

The beginning of translation



ELABORATION OF LIFELONG LEARNING COURSES IN ECOLOGICAL MONITORING AND AQUATIC BIOASSESSMENT

Faculty of Sciences and Mathematics
University of Banja Luka

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Working group for the preparation of the Elaboration of Lifelong learning courses in ecological monitoring and aquatic bioassessment:

- ✚ Dr Goran Trbić
- ✚ Dr Svjetlana Lolić
- ✚ Dr Radoslav Dekić
- ✚ Dr Dragojla Golub
- ✚ Dr Biljana Lubarda
- ✚ Dr Maja Manojlović
- ✚ Branka Trninić, bachelor of laws
- ✚ Željka Ostojić
- ✚ Sanja Karajlić

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1. Name

Lifelong learning courses in ecological monitoring and aquatic bioassessment:

2. Description

The specific objectives of the project are:

- Development and implementation of the advanced master's curriculum Ecological monitoring and aquatic bioassessment (EMAB) at institutions of higher education in the countries of the Western Balkans, in accordance with the Bologna and national standards for accreditation;
- Development and implementation of lifelong learning courses for the environmental monitoring sector in accordance with the EU Water Framework Directive (WFD) at institutions of higher education in the countries of the Western Balkans;
- Equipping seven laboratories for Ecological monitoring and aquatic bioassessment (EMAB) in institutions of higher education in the countries of the Western Balkans;
- Development of the regional academic ECOBIAS network for the organization and promotion of regional cooperation in the field of Ecological monitoring and biological assessment of aquatic ecosystems.

Students/participants at institutions of higher education in partner countries will have a better chance of getting a job after obtaining a diploma or a certificate within the lifelong learning program, since there is an obvious need for experts in this field in the partner countries. After equipping laboratories and acquiring/sharing knowledge, skills and competencies in this area, teaching and technical staff in the field of environmental monitoring in partner countries will expand opportunities for cooperation with other higher education institutions and stakeholders in the Western Balkans region. This cooperation will result in the preparation of project proposals for other EU grants and encourage further research in this area.

Content

Within the project, eight lifelong learning courses were developed, which cover all the important fields of ecological monitoring and aquatic bioassessment of inland waters.

Course	ETCS points
Aquatic ecotoxicology	6
Aquatic and semi-aquatic macrophytes	6
Aquatic macroinvertebrates in bioassessment	6
Phycology	6
Ichthyology	6
Freshwater microbiology	6
SERCON system for evaluating rivers for conservation	6
Water protection technologies	6

Participants choose one of the offered courses from the lifelong learning program.

Assessment of needs on the labor market

A comparative analysis of existing data on water resources in the countries of the Western Balkans indicates a lack of reliable data, which hinders the assessment of the current and future state of water resources. Also, this analysis indicates high sensitivity and vulnerability of water resources in the Western Balkan region, as well as the lack of coordinated water management. Therefore, this attractive ecological and scientific problem makes a pressing issue in the field of environmental protection, and the equipment of modern laboratories is exceptionally important for realizing effective ecological monitoring and aquatic bioassessment of freshwater ecosystems.

For the purposes of starting this program, a labor market analysis was carried out, which included a total of 13 institutions from the field of ecological monitoring and aquatic bioassessment in order to estimate the number of new work positions necessary. The institutions included in this research expressed the need for personnel qualified to perform the following activities:

- ↓ monitoring of aquatic macrophytes,

- ⬇ macroinvertebrate monitoring,
- ⬇ microbiological monitoring of aquatic ecosystems,
- ⬇ monitoring and assessment of fish populations,
- ⬇ monitoring of riparian habitats,
- ⬇ monitoring of macroalgae and cryptogamous flora,
- ⬇ GIS and remote research,
- ⬇ environmental engineering and water protection technologies,
- ⬇ data processing,
- ⬇ administrative tasks related to national and EU legislation and policy in the field of water quality and conservation of freshwater ecosystems,
- ⬇ writing project proposals,
- ⬇ molecular methods for routine monitoring of aquatic ecosystems.

The results of the research clearly showed that there is a great need for specialization in this area (based on the need for professional retraining, as well as the creation of new job positions) primarily in: Civil Engineering Institute "IG", Public Health Institute of the Republic of Srpska and Public institution "Waters of Srpska" in Banja Luka and Public Health Institute Zvornik and the Faculty of Technology in Zvornik. The results of the research are available at the link:

https://www.ecobiaserasmus.com/wp-content/uploads/2020/06/ECOBIAAS_TASK-1_4-REPORT.pdf

The results are quite expected, bearing in mind the fact that the EU Water Framework Directive requires the use of different multimetric water quality assessment systems. This is precisely why the EU funded many projects whose main goal was to develop a framework for a future European aquatic quality bioassessment system based on algae, benthic macroinvertebrates, aquatic macrophytes and fish that had an output in multimetric indices (AQEM. 2002; Fame Consortium, 2004 .; 2009; Schmutz & Sendzimir, 2018).

The Water Framework Directive (WFD) is linked to a number of other EU directives. These include directives related to the protection of biological diversity, directives related to specific uses of water and directives related to the regulation of activities undertaken in the environment, etc.

The development of the system of ecological assessment and classification is not a simple matter, but one of the most significant and technically demanding parts of the implementation of the Water Framework Directive, which is why great attention is paid to capacity building in higher education and the implementation of joint projects with this topic in the Western Balkans. Additional knowledge and skills are necessary for successful ecological monitoring and bioassessment, which mainly relates to data processing skills and administrative tasks related to EU and national legislation and policy on water quality and conservation of freshwater ecosystems.

According to the Water Framework Directive (WFD), not only highly industrialized, but also developing countries are obliged to protect and restore all their water ecosystems so that their water bodies (lakes, rivers, groundwaters, transitional and coastal waters) are ecologically in good condition by 2027 at the latest.

This program directs and accelerates capacity building processes for successful monitoring of the state of freshwater ecosystems and biological assessment, especially in developing countries where existing capacities are limited in terms of technology and people. All institutions working in the field of monitoring and bioassessment of inland waters should ensure an optimal number of employees with appropriate knowledge, skills and competences to enable the availability of scientific data analysis to the general public. Biomonitoring of inland aquatic ecosystems must be based on scientific data and understanding of these ecosystems and their main components, as well as hydrological and ecological processes.

The availability of all necessary profiles in the field of inland aquatic bioassessment and ecological engineering will enable effective monitoring in accordance with the Water Framework Directive in the future.

International comparability

Within the framework of the Erasmus + ECOBIAS project itself, apart from the Faculty of Natural Sciences and Mathematics of the University of Banja Luka, planned are the accreditation of master's studies and the implementation of LLL courses (lifelong learning courses) in the field of aquatic bioassessment at higher education institutions in Bosnia and Herzegovina, namely:

- ✚ LLL courses - *University of Mostar,*
- ✚ Master's studies - *University of Sarajevo, University of Tuzla, University of East Sarajevo, International University of Travnik,*

as well as the accreditation of the LLL course at the University of Podgorica, Montenegro.

Individual modules related to water management and the ecology of aquatic ecosystems exist at numerous Universities in the region, namely:

- ✚ *University of Banja Luka, Department of Ecology and Environmental Protection* <https://pmf.unibl.org/wp-content/uploads/2019/05/2-ciklus-ekologija-zivotinja.pdf>.
- ✚ *University of Tuzla, Department of Applied Biology* http://pmf.untz.ba/wp-content/uploads/2017/04/Primijenjena_biologija.pdf;
- ✚ *University of Bihać, Department of Environmental Protection* https://btf.unbi.ba/?page_id=1122;

In addition to the abovementioned modules in the region, there are numerous programs in ecology and ecological monitoring as well as aquatic bioassessment in the European Union countries. For example, in Germany there are more than 35 master's programs in the field of ecology and environmental monitoring.

An overview of the programs is available at the link:

(<https://www.ecobiaserasmus.com/wp-content/uploads/2020/04/ECOBIAAS-REPORT-CURRICULA.pdf>).

Some of the universities where the mentioned programs are conducted are:

- ✚ *University of Duisburg - Essen* has master's programs: Environmental Toxicology (EnviTox) <https://www.uni-due.de/studienangebote/studiengang.php?id=40>; Transnational ecosystem-based Water Management <https://www.uni-due.de/studienangebote/studiengang.php?id=103>;
- ✚ *University of Stuttgart* has master's program: Water Resources Engineering and Management (WAREM) <https://www.warem.uni-stuttgart.de/> itd.

3. The goals of lifelong learning courses

The general goals of lifelong learning courses are:

- ✚ Enabling students to work independently in the field of environmental monitoring and aquatic quality bioassessment,
- ✚ Introducing the participants to basic terms, principles and concepts in the field of biomonitoring,
- ✚ Introducing the participants to ecological principles in the analysis of the relationship between habitats and the organisms that inhabit them.

The specific goals of lifelong learning courses are:

- ✚ improving the knowledge, skills and competencies of participants in the field of water resources management according to the standards of the Water Framework Directive,
- ✚ providing participants the opportunity to become familiar with standards in the field of water resources management,
- ✚ providing participants the opportunity to develop fundamental skills important for laboratory work in the field of environmental protection,
- ✚ providing participants with the opportunity to develop fundamental skills in understanding problems in the field of environmental protection, and applying tools for analysis and evaluation of the state of the ecosystem.

4. Coordinator

Dr Svjetlana Lolić

5. Short biography of the coordinator

Dr Svjetlana Lolić is Associate professor at Faculty of Sciences and Mathematics of the University of Banja Luka.

Education:

- ✚ 2013. PhD of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka.
- ✚ 2007. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Novi Sad.

- ✚ 2003. Bachelour of Biology, Faculty of Sciences and Mathematics, University of Banja Luka.

Academic, scientific and professional titles:

- ✚ 2019. – today, Associate Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2014 – 2019., Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2008. – 2014., Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2003. – 2008., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

Courses:

Undergraduate studies:

- ✚ Microbiology
- ✚ Ecology and diversity of microorganisms
- ✚ Ecology of microorganisms
- ✚ Biology of algae
- ✚ Ecology and diversity of algae
- ✚ Biology of fungi and lichenes
- ✚ Micology

Graduate studies:

- ✚ Genetic resources of microorganisms and invertebrates
- ✚ Methodology of scientific research

Textbooks:

- ✚ Lolić, S. (2018): Biologija gljiva. Univerzitet u Banjoj Luci. ISBN 978-99955-21-72-1
- ✚ Paraš, S., Lolić, S., Škondrić, S., Bilbija, B., Golub, D. (2017): Biologija za prvi razred Gimnazije. Zavod za udžbenike i nastavna sredstva, Istočno Sarajevo.

