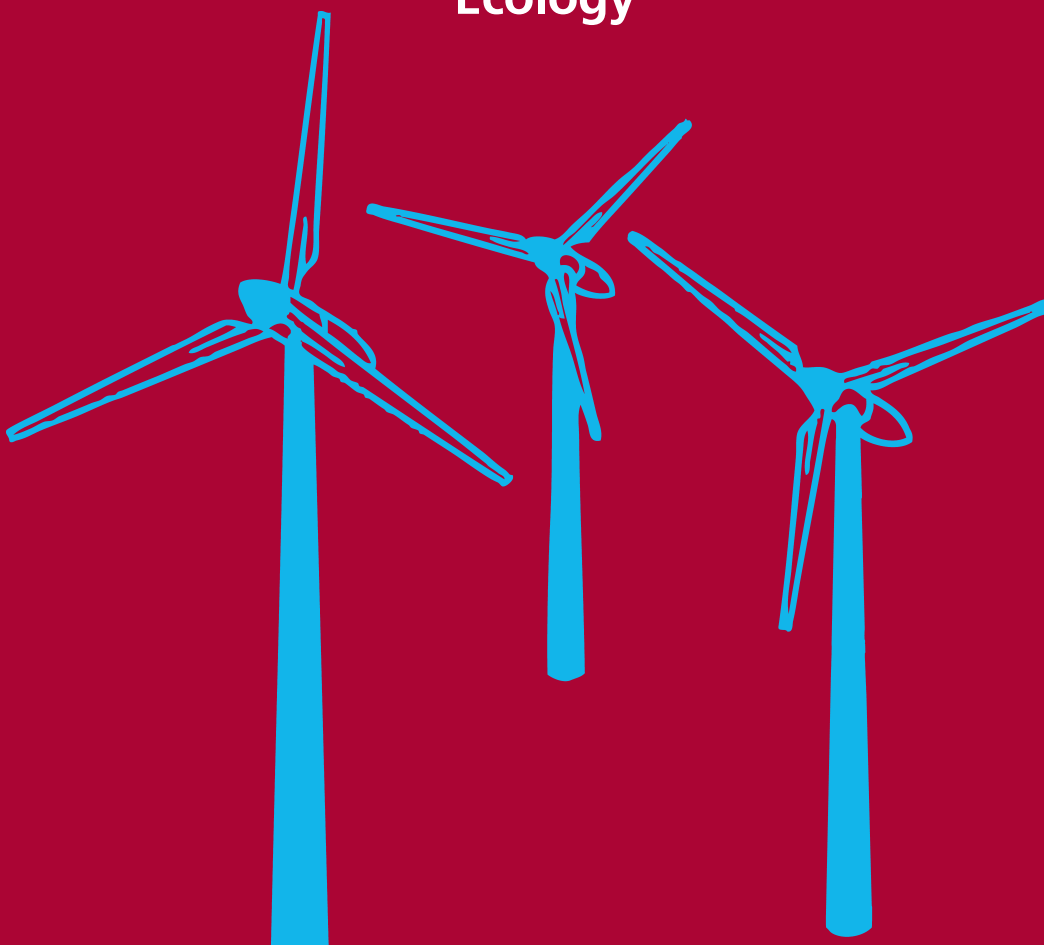
Tuning

Russia

Reference Points for the Design and Delivery of Degree Programmes in Ecology



Reference Points for the Design and Delivery of Degree Programmes in Ecology

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2013
University of Deusto
Bilbao

Reference Points for the Design and Delivery of Degree Programmes in Ecology

Reference Points are non-prescriptive indicators and general recommendations that aim to support the design, delivery and articulation of degree programmes in Ecology. The document has been developed by subject area group, including experts from Russian and European universities, in consultation with different stakeholders (academics, employers, students and graduates).

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Content

Preface

Tuning started as a project in 2000, initiated by higher education institutions and their academics, and strongly supported morally and financially by the European Commission. Over time Tuning has moved beyond the EU and gradually transformed itself into a global methodological system covering educational sectors in many regions of the world.

Androulla Vassiliou, the European Commissioner for Education, Culture, Multilingualism and Youth, underlined when closing the "Tuning in the World: New Degree Profiles for New Societies" Conference in Brussels on 21 November 2012, that whilst Tuning started as an attempt to solve a strictly European problem, it has become a methodology that can be adapted to different higher education structures in very different cultural contexts and that the commitment of the universities, the associations and the national authorities involved is key to the continuing success of this initiative.

The Tuning Russia project has been designed as an independent university-driven project with contributions of university staff members from different countries. The Tuning Russia project reflects the idea that universities do not look for the harmonisation of their degree programmes or any sort of unified, prescriptive or definitive curricula; but, simply for points of convergence and common understanding. The protection of the rich diversity of education has been paramount in the Tuning project from the very start and the Tuning Russia project in no way seeks to restrict the independence of academic and subject specialists, or damage local and national academic authorities. The objectives are completely different. Tuning looks for common reference points. The Reference points are

non-prescriptive indicators that aim to support the articulation of degree programmes.

The publication of the "Tuning Russia Reference Points" series became a reality due to collective work of Subject Area Groups and project teams at participating European and Russian universities, their academic and administrative personnel to whom we would like to express our sincere gratitude. We stress our deep appreciation to all European and Russian experts who have made a significant contribution to the development of reference points for the design and delivery of degree programmes in various subject areas.

The Tuning process in Russia has been supported by the National Tempus Office in the Russian Federation from the very beginning of the project. Our special thanks go to Director Olga Oleynikova, whose support and recommendations were invaluably important during the implementation of the project. The project and this publication would not have been possible without the coordination and recommendations of Tuning General Co-Coordinators Julia González and Robert Wagenaar.

We hope that readers will find this book both useful and interesting.

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1

General Introduction

The convergence of national educational systems within the EU is an important milestone in the global development of modern higher education in the 21st century. The day when the Bologna Declaration[1] was signed (19 June 1999), is considered the official starting point of the harmonization process of higher education systems within Europe, a process whose end aim consists in the creation of the European Higher Education Area (EHEA). Russia joined the Bologna process in September 2003 at the Berlin Conference of European Ministers in charge of Higher Education.

Signing the Bologna Declaration has led to a series of reforms in the educational systems of the majority of European countries. For higher education institutions (HEIs) these reforms consist in tuning basic teaching programmes in terms of both the structure and the outcomes of degrees. A prominent role should be given to the graduate and degree profiles so that they meet the needs of both the labour market and society, as well as to the specific tasks an academic community has to solve. Therefore, it is particularly important to express all the various educational levels in terms of competences and learning outcomes.

1.1. The contribution of universities to the Bologna Process and Tuning

It is well known that the Tuning Project —"Tuning educational structures"— has developed within the broader context of continuous

[1] The Bologna Declaration on the European space for higher education. http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf

reforms of European higher education systems, when society at large has been undergoing rapid changes. The name Tuning was chosen for the project to reflect the idea that universities do not look for uniformity in their degree programmes or any sort of unified, prescriptive or definitive European curricula but simply for points of reference, convergence and common understanding. The protection of the rich diversity of European education has been paramount in the Tuning Project from the very start and the project in no way seeks to restrict the independence of academic and subject specialists, or undermine local and national academic authority.

Tuning Educational Structures in Europe[2] started in 2000 as a project to link the political objectives of the Bologna Process and at a later stage the Lisbon Strategy to the higher educational sector. Over time, Tuning has developed into a Process, an approach to (re-) design, develop, implement, evaluate and enhance quality first, second and third cycle degree programmes. The Tuning Project and its methodology constitute one of the academic tools for creating the EHEA. The need for compatible, comparable and competitive higher education in Europe reflects the students' requirements. As student mobility increases, so does the demand for reliable and objective information on the degrees offered by different HEIs. Apart from this, employers both within and outside Europe require reliable information on qualifications awarded and on what these qualifications mean in practice and in the labour market context. Therefore, the process of creating national qualification frameworks is inseparable from the EHEA development process.

Tuning aims to meet the needs of educational institutions and structures and to offer a concrete approach to implementing the Bologna Process at the level of higher education institutions and subject areas. The Tuning approach proposes a methodology to (re-) design, develop, implement and evaluate study programmes for each of the higher education cycles. Furthermore, Tuning serves as a platform for developing reference points at subject area level. These are relevant to making study programmes comparable, compatible and transparent. The agreed-upon reference points for subject areas and their degree programmes are expressed in terms of competences and learning outcomes.

Tuning in general has emerged from the understanding that the Bologna Process is about universities, their students, academic and non-academic

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[2] Tuning Educational Structures in Europe. http://www.unideusto.org/tuningeu/

staff. It is they, with all their knowledge and experience, who should be deciding upon higher education innovation strategies. Tuning is a university-driven project and movement, which came into being as a reaction of HEIs to new challenges and new opportunities that emerged within the process of European integration and the creation of the EHEA.

1.2. Tuning in Russia

The Tuning methodology, which allowed European Universities to cooperate successfully and coordinate their activities aimed at creating unified educational cycles, uniform requirements for the structure of programmes, the development of common approaches to comparison and the assessment of learning outcomes, has become a "road map" for the Bologna process. Developed within the framework of the "Tuning educational programmes in European universities" project, the Tuning methodology as a universal tool for modernizing curricula in the context of achieving professional competences, has today gone beyond the borders of the EU and has acquired international significance. Universities in different countries and continents in expanding cooperation have increasingly resorted to using it to build joint programmes involving academic mobility, integrated education, introduction of a credit system, the exchange of educational modules and the mutual recognition of qualifications.

Russian Universities are also mastering the principles of the Tuning methodology through incorporating generic and subject specific competence descriptions into educational planning at the level of full degrees and individual degree components. Upon the implementation of the third-generation Federal State Educational Standards[3] based on principles compatible with the Tuning methodology – namely, making use of a credit-modular system, increasing the variety and number of elective courses, placing more emphasis on quality, taking into account professional qualification requirements, etc. – the interest in actively using the Tuning methodology to design educational programmes in different areas has increased significantly.

The first Russian HEIs that supported the need to develop the Tuning methodology were the Higher School of Economics, People's Friendship

[3] Federal State Educational Standards. http://xn--80abucjiibhv9a.xn--p1ai/документы/336

University of Russia and the Tomsk State University. In 2006-2008, within the framework of the "Tuning educational programmes in Russian universities"[4] TEMPUS project, these three centres designed bachelor and master degree programmes in the areas of «European Studies» and «Applied Mathematics».

The next step in the promotion of competence-oriented techniques within the system of higher education in Russia was the participation of Moscow State University, the Russian State University for the Humanities, St. Petersburg State University and Chelyabinsk State University along with the EU partners (2007-2008) in the "Russian Tuning-ECTS based model for the Implementation of the Bologna Process in Human Sciences" (RHUSTE)[5] TEMPUS project. Lists of generic and subject-specific competences and Bachelor's and Master's degree programmes in the areas of *History* and *Cultural Studies* were an outcome of that project. The experience of the reform of higher education in Russia in accordance with the principles of the Bologna process was summed up; Tuning methodology was analysed and recommendations on its implementation within the framework of Russian higher education system were advanced.

The "Tuning Russia"[6] project (TEMPUS, 2010-2013), which has brought together four EU universities (the project coordinator - University of Deusto, Bilbao, Spain; University of Groningen, Groningen, Netherlands; Trinity College Dublin, Dublin, Ireland; University of Padua, Padua, Italy), 13 Russian Universities (Astrakhan State University; Don State Technical University; Moscow State Academy of Business Administration; Moscow State Oblast (Region) University; Lomonosov Moscow State University; Moscow State University of Railway Engineering; N.I. Lobachevsky State University of Nizhni Novgorod; Yaroslav-the-Wise Novgorod State University; Russian State University for the Humanities; North Caucasus Federal University; Tver State University; Lev Tolstoy Tula State Pedagogical University; Udmurt State University) and the Association of the Classical Universities of Russia, tries to institutionalise the use of the Tuning methodology in the Russian Federation's educational practice. Its aim is to create a network of Tuning Centres in Russia and to develop a common

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[4] Tuning educational programs in Russian universities. http://www.hse.ru/org/hse/iori/pr15

[5] Russian Tuning-ECTS based model for the Implementation of the Bologna Process in Human Sciences (RHUSTE) http://ru-ects.csu.ru/

[6] Tuning Russia. http://tuningrussia.org/

list of generic and subject-specific competences which will be used later on in the process of structuring and describing higher education degree programmes of all levels in the following subject areas: Ecology, Economics and Management, Education, Environmental Engineering, Information and Communication Technologies, Languages, Law, Social Work, and Tourism.

This book contains the key general findings of the Subject Area Group within the Tuning Russia project. These reflect in synthesis the consensus reached by the group members and international experts on the subjects mentioned above. We hope and believe that the material contained in this book will be very useful for all higher education institutions wishing to implement the Bologna Process, and that it will help them to find and use the most suitable tools for adapting or creating higher education programmes in order to respond to the needs of today's society.

Julia González and *Robert Wagenaar*
Tuning General Co-Coordinators

2

Introduction to the subject area Ecology

2.1. Definition of the subject area

According to Ernst Haeckel's original definition Ecology is the "perception of nature's economy, simultaneous study of all living things' relationship with organic and inorganic components of the environment, including non-antagonistic and antagonistic relationships of plants and animals contacting each other. In a word, Ecology is the study of all those complex interactions referred to by Darwin as the conditions of the struggle for existence. Currently it is defined in the following way: "Ecology is an interdisciplinary field of knowledge about biological systems of different levels (from organisms to the biosphere) of response to various environmental factors, both abiotic and biotic, including the impact of human activity on the environment and human beings" or "Ecology is a set of different sciences, having in common study of the laws of existence and development of life on Earth, as well as potential hazards to life (including humans) from unbalanced human activities (irrational nature)."

