

<b><i>Study Course Title</i></b>	<b><i>Environmental science</i></b>
<b><i>Study Course Code</i></b>	VidZ1012
<b><i>Branch of Science</i></b>	Environment
<b><i>Credits</i></b>	3
<b><i>European Credit Transfer and Accumulation System Credits</i></b>	4.50
<b><i>Total Number of Contact Hours</i></b>	<b>48</b>
<b><i>Number of Lecture Hours</i></b>	32
<b><i>Number of hours for practical assignments</i></b>	16

***Course lecturer(-s)***

Dr.biol., doc. Dāvis Gruberts

***Course author(-s)***

Dr.biol., doc. Dāvis Gruberts

***Study Course Abstract***

The aim of the course is to provide information on the most actual global environmental problems, their causes and ways to solve them. The interaction between human society and nature and its various aspects is explained.

***Course Plan***

1. Introduction to Environmental science, its historical development. (L 2)
2. Earth as a single system and its subsystems. (L 2)
3. Environmental Impact Assessment of the municipal waste landfill project. (P 2)
4. Biogeochemical cycles. (L 2)
5. Environmental pollution and its sources. (L 2)
6. Environmental Impact Assessment of the hydroelectric dam project. (P 2)
7. Air pollution, its sources and effects. (L 2)
8. Water resources and pollution. (L 2)
9. Environmental Impact Assessment of the pulp mill project. (P 2)
10. Groundwater - its protection and use. (L 2)
11. Effects of chemical pollution on organisms and populations. (L 2)
12. Environmental Impact Assessment of the bypass construction project. (P 2)
13. Physical factors and their impact on the environment. (L 2)
14. Anthropogenic impacts on species and populations. (L 2)
15. General characterization of the environmental status of the river basin. (P 2)
16. Ozone layer and its degradation. (L 2)
17. Climate change and global warming. (L 2)
18. General description of the protected nature area. (P 2)
19. Biodiversity and its protection. (L 2)
20. Genetic diversity and factors affecting it. (L 2)
21. Calculation of the ecological footprint. (P 2)
22. Urbanization and the environment. (L 2)
23. Desertification and soil degradation. (L 2)
24. Evaluation of urban air quality using bioindication methods. (P 2)

L - lecture; P - practical work

## CHARACTERISTICS OF THE ORGANIZATION AND TASKS OF STUDENTS' INDEPENDENT WORK

Students' independent work: 72 acad. hours.

Students independently fulfill the tasks given in practical work. Students should prepare for practical works by reading and analyzing information / literature provided by the lecturer, finding the necessary information to complete the task (see topics of Practical Works and lists of available sources), and completing homework given by the lecturer (reading theoretical literature and articles on specific topics). During the study process two mid-term examinations are organized - written tests to check the independently acquired theoretical knowledge (one in the middle of the semester and the other at the conclusion).

### ***Learning Outcomes***

Knowledge:

- 1) understands the difference between Environmental science and other scientific disciplines;
- 2) is able to characterize the Earth as a single system, its main components, feedback effects and biogeochemical cycles in nature;
- 3) understands current global environment problems, their causes and consequences;
- 4) understands the interaction between environment and society, its various aspects.

Skills:

- 1) is able to assess potential environmental impact of a municipal waste dump, a hydroelectric dam, a pulp mill and a bypass project and to choose the less harmful options;
- 2) is able to assess the overall environmental impact of one's lifestyle through calculations of the Ecological Footprint;
- 3) is able to determine the air quality in the city using bioindication methods.

Competencies:

- 1) teamwork skills in analyzing and solving environmental problems and situations of different scales;
- 2) is able to independently analyze and systematize information on the environmental status of a given territory and the factors affecting it.

### ***Requirements for Awarding Credits***

During the semester all the practical works planned in the study program have been worked out, submitted according to the specified deadlines and successfully evaluated. Study course acquisition is evaluated using a 10-point scale. The final mark for the study course consists of the following results: (1) 40% in the exam, (2) 60% in practical assignments, provided that each of the components of the total mark cannot be lower than 4 points.

### ***Course content***

Lectures:

1. Introduction to Environmental science, its historical development. Concept of the environment. Origin and development of environmental consciousness and Environmental science, its division and connection with other fields of science.
2. Earth as a single system and its subsystems. Types of systems, feedback effects in

nature. Atmosphere, hydrosphere, lithosphere, biosphere and pedosphere, their main characteristics and interactions.