Field of scientific research:

Microbiology of aquatic ecosystems, algology, mycology, surface water monitoring, transmission of human pathogens through plant cultures

Selected projects:

- ✚ 2020-2022: ERASMUS+ project „ Development of master curricula in ecological monitoring and aquatic bioassessment for Western Balkans HEIs“ (ECOBIAS)
- ✚ 2019-2022: Development of the Environmental Strategy and Action Plan of Bosnia and Herzegovina (BiH ESAP 2030+); Embassy of Sweden
- ✚ 2020: Examination of the water quality of watercourses in the Republic of Srpska in 2020. Fund for environmental protection and energy efficiency of the Republic of Srpska
- ✚ 2018 - 2019: Transmission of human pathogenic microorganisms through vegetable crops - impact of irrigation and fertilization. Ministry of Scientific and Technological Development, Higher Education and Information Society of the RS
- ✚ 2014 – 2015: Antimicrobial activity of indigenous Basidiomycota species. Ministry of Science and Technology RS
- ✚ Cost Action CA18225 Taste and Odor in early diagnosis of source and drinking Water Problems (2019-2023)
- ✚ Cost Action CA18226 New approaches in detection of pathogens and aeroallergens (2019-2023)
- ✚ Cost Action CA16110 Control of Human Pathogenic Micro-organisms in Plant Production Systems (2017-2021)

Selected references:

- ✚ Radusin Sopić, B., Lamovšek, J., Lolić, S., Đurić, G., Antić, M. (2021): First report of *Xanthomonas phaseoli* pv. *phaseoli* in locally produced bean seeds in Bosnia and Herzegovina. *Journal of Plant Pathology* <https://link.springer.com/article/10.1007/s42161-020-00728-7>
- ✚ Maksimović, T., Lolić, S., Kukavica, B. (2020): Seasonal changes in the content of photosynthetic pigments of dominant macrophytes in the Bardača fishpond area. *Ekológia* (Bratislava), Vol. 39, No. 3, p. 201–213, 2020. DOI:10.2478/eko-2020-0015
- ✚ Dekić, R., Lolić, S., Gnjato, R., Trbić, G., Gnjato, O., Ivanc, A. (2011): Indicators of the environmental state of the Bilećko Jezero Lake. *Archives of Biological Sciences*, vol. 63, No. 3, pp. 775-783, Belgrade.

- ✚ Gnjata, S., Dekić, R., Lolić, S., Gnjata, O., Ivanišević, M. (2019): Elements of Sustainability and Water Quality of Kotlaničko Lake. *Herald*, No. 23, pp. 59-72. 10.7251/HER1923059G
- ✚ Golub, D., Lolić, S., Dmitrović, D., Dekić, R., Šukalo, G., Cvijić, S. (2018): Physical, Chemical and Biological Indicators of the Jablanica River Water Quality (Republic of Srpska, Bosnia and Herzegovina). *Water Research and Management*, Vol. 8, No. 4 (2018) pp. 11-18
- ✚ Vujčić S., Lolić S., Bojić M., Ilić P., Novaković M., Karaman M., Matavulj M. (2013): Invasive zoopathogenic Mastigomycotina in Republika Srpska, Serbia and neighboring countries with special reference to *Aphanomyces astaci*. *Jour. Nat. Sci. Matica Srpska Novi Sad*, 124: 341-354. <http://www.doiserbia.nb.rs/img/doi/0352-4906/2013/0352-49061324341V.pdf>

Other:

- ✚ Participant of 20 national projects, 3 international projects and 3 COST actions
- ✚ Author and co-author of 24 papers published in scientific journals and 34 papers and announcements at scientific conferences
- ✚ Co-author of 5 scientific books
- ✚ Head of SP Ecology and Environmental Protection; Faculty of Science and Mathematics, University of Banja Luka, 2014 – 2018
- ✚ Head of the Department of Microbiology and Cell Biology at the University of Banja Luka from 2014 to the present
- ✚ Member of the working group Microorganisms and Invertebrates at the Institute for Genetic Resources, University of Banja Luka
- ✚ Mentoring: 10 undergraduate and 1 master thesis
- ✚ Scholarship of the "Dr. Milan Jelić" Fund, scholarship of the Ministry of Science and Technology of the RS
- ✚ Member of the scientific board of 5 scientific symposia and conferences

List of academic staff in charge of lifelong learning courses:

Course	Responsible teachers
Aquatic ecotoxicology	dr Tanja Maksimović dr Radoslav Dekić dr Maja Manojlović

Aquatic and semi-aquatic macrophytes	dr Biljana Lubarda dr Tanja Maksimović
Aquatic macroinvertebrates in bioassessment	Dr Dejan Dmitrović Svjetlana Cvijić, ma
Phycology	dr Svjetlana Lolić Biljana Radusin-Sopić, ma
Ichthyology	dr Radoslav Dekić dr Dragojla Golub dr Maja Manojlović
Freshwater microbiology	dr Svjetlana Lolić Biljana Radusin-Sopić, ma
SERCON system for evaluating rivers for conservation	dr Biljana Lubarda dr Svjetlana Lolić dr Maja Manojlović
Water protection technologies	dr Maja Manojlović dr Svjetlana Lolić

6. Short biographies of academic staff who conduct lifelong learning courses:

dr Tanja Maksimović

Education:

- ⬇ 2014. PhD of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka.
- ⬇ 2007. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka.
- ⬇ 2001. Professor of Biology, Faculty of Sciences and Mathematics, University of Banja Luka

Academic, scientific and professional titles:

- ⬇ 2021. – today, Associate Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2016 – 2021., Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2008 – 2015. Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

- ✚ 2001 – 2007. Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

COURSES:

Undergraduate studies:

- ✚ Physiology of plants
- ✚ Physiology and ecophysiology of plants I
- ✚ Physiology and ecophysiology of plants II

Graduate studies:

- ✚ Biochemistry of plants
- ✚ Methodology of scientific research
- ✚ History of botanics
- ✚ Experiments in biology

Textbooks:

- ✚ Janjić, T., Maksimović, T., Lubarda, B. (2015): Atlas plodova. Pomoćni univerzitetski udžbenik. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet, Banja Luka. ISBN: 978-99955-21-41-7.
- ✚ Maksimović, T., Stanković, Ž. (2019): Fiziologija biljaka. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet, Banja Luka. ISBN: 978-99955-21-83-7.
- ✚ Lubarda, B., Maksimović, T., Škondrić, S. (2018): BIOLOGIJA za 2. razred gimnazije opšteg i prirodno-matematičkog smjera. JP „Zavod za udžbenike i nastavna sredstva” a.d. Istočno Sarajevo. ISBN: 978-99955-1-331-3.
- ✚ Lubarda, B., Golub, D., Dekić, R., Janjić, N., Lolić, S., Dmitrović, D., Maksimović, T., Manojlović, M., Paraš, S., Škondrić, S., Šukalo, G., Cvijić, S., Šibarević, M., Pljevaljić, T., Radusin Sopić, B. (2019): Test pitanja za pripremu prijemnog ispita iz biologije. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet, Banja Luka. ISBN: 978-99955-21-79-0.
- ✚ Maksimović, T., Stanković, Ž. (2020): Praktikum iz fiziologije biljaka, drugo dopunjeno izdanje. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet. ISBN:978-99955-21-88-2.

Field of scientific research: So far, research has been focused on various physiological processes in plants, the field of mineral nutrition with a special emphasis on heavy metals and phytoremediation. As part of the doctoral thesis, the

antioxidant metabolism of aquatic macrophytes, heavy metals and stress physiology are discussed

Selected projects:

- ✚ What do we eat in the city markets? Nitrates in vegetables: toxicity, content, intake and permitted concentrations. Ministry of Science and Technology, 2019. (Contract no 19/6-020/961-135/18).
- ✚ 2020-2022: ERASMUS+ project „ Development of master curricula in ecological monitoring and aquatic bioassessment for Western Balkans HEIs“ (ECOBIAS) Number of project:1259043. Duration: 1.2.2010-31.3.2023.

Selected references:

- ✚ Maksimović, T., Janjić, N., Lubarda, B. (2021): Effect of Drought-induced Stress on Seed Germination and Seedling Growth of Zea mays Indian Journal of Agricultural Research. 1-5. DOI: 10.18805/IJARE.A-602.
- ✚ Maksimović, T., Hasanagić, D., Kukavica, B. (2020): Antioxidative Response of Water Macrophytes to Changes in the Living Environment During Vegetation Season: An Experimental Study. In: Shukla, V., Kumar, N. (eds:). Environmental Concerns and Sustainable Development. Springer, Singapore. DOI: 10.1007/978-981-13-58889-0_6
- ✚ Maksimović, T., Lolić, S., Kukavica, B. (2020): Seasonal changes in the content photosynthetic pigments of dominant macrophytes in the Bardača fishpond area. Ekológia (Bratislava), 39 (3): 201-213. DOI:10.2478/EKO-2020-0015
- ✚ Maksimović, T., Janjić, N., Lubarda, B. (2020): Effect of different concentrations of mannitol on germination of pea seeds (*Pisum sativum*). Agriculture&Forestry, 66 (3): 65-72. DOI: 10.17707/AgricultForest.66.3.06
- ✚ Maksimović, T., Janjić, N., Lubarda, B. (2020): Impact of the varying intensity light on some morpho-anatomical characteristics and physiological parameters in young plants of *Pisum sativum* ZEMLJIŠTE I BILJKA, 69 (1): 46-55. DOI: 10.5937/ZemBilj2001046M.
- ✚ Maksimović, T., Rončević, S., Kukavica, B. (2019): *Utricularia vulgaris* and *Salvinia natans* (L.) All. heavy metal (Fe, Mn, Cu, Zn and Pb) bioaccumulation specificity in the area of Bardača fishpond. Ekológia (Bratislava), 38 (3): 300-313. DOI:<https://doi.org/10.2478/eko-2019-0016>
- ✚ Maksimović, T., Rončević, S., Kukavica, B. (2019): Seasonal dynamics of heavy metal bioaccumulation (Fe, Mn, Cu, Zn and Pb) in *Phragmites australis*

(Cav.) Trin. Ex Steud. in Bardača fishpond. Kragujevac Journal of Science, 41: 169-180. DOI: 10.5937/KgJSci1941169M

- ✚ Janjić, N., Maksimović, T. (2018): An Impact of air pollution on characteristics of stomata and photosynthetic apparatus of *Tilia cordata* and *Tilia platyphyllos* Scop. on Banja Luka area. Bulletin of the Faculty of Forestry, University of Banja Luka, 28: 59-70. DOI: 10.7251/GSF1828059J
- ✚ Janjić, , Hasanagić, D., Maksimović, T. (2017): Stomatal apparatus response of *Tilia cordata* (Mill.) and *Betula pendula* (Roth.) to air quality conditions in Banjaluka (Bosnia and Herzegovina). *Biologia Serbica*, 39 (2):9-16. DOI 10.5281/zenodo.827182
- ✚ Maksimović, T., Rončević, S., Kukavica, B. (2016): Seasonal changes of Cu and Zn at *Phragmites communis*, *Salvinia natans* L. and *Utricularia vulgaris* L. at area of fishpond Bardača. *Contemporary Materials. Academy of Sciences and Arts of Republic of Srpska. Banja Luka*. Pp:579-589.

