an interdisciplinary field. In both countries, educational programmes include theoretical training, practical work, field studies, laboratory components and preparation for professional activity in environmental protection. Both systems also recognise the need to train specialists capable of working in public administration, research institutions, environmental organisations and private companies. These common features reflect broader European and global tendencies in ecological education.

At the same time, the comparison reveals important differences. Czech programmes are more strongly associated with flexible specialisation, internationalisation, EU environmental policy, research mobility and the integration of advanced field and laboratory infrastructure. Ukrainian programmes, while also interdisciplinary, are more closely connected with national environmental regulation, ecological audit, environmental protection, sustainable development, green recovery and restoration of territories affected by contemporary socio-ecological challenges. These differences do not indicate the superiority of one system over the other, but rather reflect different environmental priorities, institutional capacities and socio-historical conditions.

The reviewed literature also points to several unresolved issues. First, there is a need for deeper analysis of how ecological education can respond to rapidly changing environmental and geopolitical conditions. Fixed educational trajectories may be insufficient when ecological risks develop dynamically and require new competencies. Secondly, more attention should be paid to the balance between fundamental ecological theory and applied professional training. Thirdly, there is a need to strengthen individual learning pathways and modular curriculum design, especially in contexts where students must prepare for diverse professional roles. Fourthly, the

integration of digital technologies, ecological data analysis, environmental modelling and interdisciplinary project-based learning remains an important direction for the development of ecological education.

Thus, the literature review confirms that the professional training of future ecologists is a complex interdisciplinary problem that requires comparative analysis. Existing studies and institutional sources provide a basis for understanding ecological education as a field shaped by global environmental challenges and national educational priorities. However, the comparative dimension of Ukrainian and Czech experience remains insufficiently systematised. This creates a research gap that the present study addresses by analysing the common and distinctive features of professional training of ecologists in Ukraine and the Czech Republic, with particular attention to curriculum structure, practical training, fieldwork, internationalisation, European policy alignment and responsiveness to contemporary environmental challenges.

Results

The professional training of ecologists in the Czech Republic is very thorough and combines intensive fieldwork, data analysis and laboratory research. Programs often integrate applied landscape ecology, conservation biology and ecological monitoring. Key academic centers have strong international partnerships, EU policy training and unique specialized institutes (*Czech Universities, 2020*). Practical training emphasizes modern computational biology, data interpretation, and statistical modeling. Students have direct access to well-funded state and EU-backed research centers, allowing for extensive hands-on experience with advanced analytical chemistry and bioinformatics. Researchers state the Czech system offers highly modular, flexible study tracks and students can shape their learning paths, choosing specialized subjects like tropical ecology, ecogeography, or behavioral ecology starting from the master's level.

Professional training for environmentalists in Ukraine focuses on green recovery, European integration, and sustainable development. The curriculum, delivered by universities and research institutes, covers bachelor's, master's, and doctoral levels, integrating programs in ecomanagement, ecological audit, and climate decarbonization (*National University of Food Technologies, 2026*).

The training of ecologists in the Czech Republic is focused around interdisciplinary study programs (Bachelor, Master, PhD) and specialized field practice. The country is home to several world-class research and academic centers, whose programs often use European Natura 2000 protected areas and local biosphere reserves to conduct large-scale practical field research (Czech Society for Ecology). Leading institutions in this field are the Czech University of Life Sciences in Prague (CZU), which offers highly regarded programs such as the Applied and Landscape Ecology Program at Mendel University, and specialized degrees (e.g., Nature Conservation) at the CZU Faculty of Environmental Sciences; Charles University (Prague), which offers internationally recognized master's and doctoral programs in ecology, closely affiliated with the Czech Academy of Sciences; Masaryk University (Brno), known for its strong emphasis on aquatic and theoretical ecology; Palacký University in Olomouc, which has the specialized department of ecology, focusing on ecosystem services and public engagement (Palacký University Olomouc: Department of Ecology and Environmental Sciences). The researchers note that curricula at Czech universities largely focus on fundamental ecological theory, evolutionary biology, and empirical research. Universities such as Charles University and the Czech University of Life Sciences (ČZU) focus on

specialized fields such as macroecology, invasion ecology, and microbial ecology. Concerning EU policy, the Czech programs are strictly aligned with EU environmental policies and the degrees naturally prepare students for international research grants, cross-border conservation projects, and EU-level environmental law.

In Ukraine, training of specialists in the "Ecology" specialty is carried out in more than 90 higher educational institutions. Educational programs focus on both classical ecology and green restoration of territories. Leading universities involving high-quality environmental education are concentrated throughout the country. Among the leading higher education institutions are Taras Shevchenko National University of Kyiv, National University of Life Resources and Environmental Sciences of Ukraine, National University "Kyiv-Mohyla Academy", Ivan Franko Lviv National University, National Forestry University of Ukraine, V. N. Karazin Kharkiv National University, Odesa State Ecological University and others.

The curriculum for the "Ecology" specialty in Ukraine has traditionally been interdisciplinary. Due to recent events, the curriculum now places a strong emphasis on military ecology, restoration of ecosystems damaged by war, and environmental epidemiology (National University of Kyiv Mohyla Academy: Environmental Studies). Fieldwork is foundational, but programs often rely more heavily on classical monitoring methods. The researchers state that the educational framework is adapting to comply with the European Higher Education Area (Bologna Process) but retains its own distinct national standards, placing strong emphasis on state regulations and environmental auditing. Concerning specialization and flexibility in Ukraine, students typically choose a broad, designated educational program (e.g., Ecology and Environmental Protection) with less room to customize individual course trajectories.

