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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
1 st cycle	<ol style="list-style-type: none">1. Ecology and use of natural resources2. Water resources and aquaculture3. Bioengineering systems and technologies4. Energy and resource saving in chemical engineering, petroleum chemistry and biotechnology5. Landscape architecture6. Forestry7. Environmental engineering and water resources management8. Applied hydrometeorology	Bachelor	240

Cycle	Degrees	Qualification awarded	ECTS credits
2 nd cycle	<ol style="list-style-type: none"> 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
2 nd cycle	Fire safety	Specialist	At least 300

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

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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

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.

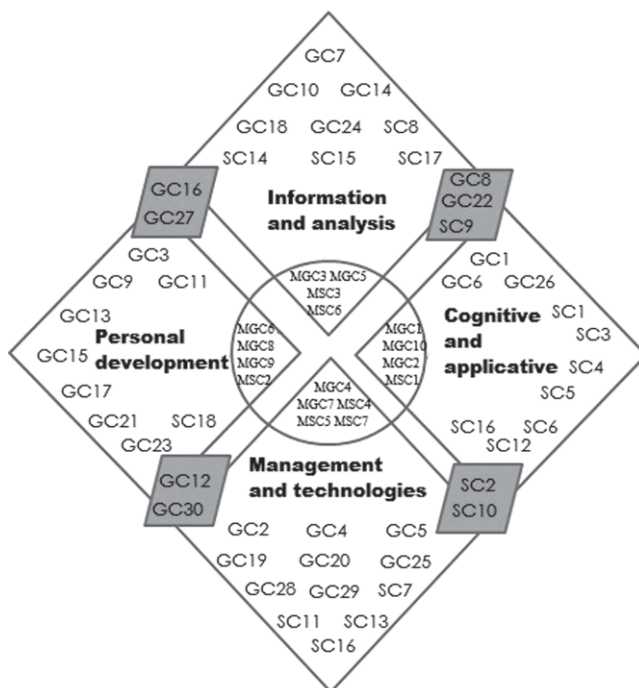
Discussions resulted into the following meta-competences allocated to appropriate clusters:

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

Table 13
Learning outcomes by levels of education

Level of education	Learning outcomes
<p align="center">First level: Bachelor degree</p>	<p>A graduate of the first level (Bachelor) in the subject area of «Ecology» should know / understand:</p> <ul style="list-style-type: none"> • 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. <p>Bachelor should be able to do:</p> <p>use ethical and legal rules governing the relation of man to man, to society, to the environment,</p> <ul style="list-style-type: none"> • 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 <p>The bachelor should have and demonstrate:</p> <ul style="list-style-type: none"> • 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	<p>A graduate of the second level (Master) in the subject area of «Ecology» should know / understand:</p> <ul style="list-style-type: none"> • 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 <p>A Master should be able to:</p> <ul style="list-style-type: none"> • 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. <p>A Master should have:</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Anthropological influence on the environment, degree of ecological risk 	Must be able to analyze: <ul style="list-style-type: none"> • 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	<p>Must be able to use:</p> <ul style="list-style-type: none"> • 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 	<p>Must be able to apply:</p> <ul style="list-style-type: none"> • 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	<p>Should know:</p> <ul style="list-style-type: none"> • fundamental branches of mathematics, physics, chemistry and biology, • Fundamental branches of general geology, theoretical and practical geography, soil science. 	<p>Should understand:</p> <ul style="list-style-type: none"> • 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	<p>Should know:</p> <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<p>Be able to understand, describe and critically analyse the basic information in the field of ecology and environmental management</p>	<p>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</p>