Mentoring: membership in the commission of four master theses and 23 mentorships in the undergraduate studies.

Other:

- ✚ Member of the organizing board - IV Symposium of Biologists and Ecologists of the Republic of Srpska with international participation (SBERS 2020), Banja Luka, 12-14 November 2020.
- ✚ Member of the Society for Plant Physiology of Serbia (DFBS).

dr Radoslav Dekić

Education:

- ✚ 2010. PhD of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2006. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2001. Professor of Biology, Faculty of Sciences and Mathematics, University of Banja Luka

Academic, scientific and professional titles:

- ✚ 2016. – today, Associate Professor, Faculty of Sciences and Mathematics, University of Banja Luka

- ✚ 2011 – 2016., Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2006. – 2011., Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2001. – 2006., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

COURSES:

Undergraduate studies:

- ✚ General Animal Physiology
- ✚ Comparative Animal Physiology 1 i 2
- ✚ Comparative hematology
- ✚ Immunology
- ✚ Animal Physiology and Ecophysiology
- ✚ Mechanisms of physiological adaptations

Graduate studies:

- ✚ Biochemical basis of physiological responses
- ✚ Aquatic genetic resources (combined study program Conservation and sustainable use of genetic resources, Faculty of Agriculture and Natural Sciences and Mathematics, University of Banja Luka)

Textbooks:

- ✚ Crnogorac, Č., Trbić, G., Rajčević Vesna, Dekić, R., Pešević Dušica, Lolić Svjetlana, Milošević, A. i Čelebić, M. (2013): Riječna mreža opštine Mrkonjić Grad (Fizičkogeografska i ekološka istraživanja) autori: Geografsko društvo Republike Srpske, Posebna izdanja – 32 (2013).
- ✚ Ivanc, A. Dekić, R. (2006): Praktikum Opšte fiziologije životinja, Prirodno-matematički fakultet, Banja Luka.
- ✚ Ivanc Aleksandar, Dekić Radoslav (2017): Mehanizmi fizioloških adaptacija. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet. Štampa Dnevne nezavisne novine.

Field of scientific research: Ecophysiology, physiology, hematology, ichthyology, ichthyophysiology, monitoring of surface water

Selected projects:

- ✚ 2020: Examination of the water quality of watercourses in the Republic of Srpska in 2020. Fund for environmental protection and energy efficiency of the Republic of Srpska
- ✚ 2018 - 2019: Transmission of human pathogenic microorganisms through vegetable crops - impact of irrigation and fertilization. Ministry of Scientific and Technological Development, Higher Education and Information Society of the RS
- ✚ 2018-2019: Endemic fish species of the Republic of Srpska - distribution, habitat characteristics and physiological research". Faculty of Sciences and Mathematics of the University of Banja Luka, financed by the Ministry of Science and Technology Development, Higher Education and Information Society.
- ✚ 2015-2016: Comparative research on hematology of indigenous fish species and water quality (Ministry of Science and Technology of the Republic of Srpska, 2016)
- ✚ 2013-2014: Support to Bosnia and Herzegovina in revising the National Strategy for Biological and Landscape Diversity and drafting the Fifth National Report, NBSAP. CENER 21, , financed by the UNEP.
- ✚ 2012-2014: Environmental Monitoring and Biodiversity, Ministry of Science and Technology of the Republic of Srpska.

Selected references

- ✚ Ludoški, J., Francuski LJ., Lukač, M., Dekić, R., Milankov, V. (2021): Toward the conservation of the endemic monotypic fish genus *Aulopyge* from the Balkan Dinaric karst: Integrative assessment of introduced and natural population. *Ecology and evolution*, vol, 11 (2), 688-699.
- ✚ Dekić, R., Ivanc, A., Četković, D. and Lolić, S. (2020): Anthropogenic Impact and Environmental Quality of Different Tributaries of the River Vrbas (Bosnia and Herzegovina), pp. 169-213; in Bănăduc Doru, Curtean-Bănăduc Angela, Pedrotti Franco, Cianfaglione K., Akeroyd J., (eds), *Human Impact on Danube Watershed Biodiversity in the XXI Century*, Hardcover ISBN 978-3-030-37241-5, eBook ISBN 978-3-030-37242-2, DOI 10.1007/978-3-030-37242-2, 107

- illustrations in colour, Springer International Publishing, First edition, 437 pp., 2020.
- ✚ Lukač, M., Francuski, Lj., Dekić, R., Milankov, V. (2017): Molecular variability and identification of *Telestes metohiensis* (Steindachner, 1901) and *Telestes dabar*, Bogutskaya, Zupancic, Bogut & Naseka, 2012. 1st Southeast European Ichthyological Conference (SEEIC 2017). 27 to 29 September, 2017 in Sarajevo. Book of abstracts 16.
 - ✚ Paraš, S., Janković, O., Trišić, D., Čolović, B., Mitrović-Ajtić O., Dekić, R., Soldatović, I., Živković-Sandić, M., Živković, S., Jokanović, V. (2019): Influence of nanostructured calcium aluminate and calcium silicate on the liver: histological and unbiased stereological analysis. *International endodontic journal*, 1-10.
 - ✚ Dzafic, S., Bećiraj Bakrač, A., Suljević, D., Dekić, R. (2019): Effects of Hyperthermia on Erythrocyte Parameters of Carp *Cyprinus carpio* (Linnaeus, 1758) from Bardaca Swamp, Bosnia and Herzegovina. *Asian Journal of Fisheries and Aquatic Research* 2 (4): 1-7, 2018; Article no.AJFAR.47351.
 - ✚ Gnjato, S., Dekić, R., Lolić, S., Gnjato, O., Ivanišević, M. (2019): Elements of Sustainability and Water Quality of Kotlaničko Lake. *Herald*, No. 23, pp. 59-72. 10.7251/HER1923059
 - ✚ Golub, D., Lolić, S., Dmitrović, D., Dekić, R., Šukalo, G., Cvijić, S. (2018): Physical, Chemical and Biological Indicators of the Jablanica River Water Quality (Republic of Srpska, Bosnia and Herzegovina). *Water Research and Management*, Vol. 8, No. 4 (2018) pp. 11-18.
 - ✚ Dekić Radoslav, Savić Nebojša, Manojlović Maja, Golub Dragojla, Pavličević Jerko (2016): Condition factor and organosomatic indices of rainbow trout (*Onchorhynchus mykiss*, Wal.) from different brood stock. *Biotechnology in animal husbandry* VOL 32, 2.229-235.
 - ✚ Dekić, R., Friščić Jasna, Ivanc, A., Kukavica Biljana (2016): Characterization of Proteins from Popovo Minnow (*Delminichthys ghetaldii* Steindachner, 1882) Muscle. *Turkish Journal of Fisheries and Aquatic Sciences* 16: 637-642.
 - ✚ Dekić, R., Manojlović, M., Friščić, J., Lolić, S., Golub, D. (2016): Morphometric and physiological characteristics of brown trout (*Salmo trutta*) from river Ponor. *Agro-knowledge Journal*, vol. 17, no. 3, 2016, 233-242.

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- ✚ Dekić R., Lolić Svjetlana, Gnjato, O, Gnjato S., Stanojević M. (2016): Black Lake of the Zelengora mountain-sustainability problems. *Herald*, Vol. 20, 97-111.
- ✚ Dekić, R., A. Ivanc, Ž. Erić, R. Gnjato, G. Trbić, Svjetlana Lolić, Maja Manojlović and Nina Janjić (2014): Hematological characteristics of *Delminichthys ghetaldii* (Steindachner 1882) inhabiting the karst region of Eastern Herzegovina. *Arch. Biol. Sci.*, Belgrade, 66 (4), 1423-1430, 2014.
- ✚ Dekić, R., A. Ivanc, D. Cetković, Z. Dolicanin and S. Obradović (2014): Hematology of Bosnian pony. *Bulg. J. Agric. Sci.*, 20 (No 5): 1237-1244.
- ✚ Dekić, R., Lolić, S., Gnjato, R., Trbić, G., Gnjato, O., Ivanc, A. (2011): Indicators of the environmental state of the Bilećko Jezero Lake. *Archives of Biological Sciences*, vol. 63, No. 3, pp. 775-783, Belgrade.
- ✚ Ivanc, A., Hasković, E., Jeremić, S., Dekić, R. (2005): Hematological Evaluation of welfare and health of fish, *Praxis veterinaria* 53 (3) 191-202.