Ecology is focused on the study of the formation, development and sustainability of biological systems of a wide range and how they are affected by interactions between organisms and their environment. The environment of an organism includes both the physical properties, which can be described as the sum of local abiotic factors like climate and geology, as well as the other organisms that share its habitat.

Ecology may be more simply defined as the relationship between living organisms and their abiotic and biotic environment or as the study of

the structure and function of nature. In this latter case, structure includes the distribution patterns and abundance of organisms, and function includes the interactions of populations, including competition, predation, symbiosis, and nutrient and energy cycles.

Ecology is focused on the study of most of the environmental disciplines based on the "object-environment" system. The specific research objects (biota, human being, society and etc.) in conjunction with the environment (natural, technological, socio-economic and etc.) are considered in the framework of various study disciplines (Bio-ecology, human ecology, social ecology, etc.). This complicated systems study in a comprehensive way requires the integrated efforts of the social and natural sciences, and engineering, conceptual ideas synthesis and empirical evidence.

During the XX century, the Ecology subject area has undergone significant extension through involving independent knowledge areas that have led to the formation of super-system environmental field of knowledge – mega science.

Ecology is targeted at investigating the following interactions:

- between organisms (including both nutritive and non-nutritive);
- between organisms and the environment
- inside the ecosystem itself;
- structure and functions in certain environment.

In the latter case structure is considered as the distribution and occurrence and functions of organisms present the populations interaction patterns including competition, carnivorism, symbiosis and food and power cycles. As a multidisciplinary science ecology addresses organisms at different levels from separate atoms up to biocenoses and bioenvironment.

Being a complex science, ecology provides diverse knowledge and deals with different aspects of nature and human interaction of all kinds.

Global (universal) ecology considers the peculiarities of the interaction between nature and society in the framework of the entire globe, including

the global environmental problems (climate warming of the planet, the reduction of the forest area, desertification, pollution of the habitat of living organisms, etc.).

Classical (biological) ecology explores the connection between living systems (organisms, populations, communities) and their habitat environment, both in the present and in the past (paleoecology). The different branches of biological ecology study different living systems: autecology - ecology of organisms, population ecology - ecology of populations, synecology - ecological communities.

Applied ecology defines the standards (limits) for natural resources usage, provides calculations of the permissible natural environment load for its maintenance and suitability for natural systems life activity.

Social ecology explains and forecasts the basic roadmaps for human society's interaction with the natural environment.

Regional ecology reveals features of the mutual influence of natural environment and human activities in the specific circumstances of individual territories and regions taking into account both administrative and natural boundaries.

This subdivision is based on a research-subject basis.

Ecology is a broad science which can be subdivided into major and minor sub-disciplines. The major sub-disciplines include:

- Physiological ecology (or ecophysiology), which studies the influence of the biotic and abiotic environment on the physiology of the individual, and the adaptation of the individual to its environment;
- Behavioural ecology, which studies the ecological and evolutionary basis for animal behaviour, and the roles of behaviour in enabling animals to adapt to their ecological niches;
- Population ecology (or autecology), which deals with the dynamics of populations within species and the interactions of these populations with environmental factors;
- Community ecology (or synecology) which studies the interactions between species within an ecological community;

- Demoecology (Ecology of populations and species) studies the relationship between populations and their environment, demography and a number of other population characteristics in regard to the environment;
- Ecosystem ecology, which studies the flows of energy and matter through ecosystems;
- Medical ecology, which studies issues of human health in which environmental disturbances play a role
- Landscape ecology, which studies the interactions between discrete elements of a landscape and spatial patterns, including the role of disturbance and human impacts;
- Global ecology, which looks at ecological questions at the global level, often asking macro-ecological questions;
- Evolutionary ecology, which either can be considered the evolutionary histories of species and the interactions between them, or approaches the study of evolution by including elements of species interaction;
- And eco-linguistics, which looks at the relation between ecology and language.

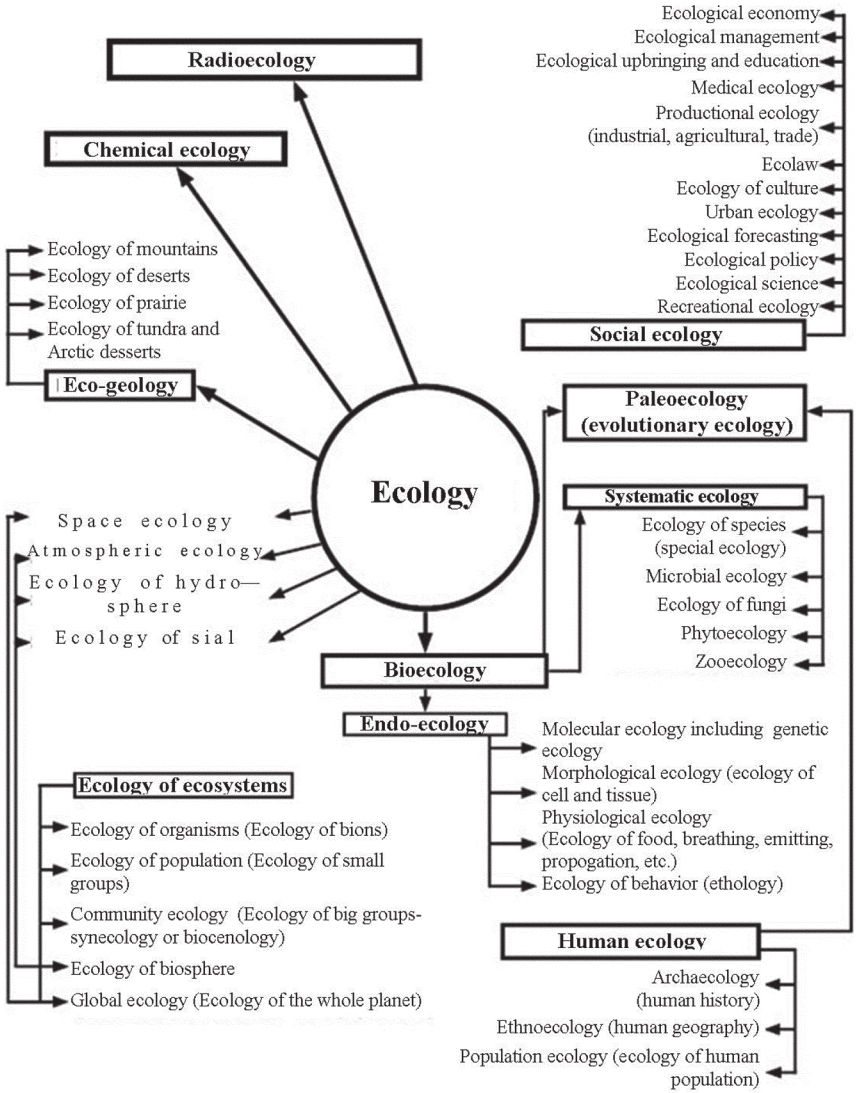
Ecology can also be sub-divided on the basis of target groups to animal ecology, plant ecology, insect ecology, human ecology, and so forth.

Ecology and Environment Protection is an interdisciplinary field of knowledge and practical activities including more than ten fundamental knowledge areas (according to the official knowledge classification), in addition to Biology, Geology, Geography, Soil Science, Chemistry, Physics, Economy, Law, Sociology, Psychology, as well as Information Technology, Pedagogy and so on.

Ecology can, in addition, be sub-divided from the perspective of the studied biomes to arctic ecology (or polar ecology), tropical ecology, desert ecology, aquatic ecology, terrestrial ecology, wetland ecology, and temperate zone ecology.

Ecology can also be sub-divided on whether or not the emphasis is on application to human activities, such as resource management, environmental conservation, and restoration to theoretical ecology and applied ecology (including such sub fields as landscape ecology, conservation biology, and restoration ecology) etc.

Historically, the Russian higher education environment has determined three independent areas: "Bio-ecology" in the framework of Biology;



Picture 1
Structure of modern ecology

"Ecology and Nature Management" based on the separate interdisciplinary field implemented in the classical universities;" Environment Protection" in

the field of Engineering. These three areas are distinguished significantly one from another according to training content and graduates competencies.

The first area - Bio-ecology (Ecology) is the part of Biology. The main task of Bio-ecology is to study the reaction of the organisms, population and ecosystems to the influence of the environmental factors (including biological) and to use this knowledge for solving such applied problems as: cultivation of individual species, agriculture, forestry, etc., as well as for providing biological monitoring, environment impact evaluation on biological systems at all levels. One of the most important tasks of this field of science is to determine the lowest-observed adverse effect level on organisms, populations and ecosystems (work load, doses and etc.). In this area, the biological disciplines prevail in the structure of the educational programmes. The first training cycle corresponds to the Bachelor of Biology.

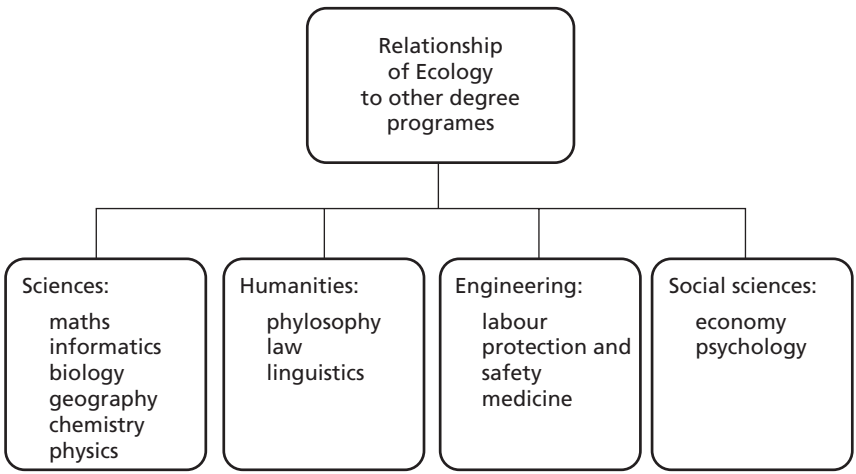
The second area - Ecology and Nature Management (Environmental Science) is considered as cross-disciplinary field according to its content and methods. This subject area is defined to a special part in the science classification with such sciences as Biology, Geology, Chemistry, etc. The main objective of Ecology and Nature is constituted by the rules of environment conservation development and of its effective implementation and control. Environment and Nature Management Experts should have all the knowledge necessary for conducting complex multidisciplinary projects, reviews and economic activities in the context of anticipated effects on environment, biological systems and human being. These area key indicators are the standards of admissible environment impact. That is why the training should provide an in-depth understanding by graduates of the criteria and indicators that determine the final standards value.

The third area is Environment Protection (Engineering Environment). The main objective of this area in higher education is targeted at the analysis of methods of technical implementation on the environmental requirements and standards basis. In other words, Environment Protection deals with technological support to environmental and natural problems. In Russia the three areas mentioned above, institutionalized in the relevant subject knowledge areas, have developed independently from each other for the last 20-25 years. The training content was developed by the Ministry of Education through three different committees comprised of highly qualified experts. In this project environmental education is determined on "Ecology and Nature" basis.

2.2. The relationship of the subject area with other degree programmes

Currently ecology deals with a huge range of issues and is closely connected with social sciences, engineering and humanities, being considered as universal, fundamental and integrated science.

The methodology of ecology nowadays emphasizes the integration focus, defining its place in the system of sciences. Ecology is an independent branch of scientific knowledge being at the same time linked or related to many areas of natural sciences, humanities and engineering as well as to various spheres of human activity. Ecology is based on a variety of sciences related to its origin (e.g., biology) or the object of the study (geography, geology). Thus, this subject area has an interdisciplinary character and makes up a multidimensional sphere of knowledge



Picture 2
The relationship of Ecology area to other degree programmes

In the field of natural science and mathematical background:

- The graduate should possess the knowledge necessary for the development of the physical, chemical and biological principles in ecology and environmental management, own methods of chemical

analysis, methods of sampling and analysis of geological and biological samples, have the skills to identify and characterize biological diversity, its assessment by modern methods of quantitative information analysis;
- Should have a basic knowledge of the fundamental areas of mathematics to the extent necessary for the possession of the mathematical apparatus of environmental sciences, data processing and analysis of data in ecology and environment management, mathematical modelling of environmental processes, to have a basic knowledge of computer science, be skilled in the use of software tools and work in computer networks, the ability to create databases and use the resources of the Internet;
- Have a basic knowledge of the fundamental branches of physics, chemistry and biology to the extent necessary for the development of the physical, chemical and biological principles in ecology and environmental management, as well as methods of sampling and analysis of geological and biological samples, have the skills to identify and characterize biological diversity, its assessment by modern methods of quantitative information analysis;
- Have a professionally profiled knowledge and practical skills in general geology, theoretical and practical geography, soil science and be able to use them in the field of ecology and environmental management.

In the field of technical training:

- The graduate, using the knowledge and techniques of natural and scientific disciplines and mathematical modelling should be able to predict the processes that occur in the biosphere under the influence of various anthropogenic factors; know the emission control system of toxic substances, and be able to assess the impact of these processes on human health and the environment.

