

## **Compulsory Subjects**

1. Psychology of Childhood and Education
2. **Environmental Science**
3. Chemistry and Society
4. **Laboratory Practicum I**
5. Pedagogical Communication and School Evaluation
6. **Introduction to Ecosystem Sciences**
7. **Basics of Statistics**
8. **Research Project Internship**
9. Inclusion in Education
10. **Global Environmental Problems**
11. **Environmental Education in the School Environment**
12. School Policy and Administration
13. **Practical Solutions to Environmental Problems**
14. **Environmental Management**
15. Planning, Development and Implementation of Curriculum
16. **Environmental and Green Technologies**
17. **Sustainable Development**
18. **Bachelor's Thesis Defense**
19. **Renewable Energy Sources**
20. Environmental Policies and Law
21. **Professional Internship I**

## **Compulsory Elective Subjects**

1. Teaching Profession and Professional Ethics
2. Biological Aspects of Pupil Development
3. Concept of Learning and Education
4. Problem Behaviour of Pupils
5. History of Institutional Education
6. Reading and Media Literacy
7. Academic Writing
8. Culture of Teacher's Speech and Cultural Literacy
9. **Geographic Information Systems**
10. **Remote Sensing of the Earth**
11. **Introduction to Radioecology**
12. **Security of Environmental Data and Information**
13. Fundamentals of Population Ecology
14. Communication of Environmental Topics
15. Environmental Ethics
16. Crisis Management, Mediation / Association
17. **Environmental Monitoring and Bioindicators**
18. **Methods of Ecological Research**
19. **Fundamentals of Research Project Preparation**
20. **Toxicological Aspects in Environmental Components**
21. **Laboratory Practicum II**
22. **Professional Internship II**

## **Profile subjects**

## **Compulsory subjects**

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Basics of Statistics
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 5	
<b>Recommended semester of study:</b> 2.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Subject Completion Requirements:</b>	
<b>Continuous assessment:</b> During the continuous assessment, a written test will be administered for 40 points.	
<b>Final assessment:</b> The exam will consist of a practical part where the student can earn 60 points. In total, the student can earn 100 points.	
<b>Method of completion:</b> The exam is conducted in oral form.	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning Outcomes:</b>	
Upon successful completion of the course, the student will acquire:	
<ul style="list-style-type: none"> <li>- Knowledge of methods for collecting and processing data obtained through mass surveys or measurement of a specific characteristic;</li> <li>- The ability and skill to analyze a statistical dataset, particularly univariate variables, using statistical methods suitable for studying technical and natural science processes;</li> <li>- The ability to examine and analyze the influence of factors on given processes, express relationships between phenomena, verify assumptions, and estimate characteristics of the observed processes.</li> </ul>	
<b>Brief Subject Outline:</b>	
<ol style="list-style-type: none"> <li>1. Theory of probability, basic concepts, calculation of probabilities of simple events, analytical methods for calculating probabilities of complex events.</li> <li>2. Random variable, distribution of random variables, ways of describing probabilistic behavior of random quantities. Description using quantitative characteristics: location, variability, skewness, kurtosis, moment characteristics.</li> <li>3. Theoretical distribution models of univariate random variables, models of discrete variables (binomial, hypergeometric, Poisson distribution).</li> <li>4. Models of continuous variable distributions (normal, Student's, Snedecor's distributions).</li> </ol>	

5. Sampling methods, nature of sampling, population, sample, distribution and properties of sample statistics.
6. Determination of population characteristics, point estimate, interval estimate, confidence interval for mean and variance, estimation in binomial distribution.
7. Determining sample size, for normally distributed populations and for binomial distribution.
8. Hypothesis testing – process, types of tests.
9. Testing means and variances, testing significance of differences between means, paired value tests.
10. Frequency testing – goodness-of-fit tests (parametric and non-parametric), tests of independence, tests for outliers.
11. Analysis of variance (ANOVA), types of problems, one-factor balanced design.
12. Correlation analysis – types of problems, regression and correlation tasks, simple linear correlation.

**Recommended literature:**

KUČEROVÁ, M., FIDLEROVÁ, H. 2012. Štatistické metódy. Trnava: AlumniPress, 192 s. ISBN978-80-8096-155-8.