Other:

- ✚ Vice Dean for Education
- ✚ Participant of many national and international projects
- ✚ Author and co-author of 35 papers published in scientific journals and more than 60 papers and announcements at scientific conferences
- ✚ Head of SP technical education and informatics; Faculty of Science and Mathematics, University of Banja Luka, 2010 – today

- ✚ Head of the working group Aquatic genetic resources at the Institute for Genetic Resources, University of Banja Luka
- ✚ Mentoring: 42 undergraduate, 4 master and 1 PhD thesis
- ✚ Author and co-author of several professional studies on the subject of water quality, ichthyology and ichthyophysiology.
- ✚ Member of the Commission for the professional exam for the aquaculture work. Ministry of Agriculture, Forestry and Water Management, since 2020.
- ✚ TAIEX expert mission- Data collection in the field of fisheries, 22.01.2018. – 26.01.2018.
- ✚ Member of the Scientific Committee of the scientific conference Marking 20 years of existence and work of the Faculty of Sciences and Mathematics, University of Banja Luka, the Republic of Srpska, BiH (16-17. 10. 2016.)
- ✚ Member of the scientific board - IV Symposium of Biologists and Ecologists of the Republic of Srpska with international participation (SBERS 2020), Banja Luka,, BiH (12.11. - 14.11. 2020.).
- ✚ Membership in Organizations: Serbian Society for Water Protection, Belgrade, Serbia; Serbian Biological Society, Belgrade, Serbia.
- ✚ Participation at IUCN Red List Assessor Training Workshop, Sarajevo, Bosnia and Herzegovina 11. – 14.11.2019.
- ✚ Reviewer for journals: SKUP, Croatian Journal of Fisheries, Biotechnology in Animal Husbandry, Veterinaria etc.

dr Biljana Lubarda

Education:

- ✚ 2013. PhD of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2006. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2001. Professor of Biology, Faculty of Sciences and Mathematics, University of Banja Luka

Academic, scientific and professional titles:

- ✚ 2019. – today, Associate Professor, Faculty of Sciences and Mathematics, University of Banja Luka

- ⬇ 2014 – 2019., Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2007. – 2014., Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2001. – 2007., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

Courses:

Undergraduate studies:

- ⬇ Ecology of plants with phytogeography I
- ⬇ Ecology of plants with phytogeography II
- ⬇ Environmental protection
- ⬇ Biogeography and protection of diversity I
- ⬇ Biogeography and protection of diversity II
- ⬇ Idioecology of plants
- ⬇ Protection of Biodiversity
- ⬇ Protected areas
- ⬇ Restoration and improvement of the ecosystem

Graduate studies:

- ⬇ General aspects of biodiversity and methods of conservation
- ⬇ In situ conservation of genetic resources

Textbooks:

- ⬇ Janjić, T., Maksimović, T., Lubarda, B. (2015): Atlas plodova. Pomoćni univerzitetski udžbenik. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet, Banja Luka. ISBN: 978-99955-21-41-7.
- ⬇ Lubarda, B., Maksimović, T., Škondrić, S. (2018): BIOLOGIJA za 2. razred gimnazije opšteg i prirodno-matematičkog smjera. JP „Zavod za udžbenike i nastavna sredstva” a.d. Istočno Sarajevo. ISBN: 978-99955-1-331-3.
- ⬇ Lubarda, B., Golub, D., Dekić, R., Janjić, N., Lolić, S., Dmitrović, D., Maksimović, T., Manojlović, M., Paraš, S., Škondrić, S., Šukalo, G., Cvijić, S., Šibarević, M., Pljevaljčić, T., Radusin Sopić, B. (2019): Test pitanja za pripremu prijemnog ispita iz biologije. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet, Banja Luka. ISBN: 978-99955-21-79-0.

Scientific books:

- ✚ Lubarda, B. (2018): Balkanski endemi u flori Bosne i Hercegovine. Naučna knjiga. Univerzitet u Banjoj Luci, Prirodno-matematički fakultet.

Field of scientific research: endemic plants, macrophyta, urban flora, idioecology of plants

Selected projects:

- ✚ 2020-2022: 2020-2022: ERASMUS+ project „ Development of master curricula in ecological monitoring and aquatic bioassessment for Western Balkans HEIs“ (ECOBIAS)
- ✚ Open Regional Funds for South-East Europe – Biodiversity (ORF-BD) Sub-project: Regional Network for Biodiversity Information Management and Reporting (BIMR) Activity 1: Endemic list of selected terrestrial plant and animal taxa of the South-East Europe (SEE)
- ✚ Ramsar SGF Project No. SGF/05/BA/01: Restitution and rehabilitation of the wetland area of Bardača, Bosnia and Herzegovina

Selected references:

- ✚ Lubarda, B., Stupar, V., Milanović, Đ, Stevanović, V. (2014): Chorological characterization and distribution of the Balkan endemic vascular flora in Bosnia and Herzegovina. *Botanica Serbica*. Vol. 38 (1), 167-184
- ✚ Stevanović, V., Vladimirov, V., Niketić, M., Vukojičić, S., Jakovljević, K., Lubarda, B., Tomović, G. (2014): Plant species and subspecies discovered by Dr. Josif Pančić 1 – distribution and floristic importance. *Botanica Serbica*. 38 (2), 251-268
- ✚ Lubarda, B., Topalić-Trivunović, Lj.: Alien flora of the city of Banja Luka (Bosnia and Herzegovina). *Nat. Croat.*, Vol. 29, No. 2, 2020, Zagreb.
- ✚ Maksimović, T., Janjić, N., Lubarda, B. (2020): Effect of different concentrations of mannitol on germination of pea seeds (*Pisum sativum* L.). *Agriculture & Forestry*, 66 (3): 65-72. DOI: 10.17707/AgricultForest.66.3.06
- ✚ Maksimović, T., Janjić, N., Lubarda, B. (2020): Impact of the varying intensity light on some morpho-anatomical characteristics and physiological parameters in young plants of *Pisum sativum* L. *ZEMLJIŠTE I BILJKA*, 69 (1): 46-55. DOI: 10.5937/ZemBilj2001046M.

- ✚ Maksimović, T., Janjić, N., Lubarda, B. (2021): Effect of Drought-induced Stress on Seed Germination and Seedling Growth of Zea mays L. *Indian Journal of Agricultural Research*. 1-5. DOI: 10.18805/IJARE.A-602.

Other:

- ✚ Author and co-author of 17 papers published in scientific journals and over 30 papers and announcements at scientific conferences
- ✚ Head of SP Biology; Faculty of Science and Mathematics, University of Banja Luka since 2014
- ✚ Head of the Department of Ecology at the University of Banja Luka since 2014
- ✚ Mentoring: 18 undergraduate and 1 master thesis
- ✚ Member of the scientific board - IV Symposium of Biologists and Ecologists of the Republic of Srpska with international participation (SBERS 2020), Banja Luka, BiH (12.11. - 14.11. 2020.).
- ✚ Member of the expert team for the reform of preschool, primary and secondary education; Expert team for primary education and secondary education for the subject: Biology. Ministry of Education and Culture of the Republic of Srpska, since 2020
- ✚ Member of the Serbian Biological Society, Belgrade, Serbia.
- ✚ Member of the Society for the Protection of Natural Heritage – ARBOR MAGNA, Banjaluka

dr Dragojla Golub

Education:

- ✚ 2007. PhD in Environmental Sciences, Department of Zoology, Faculty of Mathematics, Physics and Natural Sciences, University of Bari, Italy (Dipartimento di Zoologia, Facolta di Scienze Matematiche, Fisiche e Naturali, Universita degli Studi di Bari, Italia)
- ✚ 2001. Professor of Biology, Faculty of Sciences and Mathematics, University of Banja Luka.

Academic, scientific and professional titles:

2017. – today, Associate Professor, Faculty of Sciences and Mathematics, University of Banja Luka

2008 – 2017., Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka

2001. – 2008., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

COURSES:

Undergraduate studies

- ✚ Bioindicators and monitoring system
- ✚ Ecomonitoring and bioindicators
- ✚ Chordate zoology 1
- ✚ Chordate zoology 2
- ✚ Chordate ecology and diversity
- ✚ Antropology
- ✚ Zoological practicum
- ✚ Field practice 3
- ✚ Ecology (Faculty of Philosophy, study programs Teacher Studies and Preschool Education)

Graduate studies

- ✚ Zoocenology
- ✚ Ecology and systematics of selected vertebrate
- ✚ Comparative anatomy of a selected vertebrate class
- ✚ Systematics of selected vertebrate taxa
- ✚ Fauna of Bosnia and Herzegovina
- ✚ History of natural sciences
- ✚ Aquatic genetic resources (combined study program Conservation and sustainable use of genetic resources, Faculty of Agriculture and Natural Sciences and Mathematics, University of Banja Luka)

Textbook:

- ✚ Golub Dragojla (2016): Ekologija za studente učiteljskog studija i predškolskog vaspitanja. Osnovni udžbenik. Prirodno-matematički fakultet Univerziteta u Banjoj Luci. ISBN 978-99955-21-51-6, 1-192.

Field of scientific research:

Ichthyology (biology and ecology of freshwater fish); bioindication in the assessment of the quality of surface water, monitoring of the ecological status of surface water

Selected projects:

- ✚ 2020-2023: ECOBIAS – Development of master curricula in ecological monitoring and aquatic bioassessment for Western Balkans HEIs (609967-EPP-1-2019-1-RS-EPPKA2-CBHE-JP, contract number: 2019-1991 / 001-001), ERASMUS.
- ✚ 2018-2019: Endemic fish species of the Republic of Srpska - distribution, habitat characteristics and physiological research". Faculty of Science and Mathematics, University of Banja Luka, financed by the Ministry of Science and Technology, Higher Education and Information Society.
- ✚ 2015-2018: Rural Development through Integrated Forest and Water Resources Management in Southeast Europe (LEIWW), GIZ (German Development Cooperation), Regional Rural Development Standing Working Group (SWG) of South Eastern Europe.
- ✚ 2014-2017: COST Action FA1304 – Swimming of fish and implications for migration and aquaculture (FITFISH).
- ✚ 2013-2014: Support to Bosnia and Herzegovina in revising the National Strategy for Biological and Landscape Diversity and drafting the Fifth National Report, NBSAP. CENER 21, financed by UNEP.
- ✚ 2011-2012: Taxonomic and geographical assessment of species in order to compile the red list of flora and fauna of the Republic of Srpska. Institute of Civil Engineering „IG“ d.o.o., financed by the Ministry of Spatial Planning, Construction and Ecology of the Republic of Srpska.
- ✚ 2010-2011: Assessment of the composition of fish populations as an indicator of the quality of watercourses of the Vrbas watershed in the area of Banja Luka. Faculty of Science and Mathematics, University of Banja Luka, financed by the Ministry of Science and Technology of the Republic of Srpska.
- ✚ 2010-2011: Valorization, potentials and preservation of the Gromiželj marsh ecosystem near Bijeljina. Faculty of Science and Mathematics, University of Banja Luka, financed by the Environmental Protection Fund of the Republic of Srpska.
- ✚ 2006-2007: Restoration and Rehabilitation of the Wetland Region Bardaca in Bosnia and Herzegovina. SGF 2005 (Ramsar Small Grants Fund for Wetland

Conservation and Wise Use). The Institute of Agroecology and Soil Sciences of the Faculty of Agriculture in Banja Luka.

- ✚ 2003-2006: Freshwater fisheries on bordering rivers – pilot study with a holistic regional approach. Akvaplan-niva, Norway (cooperation between Croatia, Serbia, Bosnia and Herzegovina and Norway).
- ✚ 2002-2005: LICENSE – Local Institutional Capacity Development in Environmental Sensitive Areas [LIFE TCY/BIH/041]. Institute for Urbanism of the Republic Srpska.