Modern ecology is working closely with the humanities and social sciences. The graduate should:

- have the culture of thinking, the ability to perceive, analyse and synthesize information, build oral and written language, use the fundamentals and techniques of social and economic sciences in solving

social and professional problems, to be able to analyse socially relevant issues and processes;
- have basic knowledge of Russian history, philosophy, economy and social science, as well as ability to use them in the field of ecology and environment management;
- have basic understanding of the legal issues.

3

Qualifications in Ecology

Within Ecology subject area the following degrees and qualifications are offered in Russian universities:

Table 1
Degrees and qualifications in Ecology

Cycle	Degrees	Qualification awarded	ECTS credits
1st cycle	1. Ecology and use of natural resources 2. Water resources and aquaculture 3. Bioengineering systems and technologies 4. Energy and resource saving in chemical engineering, petroleum chemistry and biotechnology 5. Landscape architecture 6. Forestry 7. Environmental engineering and water resources management 8. Applied hydrometeorology	Bachelor	240

Cycle	Degrees	Qualification awarded	ECTS credits
2nd cycle	1. Ecology and use of natural resources 2. Water resources and aquaculture 3. Bioengineering systems and technologies 4. Energy and resource saving in chemical engineering, petroleum chemistry and biotechnology 5. Landscape architecture 6. Forestry 7. Environmental engineering and water resources management 8. Applied hydrometeorology	Master	120
2nd cycle	Fire safety	Specialist	At least 300

4

Typical occupations of graduates in Ecology

Students with an ecology degree are able to work in a variety of areas including areas that are not necessarily within the environment, but rather within science in general because of the plethora of skills learned with the degree. Although ecological funding may be dependent on fluctuating economy, environmental issues are now major concerns in Russia as well as in many countries around the world with environmental impact studies becoming a regular part of urban planning.

A graduate may hold positions that require higher professional education according to the current legislation of the Russian Federation: ecologist, researcher, engineer, environment protection engineer, trainee-researcher in the field of Ecology, economist in natural resources, scientific editor, engineer-researcher and if the graduate conducts an appropriate professional pedagogical profile program s/he may hold the positions of higher education teacher in high schools, colleges, educational institutions.

Table 2
The areas of professional activities for Ecology area graduates

Levels of education	Areas of professional activity
First Level: Bachelor's degree	Bachelor is prepared for the following types of professional activity: • design and production, • control-audit, • administrative, • teaching • supervised research. The area of professional activities includes: In design and production activities: Collection and processing of primary documentation for the assessment of impacts on the environment, participation in the design of standard measures for the protection of nature, design and expertise of socio-economic and business activities for the implementation of projects in the areas of hierarchical level, project development of practical recommendations for the maintenance of the natural environment. In control and audit activities: Preparation of documentation for the ecological assessment of various types of project analysis. Participation in the control and audit activities, environmental audit. In administrative activities: Participation in the work of administrative government bodies. Assurance of ecological safety of the national economy and other spheres of human activity. In teaching activities: Training and educational work at educational institutions, educational institutions of primary vocational, secondary and higher vocational education. In the research activities: Participation in research in the field of ecology, conservation and other environmental sciences at academic institutions and universities under the supervision of professionals and skilled scientists, including laboratory research, collection and initial processing of the material, participation in field research; Areas of employment: • design, exploration, production, research organizations, offices, businesses, and others; • bodies for nature protection and environmental management (federal, municipal and regional agencies of the Ministry of Natural Resources, State Committee of the Russian Federation, the Ministry of Agriculture, local administrative bodies and other environmental agencies and institutions); • general special educational institutions, etc.

Levels of education	Areas of professional activity
Second Level: Master's degree	Master is prepared for the following types of professional activity: • research, • design and production, • expert - analytical and control - audit, • administration, • teaching. • Master's fields of activities include: In the research activities: Identifying issues, problems and methods of scientific research, getting new information on the basis of observations, experiments, scientific analysis of empirical data, referencing of scientific papers, analytical reviews of accumulated information in the world of science and production activities, generalization of the results in the context of previously accumulated knowledge in science, formulation of conclusions and practical recommendations on the basis of representative and original research results, conducting comprehensive research of regional, national and global environmental issues, development of recommendations for their resolution, evaluation, sustainability and the forecast of natural systems development, the assessment of health status and basic demographic trends in the region on the available statistical data reported. In the design and production activities: Design of environmental management activities, assessment of the impacts of planned buildings or other forms of economic activity on the environment, the implementation of environmental monitoring, analysis of private and common problems of natural conditions and resources, environmental management. Detection and diagnosis of the problems of nature protection, development of practical recommendations for the maintenance of the natural environment, control and audit activities, the environmental audit; In the administrative activities: Management of the department, the sector, the working group, development of systems for environmental management of enterprises and industries. In teaching activities: Educational activities at the universities. Areas of employment: • design, exploration, production, research organizations, offices, businesses, and others; • bodies of nature protection and environmental management (federal, municipal and regional agencies of the Ministry of Natural Resources, State Committee of the Russian Federation, the Ministry of Agriculture, local administrative bodies and other environmental agencies and institutions); • universities, secondary and special schools, etc.

5

Competences

5.1. Definition of competences and learning outcomes

The introduction of a two or three cycle system makes it necessary to revise all existing study programmes which are not based on the concept of cycles. In practice these programmes have to be redesigned because in a cycle system each cycle should be seen as an entity in itself. The first two cycles should not only give access to the following cycle but also to the labour market. This shows the relevance of using the concept of competences as a basis for learning outcomes.

Tuning makes the distinction between learning outcomes and competences to distinguish the different roles of the most relevant players: academic staff and students/learners. Expected learning outcomes of a process of learning are formulated by the academic staff, preferably involving student representatives in the process, on the basis of input of internal and external stakeholders. Competences are obtained or developed during the process of learning by the student/learner.

Competences are defined in Tuning as a dynamic combination of knowledge, understanding, skills and abilities. Fostering competences is the object of educational programmes. Competences will be formed in various course units and assessed at different stages. As a rule, competences cannot be fully developed within one particular discipline. Competences are normally developed in an integrated and cyclical manner throughout a programme, sensitive not only to the contents of learning but to the teaching format and methodology. Yet, in some systems (e.g. modular system) is it also feasible to develop a certain subject specific competence during one module focused on this particular competence. To make levels

of learning comparable, the cycle (level) descriptors are developed for specific subject areas and are also expressed in terms of competences.

Learning outcomes are statements of what a learner is expected to know, understand and be able to demonstrate after the completion of a learning experience. According to Tuning, learning outcomes are expressed in terms of the level of competence to be obtained by the learner. They can refer to a single course unit or module or else to a period of studies, for example, a first, a second and a third cycle programme. Learning outcomes specify the requirements for the award of a credit. Learning outcomes and assessment criteria together determine the credit allocation requirements, while a grade is given on the basis of students' achievements, which might be above or below the credit-allocation benchmark.

The *Tuning Russia* project defines "learning outcomes" as measurable and assessable competence "components" which are formulated by the teaching staff who expect learners to be able to reach and demonstrate these learning outcomes at the end of an education programme or an education programme component. Learning outcomes are described with active verbs (be able to do/demonstrate/will have completed…). To reiterate, learning outcomes may belong to a whole programme or to a programme element (unit). Learning outcomes can also belong to one particular thematic (didactic) discipline unit (module). Learning outcomes' statements form the basis for workload calculation and, therefore, for ECTS allocation among structural units of a degree programme. It is necessary to achieve the intended learning outcomes in order to be awarded the corresponding number of ECTS credits.

Competences are divided into generic and subject specific. Although Tuning fully recognises the importance of subject-specific competences, it has been found that considerable time and effort should be devoted to developing generic competences. Competences described by *Tuning Russia* project should be used as reference points by programme developers but are not meant to be interpreted as prescriptive. In other words, programme development flexibility and autonomy is preserved, while a common language for formulating programme aims and objectives is made available.

The use of learning outcomes allows for much more flexibility than is the case in more traditionally designed study programmes, because they show that different pathways can lead to comparable outcomes; outcomes

which can be much more easily recognized as part of another programme or as the basis for entrance to a next cycle programme. Their use fully respects the autonomy of other institutions as well as other educational cultures. Therefore this approach allows for diversity, not only in a global, European, national or institutional framework, but also in the context of a single programme.

5.2. List of competences

5.2.1. Selecting competences in accordance with the Tuning methodology

Introducing the student-centred approach means that the focus is shifted from the educational process to learning outcomes, that the learner's and the teacher's roles change and that the learner becomes the centre of attention. It also becomes crucial to constantly check what generic and specific competences are required in society. Therefore, consultations with different stakeholders need to be conducted and lists of competences considered relevant should be constantly revised. Since the language of competences has come from outside the world of education, it suits the consultation needs best to allow easy dialogue with stakeholders not involved directly in academic activity. The competence discourse permits designing new degrees and elaborating mechanisms for improving those degrees that exist already.

Therefore, within the *Tuning Russia* project a consultation process including employers, graduates and academic staff/faculty has been organised in order to identify the most important generic and subject-specific competences that should be formed or developed in different degree programmes. As a result, lists of generic and subject-specific competences for the selected subject areas have been produced (c.f. 5.2.2 and 5.2.3).

Consultation on generic and subject-specific competences was carried out with a help of a questionnaire. The aims were as follows:

- Initiate an all-Russia general debate on competences based on consultations carried out with the different stakeholders: employers, students, graduates and academics.
- Collect up-to-date information in order to analyse the current situation in Russia and to possibly detect current tendencies and changes.

- Based on this information, judge how different or similar various stakeholders' perspectives might be, always using precise language comprehensible to all those involved.
- Limit the debate topic to three different levels: institutional (the basis and the first level of discussion), level of subject areas (reference points for HEIs) and generalised level (related to the general situation in Russia).
- Compare the results with data obtained through similar consultations carried out in Europe and other countries, in order to determine any possible common tendencies and/or regional and/or subject-area peculiarities.

Respondents were asked to 1) indicate the level of importance and development of a competence and to 2) rank the five most important competences. For each competence, a person filling out the questionnaire had to indicate (1) the level of its importance for future professional work and (2) the level up to which this competence was deemed to be developed within a particular degree programme already in place. A four-point scale was used with 1 being equal to "zero" importance/ development level and 4 being equal to "high" importance and/or development.

The lists of generic and subject-specific competence were drawn by each *Tuning Russia* Subject Area Group (SAG) in the following way:

a) Russian labour market and Russian Federation Professional Standards for the occupational area were analysed;
b) Requirements for the basic outputs of Bachelor and Master degrees stipulated in Russian Federation State Educational Standards were analysed;
c) Existing international professional standards for the occupational area were analysed;
d) *Tuning Europe* procedures for selecting generic and subject-specific competences were analysed and adapted;
e) Russian and EU experts were consulted;
f) Initial lists of generic competences suggested by the various SAGs were discussed and the common core within the lists was identified;
g) Russian employers, students, academics and graduates were consulted about the resulting lists of generic and subject-specific competences;
h) Final lists of generic and subject-specific competences were compiled after analysing the results of the stakeholder-consultation process.

The list of generic competences comprises 30 items (section 5.2.2) and separate lists of subject-specific competences have been developed for nine subject areas: Ecology, Economics and Management, Education, Environmental Engineering, Information and Communication Technologies, Languages, Law, Social Work, and Tourism (section 5.2.3). Lists of subject-specific competences can be consulted in separate publications (like this one) —Reference Points— prepared by SAGs on the basis of discussions in groups, thematic and subject networks and professional communities. These lists account for the results of the consultations with all the stakeholders. Since every subject area has its own peculiarities, SAGs used slightly different approaches. Nonetheless, in order to obtain comparable results, a common procedure was used by all SAGs. In each case, the list was drawn up after a consensus was reached in the group discussion and after studying the ways the subject degrees are organised in different regions of Russia and in other countries. It should be borne in mind that the resulting documents may still be amplified and amended.

The use of learning outcomes and competences is necessary in order to make study programmes and their course units or modules student centred/output oriented. This approach requires that the key knowledge and skills that a student needs to achieve during the learning process determine the content of the study programme. Competences and learning outcomes, in turn, focus on the requirements both of the discipline and of society in terms of preparing for citizenship and employability.

In an output based study programme the main emphasis lies on the degree or qualification profile. This profile is determined by the academic staff and endorsed by the responsible authorities. The profile should be based on an identified and recognized need by society. Although every programme profile is unique and based on the judgements and decisions of academic staff, academics have to take into account the specific features which are seen as being crucial for the subject area concerned. In *Tuning Russia* project, the academics involved identified specific features of their own subject area. These are reflected in so-called meta-profiles, which are, in turn, based on the lists of generic and subject specific competences for each focus subject area (section 5.2.4).

5.2.2. Generic competences

One of the main aims of the *Tuning Russia* project has been that of compiling a unified list of generic competences relevant for various degrees in many subject areas. In order to determine which generic competences appeared to be the most important ones, broad consultations have been carried out with graduates, students, employers and academics. The procedure was as follows:

1. The Russian members of each SAG drew initial lists of generic competences they considered key ones;
2. The lists were discussed by the Russian members of each SAG with EU experts and were amended if this was deemed necessary;
3. Lists proposed by each SAG were compared and the following categories of competences were distinguished: the common core of generic competences selected by all SAGs was identified; competences selected by the majority of SAGs, those selected only by some SAGs and those selected by only one SAG;
4. The list of 30 generic competences was agreed upon and its Russian and English versions were established in order to be used during the consultation process;
5. Students, employers, graduated and academics were consulted;
6. Questionnaires were analysed and the final list of generic competences, common for all the Project SAGs was drawn. The results were discussed by all SAGs.