JANIGA, I. 2013. Aplikovaná pravdepodobnosť a štatistika pre inžinierov : štatistická analýza jedného a dvoch súborov dát 1.diel. Bratislava: Nakladateľstvo STU, 265 s. ISBN 978-80-227-4046-3.

JANIGA, I., STAREKOVÁ, A. 2001. Základy pravdepodobnosti a štatistiky. Bratislava : STU v Bratislave, 201s.ISBN 80-227-1603-0.

CHAJDIAK, J. 2013. Štatistika jednoducho v Exceli. Bratislava: Stasis, 344 s. ISBN 978-80-85659-74-0.

McCLAVE, J. T., DIETRICH F. H. 1998. Statistics. San Francisco : Dellen Publishing Company, 1014 s. ISBN 0-02-379260-4.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** doc. RNDr. Iveta Dirgová Luptáková, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Global Environmental Problems
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 5	
<b>Weekly:</b> 3/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 7	
<b>Recommended semester of study:</b> 3.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
<b>Continuous Assessment:</b> Students are required to submit a written seminar paper, which accounts for <b>30%</b> of the total grade.	
<b>Final Assessment:</b> Students will take an <b>oral examination</b> , which accounts for <b>70%</b> of the total grade.	
<b>Method of Completion:</b> Completion by <b>oral examination</b> .	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will acquire:	
<ul style="list-style-type: none"> <li>- Knowledge of a culturally diverse and globally interconnected world</li> <li>- The ability and competence to collect and sort information on global issues</li> <li>- The ability to express their own position on environmental issues</li> <li>- The competence to present proposals for solving global problems</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Definition of basic concepts in the subject area, biosphere, human environment (natural, work), organization of environmental care in the Slovak Republic</li> <li>2. Nature, causes, and impacts of global environmental problems on life on Earth</li> <li>3. Air pollution</li> <li>4. Climate change (greenhouse effect)</li> <li>5. Depletion of the ozone layer (ozone hole)</li> <li>6. Acidification (acid rain), smog</li> <li>7. Water pollution</li> <li>8. Soil pollution and erosion</li> <li>9. Threats to biological diversity (biodiversity)</li> <li>10. Human population growth, increasing resource consumption</li> <li>11. Waste production</li> </ol>	

12. Environmental risk assessment and management

**Recommended literature:**

BAUMAN, Z. 2000. Globalizácia: dôsledky pre ľudstvo. Bratislava : Kalligram. ISBN 80-7149-335-X.

PETROVIČ, F. (ed) 2011. Environmentálne hľadiská trvalo udržateľného rozvoja Zeme. Nitra : UKF. ISBN 978-80-558-0021-9.

MOLDAN, B. 2009. Podmaněná planeta. Praha : Karolinum. ISBN 978-80-2461-580.

HARRIS, F. 2004. Global environmental issues. West Sussex, England : John Wiley & Sons, 324 s. ISBN 0-470-84560-0.

JOHNSTON, B. R. (ed) 2012. Water, cultural diversity, and global environmental change. Springer, 560 s. ISBN 978-94-007-1866-1.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** doc. RNDr. Miroslav Horník, PhD.; RNDr. Monika Šutáková, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Environmental Management
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 7	
<b>Recommended semester of study:</b> 4.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subject:</b>	
<b>Continuous Assessment:</b> Students are required to submit a written seminar paper, which accounts for <b>30%</b> of the total grade.	
<b>Final Assessment:</b> Students will take an <b>oral examination</b> , which accounts for <b>70%</b> of the total grade.	
<b>Method of Completion:</b> Completion by <b>oral examination</b> .	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will gain:	
<ul style="list-style-type: none"> <li>- The ability and competencies to solve and manage environmental problems at the level of enterprises, public and state administration, in accordance with the requirements of the <b>STN EN ISO 14001</b> standard structure, as a modern tool in organizational management;</li> <li>- Knowledge of necessary modern environmental protection tools, including: environmental management systems, environmental audits, quality management systems (QMS), and impact assessments of activities, constructions, and facilities on the environment.</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Sustainable development and global issues</li> <li>2. Documents for addressing environmental problems</li> <li>3. Preventive strategies as part of an organization's environmental policy</li> <li>4. System management methods leading to proactive environmental action</li> <li>5. Importance of implementing QMS</li> <li>6. Total Quality Management (TQM), clean production, excellence model, Responsible Care program</li> <li>7. Environmental management</li> <li>8. Environmental management systems</li> </ol>	

- 9. Structure of the STN EN ISO 14001 standard, EMAS
- 10. Environmental audit
- 11. Environmental impact assessment
- 12. Evaluation of environmental behavior, environmental reporting

**Recommended literature:**

VIRČÍKOVÁ, E., PALFY, P. 2001. Environmentálne manažérstvo – teória a prax. Košice : Vydavateľstvo Štroffek.