Selected references:

- ✚ Golub, D., Bukva, M., Dekić, R. (2019). Morphological characteristics and condition of the bleak *Alburnus alburnus* (Teleostei; Cyprinidae) from the Bosna River. *SKUP*, 10(1): 16-28. DOI: 10.7251/SKPEN191001016G.
- ✚ Golub, D., Lolić, S., Dmitrović, D., Dekić, R., Šukalo, G., Cvijić, S. (2018). Physical, Chemical, and Biological Indicators of the Jablanica River Water Quality (Republic of Srpska, Bosnia and Herzegovina). *Water Research and management*, 8(4): 11-18.
- ✚ Šukalo, G., Dmitrović, D., Golub, D. (2018). First record of the weatherfish *Misgurnus fossilis* (Linnaeus, 1758) from the Adriatic Sea catchment area in Bosnia and Herzegovina. *Ecologica Montenegrina*, 18:126-128. DOI: <https://doi.org/10.37828/em.2018.18.12>.
- ✚ Golub, D., Šukalo G., Ranitović, M. (2017). Morfometrija digestivnog trakta nekih ciprinidnih vrsta riba iz rijeke Save. *SKUP*, 8(1): 67-74. DOI: 10.7251/SKP170801067G.
- ✚ Golub, D., Dekić, R., Manojlović, M., Friščić, J., Šukalo, G., Cvijić, S., Lolić, S. (2017). Zajednice riba kao indikator kvaliteta vode sliva rijeke Ukrine (Republika Srpska, Bosna i Hercegovina). 46. konferencija o aktuelnim temama korišćenja i zaštite voda VODA 2017, Zbornik radova, str.141-148, Vršac, Srbija.
- ✚ Dekić, R., Savić, N., Manojlović, M., Golub, D., Pavličević, J. (2016). Condition factor and organosomatic indices of rainbow trout (*Onchorhynchus mykiss*, Wal.) from different brood stock. *Biotechnology in Animal Husbandry*, 32(2): 229-237. DOI: 10.2298/BAH1602229D.

- ✚ Golub, D., Marić, Ž., Šukalo, G., Cvijić, S., Dekić, R. (2016). Morfološke karakteristike *Cobitis elongatoides* i *Sabanejewia balcanica* (Cobitidae) iz rijeke Suturlije. SKUP, 7(2): 139-148. DOI: 10.7251/SKP1607139G.
- ✚ Golub, D., Dekić, R., Lolić, S., Dmitrović, D., Filipović, S., Lubarda, B., Kukavica, B., Sidak, S., Boroja, M. (2014). Fizičko-hemijski i biološki parametri u ocjeni kvaliteta vode posebnog rezervata prirode Gromiželj kod Bijeljine. 43. konferencija o aktuelnim problemima korišćenja i zaštite voda VODA 2014, Zbornik radova, str. 211-220, Tara, Srbija.
- ✚ Šukalo, G., Đorđević, S., Golub, D., Dmitrović, D., Tomović, Lj. (2013). Novel, non-invasive method for distinguishing the individuals of the fire salamander (*Salamandra salamandra*) in capture-mark-recapture studies. Acta Herpetologica, 8 (1): 41-45. DOI: https://doi.org/10.13128/Acta_Herpetol-12065.
- ✚ Golub, D., Dekić, R., Šukalo, G., Sidak, S., Lolić, S. (2012). Diverzitet faune riba nekih pritoka rijeke Vrbas u indikaciji kvaliteta vode. 41. konferencija o aktuelnim problemima korišćenja i zaštite voda VODA 2012, Zbornik radova, str.97-104, Divčibare, Srbija.
- ✚ Vuković, D., Tursi, A., Carlucci, R., Dekić, R. (2008). Ichthyofauna of the wetland ecosystem in the Bardača area (Bosnia and Herzegovina). Croatian Journal of Fisheries: Ribarstvo, 66 (3): 89-103. orcid.org/0000-0001-8834-6919.

Other:

- ✚ Mentoring: 36 undergraduate, 5 master and 1 PhD thesis
- ✚ Member of the Scientific board - II Symposium of Biologists and Ecologists of the Republic of Srpska, Banja Luka, Republic of Srpska, BiH (04.11. - 06.11. 2010.).
- ✚ Member of the Scientific Board of the scientific conference marking 20 years of existence and work of the Faculty of Sciences and Mathematics, University of Banja Luka, Republic of Srpska, BiH (16. -17. 10. 2016.).
- ✚ Member of the organizing board - IV Symposium of Biologists and Ecologists of the Republic of Srpska with international participation (SBERS 2020), Banja Luka, 12-14 November 2020
- ✚ Membership in Organizations: Serbian Society for Water Protection, Belgrade, Serbia; Serbian Biological Society, Belgrade, Serbia.

- ✚ Participation in Region focused training program, „Wetland Conservation for Southeast European Countries” programme-JICA (Japan International Cooperation Agency) 13.07.2008. - 15.08.2008.
- ✚ Participation in Western Balkans Capacity Building Workshop on Indicators as part of NBSAP updating, Konjic, Bosnia and Herzegovina 19. – 22.03.2013.
- ✚ Participation in IUCN Red List Assessor Training Workshop, Sarajevo, Bosnia and Herzegovina 11. – 14.11.2019.
- ✚ Reviewer for journals: SKUP, EDUCA, Croatian Journal of Fisheries, Biotechnology in Animal Husbandry, Uttar Pradesh Journal of Zoology etc.
- ✚ Member of the working group in front of the Faculty of Science and Mathematics of the University of Banja Luka for the development of by-laws based on the Law on Nature Protection since 2015.
- ✚ Member of the expert team representing the academic community in BiH (Agency for the Development of Higher Education and Quality Assurance BiH), since 2019. (http://www.heg.gov.ba/Kvalitet/lista_eksperata/?id=1160)
- ✚ Member of the expert team for the reform of preschool, primary and secondary education; Expert team for primary education and secondary education for the subject: Biology. Ministry of Education and Culture of the Republic of Srpska, since 2020.
- ✚ Member of the Commission for the professional exam for the aquaculture work. Ministry of Agriculture, Forestry and Water Management, since 2020.
- ✚ Head and responsible editor of the scientific journal „SKUP”, Faculty of Science and Mathematics, University of Banja Luka, since 2015

dr Maja Manojlović

Education:

- ✚ 2016. PhD of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka.
- ✚ 2011. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka.
- ✚ 2004. Professor of Biology, Faculty of Sciences and Mathematics, University of Banja Luka.

Academic, scientific and professional titles:

- ✚ 2016 – today., Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2012. – 2016., Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ✚ 2004. – 2012., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

Courses:

Undergraduate studies:

- ✚ Animal ecology with zoogeography
- ✚ Terrestrial ecology
- ✚ Ecotoxicology
- ✚ Environmental protection (practice)
- ✚ Field practice 4

Graduate studies:

- ✚ Zooecological and zoogeographic analyses
- ✚ Biodiversity protection

Textbook:

- ✚ M. Radević, M. Manojlović, Ekologija životinja sa zoogeografijom: praktikum, Prirodno-matematički fakultet Banja Luka, 2009.

Field of scientific research: Ecology, Biodiversity protection

Selected projects:

- ✚ Erasmus+ Development Of Master Curricula In Ecological Monitoring And Aquatic Bioassessment For Western Balkans HEIs ECOBIAS, Coordinating institution University of Novi Sad, 2020-2023.
- ✚ Effects of hypothermia on induced bacterial meningitis in Wistar rats, Faculty of Sciences and Mathematics, Banja Luka, 2018/2019. (Ministry of Scientific and Technological Development, Higher Education and Information Society of the Republic of Srpska), coordinator dr Maja Manojlović.
- ✚ Examination of the water quality of watercourses in the Republic of Srpska in 2019. Fund for environmental protection and energy efficiency of the Republic of Srpska, coordinator dr Radoslav Dekić, 2019.

- ⬇ Examination of the water quality of watercourses in the Republic of Srpska in 2018. Fund for environmental protection and energy efficiency of the Republic of Srpska, coordinator dr Radoslav Dekić, 2018.
- ⬇ Transmission of human pathogenic microorganisms through vegetable crops - impact of irrigation and fertilization. Ministry of Scientific and Technological Development, Higher Education and Information Society of the RS
- ⬇ Examination of the water quality of watercourses in the Republic of Srpska in 2017. Fund for environmental protection and energy efficiency of the Republic of Srpska, coordinator dr Radoslav Dekić, 2017.
- ⬇ Comparative research on hematology of indigenous fish species and water quality. Faculty of Science and Mathematics, Banja Luka, 2017 (Ministry of Science and Technology of the Republic of Srpska)
- ⬇ Examination of the water quality of watercourses in the Republic of Srpska in 2016. Fund for environmental protection and energy efficiency of the Republic of Srpska, coordinator dr Radoslav Dekić, 2016.

Selected references

- ⬇ Katica, O. Janković, f. Tandır, N. Gradašćević, R. Dekić, M. Manojlović, S. Paraš, Lj. Tadić-Latinović, The Effects of Calcium Aluminate and Calcium Silicate Cements Implantation on Haematological Profile in Rats, *KAFKAS UNIVERSITESI VETERINER FAKULTESI DERGISI*, Vol. 26, No. 3, pp. 1-8, Mar, 2020.
- ⬇ S. Lolić, R. Dekić, M. Manojlović, B. Radusin-Sopić, FREQUENCY OF BACTERIA SALMONELLA ENTERICA AND LISTERIA MONOCYTOGENES IN VEGETABLE IN THE REPUBLIC OF SRPSKA (BiH), *Knowledge International Journal*, Vol. 42, No. 3, pp. 495 - 499, Aug, 2020, (ISSN: 2545-4439 (Online)).
- ⬇ Maja Manojlović, Radoslav Dekić, Svjetlana Lolić, Jovana Paspalj, Aleksandra Đeri, Ivica Radović (2019) synergistic effects of lead-acetate and alloxan on body weight gain and organosomatic liver index of Wistar rat infected with escherichia. *SKUP*, 2019, 10(2), University of Banja Luka, Faculty of Natural Sciences and Mathematics, Banja Luka.
- ⬇ Paraš D.S., Gajanin B.R., Manojlović LJ.M., Ružić NJ.Z. influence of high frequency electromagnetic fields produced by antennas for mobile communication on the structure of the pancreas in rats: histological and

unbiased stereological analysis. *Acta Veterinaria-Belgrade* 2018, 68 (4), 484-501.