The final list comprises the following 30 competences:

Table 3
Generic competences

Competence code	Competence
GC 1	Ability for abstract thinking, analysis and synthesis
GC 2	Ability to work in a team
GC 3	Capacity to generate new ideas (Creativity)
GC 4	Ability to identify, pose and resolve problems

Competence code	Competence
GC 5	Ability to design and manage projects
GC 6	Ability to apply knowledge in practical situations
GC 7	Ability to communicate in a second language
GC 8	Skills in the use of information and communication technologies
GC 9	Capacity to learn and stay up-to-date with learning
GC 10	Ability to communicate both orally and in written form in the native language
GC 11	Ability to work autonomously
GC 12	Ability to make reasoned decisions
GC 13	Ability for critical thinking
GC 14	Appreciation of and respect for diversity and multiculturalism
GC 15	Ability to act with social responsibility and civic awareness
GC 16	Ability to act on the basis of ethical reasoning
GC 17	Commitment to the conservation of the environment
GC 18	Ability to communicate with non-experts of one's field
GC 19	Ability to plan and manage time
GC 20	Ability to evaluate and maintain the quality of work produced
GC 21	Ability to be critical and self-critical
GC 22	Ability to search for, process and analyse information from a variety of sources
GC 23	Commitment to safety
GC 24	Interpersonal and interactional skills
GC 25	Ability to undertake research at an appropriate level
GC 26	Knowledge and understanding of the subject area and understanding of the profession
GC 27	Ability to resolve conflicts and negotiate
GC 28	Ability to focus on quality
GC 29	Ability to focus on results
GC 30	Ability to innovate

The analysis of the survey of respondents in the subject group has identified the most important generic competences for Ecology Bachelors and cut the list to 10 of great priority for the Ecology area.

Table 4
List of general competence for the subject area "Ecology"

Competence code	Competence
GC 1	Ability to apply knowledge in practical situations
GC 2	Knowledge and understanding of the subject area
GC 3	Ability to make considered decisions
GC 4	Ability to identify, formulate and solve problems
GC 5	Ability to find, process and analyze information from different sources
GC 6	Ability to work independently
GC 7	Ability to use information and communication technologies
GC 8	Self-development
GC 9	Commitment to safety
GC 10	Understanding and respect for diversity and multicultural society

5.2.3. Subject specific competences

Subject specific competences allow the graduate to understand the degree of responsibility for and form the skills aimed at ensuring the environmental safety of all spheres of human activity and the environment: participate in laboratory and field studies in the sphere of ecology and environment, to process research material, participate in the design, implementation and review of activities for the protection of the environment; to be able to work with the documentation for the environmental impact assessment, to carry out an environmental audit to make recommendations aimed at preserving the environment and environmental management.

Table 5
List of subject specific competences for the subject area of "Ecology"

Competence code	Competence
SC 1	Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology
SC 2	Recognize the applications and responsibilities of ecology and its role in society
SC 3	Show adequate knowledge of other disciplines relevant to ecology
SC 4	Independently analyse environmental materials in the field and laboratory, be able to describe, document and report the results
SC 5	Effectively apply basic principles of the natural and social sciences to current issues of ecology
SC 6	Understand and appropriately use the vocabularies relevant to issues of ecology
SC 7	Write and speak clearly about technical issues related to ecology
SC 8	Work collaboratively with other professionals in the discipline to address significant policy issues in ecology
SC 9	Choose and apply appropriate quantitative tools necessary to analyse significant issues related to ecology
SC 10	Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology
SC 11	Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs
SC 12	Demonstrate comprehensive knowledge in at least one of the specialized areas of ecology
SC 13	Be able to define, determine and implement a strategy for solving an ecology problem
SC 14	Be able to communicate ecology issues with wider society
SC 15	Understand and be able to explain the broad concepts of ecological issues to students and other professionals
SC 16	Be able to understand the interactions of environmental processes and test the results of this research
SC 17	Produce a substantial reports or thesis including an executive summary
SC 18	Demonstrate the ability to perform independent, original, and ultimately publishable and applicable research in the field of ecology

In the Russian system of higher education subject areas are subdivided into profiles (Ecology and Nature Management area is subdivided into ecology, nature management, geo-ecology, and ecological safety). The competences listed above are common to all the profiles. Subject-specific competencies are formed in the process of studying specific vocational courses that support the selected profile, so the list of subject-specific competencies may be enriched with competences typical for certain profile. It can be illustrated by the following examples taken from Federal State Education Standard for Ecology and Nature Management area.

Table 6
Competences proposed for Ecology
and Nature management area profiles

Profile	Competencies
Ecology	• to know the theoretical basics of biogeography, ecology of animals, plants and micro-organisms; • to use methods of applied ecology, environmental mapping, environmental assessment and monitoring; • to apply methods of data processing, analysis and synthesis of field and laboratory environmental information
Nature management	• to know the theoretical foundations of biogeography, the total resource studies and regional nature management, mapping; • to be competent in methods of environmental design and assessment, environmental management and auditing and environmental mapping, including: methods of data processing, analysis and synthesis of field and laboratory environmental information
Geo-ecology	• to know and be able to solve global and regional geo-ecological problems; • to use methods of landscape and geo-environmental engineering, monitoring and assessment; • to know the theoretical basis of geochemistry and geophysics of the environment, • to apply methods of geochemical and geophysical studies; • to be competent in methods of general and geo-environmental mapping to use methods of data processing, analysis and synthesis of field and laboratory geo-environmental information;

Profile	Competencies
Ecological safety	• to know the theoretical framework for ensuring environmental safety and profitability of an enterprise on the basis of eco-balanced development; • to know the impact of industry on the environment and be able to take into account the response of the environment on the functioning of various industries, • understand the application of basic engineering methods to environmental protection; • to be familiar with modern ideas about the nature, physical and chemical properties of various toxicants (xenobiotics), the laws of their chemical transformations in the environment, including anthropogenically altered, the accumulation in the ecosystem, • to be able to assess the environmental impact of the joint action of natural and anthropogenic pollutants on living objects.

As the result of the first stage of work a list of general and professional competencies was made and agreed upon by the members of the subject group after discussion with the expert in accordance with the Tuning methodology.

At the second stage there was a survey of representatives of the four target groups of stakeholders - the academic community, employers, graduates and students. Respondents were invited to assess generic and subject specific competences according to their needs and experience.

During the first stage of the design of the list of subject specific competence participants in the SAG had analysed the programmes and curricula of their European partner-universities, providing education in the field of Ecology and explored materials, presenting experience of subject specific competences elaboration in the framework of Tuning project implementation in EU countries. The SAG has compiled the initial list of subject specific competences, which was then proposed for survey to the following groups of respondents - academics, students, graduates and employers (June 2011). At this stage, Saint-Petersburg State University of Water Communications and Tyumen State University of Oil and Gas joined the SAG work and voluntarily carried out the survey in their regions that

enabled an expanded geographical reach of the questionnaire process. A total of 919 people were surveyed, the number of responses divided into groups as follows:

Group of respondents	Academics	Employers	Students	Graduates
Total number	196	193	268	262

In May-July 2011 lists of the general and professional competencies were available for inspection through the online mode. The survey was held about the importance and achievement of competences both online and on paper using a four-point scale. Links to the survey were sent to the email addresses of the respondents personally, transmitted. Competence assessment was based on data obtained from all four groups of respondents involved in the educational process.

The group of graduates was represented by ecologists, environmental engineers and inspectors as well as specialists of the ecological planning departments, further education lecturers etc. The respondents were asked to arrange the competences proposed according to the following criteria: importance and achievement. By importance we mean the decision which of the competences is more substantial and necessary for professional activities in the field of ecology. An achievement criteria shows if the level of the competence currently formed by HEIs is enough for further work. Also methods of qualitative analysis and univariate statistics were used.

There are some issues that require more detailed analysis to address the problem. First of all, it is the mismatch between teachers and employers requirements for the competencies of graduates. In most cases an employer requires a quite highly specialized worker, with a bachelor degree who is able to follow instructions and perform some specific set of functions. Quite rarely creativity and innovation are welcomed, not to mention the scientific significance of results. In this case, what are the requirements to be considered in the design of the educational program? What is the employer in the educational process - the customer or the consumer? What are the relationships between the labour market and the educational market? What are the advantages of master's education, if the master degree is for industry, if the Master

is primarily seen as a researcher? On the other hand, if there is enough knowledge given in 1st cycle programme for graduates to be successful in an enterprise?

The survey also identified regional peculiarities. For example, the main feature of the Astrakhan region is polyethnicity and economic sector's focus on hydrocarbons production. Therefore, from the point of view of employers (and it is mostly hydrocarbon production companies, representatives of specially protected nature conservation areas, the solid wastes processing companies, research institutions) core competencies of graduates should be the following: ability to work in an international environment, and to speak foreign languages. The Tver region is rich in water resources, and this is reflected in the curricula: there are many disciplines and elective courses devoted to the study, management, control and protection of water and wetland sites. Special attention is paid to the monitoring of all components of the environment (water, air, soil, etc.), mapping and GIS technologies.

The results of the survey are presented in the following graphs for each of the groups of respondents, respectively.

Analysis of the data of all four groups of respondents helps to determine the requirements of employers for graduates both taking into account general and professional competence, and shows how employers evaluate the training of future specialists in high school. Comparison of the results of the survey of university teachers and senior students with the results of the survey of employers and graduates indicate deficiencies in the training programs, a need to adjust them.

Academics

Diagram 1 demonstrates the ratio of the average values of subject specific competences importance and level of their achievement during university studies.

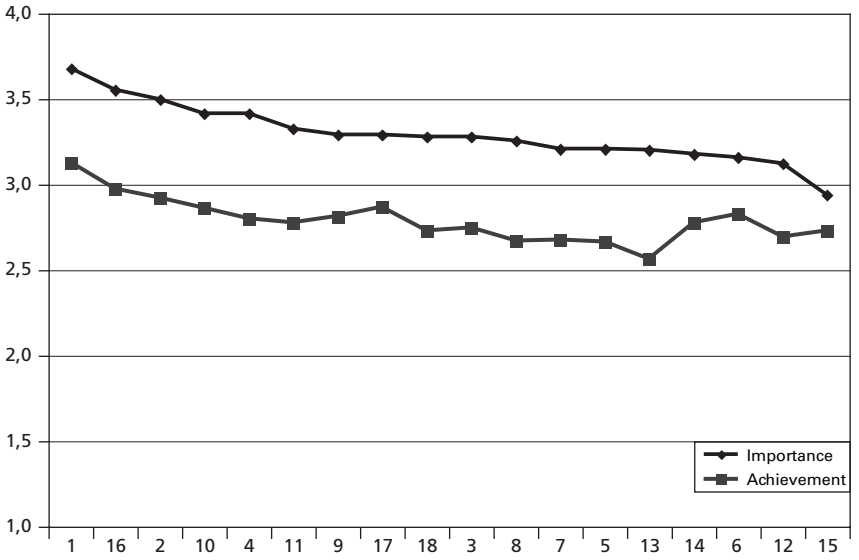


Diagram 1
The results of the survey of the academic community
(X-axis numbers of competencies, the axis Y - importance
and achievement of competences)

According to the Academics' evaluation the most important subject specific competences are the following:

- SC1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.
- SC16 Be able to understand the interactions of environmental processes and test the results of this research.
- SC2 Recognize the applications and responsibilities of ecology and its role in society.
- SC10 Evaluate sources of information for credibility and relevance for addressing significant issues related to ecology.

- SC4 Independently analyse environmental materials in the field and laboratory and to describe, analyse, document and report the results.

The least important subject specific competences are considered to be the following:

- SC6 Understand and appropriately use the vocabularies of the natural and social sciences relevant to the issues of ecology.
- SC12 Demonstrate a comprehensive knowledge in one specialized area of ecology.
- SC15 Understand and be able to explain the broad concepts of ecological issues to students and other professionals.

The ratings of the entire subject specific competences list are presented in the following table:

#	Description	Importance	Achievement
1	Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.	3,68	3,13
16	Be able to understand the interactions of environmental processes and test the results of this research.	3,55	2,98
2	Recognize the applications and responsibilities of ecology and its role in society.	3,50	2,92
10	Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology.	3,41	2,86
4	Independently analyze environmental materials in the field and laboratory, be able to describe, document and report the results.	3,41	2,80
11	Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs.	3,33	2,78

#	Description	Importance	Achievement
9	Choose and apply appropriate quantitative tools necessary to analyze significant issues related to ecology.	3,29	2,82
17	Produce a substantial report or thesis (including an executive summary).	3,29	2,87
18	Demonstrate the ability to perform independent, original and ultimately publishable and applicable research in the field of ecology.	3,28	2,73
3	Show adequate knowledge of other disciplines relevant to ecology.	3,28	2,75
8	Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology.	3,26	2,68
7	Write and speak clearly about technical issues related to ecology.	3,21	2,68
5	Effectively apply basic principles of the natural and social sciences to current issues of ecology.	3,21	2,67
13	Be able to define, determine and implement a strategy for solving an ecology problem.	3,20	2,56
14	Be able to communicate ecology issues with the wider society.	3,18	2,78
6	Understand and appropriately use the vocabularies relevant to issues of ecology.	3,16	2,83
12	Demonstrate a comprehensive knowledge in at least one specialized area of ecology.	3,13	2,70
15	Understand and be able to explain the broad concepts of ecological issues to students and other professionals.	2,94	2,73

Employers

Diagram 2 demonstrates the ratio of the average values of subject specific competences importance and level of their achievement during university studies.