ENGEL, J. (ed) 2006. Technicko-ekonomické aspekty environmentálneho manažérstva. Košice : F BERG TU.

HUNT, D., JOHNSON, C. 1995. Environmental management systems: Principles and Practice. UK : McGraw-Hill.

STARKEY, R. 1997. Environmental management tools for SMEs – A handbook. USA : Environmental Agency.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** RNDr. . Vanda Adamcová, PhD.; Ing. Sabína Královičová

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Sustainable Development
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 6	
<b>Recommended semester of study:</b> 5.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
<b>Continuous Assessment:</b>	
During the semester, students will prepare a semester presentation on a selected topic in the context of sustainable development.	
<b>Final Assessment:</b>	
Not explicitly stated, but implied as part of overall assessment.	
<b>Method of Completion:</b>	
The exam is conducted in <b>written and oral form.</b>	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will gain:	
<ul style="list-style-type: none"> <li>- Knowledge and overview of global issues affecting humanity and an understanding of the need to preserve sustainable development (life) on our planet;</li> <li>- Knowledge and overview of political activities of the state in addressing economic, social, and environmental problems, and the ability to analyze the changing nature of global security and manifestations of crisis;</li> <li>- The opportunity to become an active participant in the search for, formulation, and implementation of tools aimed at achieving sustainable quality of life and changes in the behavior of human society.</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Basic characteristics and pillars of sustainable development. History of inequality and characteristics of global problems of humanity.</li> <li>2. Dimensions of population growth.</li> <li>3. Poverty and food security issues.</li> <li>4. Public health conditions.</li> <li>5. The changing nature of global security in the 21st century.</li> <li>6. Environmental assessment and product labeling in the EU.</li> </ol>	

7. Principles of applying sustainable development in major economic sectors.
8. Principles of applying sustainable development in the non-productive sphere: education, upbringing, economic system, tourism, human settlements, value orientation, and nutrition.
9. Methods of promoting principles and criteria of sustainable development.
10. Explanation of globalization, social and environmental problems of the current stage of globalization.
11. Sustainable development from the perspective of environmental impact assessments and environmental burdens.
12. Millennium Development Goals, Sustainable Development Agenda, and EU and Slovak strategies in the context of sustainable development.

**Recommended literature:**

DEMO, M. (ed) 2007. Udržateľný rozvoj – život v medziach únosnej kapacity biosféry. Nitra : VES SPU. ISBN 978-80-8069826-3.

KLINDA, J. 2001. Agenda 21 a trvalo udržateľný rozvoj. Bratislava : MŽP SR. ISBN 80-88833-03-5.

PINDERHUGHES, R. 2004. Alternative urban futures: Planning for sustainable development in cities throughout the world. Rowman and Littlefield Pub. ISBN 978-07-4252-367-8.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** prof. Mgr. Ildikó Matušiková, PhD.; RNDr. Monika Šutáková, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Renewable Energy Sources
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 5	
<b>Recommended semester of study:</b> 6.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
<b>Continuous Assessment:</b>	
Students' acquired knowledge and competencies will be verified during the semester through <b>2 continuous tests</b> . Only students who achieve at least <b>56% success</b> in each test will be admitted to the final examination.	
<b>Final Assessment:</b>	
(not explicitly described separately, part of overall assessment)	
<b>Method of Completion:</b>	
Completion by <b>oral examination</b> .	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will acquire:	
<ul style="list-style-type: none"> <li>- Knowledge and competencies in the use of <b>renewable energy sources (RES)</b>: hydropower, wind energy, direct solar energy utilization, biomass, and geothermal energy.</li> <li>- Knowledge about the <b>technical equipment</b> used for RES, as well as the <b>economic, legal, and safety aspects</b>, and <b>environmental impacts</b> of their use.</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Non-renewable and renewable natural resources – characteristics and overview. Environmental impacts of energy production, environmental impact assessment.</li> <li>2. Renewable energy as energy sources, global energy challenges, energy policy in the Slovak Republic and the EU. Potential of RES use in Slovakia.</li> <li>3. Conventional energy production – fossil fuels. Main advantages and disadvantages of traditional fuel use. Current sources and potential replacements.</li> <li>4. Conventional energy production – nuclear fuels. Energy generation through nuclear fission. Overview of nuclear power plant and reactor technologies. Main pros and cons.</li> <li>5. Solar energy – origin in thermonuclear fusion. Active and passive solar energy utilization. Photovoltaic systems. Solar collectors.</li> </ol>	