3. Biogeochemical cycles. The life cycle of water, carbon, oxygen, nitrogen, phosphorus and sulphur in nature and its impact on humans.
4. Environmental pollution and its sources. Concept and classification of pollution. Water, air and soil pollution, its causes and main pollutants.
5. Air pollution, its sources and effects. Natural and anthropogenic sources of pollution. Smog and acid rain. Bioindication of air pollution.
6. Water resources and pollution. Water resources in the hydrosphere. Sources of pollution, major pollutants and their impact on aquatic organisms, biocenoses and ecosystems.
7. Groundwater - its protection and use. Groundwater classification and formation conditions. Depression funnels. Protection of groundwater against pollution. Groundwater resources, their rational use.
8. Impact of chemical pollution on organisms and populations. Toxic substances, their types. Teratogenic, mutagenic and carcinogenic substances, their effects. Maximum levels and acceptable level of risk.
9. Physical factors and their impact on the environment. Ionizing radiation, noise, light and heat as forms of pollution, their impact on organisms and ecosystems.
10. Anthropogenic impacts on species and populations. Direct and indirect impact. Animal species extinct due to human impact, current mass extinction of species.
11. Ozone layer and its degradation. Processes of formation and decomposition of the ozone molecule in the stratosphere, their natural and anthropogenic causes. Freon, etc. exposure to pollutants. Ozone layer, its main characteristics. Ozone holes, explanation of their origin.
12. Climate change and global warming. Greenhouse effect, Carbon dioxide concentration and increase in average global air temperature. Consequences, trends and future projections of the global warming process.
13. Biodiversity and its protection. Causes of species rarity. Basic principles for the protection of rare and endangered species. The importance of zoos in the protection of species.
14. Genetic diversity, factors affecting it and protection. Decrease in diversity of crop and livestock breeds as one of the most pressing environmental problems. Use of genetically modified organisms in agriculture and their potential effects on the environment.
15. Urbanization and environment. Concept of urbanization, stages and models of urban development. The most urbanized places in the world. Environmental problems related to urbanization.
16. Desertification and soil degradation. Role of land use intensity and climate change in desert development. Earth (soil) degradation in the world, its causes, types, distribution and future projections.

#### Practical Works:

1. Environmental Impact Assessment of the municipal waste landfill project. Group work with topographic map and a worksheet.
2. Environmental Impact Assessment of the hydroelectric dam project. Group work with topographic map and a worksheet.
3. Environmental Impact Assessment of the pulp mill project. Work in group with Latvian Geographic Atlas, outline map and worksheet.
4. Environmental Impact Assessment of the bypass construction project. Group work

with topographic map and a worksheet.

5. General characterization of the environmental status of the river catchment area. Individual work with the Latvian Geographic Atlas, outline map and worksheet.
6. General description of the protected nature area. Work individually with the Latvian Geographic Atlas, a contour map, published information sources and a worksheet.
7. Calculation of the Ecological Footprint. Group work with the World Wildlife Fund's Ecological Footprint Calculator on the Internet and a worksheet.
8. Evaluation of urban air quality using bioindication methods. Group work in field conditions with the most common lichen list and a worksheet.

#### COMPULSORY READING LIST

1. Allaby M., 2002. Basics of Environmental Science. 2nd ed. London: Routledge, pp. 323.
2. Jackson A. R. W., Jackson J. M., 2000. Environmental Science. The Natural Environment and Human Impact. 2nd ed. Harlow: Prentice Hall, pp. 405.