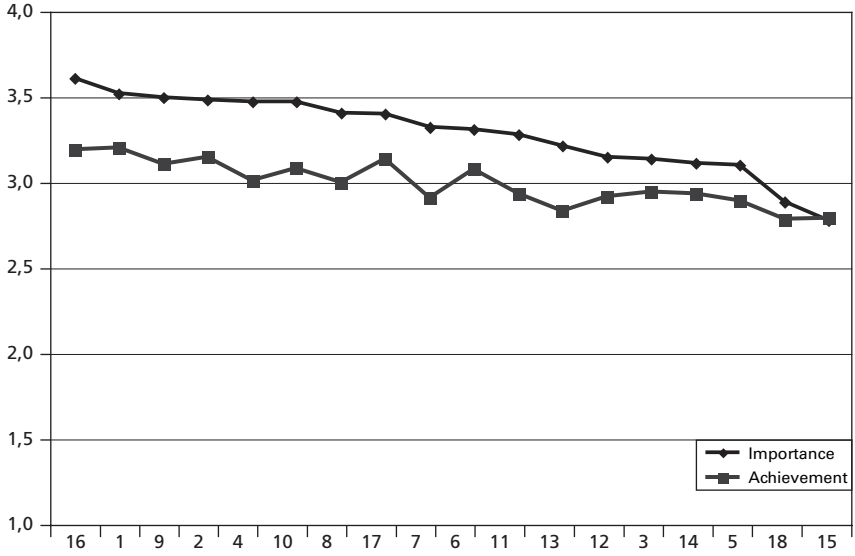


Diagram 2
The results of the survey of employers (X-axis numbers of competencies, the axis Y - importance and achievement of competences)

According to Employers' evaluation the most important subject specific competences are the following:

- SC16 Be able to understand the interactions of environmental processes and test the results of this research.
- SC1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.
- SC9 Choose and apply appropriate quantitative tools necessary to analyse significant issues related to ecology.
- SC2 Recognize the applications and responsibilities of ecology and its role in society.

- SC 4 Independently analyse environmental materials in the field and laboratory and to describe, analyse, document and report the results.

The least important subject specific competences are considered to be the following:

- SC5 Effectively apply basic principles of the natural and social sciences to current issues of ecology,
- SC18 Demonstrate the ability to perform independent, original and ultimately publishable and applicable research in the field of ecology,
- SC15 Understand and be able to explain the broad concepts of ecological issues to students and other professionals.

The ratings of the entire subject specific competences list are presented in the following table:

#	Description	Importance	Achievement
16	Be able to understand the interactions of environmental processes and test the results of this research.	3,60	3,19
1	Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.	3,51	3,20
9	Choose and apply appropriate quantitative tools necessary to analyze significant issues related to ecology.	3,49	3,10
2	Recognize the applications and responsibilities of ecology and its role in society.	3,48	3,14
4	Independently analyze environmental materials in the field and laboratory, be able to describe, document and report the results.	3,47	3,01
10	Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology.	3,46	3,08

#	Description	Importance	Achievement
8	Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology.	3,40	2,99
17	Produce a substantial report or thesis (including an executive summary).	3,39	3,13
7	Write and speak clearly about technical issues related to ecology.	3,32	2,90
6	Understand and appropriately use the vocabularies relevant to issues of ecology.	3,30	3,07
11	Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs.	3,27	2,93
13	Be able to define, determine and implement a strategy for solving an ecology problem.	3,21	2,83
12	Demonstrate a comprehensive knowledge in at least one specialized area of ecology;	3,14	2,91
3	Show adequate knowledge of other disciplines relevant to ecology.	3,13	2,94
14	Be able to communicate ecology issues with the wider society.	3,11	2,93
5	Effectively apply basic principles of the natural and social sciences to current issues of ecology.	3,09	2,89
18	Demonstrate the ability to perform independent, original and ultimately publishable and applicable research in the field of ecology.	2,88	2,78
15	Understand and be able to explain the broad concepts of ecological issues to students and other professionals.	2,77	2,79

Students

Diagram 3 demonstrates the ratio of the average values of subject specific competences importance and level of their achievement during university studies.

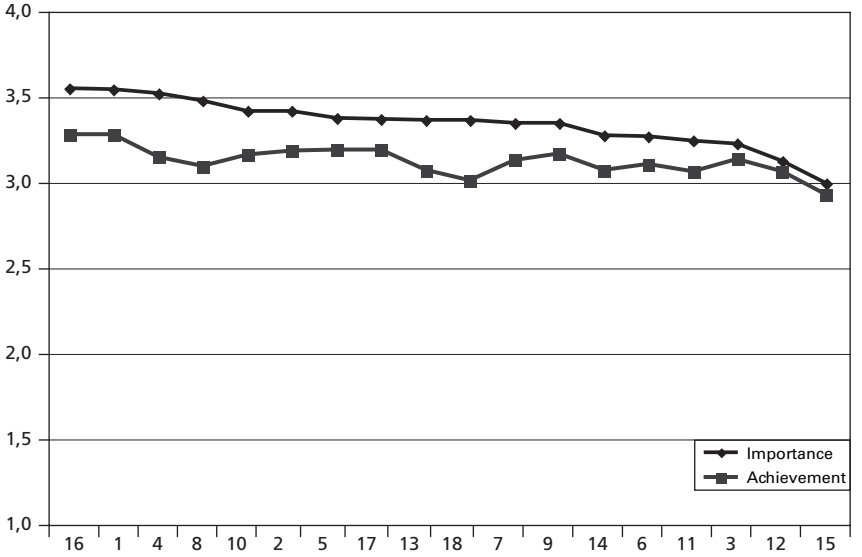


Diagram 3
The results of the survey of students (X-axis numbers of competencies, the axis Y - importance and achievement of competences)

According to Students' evaluation the most important subject specific competences are the following:

- Sc16 Be able to understand the interactions of environmental processes and test the results of this research.
- Sc1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.
- SC4 Independently analyse environmental materials in the field and laboratory and to describe, analyse, document and report the results.
- SC8 Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology.

- SC10 Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology.

The least important subject specific competences are considered to be the following:

- SC3 Show adequate knowledge of other disciplines relevant to ecology.
- SC12 Demonstrate comprehensive knowledge in one specialized area of ecology.
- SC15 Understand and be able to explain the broad concepts of ecological issues to students and other professionals.

The ratings of the entire subject specific competences list are presented in the following table:

#	Description	Importance	Achievement
16	Be able to understand the interactions of environmental processes and test the results of this research.	3,55	3,28
1	Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.	3,54	3,28
4	Independently analyze environmental materials in the field and laboratory, be able to describe, document and report the results.	3,52	3,15
8	Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology.	3,48	3,09
10	Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology.	3,42	3,16
2	Recognize the applications and responsibilities of ecology and its role in society.	3,42	3,19
5	Effectively apply basic principles of the natural and social sciences to current issues of ecology;	3,37	3,19

#	Description	Importance	Achievement
17	Produce a substantial report or thesis (including an executive summary).	3,37	3,19
13	Be able to define, determine and implement a strategy for solving an ecology problem.	3,37	3,07
18	Demonstrate the ability to perform independent, original and ultimately publishable and applicable research in the field of ecology.	3,36	3,01
7	Write and speak clearly about technical issues related to ecology.	3,35	3,13
9	Choose and apply appropriate quantitative tools necessary to analyze significant issues related to ecology.	3,34	3,17
14	Be able to communicate ecology issues with the wider society.	3,27	3,07
6	Understand and appropriately use the vocabularies relevant to issues of ecology.	3,27	3,11
11	Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs.	3,24	3,07
3	Show adequate knowledge of other disciplines relevant to ecology.	3,23	3,14
12	Demonstrate a comprehensive knowledge in at least one specialized area of ecology.	3,13	3,07
15	Understand and be able to explain the broad concepts of ecological issues to students and other professionals.	2,99	2,93

Graduates

Diagram 4 demonstrates the ratio of the average values of subject specific competences importance and level of their achievement during university studies.

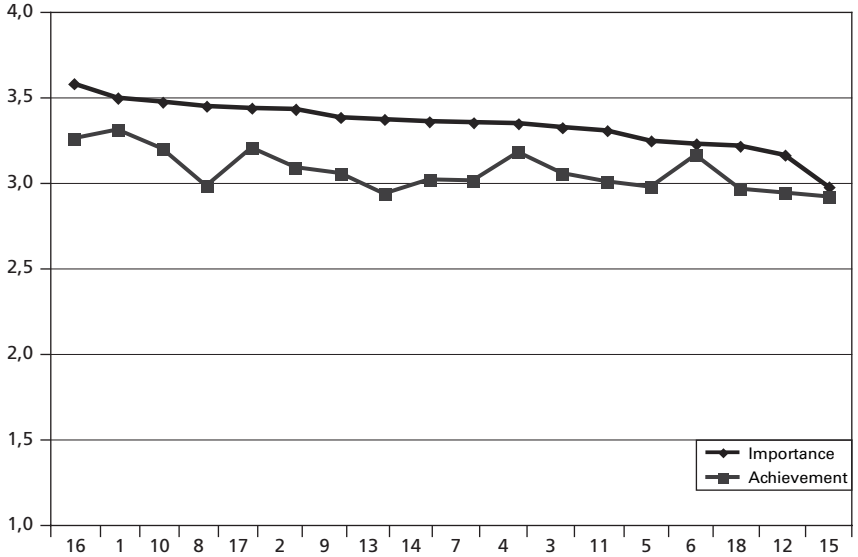


Diagram 4
The results of the survey of graduates (X-axis numbers of competencies, the axis Y - importance and achievement of competences)

According to Graduates' evaluation the most important subject specific competences are the following:

- SC16 Be able to understand the interactions of environmental processes and test the results of this research.
- SC1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.
- SC10 Evaluate sources of information for credibility and relevance for addressing significant issues related to ecology.
- SC8 Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology.

- SC17 Produce a substantial report or thesis including an executive summary.

The least important subject specific competences are considered to be the following:

- SC18 Demonstrate the ability to perform independent, original and ultimately publishable and applicable research in the field of ecology.
- SC12 Demonstrate comprehensive knowledge in one specialized area of ecology.
- SC15 Understand and be able to explain the broad concepts of ecological issues to students and other professionals.

The ratings of the entire subject specific competences list are presented in the following table:

#	Description	Importance	Achievement
16	Be able to understand the interactions of environmental processes and test the results of this research.	3,58	3,26
1	Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology.	3,49	3,31
10	Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology.	3,47	3,19
8	Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology.	3,44	2,98
17	Produce a substantial report or thesis (including an executive summary).	3,43	3,20
2	Recognize the applications and responsibilities of ecology and its role in society.	3,43	3,09

#	Description	Importance	Achievement
9	Choose and apply appropriate quantitative tools necessary to analyze significant issues related to ecology.	3,38	3,06
13	Be able to define, determine and implement a strategy for solving an ecology problem.	3,37	2,93
14	Be able to communicate ecology issues with the wider society.	3,36	3,02
7	Write and speak clearly about technical issues related to ecology.	3,35	3,01
4	Independently analyze environmental materials in the field and laboratory, be able to describe, document and report the results.	3,34	3,18
3	Show adequate knowledge of other disciplines relevant to ecology.	3,32	3,06
11	Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs.	3,30	3,01
5	Effectively apply basic principles of the natural and social sciences to current issues of ecology.	3,25	2,97
6	Understand and appropriately use the vocabularies relevant to issues of ecology.	3,23	3,16
18	Demonstrate the ability to perform independent, original and ultimately publishable and applicable research in the field of ecology.	3,22	2,97
12	Demonstrate a comprehensive knowledge in at least one specialized area of ecology.	3,16	2,94
15	Understand and be able to explain the broad concepts of ecological issues to students and other professionals.	2,98	2,92

The correlations among groups can be consequently seen as follows:

	Importance			
	Academics	Employers	Students	Graduates
Academics	1			
Employers	0,76129308	1		
Students	0,82123825	0,75397923	1	
Graduates	0,80742511	0,85295937	0,84821098	1

	Achievement			
	Academics	Employers	Students	Graduates
Academics	1			
Employers	0,82927062	1		
Students	0,66522253	0,83547532	1	
Graduates	0,86946012	0,87310302	0,78884146	1

	Ranking			
	Academics	Employers	Students	Graduates
Academics	1			
Employers	0,89242684	1		
Students	0,85333183	0,84786208	1	
Graduates	0,88787469	0,89087778	0,91301532	1

The competencies given are of top-priority for the respondents.

Table 7
Professional competencies, top-priority according to the survey

Teachers	Employers	Students	Graduates
SC 1	SC 16	SC 16	SC 16
SC 16	SC 1	SC 1	SC 1
SC 2	SC 9	SC 4	SC 10
SC 10	SC 2	SC 8	SC 8
SC 4	SC 4	SC 10	SC 17
SC 11	SC 8	SC 2	SC 2
SC 9	SC 17	SC 5	SC 9

In all groups of respondents in the first two positions we can see the competences, connected with the knowledge of the professional field. It should be noted that competence SC 10 (Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology) was highly valued with all groups, except for employers.