6. Use of wind energy – overview of key terms and technologies. Wind turbine technology.
7. Use of hydropower – overview of terms. Classification of hydroelectric plants. Water turbine technologies. Use of ocean and sea hydropower.
8. Origin and use of geothermal energy – technology overview, benefits and limitations.
9. Heat pumps.
10. Biomass – energy crops and organic waste.
11. Production and use of liquid and gaseous biofuels (ethanol, methanol, MERO, biogas). Pros and cons of biomass utilization.
12. Possibilities of energy savings. Advanced and alternative methods of energy harvesting and storage.

**Recommended literature:**

POLÁK, M. (ed) 2013. Bezlopatková miniturbína: cesta k energetickému využití nejmenších vodních zdrojů. Praha : České vysoké učení technické, 168 s. ISBN 978-80-01-05233-4.

MURTINGER, K. (ed) 2009. Fotovoltaika. Brno : Vydavatel'stvo ERA Brno, 81 s. ISBN978-80-7366-133-5.

BOLEMAN, T., FIALA, J. 2009. Obnovitelné zdroje energie. Trnava : MTF v Trnave, 72 s. ISBN978-80-89422-07-4.

PASTOREK, Z. (ed) 2004. Biomasa, obnovitelný zdroj energie. Praha : FCCC PUBLIC s.r.o., 286 s. ISBN 80-86534-06-5.

TWIDELL, J., Weir, T. 2006. Renewable energy resources. New York : Taylor & Francis, 601 s. ISBN 0-419-25320-3.

VIEIRADA, R, A. 2005. Fundamentals of renewable energy processes. New York : Elsevier Academic Press, 689 s. ISBN 978-0-12-088510-7.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** Mgr. Martin Valica, PhD.; doc. RNDr. Miroslav Horník, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## **Compulsory elective subjects**

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Geographic Information Systems
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 5	
<b>Recommended semester of study:</b> 5.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b> The student's evaluation consists of a practical component — the completion of a project assigned at the beginning of the semester. The student must obtain at least <b>56% of the total points</b> .	
<b>Overall subject evaluation:</b> <ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b> Upon successful completion of the course, the student will acquire: <ul style="list-style-type: none"> <li>- Knowledge in the field of Geographic Information Systems (GIS);</li> <li>- Understanding of fundamental concepts in this field;</li> <li>- The ability to apply the acquired knowledge during project development, e.g., creating shapefiles for various purposes, generating attribute tables, etc.;</li> <li>- Skills in evaluating and interpreting acquired data.</li> </ul>	
<b>Brief outline of the subject:</b> <ol style="list-style-type: none"> <li>1. Issues in Geographic Information Systems</li> <li>2. Basic concepts related to the use of open-source and proprietary applications</li> <li>3. Types of geographic data and their characteristics</li> <li>4. Data models</li> <li>5. Types of spatial data</li> <li>6. Classification and characteristics of spatial relationships in 2D and 3D topological structures</li> <li>7. Work and imaging techniques using unmanned aerial vehicles (drones)</li> <li>8. Creation of map outputs</li> <li>9. Working with layers</li> <li>10. Data presentation</li> <li>11. Theoretical and practical knowledge and skills in evaluating and interpreting obtained data</li> <li>12. • Presentation and defense of completed projects</li> </ol>	
<b>Recommended literature:</b>	