- ✚ Golub, D., Dekić, R., Manojlović, M., Friščić, J., Šukalo, G., Cvijić, S., Lolić, S.: Zajednice riba kao indikator kvaliteta vode sliva rijeke Ukrine (Republika Srpska, Bosna i Hercegovina). VODA, 2017.
- ✚ Dekić, M. Manojlović, J. Friščić, S. Lolić, D. Golub, Morphometric and Physiological Characteristics of Brown Trout (*Salmo trutta*) from the Ponor River, *Agro-knowledge Journal*, Vol. 17, No. 3, pp. 233-242, 2016.
- ✚ Radoslav Dekić, Nebojša Savić, Maja Manojlović, Dragojla Golub, Jerko Pavličević (2016): condition factor and organosomatic indices of rainbow trout (*Onchorhynchus mykiss*, wal.) From different brood stock. *Biotechnology in Animal Husbandry* 32 (2), p 229-237, Institute for Animal Husbandry, Belgrade-Zemun, DOI: 10.2298/BAH1602229D.
- ✚ Dekić, R., Ivanc, A., Erić, Ž., Gnjato, R., Trbić, G., Lolić, S., Manojlović, M., Janjić N. (2014): Hematological characteristics of *Delminichthys ghetaldii* (Steindachner 1882) inhabiting the karst region of Eastern Herzegovina. *Archives of Biological Sciences*, vol. 66, No. 4, pp. 1423-1430, Belgrade.

Other:

- ✚ Member of the Organizing Board of the Mountain Ecosystems and Resource Management Summer School, 2021
- ✚ President of the Committee for Ethical Issues of the University of Banja Luka, since 2017.
- ✚ Member of the Organizing board - II Symposium of Biologists and Ecologists of the Republic of Srpska, 2010
- ✚ Member of the organizing board - III Symposium of Biologists and Ecologists of the Republic of Srpska (SBERS2015), 2015.
- ✚ Member of the organizing board SBERS 2020, 2020.
- ✚ Member of the Editorial board SBERS 2020, 2020.
- ✚ Member of the Editorial board of the journal "GRASSROOTS JOURNAL OF NATURAL RESOURCES" [ISSN: 2581-6853 CODEN: GJNRA9 DOI: 10.33002] since 2020.
- ✚ Mentoring: 4 undergraduate and 1 master thesis

- ⬇ Scholarships from the Heinrich Böll Foundation and the City Administration of the City of Banja Luka - the "Petar Kočić" Foundation during undergraduate studies.
- ⬇ Member of the expert team for the reform of preschool, primary and secondary education; Expert team for primary education and secondary education for the subject: Ecology. Ministry of Education and Culture of the Republic of Srpska, since 2020.
- ⬇ Member of the Serbian Biological Society
- ⬇ Participation and organization of the Science Festival Participation in IUCN Red List Assessor Training Workshop, Sarajevo, Bosnia and Herzegovina 11. – 14.11.2019.

dr Dejan Dmitrović

Educatin:

- ⬇ 2012. PhD of Biological Sciences, Faculty of Sciences and Mathematics, University of Banja Luka.
- ⬇ 2012. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Novi Sad.
- ⬇ 2008. Professor of Biology, Faculty of Sciences and Mathematics, University of Banja Luka.
- ⬇ 2007. Bachelour of Biology, Faculty of Sciences and Mathematics, University of Banja Luka.

Academic, scientific and professional titles:

- ⬇ 2017 – today, Assistant Professor, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2012. – 2017., Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2008. – 2012., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

Courses:

Undergraduate studies:

- ⬇ General ecology
- ⬇ Basic ecology
- ⬇ Hidroecology and inland water protection
- ⬇ Water ecology and protection

Undergraduate studies:

- ✚ Population ecology of animals
- ✚ Population biology and species science
- ✚ Problems of preservation and protection of aquatic ecosystems

Textbooks:

- ✚ Lubarda, B., Golub, D., Dekić, R., Janjić, N., Lolić, S., Dmitrović, D., Maksimović, T., Manojlović, M., Paraš, S., Škondrić, S., Šukalo, G., Cvijić, S., Šibarević, M., Pljevaljčić, T., Radusin-Sopić, B. (2019): Test pitanja za pripremu prijemnog ispita iz biologije. Prirodno-matematički fakultet, Univerzitet u Banjoj Luci, ISBN: 978-99955-21-79-0

Field of scientific research: Ecology and diversity of freshwater macroinvertebrates, Assessment of the ecological status of running waters based on macrozoobenthos characteristics

Selected projects:

- ✚ " Macrozoobenthos of the springs of the Kozara National Park" (coordinator: Dr. Dejan Dmitrović, Faculty of Sciences and Mathematics, University of Banja Luka, Republic of Srpska; Ministry of Science and Technology Development, Higher Education and Information Society, Government of the Republic of Srpska, 2018-2020.
- ✚ „Science and Management of Intermittent Rivers and Ephemeral Streams" (SMIRES), (coordinator: Thibault Datry, PhD, National Research Institute of Science and Technology for Environment and Agriculture, IRSTEA, Department of Waters; COST action CA 15113), 2016-2020.
- ✚ " Ecotone biodiversity of aquatic and terrestrial biocenoses of Montenegro and Bosnia and Herzegovina" (coordinators: Associate Professor Siniša Škondrić and Dr. Vladimir Pešić, Full professor. Faculty of Sciences and Mathematics, University of Banja Luka, Republic of Srpska, Ministry of Science and Technology, Government of the Republic of Srpska and Faculty of Sciences and Mathematics, University of Montenegro, Podgorica, Montenegro, Ministry of Science, Government of Montenegro), 2016-2018.

Selected references:

- ✚ Dmitrović, D., & Pešić, V. (2020). An updated checklist of leeches (Annelida: Hirudinea) from Bosnia and Herzegovina. *Ecologica Montenegrina*, 29, 10-19.

- ⬇ Hofman, S., Osikowski, A., Rysiewska, A., Grego, J., Gloeer, P., Dmitrović, D., & Falniowski, A. (2019). Sarajana Radoman, 1975 (Caenogastropoda: Truncatelloidea): premature invalidation of a genus. *Journal of Conchology*, 43(4), 407-418.
- ⬇ Golub, D., Lolić, S., Dmitrović, D., Dekić, R., Šukalo, G., & Cvijić, S. (2018). Physical, Chemical and Biological Indicators of the Jablanica River Water Quality (Republic of Srpska, Bosnia and Herzegovina). *Water Research and Management*, 8(4), 11-18.
- ⬇ Von Fumetti, S., Dmitrović, D., & Pešić, V. (2017). The influence of flooding and river connectivity on macroinvertebrate assemblages in rheocene springs along a third-order river. *Fundamental and Applied Limnology/Archiv für Hydrobiologie*, 190(3), 251-263.
- ⬇ Dmitrović, D., Savić, A., & Pešić, V. (2016): Discharge, substrate type and temperature as factors affecting gastropod assemblages in springs in northwestern Bosnia and Herzegovina. *Archives of Biological Sciences*, 68(3), 613-621.

Other:

- ⬇ Participant of 8 scientific research projects
- ⬇ Author and co-author of 25 papers published in scientific journals, over 35 papers and announcements at scientific conferences

Svjetlana Cvijić, ma

Education:

- ⬇ 2016. Master of Biological Sciences, Faculty of Sciences and Mathematics, University of Novi Sad.
- ⬇ 2008. Bachelour of Biology, Faculty of Sciences and Mathematics, University of Banja Luka.

Academic, scientific and professional titles:

- ⬇ 2016. – today, Higher Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2010. – 2016., Assistant, Faculty of Sciences and Mathematics, University of Banja Luka

Courses:

Undergraduate studies:

- ✚ Bioindicators and monitoring system
- ✚ Ecomonitoring and bioindicators
- ✚ General ecology
- ✚ Basic ecology
- ✚ Restoration and improvement of the ecosystem
- ✚ Protected area
- ✚ Ecology

Textbook:

- ✚ Lubarda B., Golub D., Dekić R., Janjić N., Lolić S., Dmitrović D., Maksimović T., Manojlović M., Paraš S., Škondrić S., Šukalo G., Cvijić S., Šibarević M., Pljevaljčić T., Radusin Sopić B. (2019): Test pitanja za pripremu prijemnog ispita iz biologije. Ostale nastavne publikacije. Prirodno – matematički fakultet Univerziteta u Banjoj Luci. ISBN: 978-99955-21-79-0

Academic, scientific and professional titles: Ecology, hydrobiology, surface water monitoring, ichthyology

Selected projects:

- ✚ Distribution, ecology and conservation of snakes in the area of Eastern Herzegovina. Ministry of Scientific and Technological Development, Higher Education and Information Society of the RS. – member of the project team, 2019-2020.
- ✚ Macrozoobenthos of the springs of the Kozara National Park. Ministry of Science and Technology Development, Higher Education and Information Society of the RS. – member of the project team, 2018-2020.

Selected references:

- ✚ Golub, D., Lolić, S., Dmitrović, D., Dekić, R., Šukalo, G., Cvijić, S., (2018) Physical, Chemical and Biological Indicators of the Jablanica River Water Quality (Republic of Srpska, Bosnia and Herzegovina). *Water Research and Management*:11-18.
- ✚ Golub, D., Dekić, R., Manojlović, M., Friščić, J., Šukalo, G., Cvijić, S., Lolić, S. (2017) Zajednice riba kao indikator kvaliteta vode sliva rijeke Ukline (Republika Srpska, Bosna i Hercegovina), Voda 2017.

- ⬇ Golub, D., Cvijić, S., Grujičić, T., Lolić, S., Dekić, R. (2016) Otpadne vode banjalučke pivare – karakteristike i uticaj na rijeku Vrbas. 45. konferencija o aktuelnim temama korišćenja i zaštite voda VODA 2016. 481-486.
- ⬇ Golub, D., Marić, Ž., Šukalo, G., Cvijić, S., Dekić, R. (2016) Morfološke kakarakteristike *Cobitis elongatoides* i *Sabanejewia balcanica* (Cobitidae) iz rijeke Sutrulije. III Simpozijum biologa i ekologa Republike Srpske (SBERS 2015), 139-148.
- ⬇ Golub, D., Đekić, T., Dekić, R., Šukalo, G. , Cvijić, S. (2016) Ihtiofauna vodotoka Švrakava kao indikator kvaliteta vode. Osmi međunarodni kongres „Ekologija, zdravlje, rad, sport“. 152-156.
- ⬇ Janjić, N., Cvijić, S. (2017). Analiza uspjeha studenata biologije i ekologije u zavisnosti od predznanja iz srednje škole. SKUP 8 (2), Prirodno-matematički fakultet, 13-25.

Other:

- ⬇ Member of the organizing board - IV Symposium of Biologists and Ecologists of the Republic of Srpska with international participation (SBERS 2020), Banja Luka, 12-14 November 2020.