Discussion

It should be noted that the Department of Ecology and Environmental Sciences in the Palacký University in Olomouc is the oldest department of ecology in the Czech Republic. With over 30 years of tradition, the department provides education and conducts research in the field of ecology and environmental sciences. It is a modern and dynamically growing academic department with experts in various fields, which supports strong international cooperation. The goal of the department is to promote and disseminate fundamental discoveries in ecology and apply them to key environmental problems facing our society today. Whether scientists study the dynamics of species populations, microbial activity in water, soil quality or ecosystem services on agricultural lands, they use ecological approaches and encourage public involvement in solving local and global environmental problems. Working at the intersection of fundamental and applied science, the members of the department educate students and inspire professionals and the public to better understand the living world around them and to adopt a more sustainable approach to the environment (Palacký University Olomouc: Department of Ecology and Environmental Sciences).

The department offers the opportunity to obtain a bachelor's degree in ecology and environmental protection, as well as a study program in biology and environmental education. As part of further study in the master's program, the program "Ecology and Environmental Protection" is offered, as well as the program "Protection and Creation of Landscapes", "Hydrobiology" or "Teaching Biology and Environmental Education for Secondary Schools". The department is also the guarantor of a doctoral program (PhD) in ecology (Palacký University

Olomouc: Department of Ecology and Environmental Sciences). The curriculum consists of basic lectures focused on biology, supplemented by courses from the Earth Sciences portfolio, and also includes subjects in theoretical ecology, after which ecology is applied in the form of practical courses on nature and landscape conservation, management, etc. An integral part of the curriculum is a series of field trips and exercises that complement the topics discussed in the lectures. During their studies, students can participate in selected exchange internships abroad. In addition to the department's staff, a number of external staff from other universities, scientific institutions and practices participate in the teaching (Palacký University Olomouc: Department of Ecology and Environmental Sciences). It should be noted that graduates of the educational program find employment in various organizations, such as state administration (e.g., Department of Environmental Protection), Department of Protected Landscape Areas, Nature Conservation Agency and National Parks (NP). Some find employment in science and research (academic institutions, museums, universities), private companies working in the field of environmental protection (expert opinions, planning, consulting, revitalization, tourism), as well as in school and extracurricular pedagogy (primary, secondary, university, Centers for Environmental Education, etc.) (Palacký University Olomouc: Department of Ecology and Environmental Sciences). Therefore, the training of specialists in the field of biology has a long tradition and is based on the needs of society in these specialists.

In Ukraine, Bohdan Khmelnytsky National University of Cherkasy offers training for bachelor's and master's degrees in the "Ecology" educational program, the purpose of which is to form general and professional competencies in higher education applicants to perform professional tasks and duties of a practical, innovative, scientific and educational nature in the field of ecology, environmental protection and balanced nature management in institutions, organizations, higher education institutions, state and executive authorities, public associations (Cherkasy National University). The educational and professional program of the master's degree is both fundamental and applied in nature; the structure of the program provides for dynamic, integrative and interactive learning. The program offers a comprehensive approach to performing activities in the field of ecology and implements this through teaching and practical training. The disciplines and modules included in the program are focused on relevant areas within which the applicant's further professional career is possible (Cherkasy National University). The main focuses of the educational and professional program are: acquiring skills and knowledge in ecology and environmental protection, developing in graduates the abilities of practical research and assessment of the state of natural systems at various levels of organization, applying theories and scientific methods to solve complex tasks and address real environmental problems that are characterized by complexity and uncertainty of conditions. The program provides for mandatory internships in environmental departments of enterprises, research institutions, laboratories and state authorities, writing and defending a scientific project (Cherkasy National University).

It should be noted that graduates of the "Ecology" educational program can work in such institutions, enterprises and organizations as scientific and research institutions in technical and natural sciences; state and corporate institutions of environmental management; laboratories of industrial enterprises, sanitary and epidemiological stations; environmental and customs inspections; inspections for control over the use and protection of land, plant protection, civil

protection and technogenic safety; objects of the nature reserve fund (reserves, national natural parks, zoos, botanical gardens, etc.) (Cherkasy National University).

Conclusion

Thus, the modern world faces a number of ecological problems. The concept of ecology is considered as a complex, interdisciplinary science of the relationships between organisms, society and the environment. Considering the challenges of the 21st century, ecologists are essential professionals for the modern world. The training of ecology experts varies around the world and is shaped by a region's unique environmental challenges, cultural values, and economic priorities.

The "Ecology" educational program, which is offered by universities and research institutes in the Czech Republic and Ukraine, covers the bachelor's, master's and doctoral levels. At the same time, educational programs in the Czech Republic often integrate applied landscape ecology, conservation biology and ecological monitoring. Educational programs in Ukraine focus on both classical ecology and green restoration of territories. Professional training of ecologists in the Czech Republic combines intensive fieldwork, data analysis and laboratory research. Professional training of ecologists in Ukraine applies a comprehensive approach to carrying out activities in the field of ecology and implements this also through training and practical training. The individual path and specialization of the educational program is more flexible in Czech universities, and their programs are strictly aligned with EU environmental policies. The educational path in Ukraine is largely preset. It should be noted that graduates of the educational program in both the Czech Republic and Ukraine find work in various organizations, such as state and corporate institutions in the field of environmental protection, as well as in academic institutions, universities, other scientific and educational institutions.

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Conflict of Interest

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