HOFIERKA, J. (ed) 2014. Geoinformatika. Košice : Prírodovedecká fakulta UPJŠ.  
ĎURIŠ, J. (ed) 2003. Geodézia. 1. vyd. Nitra : Slovenská poľnohospodárska univerzita, 310 s. ISBN 80-8069-290-4.  
IŠTOK, R. (ed) 1999. Geografia verejnej správy. ISBN 80-88885-65-5.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** Mgr. Marián Hostovecký, PhD.; Mgr. Juraj Kubeš

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Remote Sensing of the Earth
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 5	
<b>Recommended semester of study:</b> 5.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
The student's grade is composed of a <b>practical part</b> – the development of a semester project, either in a team or individually, based on topics offered by the instructor or agreed upon with the student(s) ( <b>50% of the total grade</b> ), and a <b>theoretical part</b> – a written test ( <b>50% of the total grade</b> ).	
The student must obtain at least <b>60% of the points</b> in each part to pass.	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will acquire:	
<ul style="list-style-type: none"> <li>- Knowledge of how satellite systems, aerial imaging, and drone imaging work</li> <li>- Practical knowledge and skills from exercises using unmanned aerial vehicles (drones)</li> <li>- Knowledge and skills in photo interpretation of aerial images</li> <li>- Skills in analyzing images of the Earth's surface</li> <li>- Specific knowledge and competencies based on lectures and exercises across various geographic disciplines such as climatology, pedology, phytogeography, biogeography, hydrology, environmental science, and others</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Introduction to the course</li> <li>2. Satellite, aerial, and unmanned systems used in remote sensing</li> <li>3. Types of digital information / photometry</li> <li>4. Photography, multispectral and hyperspectral satellite images</li> <li>5. Laser images and others</li> <li>6. Principles of imaging at the satellite system level</li> <li>7. Principles of imaging using aircraft and UAVs</li> <li>8. Principles of triangulation</li> <li>9. Hardware and software solutions in the field of remote sensing</li> <li>10. Possibilities of using these systems for mapping and measuring objects in selected geographic and landscape resource sectors</li> </ol>	

11. Analysis of Earth surface imagery related to environmental quality monitoring  
12. Presentation of semester projects

**Recommended literature:**

CANADIAN CENTRE FOR REMOTE SENSING. 2012. Fundamentals of Remote Sensing (učebný text v angličtine, in English), 256 s. URL: <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/remote-sensing/fundamentals/1430>.

GALLAY, M. Diaľkový prieskum Zeme. Prírodovedecká fakulta UPJŠ.

LILLESAND, K. 2008. Remote Sensing and Image Interpretation. NY: Wiley, 756 s.

JENSEN, K. 2005. Introductory Digital Image Processing. Prentice Hall, 526 s.

HOFIERKA, J. (ed) 2014. Geoinformatika. Košice : Prírodovedecká fakulta UPJŠ.

ŽIHLAVNÍK, S., SCHEER, L. 2001. Diaľkový prieskum Zeme v lesníctve. Zvolen.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** Mgr. Marián Host'ovecký, PhD.; Mgr. Juraj Kubeš

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Introduction to Radioecology
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 5	
<b>Recommended semester of study:</b> 5.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
<b>Continuous Assessment:</b> Students are required to submit a written seminar paper, which accounts for <b>30% of the final grade.</b>	
<b>Final Assessment:</b> Students will take an <b>oral exam</b> , which accounts for <b>70% of the final grade.</b>	
<b>Method of Completion:</b> Completion by <b>oral examination.</b>	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will acquire:	
<ul style="list-style-type: none"> <li>- Knowledge of general principles in nuclear sciences, including the detection of radioactivity</li> <li>- Basic knowledge of the operation of nuclear energy technologies</li> <li>- Understanding and competencies in the sources of contamination in the atmosphere, hydrosphere, and pedosphere caused by ionizing radiation, as well as the behavior of radionuclides in environmental components</li> <li>- Competence and some practical skills in determining and monitoring natural radioactivity and natural radionuclides</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Nature of radioactivity. <math>\gamma</math> decay, metastable state and isomeric transition, internal conversion, <math>\beta^-</math> and <math>\beta^+</math> decay, electron capture, <math>\alpha</math> decay, spontaneous fission, nucleon emission, decay schemes</li> <li>2. Natural and artificial radioactivity. Radioactive decay series</li> <li>3. Kinetics of radioactive decay</li> <li>4. Secular and transient radioactive equilibrium, basics of isotope chronology</li> <li>5. Interaction of ionizing radiation with matter</li> <li>6. Physical, biological, and effective half-life</li> </ol>	