Biljana Radusin Sopić, ma

Education:

- ⬇ 2020-today, Faculty of Sciences and Mathematics, University of Sarajevo, graduate studies
- ⬇ 2021. master of genetical resources, Combined study program of master studies at University of Banja Luka
- ⬇ 2012. Bachelour of Biology, Faculty of Sciences and Mathematics, University of Banja Luka

Academic, scientific and professional titles:

- ⬇ 2018 – today, Assistant, Faculty of Sciences and Mathematics, University of Banja Luka
- ⬇ 2015–2018, Associate at the Center for Biodiversity, Institute for Genetic Resources, University of Banja Luka

Courses:

Undergraduate studies:

- ⬇ Microbiology

- ⬇ Ecology and diversity of microorganisms
- ⬇ Ecology of microorganisms
- ⬇ Biology of algae
- ⬇ Ecology and diversity of algae
- ⬇ Biology of fungi and lichenes
- ⬇ Micology

Graduate studies:

- ⬇ Genetic resources of microorganisms and invertebrates

Textbook:

- ⬇ Lubarda B., Golub D., Dekić R., Janjić N., Lolić S., Dmitrović D., Maksimović T., Manojlović M., Paraš S., Škondrić S., Šukalo G., Cvijić S., Šibarević M., Pljevaljić T., Radusin Sopić B. (2019): Test pitanja za pripremu prijemnog ispita iz biologije. Ostale nastavne publikacije. Prirodno – matematički fakultet Univerziteta u Banjoj Luci. ISBN: 978-99955-21-79-0

Field of scientific research: Water microbiology. Plant bacterioses. Bacterial biofilms.

Selected projects:

- ⬇ 2019-2020. What do we eat in the city markets? Nitrates in vegetables: toxicity, content, intake and permitted concentrations, Ministry of Scientific and Technological Development, Higher Education and Information Society - member of the project team.
- ⬇ 2020. Program of special supervision over the presence of quarantine harmful organisms on stone fruits in the territory of the Republic of Srpska in 2020. The Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska - person responsible for the method.
- ⬇ 2019-2020. Endemic fish species of the Republic of Srpska - distribution, habitat characteristics and physiological research, Ministry of Scientific and Technological Development, Higher Education and Information Society - member of the project team.
- ⬇ 2018-2019. Agricultural soil microorganisms of the Banja Luka region - Agreement on the use of allocated funds from the current grant "Programs for the preparation of projects and potential candidates for funds from the N2020 fund for the year 2017 for project co-financing - Ministry of Civil Affairs BiH - project manager.

- ⬇ 2018-2019. Introduction of modern methods for testing stone fruit tree seedlings for the presence of bacteria - Agreement on the allocation of financial support to the project, Ministry of Science and Technology of the Republic of Srpska - project manager.
- ⬇ 2018 - 2019: Transmission of human pathogenic microorganisms through vegetable crops - impact of irrigation and fertilization. Ministry of Scientific and Technological Development, Higher Education and Information Society of the RS –member of the project team
- ⬇ 2017. Special monitoring program for the presence of quarantine harmful organisms on stone fruits in the territory of the Republic of Srpska in 2017 - program manager.

COST akcije:

- ⬇ 2020-2024: COST action CA19123 - Protection, Resilience, Rehabilitation of damaged environment.
- ⬇ 2017-2021: COST action CA16107 EuroXanth: Integrating science on Xanthomonadaceae for integrated plant disease management in Europe.
- ⬇ 2015-2019: COST action ES1406 - Soil fauna - Key to soil organic matter dynamics and modeling (KEYSOM).

Selected references:

- ⬇ Radusin Sopić, B., Lamovšek, J., Lolić, S., Đurić, G. & Antić, M. (2021): First report of *Xanthomonas phaseoli* pv. *phaseoli* in locally produced bean seeds in Bosnia and Herzegovina. *J Plant Pathol* 103, 395–396. <https://doi.org/10.1007/s42161-020-00728-7>
- ⬇ Lolić, S., Dekić, R., Manojlović, M., & Radusin Sopić, B. (2020): Frequency of bacteria *Salmonella enterica* and *Listeria monocytogenes* in vegetable in the Republic of Srpska (BiH). *Knowledge International Journal*, 42(3), 495 - 499.
- ⬇ Radusin Sopić, B., Lolić, B., Nježić, B., Šipka, M., Đurić, G. (2019): Soil biogenity of the Banja Luka region as a result of the interaction of biological and chemical factors, VIII International Symposium on Agricultural Sciences and XXIV Conference of Agricultural Engineers of Republic of Srpska, pp. 201-201.
- ⬇ Radusin Sopić, B., Lolić, B., Đurić, G. (2018): *Xanthomonas arboricola* pv. *pruni* the causal agent of bacterial spot disease of stone fruits in the Republic of Srpska, 6th *Xanthomonas Genomic Conference (XGC 2018)* & 2nd Annual EuroXanth Conference, Germany, pp. 137-137.

Other:

- ✚ Member of the organizing board - IV Symposium of Biologists and Ecologists of the Republic of Srpska with international participation (SBERS 2020), Banja Luka, 12-14 November 2020.
- ✚ Member of the Microorganisms and Invertebrates Working Group, Institute for Genetic Resources, University of Banja Luka, 2020.
- ✚ Member of the Working Group for revision of curricula and programs for the first cycle of the Study Program for Biology and preparation of the Elaborate for relicensing, 2019. Faculty of Sciences and Mathematics, University of Banja Luka.

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7. Method of teaching or activities of the lifelong learning courses

Realization of lifelong learning courses in the field of Ecological monitoring of waters includes lectures, laboratory and field classes. Lectures and laboratory classes will be carried out on the premises of the Faculty of Natural Sciences and Mathematics of the University of Banja Luka (amphitheater, classrooms, laboratories), while field classes will be carried out in the field (selected nearby localities on the rivers Vrbas, Vrbanja, Crna Rijeka and such, as well as in the Bardača Research Center).

All the activities will be implemented in accordance with the Curriculum presented in the information sheets for each individual course.

Teaching materials and field protocols will be prepared by the program countries and translated into our language by experts from the partner countries. Written textbooks were reviewed by independent experts.

Teaching materials will be published online so that they are also available to students and teachers from other higher education institutions from the Western Balkan countries.

7. Physical and material prerequisites for conducting lifelong learning courses

As part of the implementation of the ECOBIAS project, a laboratory is being equipped, including the equipment for ecological monitoring of waters, whereby the existing equipment is supplemented and new one is acquired, with the aim of performing a sophisticated analysis of aquatic bioassessment.

8. Prerequisites for enrolling in lifelong learning courses

The program can be followed by participants with the minimum of completed undergraduate studies in the fields of biology, ecology, technology, agriculture and related sciences

9. Costs of enrolling and attending the course

Since the program is planned to be implemented within the Erasmus + ECOBIAS project, no enrollment and course attendance costs are foreseen.

10. The number of participants per course is not limited.

The number of participants per course is not limited.

11. Curricula

course	Aquatic ecotoxicology		
ECTS points	6		
teaching load	2+2		
Course objective: The objective of this course is to provide knowledge about interactions between anthropogenic chemicals and aquatic ecosystems, as well as methods used in aquatic toxicity testing. The origin, toxicity, fate of pollutants and their impact at the molecular, biochemical, cellular, physiological, organismal and community level will be presented. Students will also be familiar with some of the classic methodologies and understand the basic concepts of in situ and in vitro toxicity testing in water, with special attention paid to biological markers in aquatic organisms.			
Learning outcomes: Course participants should gain knowledge of the major classes of toxicants, including pollutants in water bodies and the main effects of toxicants in aquatic organisms. After attending the course, course participants will also have a good overview of the most important methods and study approaches used in the study and research of environmental pollutant chemicals.			
Learning methods:			
<ul style="list-style-type: none"> o Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants; o Practical exercises - field work; o Realization of independent research work - case study. 			
Responsible teachers :		dr Tanja Maksimović dr Radoslav Dekić dr Maja Manojlović	
Students load			
60 hours:		Lessons and exam: 20 hours - block sessions on weekends	
		Laboratory practice : 20 hours	
		Consultations and independent work: 20 hours	
Laboratory practice	20	Written exam	20
Independent research paper	20	Oral exam	40

Literature:

- Amiard-Triquet C, Amiard J-C, Mouneyrac C (2015) Aquatic Ecotoxicology: Advancing Tools for Dealing with Emerging Risks. Academic Press, Elsevier Inc., London.
- Walker, C.H., Hopkin, S.P., Sibly, R.M., Peakall, D.B. (2006) Principles of Ecotoxicology. Taylor and Francis, London.
- Teaching material published as part of the ECOBIAS project.

course		Aquatic and semi-aquatic macrophytes	
ECTS points		6	
teaching load		2+2	
Course objective: The objective of this course is to provide general knowledge on the research of aquatic macrophytes in lakes and rivers for the purpose of ecological status assessment, using these organisms as elements of biological quality in accordance with both: EU standard methods (European Committee for Standardization, Water quality: EN 15460, EN14184: 2016) as well as a fundamental scientific approach.			
Learning outcomes: Course participants will be able to plan and conduct research, to collect and identify macrophytes and vegetation structure, and to process quantitative metrics, traits and ecological indices of macrophytes.			
Learning methods :			
<ul style="list-style-type: none"> ○ Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants; ○ Practical exercises ○ Realization of projects in the field of environmental water monitoring. 			
Responsible teachers :		dr Biljana Lubarda dr Tanja Maksimović	
Students load			
60 hours:		Lessons and exam: 20 hours - block sessions on weekends	
		Field work: 20 hours	
		Consultations and independent work: 20 hours	
Field practice	20	Written exam	20
Independent research paper	20	Oral exam	40
Literature:			
<ul style="list-style-type: none"> ⚡ EN 14184: 2014 Water Quality – Guidance for the surveying of aquatic macrophytes in running waters, Comite Europeen de Normalisation ⚡ Jeppesen, E., Søndergaard, M., Søndergaard, M., Christofferson, K. (Eds.) (2012). The structuring role of submerged macrophytes in lakes. Springer Science & Business Media. ⚡ Teaching material published as part of the ECOBIAS project. 			

course		Aquatic macroinvertebrates in bioassessment	
ECTS points		6	
teaching load		2+2	

Course objective: This course will focus on acquiring knowledge about the morphological and ecological properties of common macroinvertebrate taxa in the Balkan Peninsula and the role of benthos community structure in the bioanalysis process. Benthic macroinvertebrates are probably the most complex part of the biotic quality elements (BQE) needed to assess freshwaters because of their diversity, abundance, ecological properties and life cycle. This course will provide the most up-to-date knowledge on these topics and provide the appropriate taxonomic / systematic features necessary in the macroinvertebrate identification process. Finally, we will deal with the specifics of the Balkan fauna and habitat of macroinvertebrates.