Note that all of the following top-priority competences are directly related to the activity of the ecology expert as well as his interaction with others within his/her professional activities:

- Recognize the applications and responsibilities of ecology and its role in society (SC 2).
- Independently analyse environmental materials in the field and laboratory, be able to describe, document and report the results and Choose and apply appropriate quantitative tools necessary to analyse significant issues related to ecology (SC 4 + SC 9).
- Produce a substantial reports or thesis including an executive summary (SC 17).
- Work collaboratively with other professionals in the discipline to address significant policy issues in ecology (SC 8).

The list of top-priority has also got the following:

"Effectively apply basic principles of the natural and social sciences to current issues of ecology (SC 5) - only for students, and "Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs (SC 11) - only in the group of teachers¨.

5.2.4. Meta-profile

Meta-profile reflects the structure and interrelation of competences that characterise a particular subject area. Meta-profiles are used for reference, depict mental models and should demonstrate the variety of possible and existent degree profiles within a particular subject area. Meta-profiles are determined by analysing stakeholder-consultation results through re-categorising the competence list. Such re-categorisation can be done differently in different subject areas and should reflect the subject area unique characteristics.

5.2.4.1. Meta-competences

Meta-competences take a specific place in the entire typology of competences. Defining the core of the subject area, they are considered to be quantitative indicators of the educational process delivery for the future professionals and represent the integral complex of knowledge, abilities, values formed by internal motivation and commitment for professional tasks solution at a certain level. Meta-competences serve as a certain over-structure input, which provides an effective process of subject specific competences definition within a separate profile and gives the possibility to synchronize education with labour market demands, as well as synergy between formal education and in-company training.

The process of meta-competences definition and meta-profile project diagram design includes the following stages:

1. Generic and subject specific competences ranking with respect to types of activity - primary «grouping» of the initial data. The group has formed clusters of competences and named them (set the «categories» of the data). At this stage, considering objects, tools and activities the following four clusters of competencies were formulated: information analysis, cognitive and applicative, personal development, management and technologies.

2. While forming each category, the SAG analysed the list of competencies (generic and subject specific), referred to a certain cluster. Through discussions SAG members determined which of the initial options should be:

   - joined to another, more clearly formulated
   - eliminated due to the ambiguity of the language
   - simplified, being previously too complicated
   - generalized, because they are too specific
   - separated, as they differ in content.

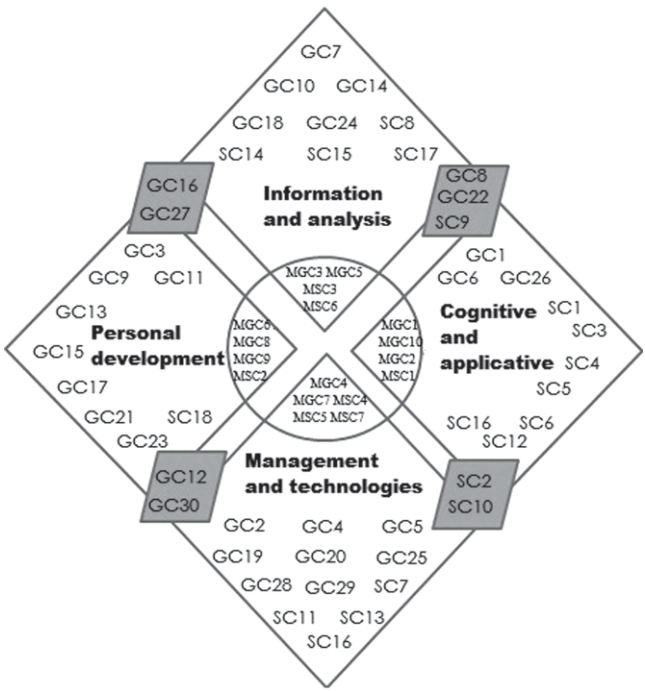
Discussions resulted into the following meta-competences allocated to appropriate clusters:

Table 8
Meta-competences

Information and analysis	Cognitive and applicative	Personal development	Management and technologies
MGC3 Ability to make reasoned decisions	MGC1 Ability to apply knowledge in practical situations	MGC6 Ability to work autonomously	MGC4 Ability to choose and implement proper methods for problem solving
MGC5 Ability to search for, process and analyse information	MGC2 Knowledge and understanding of the subject and understanding of the profession	MGC8 Ability to learn and stay up-to-date	MGC7 IT skills
MSC3 Ability to independently or in a team analyse environmental materials in the field and laboratory, be able to discuss, describe, document and report the results	MGC10 Ability to work in the international environment	MGC9 Commitment to responsibility	MSC5 Ability to evaluate sources of information for credibility and relevance for addressing significant issues related to ecology

Information and analysis	Cognitive and applicative	Personal development	Management and technologies
MSC6 Ability to understand the interactions of environmental processes and test the results	MSC1 Broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology	MSC2 Ability to recognize the applications and responsibilities of ecology and its role in society	MSC7 Ability to perform independent, original and applicable research in the field of ecology
			MSC4 Ability to choose and apply appropriate tools and equipment

5.2.4.2. Meta-profile diagram



Pic.3
Meta-profile diagram

The Implementation of the competence-based approach involves module-based course design, rating assessment and use of innovative methods and technology in teaching and learning. All of these positions are at the research stage. A module-based course provides not only the sequence of content presentation, but also the sequence in the development of the operations, activities, i.e. in the development of competencies, as well as the sequence of assessment activities to identify the levels of development and knowledge, and skills. The development of the logic of competences should lead to certain learning outcomes.

6

Level descriptors and learning outcomes

In a cycle system each cycle should have its own set of learning outcomes formulated in terms of competences. As stated before, learning outcomes are formulated both at programme level and on the level of individual course units or modules. The learning outcomes of the individual units add to the overall learning outcomes of the programme. Competences are developed in a progressive way. This means that they are formed over a number of course units or modules at different stages of the programme. During the design phase of the programme it has to be decided in which units a particular competence has to be formed.

The use of cycles automatically includes the introduction of the concept of levels. For each of these, level indicators can be used. They are called level descriptors. As part of the Bologna Process, a group of experts, the so-called Joint Quality Initiative, has developed sets of general descriptors for each cycle, which are called the Dublin descriptors. These cycle descriptors have now been endorsed by the European Ministers of Education as part of the report A Framework for Qualifications of The European Higher Education Area. The approaches of Tuning and the JQI are fully compatible and complementary.

Education programmes are targeted to increasing labour market demand for ecology graduates. The forecast is based on the following aspects: rapid globalization, permanent changes of the labour market and environmental issues promotion. The programme provides all the learning outcomes for successful career at different enterprises and institutions throughout the country and abroad. Special attention is paid to the development

of such competences as self-education, sustainability, responsibility and professional mobility of thinking.

As cycle descriptors in practice are level descriptors which identify the level of a cycle, Tuning has suggested naming these descriptors cycle level descriptors. The Project participants have produced cycle level descriptors at programme level for the first and second cycle for each of the subject areas included in the project. Below, we present generalised description of learning outcomes for each level within our subject area.

To describe the generalized results of Bachelor and Master programmes, the SAG Ecology identified competencies that are formed at different levels of education, separating them according to the degree of complexity of the tasks and the degree of independence of these tasks.

Table 9
Competences, implemented at Bachelor and Master programmes

Bachelor	Master
SC1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology	SC1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology
SC2 Recognize the applications and responsibilities of ecology and its role in society	SC2 Recognize the applications and responsibilities of ecology and its role in society
SC3 Show adequate knowledge of other disciplines relevant to ecology	SC3 – is formed at Bachelor level
SC4 – only with supervision	SC4 Independently analyse environmental materials in the field and laboratory, be able to describe, document and report the results
SC5 Effectively apply basic principles of the natural and social sciences to current issues of ecology	SC5 – is formed at Bachelor level
SC6 Understand and appropriately use the vocabularies relevant to issues of ecology	SC6 – is formed at Bachelor level

Bachelor	Master
SC7 Write and speak clearly about technical issues related to ecology	SC7 Write and speak clearly about technical issues related to ecology
SC8 – only with supervision	SC8 Work collaboratively with other professionals in the discipline of the major to address significant policy issues in ecology
SC9 Choose and apply appropriate quantitative tools necessary to analyze significant issues related to ecology	SC9 – is formed at Bachelor level
SC10 Evaluate sources of technical information for credibility and relevance for addressing significant issues related to ecology	SC10 – is formed at Bachelor level
SC11 – only with supervision	SC11 Identify significant ethical issues in ecology and be able to address these issues with respect to regional needs
SC12 Demonstrate comprehensive knowledge in at least one of the specialized areas of ecology	SC12 Demonstrate comprehensive knowledge in at least one of the specialized areas of ecology
SC13 – only with supervision	SC13 Be able to define, determine and implement a strategy for solving an ecology problem
SC14 Be able to communicate ecology issues with the wider society	SC14 Be able to communicate ecology issues with the wider society
SC15 Understand and be able to explain the broad concepts of ecological issues to students and other professionals	SC15 Understand and be able to explain the broad concepts of ecological issues to students and other professionals
SC16 Be able to understand the interactions of environmental processes and test the results of this research	SC16 Be able to understand the interactions of environmental processes and test the results of this research
SC17 Produce a substantial reports or thesis including an executive summary	SC17 – is formed at Bachelor level
SC18 – only with supervision	SC18 Demonstrate the ability to perform independent, original, and ultimately publishable and applicable research in the field of ecology

Table 10
Levels of mastery for subject specific competence SC 4 "Independently analyse environmental materials in the field and laboratory, be able to describe, document and report the results"

Levels of Mastery	Indicators	Descriptors			
		1	2	3	4
First level of mastery: Is able to analyse information	The ability to find the main ideas of the text	Cannot see the necessity to search substantial information	Can find only evident key points of the information	Is not able to take into account all the factors and define the main ideas	Is able to elicit necessary information, define the main ideas
	The ability to collect information from different sources	Cannot find different sources of information	Is able to find only single facts	is able to use different sources of information but cannot classify it	is able to classify information from different sources
	The ability to compare data and make conclusions	cannot make comparison between single facts	is able to compare single facts but cannot make any conclusions	is able to compare information but fails in making proved conclusions	makes comprehensive comparison of information and reasonable conclusions
Second level of mastery: Is able to make presentations and discuss ecological issues	Ability to make presentations	cannot find and process information for the presentation	is able to present only simple facts	is able to present substantial information but not in a consistent way	is able to present information consistently and comprehensively

Levels of Mastery	Indicators	Descriptors			
		1	2	3	4
	Ability to discuss and answer the questions	cannot answer any questions	is able to answer simple questions only	Is able to answer the questions but not in details	is able to give full answers to questions and hold a discussion
	ability to prove one's case	Is not able to define his/her point of view	is able to define his/her point of view but cannot prove it	is able to find some proofs for his/her case	is able to present comprehensive and reasonable arguments
Third level of mastery: Is able to evaluate the work data, document it and report the results.	Ability to evaluate the work data	cannot evaluate his/her work data	is able to evaluate single issues only	is able to evaluate the work data but cannot improve it	is able to evaluate the work data comprehensively and make improvements
	Ability to keep documents on environmental issues properly	cannot see the necessity to follow rules and standards for keeping documents	makes attempts to keep documents properly	Is able to keep documents properly but makes regular mistakes	is able to keep documents in accordance with rules and standards
	Ability to report on the work product	cannot make a report	is able to report on single facts only	it is able to report on the work product but partially	is able to make a comprehensive report on the work product

Table 11
Levels of achievement for generic competence GC 02 "Ability to work in a team"

Levels of Mastery	Indicators	Descriptors			
		1	2	3	4
First level of mastery: is able to communicate with people	Ability to conceive and take into account different position	cannot listen to other people	Hardly listens to the opinions of others	Demonstrates sympathy to the views of others	Is able to consider the other people's opinion of
	Ability to consider individual characteristics	cannot see individual characteristics of other people	Has difficulties in dealing with certain types of people, cannot always find a way for communication	Takes into account individual characteristics of people when trying to contact them	Takes into account individual characteristics of people and communicate them accordingly
	Ability to establish and maintains business relationships	cannot establish contact with other people	In some cases is able to make contacts	is able to establish contact with people	Builds and maintains a network of business relationships
Second level of mastery: Is able to collaborate with colleagues, effectively	Ability to promote cooperation among colleagues	Works independently, does not coordinate his/her actions and plans with colleagues	Usually, plans and coordinates his/her actions if they affect the interests of colleagues	Always coordinates his/her plans and actions with colleagues	Promotes cooperation among the members of working group

Levels of Mastery	Indicators	Descriptors			
		1	2	3	4
	Ability to overcome difficulties in business relations	Does not provoke conflicts, but is not able to resolve the dispute,	Is always looking for an opportunity to agree on somebody	In a situation of conflicts is looking for a compromise	In a situation of conflict in working group is looking for solutions that best meet the interests of the task
	Ability to keep the promises	Is not aware of the need to comply with the obligations	Sometimes forgets about the promises	Fulfils promises but not in time	Always keep his promises in time
Third level of mastery: Is able to foster effective communication and joint work	Clearly presents and convincingly gives reasons for his/her thoughts	Is not convincing in business communication, can hardly defend his thesis	Demonstrates some persistence and persuasiveness when discussing a topic but may be lost in case of objections,	Demonstrates persistence and flexibility in the discussion, overcomes objections	Demonstrates successful tactics of reasonable persuasion
	Ability to help colleagues in carrying out tasks	Does not see the need to help colleagues	is able to help from time to time but only when being asked	Always responds to requests, but may be selective in ways of helping	Demonstrates the willingness and possibility to help colleagues in carrying out tasks
	Ability to make suggestions for effective communication	Doesn't incorporate other's ideas	Makes single suggestions on managing communication	Tries to involve others in communication process and making suggestions	Involves others in active communication, makes reasonable suggestions and supports others ideas

To understand how the competences are formed, how their formation is tracked, and what the difference between competencies and learning outcomes is, we present two examples of competence indicators (indicators of competence formation) and descriptors (levels of formation promotion). As an example, there is an example of one subject specific and one generic competence.