7. Classification of radionuclides by radiotoxicity
8. Detection of radioactive radiation: ionization methods, scintillation methods, radiography
9. Stages in the development of radioecology and its place in the system of natural sciences
10. Anthropogenic environmental radioactivity: nuclear testing and nuclear power plants
11. Sources of contamination of the atmosphere, hydrosphere, and pedosphere by ionizing radiation
12. Pathways of radionuclide transfer from source to humans

**Recommended literature:**

MÁTEL, Ľ., DULANSKÁ, S. 2013. Základy jadrovej chémie. Bratislava : Vydavateľstvo UK, 219 s. ISBN 978-80-223-3365-8.

TÖLGYESSY, J., HARANGOZÓ, M. 2000. Rádioekológia. Zvolen : Bratia Sabovci, 131 s. ISBN 80-8055-346-7.

ATWOOD, D. 2010. Radionuclides in the environment. New York : Wiley, 522 s. ISBN 978-0-470-71434-8.

CHOPPIN, G. (ed) 2013. Radiochemistry and nuclear chemistry. 4th Edition. New York : Elsevier, Academic Press. 866 s. ISBN 978-0-12-405897-2.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** RNDr. Vanda Adamcová, PhD.; doc. RNDr. Miroslav Horník, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Security of Environmental Data and Information
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 5	
<b>Recommended semester of study:</b> 5.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
<b>Continuous assessment:</b> Throughout the semester, students will present the results of their individual study each week during seminars.	
<b>Final assessment:</b> Students will take a final written exam during the examination period.	
<b>Form of completion:</b> The course is completed by a written examination.	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
<b>Upon successful completion of the course, the student will be able to:</b>	
<ul style="list-style-type: none"> <li>- Understand the principles of protecting sensitive environmental data and information;</li> <li>- Comprehend the legal and ethical aspects of processing environmental data;</li> <li>- Demonstrate knowledge of modern technologies for ensuring data integrity and confidentiality;</li> <li>- Design and apply strategies for managing access to sensitive data;</li> <li>- Identify and minimize risks of information leakage in environmental research;</li> <li>- Critically assess security risks associated with environmental data;</li> <li>- Propose comprehensive solutions for the protection of environmental information systems;</li> <li>- Communicate security aspects of environmental data effectively to various stakeholders.</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Introduction to environmental data and information security</li> <li>2. Legal and regulatory frameworks for data protection in the environmental context (GDPR, environmental laws)</li> </ol>	

3. Identification and classification of sensitive environmental data
4. Principles and implementation of Zero Trust architecture in environmental information systems
5. Cryptographic methods and their application in environmental data protection
6. Access and identity management in the context of environmental data
7. Security of cloud solutions for storing and processing environmental information
8. Data protection in IoT devices used in environmental monitoring
9. Data leakage detection and prevention in environmental research
10. Ethical aspects and data minimization in environmental research
11. Security audits and risk assessment in environmental information systems
12. Incident response and recovery plans for environmental data systems. Emerging trends in environmental data and information protection.

**Recommended literature:**

KOLOUCH, J. 2019. *CyberSecurity*, CZ.NIC, z.s.p.o. 2019.

<https://web2.mlp.cz/koweb/00/04/49/72/14/cybersecurity.pdf>

LAYODE, O., NAIHO, H. N. N., ADELEKE, G. S., UDEH, E. O., LABAKE, T. T. 2024. Data privacy and security challenges in environmental research: Approaches to safeguarding sensitive information. *International Journal of Applied Research in Social Sciences*, 6(6), 1193-1214.

SULICH, A., RUTKOWSKA, M., KRAWCZYK-JEZIERSKA, A., JEZIERSKI, J., ZEMA, T. 2021. Cybersecurity and sustainable development. *Procedia Computer Science*, 192, 20-28.

HURAJ, L., ŠIMON, M. 2019. Cloudové a gridové technológie: princípy a bezpečnosť. 1. vyd., Banská Bystrica: Belianum. 2019, 153 s. ISBN: 978-80-557-1660-2.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** Ing. Peter Střelec, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.