Learning outcomes :

Course participants will be able to identify the main groups of macroinvertebrates, which will allow them to build appropriate databases and calculate some of the indices used in the assessment of freshwater biological areas as well as lotic and lentic habitats.

Learning methods :

- o Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants;
- o Practical exercises
- o Realization of projects in the field of environmental water monitoring.

Responsible teachers:

dr Dejan Dmitrović
Svjetlana Cvijić, ma

Students load

60 hours:

Lessons and exam: 20 hours - block sessions on weekends

Field work: 20 hours

Consultations and independent work: 20 hours

Field practice

20

Written exam

20

Independent research paper

20

Oral exam

40

Literature:

- ↓ Hauer, F.R. & Resh., V.H. (1996). Benthic Macroinvertebrates, In: Methods in Stream Ecology, F.R. Hauer & G.A. Lamberti (eds), pp. 339-369, Academy Press, New York, USA.
- ↓ Teaching material published as part of the ECOBIAS project.

Course

Phycology

ECTS points

6

Teaching load

2+2

Course objective: The course is designed to clarify the importance of microalgae and cyanobacteria in natural ecosystems, in order to prepare students to solve various problems related to water quality and environmental protection. Emphasis is placed on understanding the importance of algae and cyanobacteria in terms of their biochemical, physiological and genetic potential, as well as biotechnological applications.

Learning outcomes :

Course participants will demonstrate an understanding of the specific cellular organization and growth patterns of microalgae and cyanobacteria; explain the main pathways in the physiology and genetics of microalgae and cyanobacteria; describe the role of microalgae and cyanobacteria in different ecosystems; explain the role of microalgae and cyanobacteria in various biotechnological processes; prepare cultural collections.

Learning methods :

- o Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants;
- o Practical exercises
- o Realization of projects in the field of environmental water monitoring.

Responsible teachers:

dr Svjetlana Lolić

Biljana Radusin-Sopić, ma			
Students load			
60 hours:	Lessons and exam: 20 hours - block sessions on weekends Laboratory practice: 20 hours Consultations and independent work: 20 hours		
Laboratory practice	20	Written exam	20
Independent research paper	20	Oral exam	40
Literature:			
<ul style="list-style-type: none"> ○ Teaching material published as part of the ECOBIAS project. ○ Svirčev Z. (2005): Microalgae and Cyanobacteria in Biotechnology. Faculty of Sciences, University of N. Sad. ○ Blaženčić J. (1988): Systematics of Algae. Naučna knjiga, Belgrade. 			

Course	Ichthyology		
ECTS points	6		
Teaching load	2+2		
Course objective: This course deals with all aspects of fish ecology from their basic physiology through food web interactions, competition, reproductive strategies and the importance of size to ecological interactions. The importance of fish as biological indicators will be highlighted. Different multimetric approaches used in bioassessment will be presented.			
Learning outcomes :			
Course participants will be able to relate fish to habitat categories, river types and eco-regions, as well as apply knowledge of fish ecology, physiology and zoogeography to understand the functioning of an aquatic ecosystem. Course participants will learn about the application of various indices based on the ichthyofond in assessing the ecological status of inland waters.			
Learning methods :			
<ul style="list-style-type: none"> ○ Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants; ○ Practical exercises ○ Realization of projects in the field of environmental water monitoring. 			
Responsible teachers:	dr Radoslav Dekić dr Dragojla Golub dr Maja Manojlović		
Students load			
60 hours:	Lessons and exam: 20 hours - block sessions on weekends Field work: 20 hours Consultations and independent work: 20 hours		
Field practice	20	Written exam	20
Independent research paper	20	Oral exam	40
Literature:			
<ul style="list-style-type: none"> ○ Matthews W.J. (2012) Patterns in Freshwater Fish Ecology. Chapman & Hall, New York. ○ Wootton, R.J., (2012) Fish ecology: tertiary level biology. Blackie, London. 212 pp. 			

- o Teaching material published as part of the ECOBIAS project.

Course	Freshwater microbiology		
ECTS points	6		
Teaching load	2+2		
Course objective: The objective of this course is to understand the role of microorganisms in freshwater ecosystems and their importance in monitoring water quality in different freshwater environments.			
Learning outcomes: After successfully completing the pre-exam and exam requirements, course participants can describe the dynamic activities of freshwater microbes in various environmental systems, including lakes, rivers and wetlands; predict the microbial response to eutrophication, as well as the ecological consequences associated with the increase in nutrients. Course participants will be able to recognize and use the most important microbiological indicator groups in assessing the degree of deterioration of the freshwater environment.			
Learning methods :			
<ul style="list-style-type: none"> o Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants; o Practical exercises o Realization of projects in the field of environmental water monitoring. 			
Responsible teachers:	dr Sveltana Lolić Biljana Radusin-Sopić, ma		
Students load			
60 hours:	Lessons and exam: 20 hours - block sessions on weekends		
	Laboratory practice: 20 hours		
	Consultations and independent work: 20 hours		
Laboratory practice	20	Written exam	20
Independent research paper	20	Oral exam	40
Literature:			
<ul style="list-style-type: none"> ⬇ Sigeo, D. (2005): Freshwater Microbiology. John Wiley and Sons Ltd. England. ⬇ Markert, B.A., Breure, A.M., Zechmeister, H.G. (2003) Bioindicators & Biomonitoring Principles, Concepts and Applications. Elsevier Science Ltd. ISBN 0-08-044177-7 (selected chapters) ⬇ Maier R.M., Pepper I.L., Gerba Ch.P. (2000): Environmental microbiology. Academic press, London UK. (selected chapters) ⬇ Marylynn V. Yates, Cindy H. Nakatsu, Robert V. Miller, Suresh D. Pillai (2016): Manual of Environmental Microbiology, Fourth Edition. ISBN : 9781555816025 (selected chapters) ⬇ Petrović O., Gajin S., Matavulj M., Radnović D., Svirčev Z. (1998): Microbiological investigation of surface water quality. Institute of Biology, Faculty of Sciences, University of Novi Sad. ⬇ Teaching material published as part of the ECOBIAS project. 			

Course	SERCON system for evaluating rivers for conservation		
ECTS points	6		
Teaching load	2+2		
Course objective: The main objective of the course is to enable participants to acquire knowledge and skills related to the ecological and conservation assessment of rivers according to the SERCON			

methodology.			
Learning outcomes: After attending the course, participants will be able to: collect and evaluate data for the application of the SERCON methodology; analyze data in accordance with conservation criteria; apply SERCON software tools for the assessment of river habitats; interpret the information obtained and propose conservation measures.			
Learning methods :			
<ul style="list-style-type: none"> o Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants; o Practical exercises o Realization of projects in the field of environmental water monitoring. 			
Responsible teachers:		dr Biljana Lubarda dr Svjetlana Lolić dr Maja Manojlović	
Students load			
60 hours:		Lessons and exam: 20 hours - block sessions on weekends	
		Field work: 20 hours	
		Consultations and independent work: 20 hours	
Field practice	20	Written exam	20
Independent research paper	20	Oral exam	40
Literature:			
<ul style="list-style-type: none"> o Boon PJ, Holmes NTH, Maitland PS and Fozzard L. (2004): Sercon Version 2 System For Evaluating Rivers For Conservation, User's Guide and Technical Guide, 2004, SNH UK o Ovuka M, Racković M, Radulović S, Cvijanović D, Živković M, Novković M and Boon P. SERCON Software (System for Evaluating Rivers for Conservation), Version 3.1 (2012-2015): PMF UNS script and available from: http://sercon.pmf.uns.ac.rs/SerconWeb/ o Teaching material published as part of the ECOBIAS project.. 			

Course	Water protection technologies		
ECTS points	6		
Teaching load	2+2		
Course objective: The main objective of the course is to enable participants to acquire key knowledge related to water quality, types of pollution, water protection treatments and pollution control.			
Learning outcomes: Acquiring knowledge about water protection technologies. Course participants will be able to describe different types of water pollutants, explain possible ways of water pollution, including chemical processes in aquatic ecosystems, and understand the processes of wastewater treatment and control.			
Learning methods :			
<ul style="list-style-type: none"> o Lectures with the usage of multimedia tools, active learning techniques and with active participation and discussions of participants; o Practical exercises o Realization of projects in the field of environmental water monitoring. 			
Responsible teachers:		dr Maja Manojlović dr Svjetlana Lolić	
Students load			
60 hours:		Lessons and exam: 20 hours - block sessions on weekends	
		Laboratory practice : 20 hours	
		Consultations and independent work: 20 hours	

Laboratory practice	20	Written exam	20
Independent research paper	20	Oral exam	40

Literature:

- ✚ Teaching material published as part of the ECOBIAS project
- ✚ Metcalf & Eddy. (2014): Wastewater Engineering, treatment disposal reuse. McGraw-Hill.
- ✚ Hammer, M.J.(2004): Water and wastewater Technology. Pearson, Prentice Hall.
- ✚ Nastavni materijal publikovan u okviru ECOBIAS projekta.
- ✚ Crittenden, J.C., Trussell, R.R., Hand, D.W., Howe, K.J., Tchobanoglous, G. (2005):Water Treatment: Principles and Design, 2nd ed., John Wiley & Sons, Hoboken, New Jersey.
- ✚ Degremot, S. (2007):Water Treatment Handbook, 7th edition

12. Forms of monitoring the quality of teaching (participant survey or other methods)

After the completion of each lifelong learning course in the field of ecological monitoring of waters, the plan is to conduct a process of surveying the participants in order to identify the degree of satisfaction with the course program, program contents, literature, lecturers, method of organization of field classes, etc. The survey of participants will be carried out in accordance with the Quality Assurance Strategy of the University of Banja Luka. The results of the survey will be analyzed by the management of the Project Team and will serve as a basis for continuous improvement of the quality of the program itself.

13. Obligations of lifelong learning course participants

Participants are obliged to regularly follow the lectures, laboratory and field classes realized as a part of the course, as well as to actively participate in the implementation of all activities that are planned in the information sheets.

14. Type and content of the document obtained upon completion of lifelong learning courses

Following the successful completion of the program, participants receive a certificate of successful completion of the lifelong learning course.

The end of translation

I hereby confirm that this translation is true to the original written in the Serbian language.

Reg. No.: 23/22



In Banja Luka, on 10 October 2022

Saša Leper