The Bachelor has a complete set of common cultural and general professional skills, which identify him as a cultural, professional and promising performer of complex research and production works.

Master is proposed to carry out independent research and scientific and production activities, continuing education in graduate school and is ready to teach in specialized secondary and higher educational institutions. A Master is also able to guide the research work (R & D) of students and the work of scientific and industrial community.

Given the specifications a set of actions that bachelors and masters should be able to perform within certain areas, may be represented as following

Table 12
Professional activities of university graduates

Main Bachelor's activities	Main Master's activities
In research activity	
• Research activities within the group • Preparation of research facilities • Preparation of abstracts and bibliographies	• Self-selection and justification of the purpose of the organization and conduct of scientific research • Choosing the rationale and development of methods • Preparation and execution of scientific publications, reports, presentations, etc.
In research and project activity	
• Participate in planning and conducting applied research in accordance with the specialization • Obtaining of the materials for application development • The patent work • Preparation of materials for publication • Preparation of project, budget and accounting documentation	• Independent planning and conducting of applied research • Development and participation in the development of new technologies; • Processing and critical analysis of the data • Preparation and publication of reviews, articles, reports, projects, • Preparation of regulatory guidance documents

Main Bachelor's activities	Main Master's activities
In organizational and management activity	
• Participate in planning and conducting research and production activities • Participation in the organization of seminars, conferences • Participate in the preparation of estimates and reports	• Planning and implementation of research and production activities • Planning and conducting of seminars and conferences • Preparation of project, budget and report documentation
In teaching and educational activity	
• Preparing and conducting classes in high school • Excursion work • Educational work • Group work	• Preparing and conducting special courses • Organization of training sessions and research of students of the university • Guidance of students final works

Table 13 summarizes the learning outcomes by levels of education in "Ecology", where the following positions are marked: to know / understand, to be able to / be able to do, to have.

Table 13
Learning outcomes by levels of education

Level of education	Learning outcomes
First level: Bachelor degree	A graduate of the first level (Bachelor) in the subject area of «Ecology» should know / understand: • basics of mathematics data processing and analysis of data on ecology and environmental management; • basics of physics, chemistry and biology, hardware and software, basics of information technology; • legal, moral and ethical standards in the field of environmental protection, basics of economics and sociology; • basics of teaching about the atmosphere, hydrosphere, the biosphere and landscape studies; • theoretical basis for environmental monitoring, regulation and reduction of environmental pollution, man-made systems and environmental risks; • basis of biogeography, the total resource science and regional environmental management, have a professionally profiled knowledge of the general geology, theoretical and practical geography, soil science; • theoretical concepts of general ecology, geo-ecology, human ecology, social ecology, environment, know the basics of environmental management, environmental economics, sustainable development, impact on the environment, the legal basis of natural resources and environmental protection; • know the theoretical basis for environmental monitoring, regulation and the methods and means of reducing pollution, man-made systems and ecological risk. Bachelor should be able to do: use ethical and legal rules governing the relation of man to man, to society, to the environment, • use natural science knowledge in the analysis and solution of environmental problems. • use software and work in computer networks. To be able to create databases and use the resources of the Internet, to own GIS technology to use professional knowledge and practical skills in the general geology, theoretical and practical geography, soil science in the field of environment and natural resources. • assess in general human impact on the environment, assess the extent of environmental risk under the guidance of specialists and qualified researchers to conduct laboratory research, to collect and initial processing of the material, to take part in full-scale field trials; • collect and process primary documentation for the assessment of impacts on the environment, use environmental knowledge for the analysis of practical problems in various fields of economic activity, to prepare documentation for the environmental assessment of various types of project analysis. • demonstrate the efficient and proper use of laboratory equipment; • participate in the drafting of practical recommendations for the maintenance of the natural environment; • be able to understand, describe and critically analyze the basic information in the field of ecology and environmental management The bachelor should have and demonstrate: • practical skills in the field of general geology, theoretical and practical geography, soil science; • methods of search and exchange of information in the global and local area computer networks; • methods of chemical analysis, and the methods of sampling and analysis of geological and biological samples; • skills to identify and characterize biological diversity, its assessment by the modern methods of quantitative information processing.

Level of education	Learning outcomes
Second level: Master's degree	A graduate of the second level (Master) in the subject area of «Ecology» should know / understand: • key research areas and concepts, methods and techniques of scientific research, principles and methods of system analysis, advanced computer technology used in the professional field, to understand the current problems of ecology and environmental management; • basis for sustainable human development at the global and regional levels; • legal basis for professional activity; • fundamental and applied topics of general ecology, geo-ecology, human ecology, social ecology, environment, environmental management, evaluate the impact on the environment and other sections in accordance with the profile of training; • basis of international cooperation on environmental issues. • regulations for production and technological environmental activities A Master should be able to: • Use in-depth knowledge of the legal and ethical standards in the evaluation of their professional activities in the development and implementation of social projects. • Independently use modern computer technology to solve professional problems • Use basic ecological concepts in the area of professional activity • To put into practise skills in the organization of scientific-research and scientific-production work in the management of scientific staff • use modern methods of processing and of the interpretation of environmental information for scientific and industrial research, • define the specific conditions under which natural or human activities can affect terrestrial and aquatic ecosystems; ability to develop environmental protection measures • assess the impact of the planned buildings or other forms of economic activity on the environment • use chemical and biological methods for monitoring the environment for future forecasting of its changes and development of recommendations for the adoption of preventive measures; • analyse the basic processes of human impact on the environment and ecology of communities, biodiversity and sustainability; • interpret observations of life in a particular microenvironment using the principles of heredity and environment community; • define problems of protection of nature, to develop best practices for maintenance and sustainable development • make assessment of various environmental impact , carry out an environmental audit of any object, and develop recommendations for the maintenance of the environment • carry out the organization and management of production and analytical work in the field of environmental management communicate in scientific, industrial, social and public audience; describe and discuss in native and foreign languages the major environmental problems dealing with the current and future anthropogenic impacts on urban-ecosystems and agro-ecosystems. A Master should have: • A deep understanding of the philosophical concepts of natural science and the foundations of the methodology of scientific knowledge • deep understanding and creative use of knowledge of basic and applied branches of special subjects of Master's program in scientific and technological activities of production; • skills of independent research: the ability to formulate problems, challenges and methods of scientific research, to obtain new reliable facts on the basis of observations, experiments, scientific analysis of empirical data, abstract research papers, write analytical reviews of the accumulated data in the world of science and production activities; generalize received results in the context of previously accumulated knowledge in science, draw conclusions and practical recommendations on the basis of representative and original research results, methods to assess the representativeness of the material, the volume of samples for quantitative research, statistical methods to compare the obtained data and determine patterns;

Level of education	Learning outcomes
Second level: Master's degree	• the ability to methodically develop the plan for environmental auditing, monitoring compliance with environmental requirements, environmental management of production processes; • the basics of designing, expert and analysis activity, and perform research using modern approaches and methods, apparatus and computer systems (according to the master's specialization; • ability and willingness to actively communicate in scientific, industrial, social and public spheres of activity, skills of working in the scientific team, the ability to generate new ideas and the ability to freely use Russian and foreign languages; • theoretical knowledge and practical skills for teaching work in high schools, to be able to competently carry out the training-methodical planning activities for environmental education and education for sustainable development

In consequence of Bloom's taxonomy the learning outcomes may be ranged as follows:

Bloom taxonomy	Bachelor	Master
Assessment		Must be able to perform: • Assessment of the impact of planned facilities or other forms of economic activity on the environment • Environmental assessment of various types of project tasks • Environmental audit of any object
Synthesis		Must be able to perform: • Diagnosis of the problems of nature protection • The development of practical recommendations on environmental protection and sustainable development • The development of model of environmental activities
Analysis	Must be able to analyse: • Anthropological influence on the environment, degree of ecological risk	Must be able to analyze: • The specific conditions under which natural or human activities can affect terrestrial and aquatic ecosystems, • Problems of environmental protection • The basic processes of human impact on the environment and ecology of communities, biodiversity and sustainability

Bloom taxonomy	Bachelor	Master
Comment	Must be able to use: • Ethical and legal rules governing the relations of man to man, society, environment • The natural and science knowledge in the analysis and solution of environmental problems • Professional knowledge and practical skills in general geology, theoretical and practical geography, soil science in the field of ecology and environmental management • Software, computer network, databases, Internet resources, GIS technology • Laboratory Equipment	Must be able to apply: • In-depth knowledge of the legal and ethical standards in the evaluation of their professional activities in the development and implementation of social projects • Fundamental ecological representation in the professional field • Modern methods of processing and interpretation of environmental information for scientific and industrial research • The ability to organize research and scientific-production work in the management of scientific staff • Chemical and biological methods for monitoring the environment for future forecasting of its changes and develop recommendations for the adoption of precautionary measures • Modern computer technology to solve professional problems
Understanding	Should know: • fundamental branches of mathematics, physics, chemistry and biology, • Fundamental branches of general geology, theoretical and practical geography, soil science.	Should understand: • Up-to-date problems of ecology and environmental management • The basis for sustainable human development at the global and regional levels; • Fundamental and applied branches of general ecology, geo-ecology, human ecology, social ecology, environmental protection, environmental management, assessment of the impact on the environment and other branches in accordance with the profile of training

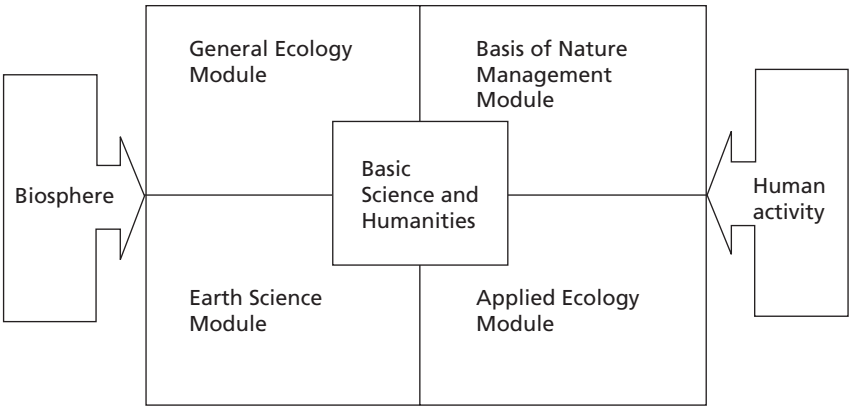
Bloom taxonomy	Bachelor	Master
Information/Knowledge	Should know: • The basics of computer science, hardware and software implementation of information technology; • Legal, moral and ethical standards in the field of environmental protection • The basics of economics and sociology • The basis of the doctrine of the atmosphere, hydrosphere, the biosphere and landscape studies • Theoretical basis of environmental monitoring, regulation and reduction of environmental pollution, man-made systems and ecological risk • The basis of biogeography, general and regional environmental management • The theoretical foundations of the general ecology, geo-ecology, human ecology, social ecology, environment • The basis of environmental management, environmental economics, sustainable development, assessment of the impact on the environment, the legal basis of environmental management and environmental protection • Theoretical basis of environmental monitoring, valuation methods and means of reducing pollution, man-made systems and ecological risk	• The main research areas and concepts, methods and techniques of scientific research; • Principles and methods of system analysis; • Modern computer technology used in the professional field • The legal basis of professional activity • Regulations governing the organization of technological and production activities (in accordance with the master's specialization).
Communications	Be able to understand, describe and critically analyse the basic information in the field of ecology and environmental management	To communicate in scientific, industrial, social and public spheres of activity; to describe and discuss the major environmental problems associated with the current and future anthropogenic impacts on urban eco-systems and agro-ecosystems in the native and foreign languages

7

Learning, teaching and assessment

The principles of Natural science are ones of consistency, integration, scientific character, links between theory and practice, effectiveness and student-oriented teaching.

Two polar blocks of disciplines are involved in the basic part of the subject knowledge. The first block comprises the disciplines that characterize the natural biosphere processes («General ecology» and «Earth Science» modules), and the second involves transforming human activities («Basis of nature management» and «Applied ecology» modules).



Pic.4
The structure of the basic part of the higher professional ecological education content

The fundamental knowledge basis is formed during teaching such disciplines as mathematics, physics, chemistry, geography, biology and etc.

Subject specific disciplines - ecology, natural resources, human ecology, environment protection and others – are targeted to subject specific competences development.

Applied disciplines - environmental law, environmental Economics, environmental toxicology and etc. - reflect the interdisciplinary approach. The applied disciplines make the responsibilities to acquire professional knowledge and to form practical skills in specific applied fields. The disciplines of the regional component are necessary for future specialists to solve local and regional problems of environmental protection.

Training, production and placements are obligatory for all the students.