## Subject information list

<b>University:</b> <i>University of SS. Cyril and Methodius in Trnava</i>	
<b>Faculty:</b> <i>Faculty of Natural Sciences</i>	
<b>Subject code:</b>	<b>Subject Name:</b> Environmental Monitoring and Bioindicators
<b>Type of educational activities:</b> lecture/seminar; <i>profile subject</i>	
<b>Scope of educational activities (in hours):</b> 4	
<b>Weekly:</b> 2/2	
<b>During the study period:</b> winter	
<b>Method of educational activity:</b> in-person	
<b>Number of credits:</b> 6	
<b>Recommended semester of study:</b> 4.	
<b>Level of study:</b> 1.	
<b>Prerequisite subjects:</b>	
<b>Requirements for completing the subjects:</b>	
<b>Continuous Assessment:</b>	
A prerequisite for completing the course is active participation in classes in accordance with the Study Regulations of UCM in Trnava. Preparation of a semester paper on current topics in the field of environmental monitoring and bioindicators (20% of the total grade).	
<b>Final Assessment:</b>	
Students will undergo an oral exam (80% of the total grade).	
<b>Method of Completion:</b>	
Completion through an oral exam.	
<b>Overall subject evaluation:</b>	
<ul style="list-style-type: none"> <li>• <b>A (1.0) excellent</b> – outstanding results with only minor errors (92–100%)</li> <li>• <b>B (1.5) very good</b> – above-average results with some minor errors (83–91%)</li> <li>• <b>C (2.0) good</b> – generally good, average performance (74–82%)</li> <li>• <b>D (2.5) satisfactory</b> – acceptable results, but with significant errors (65–73%)</li> <li>• <b>E (3.0) sufficient</b> – results meet minimum criteria (56–64%)</li> <li>• <b>FX (4.0) insufficient</b> – completion of the subject requires significant additional effort and work from the student (0–55%)</li> </ul>	
<b>Learning outcomes:</b>	
Upon successful completion of the course, the student will acquire:	
<ul style="list-style-type: none"> <li>- the ability to comprehensively understand the principles of environmental monitoring and the importance of bioindicators in assessing the state of the environment;</li> <li>- skills to apply various methodologies for data collection and evaluation in environmental monitoring, with an emphasis on their use in scientific research activities;</li> <li>- skills in assessing water, soil, and air quality, biodiversity status, and the condition of selected ecosystems using bioindicators;</li> <li>- the ability to apply acquired knowledge and skills in practice, for example in monitoring and evaluating the state of the environment, in the preparation of environmental reports and studies, as well as in designing and implementing nature protection measures.</li> </ul>	
<b>Brief outline of the subject:</b>	
<ol style="list-style-type: none"> <li>1. Principles of environmental monitoring, definitions of basic concepts, and the importance of bioindicators.</li> <li>2. Factors affecting the distribution, abundance, and species interactions of organisms.</li> </ol>	

3. Types of bioindicators and selection of appropriate bioindicators.
4. Use of endemism and surrogate species (“keystone, flagship, and umbrella” species).
5. Monitoring and bioindication – microorganisms.
6. Monitoring and bioindication – flora I.
7. Monitoring and bioindication – flora II.
8. Monitoring and bioindication – fauna I.
9. Monitoring and bioindication – fauna II.
10. Pollution and toxicity monitoring.
11. Assessment of water, soil, and air quality.
12. Biodiversity assessment, evaluation of the status of selected ecosystems using bioindicators.

**Recommended literature:**

KALISÍŇSKA, E.: Mammals and Birds as Bioindicators of Trace Element Contaminations in Terrestrial Environments, Springer, 2019.

OROLÍNOVÁ, M.: Chémia a životné prostredie, Trnavská univerzita v Trnave, 2009.

BOHÁČ, J.: Ochrana biodiverzity, Jihočeská univerzita v Českých Budějovicích, 2013.

**Language required for subject completion:** english

**Notes:**

**Subject Evaluation:**

Total number of evaluated students:

A	B	C	D	E	FX

**Teachers:** Mgr. Richard Hančinský, PhD.; doc. RNDr. Miroslav Horník, PhD.

**Date of last update:** 28.3.2025

**Approved by:** prof. RNDr. Alfréd Trnka, PhD.