#### FURTHER READING LIST

1. Kļaviņš M., Filho W. L., Zaļoksnis J (eds.), 2010. Environment and Sustainable Development. Rīga: Academic Press of University of Latvia, pp. 300.
2. Lovelock J., 2000. Gaia. A New Look at Life on Earth. Oxford: University Press, pp. 148.
3. Lovelock J., 2006. The Revenge of Gaia. London: Allen Lane, pp. 177.
4. Ernšteins R., Jūrmalietis R., 2000. Vides zinības. Angļu – latviešu skaidrojošā vārdnīca. Rīga: N.I.M.S., 135 lpp.
5. Kļaviņš M., Nikodemus O., Segliņš V., Melecis V., Vircavs M., Āboliņa K., 2008. Vides zinātne. Rīga: LU Akadēmiskais apgāds, 599 lpp.
6. Kļaviņš M., Zaļoksnis J. (red.), 2010. Vide un ilgtspējīga attīstība. Rīga: LU Akadēmiskais apgāds, 334 lpp.
7. Kļaviņš M., 2012. Vides piesārņojums un tā iedarbība. Rīga: LU Akadēmiskais apgāds, 200 lpp.
8. Melecis V., 2009. Ekoloģijas un vides zinātnes saturs: līdzsvara meklējumos. Krāj.: Kļaviņš M., Zaļoksnis J. (red.) Vides izglītība augstskolā. Rīga: LU Akadēmiskais apgāds, 176-184. lpp.
10. Melecis V., 2011. Ekoloģija. Rīga: LU Akadēmiskais apgāds, 352 lpp.
- Nikodemus O., Brūmelis G. (red.), 2015. Rīga: LU Akadēmiskais apgāds, 288 lpp.
11. Ozola Ā. (red.), 2016. Klimata izmaiņas, ko rada antropogēnie procesi – atkritumu un notekūdeņu apsaimniekošanā. Rīga: Tipogrāfija "NRJ Printing", 146 lpp.
12. Porteous A., 2003. Dictionary of Environmental Science and Technology. 3rd ed. Chichester: John Wiley & Sons, pp. 707.
13. Rydén L., Migula P., Andersson M.(eds.), 2003. Environmental Science. Uppsala: Baltic University Press, pp. 824.
14. Vakerneidžels M., Rīss V., 2000. Mūsu ekoloģiskais pēdas nospiedums. Rīga: Norden AB, 193 lpp.

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1. Kļaviņš M., Nikodemus O., Segliņš V., Melecis V., Vircavs M., Āboliņa K., 2008. Vides zinātne. Rīga: LU Akadēmiskais apgāds, 599 lpp.
2. Kļaviņš M., Zaļoksnis J. (red.), 2010. Vide un ilgtspējīga attīstība. Rīga: LU Akadēmiskais apgāds, 334 lpp.

#### ***Further Reading List***

1. Allaby M., 2002. Basics of Environmental Science. 2nd ed. London: Routledge, pp.

323.

2. Eberhards G., 1999. Ievads vides zinātnē. Mācību līdzeklis. Rīga: LU, 118 lpp.
3. Ernšteins R., Jūrmalietis R., 2000. Vides zinības. Angļu – latviešu skaidrojošā vārdnīca. Rīga: N.I.M.S., 135 lpp.
4. Jackson A. R. W., Jackson J. M., 2000. Environmental Science. The Natural Environment and Human Impact. 2nd ed. Harlow: Prentice Hall, pp. 405.
5. Kļaviņš M., 2012. Vides piesārņojums un tā iedarbība. Rīga: LU Akadēmiskais apgāds, 200 lpp.
6. Kļaviņš M., Filho W. L., Zaļoksnis J (eds.), 2010. Environment and Sustainable Development. Rīga: Academic Press of University of Latvia, pp. 300.
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8. Lovelock J., 2006. The Revenge of Gaia. London: Allen Lane, pp. 177.
9. Melecis V., 2009. Ekoloģijas un vides zinātnes saturs: līdzsvara meklējumos. Krāj.: Kļaviņš M., Zaļoksnis J. (red.) Vides izglītība augstskolā. Rīga: LU Akadēmiskais apgāds, 176-184. lpp.
10. Melecis V., 2011. Ekoloģija. Rīga: LU Akadēmiskais apgāds, 352 lpp.
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14. Vakerneidžels M., Rīss V., 2000. Mūsu ekoloģiskais pēdas nospiedums. Rīga: Norden AB, 193 lpp.

### ***Periodicals and Other Sources***

Journal of Environmental Sciences <https://www.journals.elsevier.com/journal-of-environmental-sciences>

Frontiers in Environmental Science

<https://www.frontiersin.org/journals/environmental-science#>

International Journal of Environmental Science and Technology

<https://www.springer.com/journal/13762>

"Vides Vēstis"

"Ilustrētā Zinātne"

Internet resources:

LVGMC: [www.meteo.lv](http://www.meteo.lv) Ekoloģiskā pēdas nospieduma kalkulators:

<http://www.pdf.lv/epeda/epeda.html>

### ***Notes***

Language of the course: English or Latvian