Learning

The training system should be based on the basis of the problem-oriented system, which involves student activity at all stages of training. The key principle of this system is that knowledge and skills are assessed at each stage of learning.

Constant development is the basis of the ecologist's training. The educational process should:

- provide an interdisciplinary point of view on problems, which ecologists will resolve in practice;
- develop understanding of the links between environment, economic activities and society;
- develop the ability to use natural science knowledge for the complex problems solution.

The student should be involved in different training activities.

The training is offered in the form of various types of lectures (introductory lectures, informative lectures, reviews and problematic lectures, lectures-visualizations, etc.), seminars, group work, and individual projects. Placements and in-company training are organized by partner enterprises.

The problem-oriented courses, tasks solutions, research training, laboratory practices, reflexive, internship, group work, Internet-technologies are used.

Classroom training should not exceed 50% of the total workload.

The maximum amount of classroom training sessions per week for full-time training is 32 hours.

Assessment

Accordance of methods of assessment to education results.

Education results	Methods of assessment
Knowledge and understanding of the material	Tests; independent work, tests, answers to questions (in written and oral forms), an essay on a given topic, a report, etc.
Ability to communicate in oral and written forms in the native language	Written presentation, oral presentation, group work, participation in discussions, keeping a portfolio, etc.

Information systems and technologies: computer-based testing Programmes, Learning objectives, Comprehensive situational tasks

Examples of innovative evaluation:

- Case-study.
- Module-rating system.
- Test including creative task.
- Portfolio.
- Role-playing.
- Method of cooperation.
- Project.

Case-study: analysis of specific situations (Case study). Case study, real-life situations. Students should analyse the situation, understand the content of the problems, offer possible solutions and select the best of them. There are simulated situations based on real-life material, and (fictional) cases.

«+» The ability to define objectives, situation analysis, decision-making, information analysis, making conclusions, critical thinking and self-evaluation are assessed.

«–» Time expenditures, design complexity

Module-rating system - training modular system, with the credit system, of the student's activities and achievements.

«+» Both student knowledge, skills and also personal qualities are assessed: commitment, original solutions for problems, the ability to organize group-work and etc.

«–» great workload, absence of clear criteria for assessment

Test including a creative task

«+» can be used for intermediate and final controls

«–» Great workload for the task's development, difficulties in assessment, fewer learning outcomes can be assessed

Portfolio

«+» facilitates the clear identification of the levels of mastery for different competences

«–» assessment criteria may be rather complicated for the student, if not defined clearly enough; can be a haphazard collection of student works without demonstrating the dynamics of development and level of mastery achieved; difficult to analyse and highlight milestones of achievement.

Role-playing game:

«+» Facilitates the assessment of both the generic and subject specific competences, for example: team-work; Ability to apply knowledge in practical situations; ability to make decisions, to define and apply the best methods for problem solving.

«–» design complexity, time expenditures, limited content.

Method of cooperation:

setting tasks for students cooperation and roles distribution.

«+» allows to evaluate generic competences as well: teamwork, decision-making, responsibility etc.

«–» as the whole group's work is assessed, it is difficult to give personal assessment for every student

Project:

«+» facilitates assessment: critical and analytical thinking, creativity, self-evaluation, team work, communication skills, etc.

«–» impossible to be used for several subjects simultaneously; difficulties in tasks design; project presentation requires extra time.

An example of best practice is presented in Annex 1.

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Annex

Annex 1

Example of best practice

Methods of learning

The purpose of this section is to show how generic and subject specific competencies are formed in class, and how to assess through specific education results.

We demonstrate an example of the individual class in the subject "Introduction to Ecology and Environmental management", which is a compulsory subject of a comprehensive base of the module "Basics of environmental management", covering various aspects of human impact on the environment, the protection of natural systems from over-exploitation and pollution with the use of complex legal, organizational, economic and other measures.

The topic of the lesson is "Acid rains." In the group of 25-30 people a teacher holds a lecture. For this lecture we have chosen strategy "Logbook" developed by the authors of "Development of critical thinking through reading and writing". The purpose of this technology is the formation of the critical thinking skills of students through interactive inclusion of students in the educational process. The lesson includes three stages:"Challenge" - "Understanding" - "Thinking".

The text of the lecture, the full description of the course activities, and a description of basic technology are published on the website.

Table 14

Correlation of formed competencies to learning outcomes in class "Acid rain"

Subject specific competence	Learning outcomes
	By the end of the lesson student has to
SC1 Show a broad knowledge and understanding of the essential facts, concepts, processes, principles and theories of ecology	know: • PH value of acid rain; • Substance and chemical reactions in the atmosphere, causing acid rain; • Sources of ingress of contaminants into the atmosphere • The activity of the international community to limit or reduce emissions into the environment of substances that cause acid rain (conventions, documents) • have an understanding of: • Factors that violate the mechanisms of functioning of ecosystems as a result of acid rain; • The processes occurring in ecosystems with acid deposition; • Effects of acid precipitation to the atmosphere, hydrosphere, lithosphere, and biosphere.
SC16 Be able to understand the interactions of environmental processes and test the results of this research	understand: • pollution inevitably leads to pollution of all layers of the Earth and the disruption of ecosystem functioning regardless of the place of the rainfall; • each person is responsible for the pollution of the environment as a result of industrial and household activity.
Generic competence	Learning outcomes
	By the end of the lesson students will be able to
GC19 Ability to plan and manage time	• Solve the task within limited time
GC24 Interpersonal and interactional skills	• Create a mini-project in a team, listen to and consider all points of view, discuss other positions

Subject specific competence	Learning outcomes
GC10 Ability to communicate both orally and in written form in the native language	• Formulate, explain and prove their position (for example, the selection of the «best questions»)
GC2 Ability to work in a team	• Perform group mini-projects (drawing up a list of questions, charting lecture from the group)
GC1 Ability for abstract thinking, analysis and synthesis	• Choose from a set of information (text of the lecture) the data necessary for his/her personal logbook
GS 17 Commitment to the conservation of the environment	• Compare the activities of people in production and daily life, with consequences for the environment

Plan of the lesson

At the beginning of the lesson the teacher describes the topic and gives out a sheet with the scheme of the lesson (see Appendix 1) to be filled.

Stage "Challenge"

1. The report includes key concepts of the lecture, in which each group is asked to determine the theme of the class. Based on the available knowledge students can define the lecture: "Acid rain" (or subject is reported by the teacher). Key concepts are chosen in such a way that the theme of the lecture arise interest among the students.
2. Key concepts are written in every personal "Log Book" (LB) in the appropriate box, pH, sulphur dioxide, nitrogen oxides, "acid shock", aluminium, anaerobes, "stone cancer ", environmental awareness.
3. In the column "Links that I can set" every student writes proposals that can be made with the keywords, relating to the theme of the class. Every sentence can contain two or more keywords. There can be a lot of such phrases - sentences. For this procedure students have 5-7 minutes.
4. When the time is over, students present the results to the audience (if desired).

5. In addition, every student individually makes questions about the topic using keywords (recorded in the appropriate column of personal LB). In order to divert students from drawing only factual questions the method of "interrogative words" is used. On the blackboard the teacher writes the words for beginning the question: what, where, why, why, how is connected, what is the reason. If students are not familiar with the methods of compilation of multi-level issues, in accordance with Bloom's taxonomy, interrogative words —such as why, for what purpose and similar lead students to make analytical questions— and therefore answers must contain the elements of the analysis.
6. There can be any number of questions. This piece of work also takes 5-7 minutes.
7. Further work is going on in groups of 4-6 people.
8. Lists of issues are discussed in each group and they select questions or compile other questions that, according to the members of the group, are the most interesting and important for the disclosure of the topic. The group has to make at least 5 questions.
9. Questions are read aloud. Groups in turn offer questions - in this case the group should keep track of the questions that were read in the audience not to duplicate. The teacher writes them on sheets of A4 paper and then use magnets to put sheets with questions on the board so that they form a logic of presentation. At the same questions become a "guide" for the teacher who is giving a lecture, answering students' questions.
10. At this time, each of the students writes in his "Log" (page two) the questions from the general list on the board, the answers to which he would like to write more fully. Perhaps he will formulate new questions.

Stage "Understanding"

11. The teacher is giving a lecture. Brief description of the content of the lecture is given in the appendix to this lesson (see Appendix 2).
12. At the time of reading. Each student individually writes answers in his individual logbook. If there is more information that he is interested in, he can take notes in a notebook.

Stage of "Thinking"

13. Questions are discussed in groups. Everyone can add or delete something when discussing.

14. Students look at the questions on the board trying to identify those questions, the answers to which were not heard during the lecture. Depending on the remaining class time teacher can either give information on these questions or leave them for homework giving the sources where you can find answers to questions.
15. Students build individual scheme of messages in the appropriate place in LB.
16. Then they discuss them in groups and sketch the general scheme of the group on sheets of A3 paper.
17. Draw the diagram and represent to the audience.

Table 15
Assessing competencies and learning outcomes according to the strategy of "Logbook"

Competencies	Used methods for competence development	Ways to track the formation of competencies
Subject specific competencies: Knowledge and understanding of the basic facts, concepts, processes, principles and theories of ecology	A lecture given according to the students' questions Providing a full text of the lecture held after classes for individual study	Knowledge of the facts is checked by conventional methods of assessment, such as a test of learning control. Understanding - answers to the questions of different levels, maintaining a personal portfolio that reflects individual and group work performed at a classroom and during extracurricular time (individual and group questions compiled, connection between the key concepts). The portfolio contains answers to the questions of different levels; Presentation of the general group assignments.
Possess the basis of the theory of natural sciences (Chemistry)	Tasks for identifying connection between the materials given in the class with the fundamental chemistry sections. Identify the topic of the lesson by keywords: pH, sulphur dioxide, nitrogen oxides, «acid shock», aluminium, anaerobes, «cancer of stone», environmental awareness, comment on each concept, linked to different sections of chemistry.	Work, where students used their knowledge of the fundamental areas of chemistry for the interpretation of the course; students compose questions to understand the connection between the subject and other areas of knowledge, problem questions, copies of text and files from Internet sites, computer programs and encyclopaedias, read by the students on the topic. Presentation of tasks.

Competencies	Used methods for competence development	Ways to track the formation of competencies
Understanding the interaction of environmental processes and the ability to assess their impact	Interpretation of new information: Charting lectures and identifying the links between the key concepts of the lecture	The portfolio includes the results of a strategy of «Logbook»: questions, charts, tables, drawings and models of objects, made by a student or group of students. Evaluation of group work presentations, assessment of the records in the portfolio.
General competences: build oral and written speech logically correct, reasoned and clearly	Working in groups, answering the questions. Presentation of assignments. Creation of written texts	Observation of participation in discussions. Availability of a written report to the portfolio.
Be able to work in a team, collaborate with colleagues, to adapt to different work situations	Work in groups to achieve common goals, create projects and presentations from groups..	The observations of the teacher. The presence of common group tasks and tasks performed by students individually in the portfolio

Analyzing the experience gained through the active methods, we compared two different approaches to learning - traditional and active learning methods (Table 16).

Table 16
Traditional and active learning methods

Traditional learning	Active learning methods
Goals of the course	
The assimilation of the necessary knowledge and skills in the subject.	Assimilation of knowledge through activities. Development of student's abilities to work independently, the ability to formulate and solve problems, to think, make conclusions, to prove one's point of view, to evaluate the results. Knowledge and skills in this training are a means to build competencies.
Curriculum	
The system of the studied material is often incomprehensible to the student and is perceived as a conglomeration of private information.	The material is organized around key ideas, methods of cognition. Details are systematized and are matched with the main ideas.
Methods and forms of organization of lessons and activities of students	
The prevalence of explanatory and illustrative method: teacher's explanation, demonstration activities, learning through exercises, control.	The predominance of search and research method in which students establish insufficiency of existing knowledge and are aware of the need of a new knowledge. The joint search activity, variability n and consolidation, self-assessment.
The prevailing form of organization of the lessons is frontal.	Activities are organized in small groups.
The teacher himself puts the target relative to the knowledge and skills in the subject.	The teacher carries out joint goal setting, encourages students to set goals themselves, and organizes the process of task-solving.

Traditional learning	Active learning methods
Communication style	
Authoritarianism, control and execution, management and submission	Democracy, confidence, openness, partnership, cooperation, willingness to listen to each other
Ongoing evaluation of student activity	Self-assessment of joint actions
The direct effect	Impact through interaction
The flow of information is sent from the teacher to the student.	The dialogue of students, discussion, in which the teacher helps students to speak
The student is afraid to give incorrect answer and being ridiculed.	The student has the right to be wrong, to have his own opinion, is not afraid to express his point of view. Mistakes are used to correct activities
Monitoring and evaluation	
Emphasis on memorization, constant results. Focus on the mark	Focus on the application of knowledge, figuring out the ways and methods, the process of learning, self-assessment. Focus on development, personal growth, self-evaluation.

Annex 2

Scheme of the «Log Book»

Log Book

Name _____

Topic _____

Date _____

Work Time _____

Key words

_____

_____

_____

_____

_____

_____

_____

Drawing (scheme)

Links that I can set:

Questions

Question 1. _____

Answer

Question2. _____

Answer

_____

_____

_____

_____

Question3. _____

Answer

_____

_____

_____

_____

Question4. _____

Answer

_____

_____

_____

_____

_____

Question 5. _____

Answer

_____

_____

_____

_____

_____

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